"Transportation-Related Land Use Strategies to Minimize Motor Vehicle Emissions:
An Indirect Source Research Study"

Final Report, Chapters 1 - 7
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by JHK and Associates
for the
California Air Resources Board
(Contract # 92-348)

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ABSTRACT

The ARB funded this project to obtain a better understanding of the quantitative benefits of land use planning and development in conjunction with multi-modal transportation facilities that provide convenient alternatives to personal vehicle travel. The results of this research are intended to provide information to local governments, air districts, planning organizations, designers, builders and other interested parties. The information may be used in developing land use-related programs that can increase the rate of walking, bicycling and transit use. Such strategies can reduce dependence on automobile travel while helping to ensure personal mobility and providing cleaner air.

The report suggests community-level performance goals that can reasonably be attained in urban, suburban and rural/exurban communities by implementing packages of transportation-related land use strategies in coordination with a multimodal transportation system. The performance goals are listed in terms of average annual vehicle travel per household and related vehicular emissions. The report recommends eight packages of transportation-related land use strategies appropriate for urban, suburban, and rural/exurban communities. It also provides detailed descriptions of specific strategy characteristics for each type of community, including suggested development densities and mixtures and configurations of land uses. In addition, implementation mechanisms for local governments are listed and examples provided of existing programs.

The performance goals and recommended strategy packages included inChapters 5 and 6 of the report are based primarily on data gathered in a recent study of travel behavior, land use and transportation characteristics of twenty-eight sample communities in California by Dr. John Holtzclaw. In addition, an extensive review of the literature, as well as travel survey data from communities in California, Oregon and Canada are used. An extensive annotated bibliography and summary of references on the topic are also included (Appendix B).

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DISCLAIMER

Chapter 1. SUMMARY AND CONCLUSIONS

A goal of the California Air Resources Board (ARB) is to reduce emissions from motor vehicles in an effort to meet the State and Federal Clean Air Act requirements. One area of research that can be performed is the quantification of travel and emissions impacts of transportation-related land use strategies.

The need to travel and the method of travel from an origin to a destination is influenced by land use patterns and the availability of transportation services. In this research project, transportation-related land use strategies have been identified that can be implemented to improve the efficiency and facilitate the use of transit, pedestrian, and other alternatives to single-occupant motor vehicles. As a result, these strategies would reduce, or slow the growth of, vehicle trips (VT), vehicle miles traveled (VMT) and pollutant emissions. The strategies examined in this study are intended to work in combination with other air quality programs designed to decrease reliance on driving, reduce vehicular emissions, and control of stationary sources of pollution. Transportation-related land use strategies are not expected to attain air quality standards by themselves, but they can be an important part of the effort to improve air quality. Not included in this research project are strategies that are primarily transportation incentives and disincentives that do not include a land-use-related component. Examples of strategies not included in this study are: transportation demand management (TDM) strategies; small, incremental increases in transit service; increased gasoline costs or other pricing programs; and low or zero-emission vehicles.

The places people travel, such as major shopping centers, universities, and employment centers (for example), are referred to as "indirect sources" by air quality specialists because they attract vehicle travel. Numerous vehicle trips to and from such destinations produce emissions that can be quite significant when compared to pollutants emitted by typical stationary sources of air pollution, such as power plants, oil refineries, and manufacturing facilities. For this reason, the California Clean Air Act, adopted in 1988, required air districts to develop air quality attainment plans that include a provision to develop a program to reduce emissions related to such "indirect sources." However, State law prohibits air districts from infringing on existing local government land use authority in controlling indirect source emissions. (Cal. Health and Safety Code Section 40716(b)).

The information contained in this report is advisory and intended to assist local governments in considering air quality criteria when making transportation and land use decisions. A primary goal of this project has been to provide information to local governments, air quality districts, developers, and other interested parties on how land use planning can be used in conjunction with transportation systems to help improve air quality. The specific objectives of the research project were as follows:

- Provide a comprehensive review of the literature and existing databases as they pertain to the relationships among land use, transportation and air quality.

- Identify transportation-related land use strategies that are effective, realistic, and implementable for a given situation (e.g., type of community, air quality problem).

- Define levels of performance goals for urban, suburban, and rural (exurban) communities that local government air quality districts and others can use in determining the appropriate performance goal for their situation.

- Recommend appropriate combinations of strategies that could assist in reaching the performance goals.

- Describe implementation mechanisms that can be used to implement the transportation-related land use strategies identified within existing local government policy-making structures for land use decisions.

The results from this project will provide a better understanding of the relationships among land use, transportation and air quality, and will aid the ARB and local air districts in working with communities in their efforts to help meet air quality attainment goals.

1.1 KEY FINDINGS OF THE STUDY

The most significant finding of this research study is that it is possible to develop recommendations for combinations of transportation-related land use strategies that are based on quantified data available from actual communities in California and that are applied separately to urban, suburban, and exurban communities. The recommended strategies are an example of ways that land use planning and development can be implemented in conjunction with transportation systems to reduce the amount of, or growth in, vehicle travel per household and resulting motor vehicle emissions. The availability of detailed travel and land use data for a sample of communities in California allowed the recommendations to have a quantitative basis. If data were made available for a larger number of communities in California, the strategy recommendations could be even further refined.

Throughout this research study, a number of key findings emerged. The most significant of these are summarized below.

Literature Review

Much of the literature on transportation-related land use strategies does not contain analyses of modeled or empirical data. A significant finding of this research study was the identification of those literature sources with the most complete and defensible quantification of impacts. Quantifiable effectiveness data obtained from the literature review was summarized in a matrix. Together with a detailed annotated bibliography, this format facilitated the use of the literature review in the

development of the performance goals and strategy recommendations. It is difficult to quantify reductions in vehicle use and emissions from individual transportation-related land use strategies applied separately or on a site-specific basis, as opposed to community-wide. However, this study found that comprehensive packages of strategies, applied on a community-wide level, can be a fairly reliable method for achieving quantifiable reductions in emissions from vehicle use.

Case Study Community Data

Communities located in California and outside of California were used as case studies for this research study. The California communities were examined to determine how travel and land use characteristics vary within the state. Travel and land use data from Portland, Oregon and some Canadian cities were examined to provide a basis of comparison for the characteristics found in California and to serve as a reasonableness check for our recommendations. These cities serve as potential models of improvement for California communities because they are similar in age and development patterns, yet they have maintained greater transit use and lower levels of household vehicle use. Suburban residents of Canadian cities average roughly half as much VMT per household as do suburban residents of the sample California communities. Summaries for each of the case study communities are provided in Chapter 4 of this report.

Holtzclaw Study

A significant resource used for this research study was a detailed examination of travel data and transportation and land use characteristics from California communities conducted by John Holtzclaw. This study, *Using Residential Patterns and Transit to Decrease Auto Dependence and Costs*, was prepared for the Natural Resources Defense Council in June 1994. The data from this study provided the basis for developing the performance goals and defining specific characteristics related to the density, intensity, and mix of development needed to support a multimodal transportation system and reduce driving.

Performance Goals

A significant achievement of this project was the identification of community-level performance goals related to vehicle use per household. The strategy for developing the goals is described in Chapter 5, and summarized in Table 1-1. Using primarily the data from the case studies, three ranges of performance goals for urban and suburban areas and two ranges of performance goals for exurban areas were specified. Based on its community type, a local jurisdiction could select a performance goal level that represents the amount of reduction in per-household vehicle travel and associated vehicle emissions desired from transportation-related land use strategies. The performance goals are described in more detail in Chapter 5, and a summary is provided in Table 1-2.

Table 1-1

DEVELOPMENT OF PERFORMANCE GOALS

SAMPLE COMMUNITY	REGIONAL LOCATION	AVERAGE VMT Per Household Per Year	PERFORMANCE GOALS: Average VMT Per Household Per Year
URBAN COMMUNITIES			
San Francisco (northeast portion)	San Francisco (SF) Bay Area	5,500	**Urban Level 1 <10,000**
Sacramento (central)	Sacramento	10,100	**Urban Level 2 10,000 to 13,000**
San Francisco (total)	SF Bay Area	11,300	
Berkeley (central)	SF Bay Area	12,500	
Beverly Hills (southwestern)	Los Angeles	13,000	
Rockridge District (Oakland)	SF Bay Area	14,300	**Urban Level 3 13,001 to 16,000**
Santa Monica (southern)	Los Angeles	14,700	
Long Beach (southern)	Los Angeles	15,300	
Uptown San Diego	San Diego	15,500	
SUBURBAN COMMUNITIES			
Alameda	SF Bay Area	17,000	**Suburban Level 1 <20,000**
Pasadena (south central area)	Los Angeles	17,300	
Daly City	SF Bay Area	19,300	
Downey (central)	Los Angeles	21,400	**Suburban Level 2 20,000 to 22,000**
Alhambra	Los Angeles	21,700	
Escondido	San Diego	21,700	
Walnut Creek	SF Bay Area	22,300	**Suburban Level 3 22,001 to 25,000**
Lafayette	SF Bay Area	22,300	
Clairemont	San Diego	22,700	
Riverside (northern)	Los Angeles	23,700	
EXURBAN COMMUNITIES			
(No case study communities available for this level)			**Exurban Level 1 <28,000**
Morgan Hill	SF Bay Area	28,400	**Exurban Level 2 28,000 to 30,000**

Sources: JHK & Associates, 1995, Table 5-2. Source of community data: Dr. John Holtzclaw, *Using Residential Patterns and Transit to Decrease Auto Dependence and Costs,* June 1994. (Community data was grouped and annotated by JHK & Associates and ARB staff.)

Table 1-2
Motor Vehicle Use
PERFORMANCE GOALS

GOALS:	Average Annual Vehicle Trips per Household	Average Annual Vehicle Miles of Travel per Household	Mode Share of Person Trips: Auto Driver	Mode Share of Person Trips: Other (transit, walk, bike, carpool)	Average Annual Vehicle Emissions/ Household
	URBAN COMMUNITIES				
Urban Level 1	**<1,600**	**<10,000**	40%	60%	ROG: <31 CO : <348 NO: <27
Urban Level 2	**1,600 to 2,100**	**10,000 to 13,000**	45%	55%	ROG: 31-40 CO: 348-455 NOx: 27-35
Urban Level 3	**2,101 to 2,600**	**13,001 to 16,000**	55%	45%	ROG: 40-50 CO: 455-562 NOx: 35-43
	SUBURBAN COMMUNITIES				
Suburban Level 1	**<3,200**	**<20,000**	60%	40%	ROG: <62 CO: <696 NOx: <54
Suburban Level 2	**3,200 to 3,500**	**20,000 to 22,000**	65%	35%	ROG: 62-68 CO: 696-763 NOx: 54-59
Suburban Level 3	**3,501 to 4,000**	**22,001 to 25,000**	70%	30%	ROG: 68-77 CO: 763-870 NOx: 59-67
	EXURBAN COMMUNITIES				
Exurban Level 1	**<4,500**	**<28,000**	65%	35%	ROG: <87 CO: <977 NOx: <76
Exurban Level 2	**4,500 to 4,800**	**28,000 to 30,000**	70%	30%	ROG: 87-93 CO: 977-1044 NOx: 76-81

Source: JHK and Associates, Table 5-4.

Notes:

1. Vehicle trips per household per year.
2. Vehicle miles traveled per household per year, on average.
3. The percentage of trips made by individuals using a given travel mode.
4. Auto Drivers include single-occupant vehicles, and drivers of carpools and vanpools. (e.g., 40% means that for 100 'person trips' there are 40 vehicles on the road.)
5. "Other" includes all non-motorized forms of transportation; transit riders; and passengers of carpools and vanpools.
6. Average pounds per household per year total emissions from light and medium-duty vehicles and motorcycles, as of 1995. (Data includes medium-duty commercial vehicles.) ROG is Reactive Organic Gases; CO is Carbon Monoxide; NOx is Oxides of Nitrogen. Source: Calif. ARB's *EMFAC 7F1.1 and BURDEN* inventory, 1994.

Recommended Strategies

After reviewing the literature, the case studies, and the Holtzclaw study, a list of recommended strategies was developed. Not all of the strategies are recommended for each community type or performance goal level (as described in the strategy packages). Many of the elements of the recommended strategies already exist in a number of communities in California. A brief description of each of the recommended strategies is provided below.

Provide Pedestrian Facilities. This strategy emphasizes pedestrian accessibility through the provision of convenient and direct pedestrian and bicycle facilities including sidewalks, crosswalks, and protection from fast vehicular traffic.

Increase Density Near Transit Corridors. This strategy consists of efforts to intensify land uses within walking distance of a transit corridor or surface transit route. This strategy is typically characterized by new development, infill and redevelopment.

Increase Density Near Transit Stations. This strategy encourages efforts to intensify land uses around existing or planned high-capacity transit stations (bus and/or rail). It includes new development, infill and redevelopment, and incorporates direct and convenient pedestrian linkages.

Encourage Mixed-Use Development. This strategy encourages the location of compatible land uses within walking distance of each other. Mixed-use development typically results in a higher level of walking, as well as a greater potential for transit use, compared to single-use development.

Encourage Infill and Densification. This strategy includes the infill, redevelopment and reuse of vacant and underutilized parcels within an already developed area. Implementation of this strategy tends to encourage walking and higher rates of transit use, and also increases the efficiency of transit systems.

Develop Concentrated Activity Centers. This strategy clusters higher-density development appropriately into concentrated nodes to provide more convenient access to transit as well as increased opportunities for non-motorized travel.

Strengthen Downtowns. Downtowns, also referred to as central business districts, are a special kind of Concentrated Activity Center. A strong downtown serves as a commercial, employment and cultural center which can encourage pedestrian travel within the area and also provides an important focal point for an area-wide transit system.

Develop Interconnected Street Network. This strategy provides more direct routes for motor vehicles as well as pedestrians and bicycles. It reduces barriers created by wide arterial streets with fast-moving traffic and infrequent intersections while maintaining travel time for vehicles, even at somewhat lower speeds. Slower vehicular speeds help create a safer and more appealing environment for pedestrians and bicyclists.

Provide Strategic Parking Facilities. It is possible to provide a lower amount of parking supply in areas with increased rates of transit use and walking/bicycling occurring as a result of

the implementation of the strategies listed above. Less surface parking area reduces the distances between different land uses, which allows them to be more easily accessed by walking and transit use. Required parking supply should vary by land use type, proximity to transit service and accessibility to pedestrian and bicycle travel.

Description of Strategy Packages

As mentioned previously, one of the most significant findings of this study was that packages of transportation-related land use strategies for each of the community types may significantly reduce vehicle travel per household. For a local jurisdiction to determine which strategy package to pursue, the jurisdiction may identify its community type, determine current conditions, and select the performance goal that best meets its needs. The selection of a performance goal will be based on the amount of multimodal travel and air quality improvement desired for the community. The locality would then select an appropriate package of recommended strategies for the selected goal. Those strategies that have already been implemented in the jurisdiction can be determined and the remaining items would become the targeted strategies.

The recommended strategy packages, including specific details on density, mixture of uses, and proximity to transit, are provided in Chapter 6 of this report. These recommendations were based on the Holtzclaw study, the literature review, information made available by the Building Industry Association on the building types feasible at various densities, and the expertise of the consultants, Advisory Committee Members, and ARB staff.

Implementation Mechanisms

The study developed guidance on available mechanisms for implementing the recommended strategies. Descriptions of the implementation mechanisms are provided in Chapter 7 of this report and are organized in the following topic areas:

- policies;
- policy documents;
- administrative actions;
- organizational tools;
- resource tools;
- problems/solutions; and
- monitoring methods.

Some methods of implementing the recommended strategies are already available to communtiies through existing institutions and organizations. Examples of locations that have

implemented these mechanisms are also provided. Table 1-3 indicates which of the implementation mechanisms are appropriate for each of the recommended strategies.

Future Research

The JHK team, ARB staff, and Advisory Committee members have identified a number of areas, listed below, that would benefit from future research and study.

- Expand the number of case study communities (as in the Holtzclaw study) to add to the database.
- Collect data for exurban communities to serve as case studies.
- Implement demonstration projects for transportation-related land use strategies and track changes in travel behavior associated with them.
- Develop baseline data for local jurisdictions in California that are comparable to the performance goals suggested in this report.
- Develop level-of-service standards for pedestrians, bicycles, and transit similar to those for intersections and streets.
- Evaluate the impact of traffic level-of-service standards on development densities.
- Perform additional analyses to further isolate the causality of a number of factors that influence travel behavior: density, lifestyle, income, availability of modes, attitudes, etc.
- Examine relationships between parking use, parking supply, parking costs, and parking requirements.
- Examine the relationship between quality of life characteristics such as crime, income, and density.
- Collect land-use-specific vehicle trip generation rates in California and evaluate how they are impacted by factors such as density, mixture of uses, location within metropolitan areas, and transit availability.

1.2 HOW THE WORK WAS PERFORMED

This study was performed according to eight tasks defined by ARB staff. These tasks are listed below, and also described in more detail in Chapter 2 of this report. More detailed information on the methodologies applied in this research effort is provided throughout this report.

Task 1. Review of Literature
Task 2. Identification of Potential Effects

Task 3. Development and Description of Strategies
Task 4. Assessment of Strategy Effectiveness
Task 5. Specification of Performance Goals
Task 6. Recommendation of Strategies
Task 7. Identification of Implementation Mechanisms
Task 8. Preparation of the Final Report

The ARB formed an Advisory Committee to provide guidance throughout the study, review its progress at key points, assist in the selection of the transportation-related land use strategies, and review the analytical approach. Members of the Advisory Committee included representatives from air districts, public transit districts, metropolitan planning organizations, cities and counties, the building and retail industries and environmental organizations.

The first step in the study was the development of descriptions for the three community types: urban, suburban, and exurban/rural. Each of the community types is described according to the following characteristics: function, size, centrality, density and age. A summary of the characteristics for each of the community types is provided in Chapter 4.

An extensive review of the literature on transportation-related land use strategies was performed to identify studies that included quantitative evaluations of travel and emissions impacts. The identification of recently-available studies for use in this research project was an important aspect of this review because the effort to examine land use impacts on transportation behavior is a growing field.

Based on the review of the literature, eleven transportation-related land use strategies were identified as potentially effective at facilitating the provision and increased use of transit, bicycle, and pedestrian facilities, and thus reducing emissions from the use of motor vehicles. An important consideration in the identification of these strategies was the ability to potentially combine them for each of the community types. (The potential strategies are listed and described in more detail in Chapter 3.) Data used for evaluating the transportation-related land use strategies included information collected from an extensive literature review, case study evaluations of communities within California, and examples of cities outside of California that have historical land use development similar to California communities.

Based on the data collected for this study, three levels of performance goals were recommended for the urban and suburban community types, and two levels for exurban areas. (Only two categories of performance goals were suggested for exurban areas because of the limited case study data available for this community type.) The performance goals are set at levels expressed as vehicle trips (VT) per household (HH) per year, vehicle miles traveled (VMT) per HH per year, and modal shares. For each

performance goal level and area type, pollutant emissions that would result from the average VT and VMT per HH per year were estimated. The performance goals have been set as suggested targets that many communities can reasonably achieve with a concerted effort to implement transportation-related land use strategies. The goals were established based on travel characteristics found in actual communities in California, and in similar communities outside of California.

Recommendations for transportation-related land use strategies were also developed that will assist local jurisdictions in attaining each of the performance goal levels. One package of recommended strategies is presented for each of the eight sets of performance goals (three levels each for urban and suburban jurisdictions, and two levels for exurban jurisdictions).

Mechanisms that can be used by local jurisdictions to implement each of the recommended strategies were identified and described. Many of the policies and programs recommended are compatible with the existing planning programs and goals in many of California's communities. The implementation of actions described not only help minimize motor vehicle emissions; they can also contribute to other local and regional priorities.

Finally, recommendations were developed for future research efforts. In conducting this study, a number of areas were identified where additional data may be useful. These are listed in Chapter 8.

Chapter 2. PROJECT SCOPE AND PURPOSE

2.1 PURPOSE

The need to travel, and the method of travel from an origin to a destination, are influenced by land use patterns and the availability of transportation services. For decades, land use development trends in many areas in California have been towards less dense land uses along transportation corridors, away from city centers. This has led to longer trip lengths in some cases, the provision of fewer alternative modes of transportation (such as transit), and increased vehicle miles traveled (VMT) and resulting vehicle emissions. Although improved vehicle technology has provided automobiles that pollute less, the reduction in emissions tends to be offset by the growth in the number of vehicle trips made and the average length of these trips.

In this research project, transportation-related land use strategies have been identified that can be implemented to reduce vehicle trips (VT), vehicle miles traveled (VMT) and related pollutant emissions for many land uses typical in California. A primary goal of this project has been to provide information to local governments, air quality districts, developers, and other interested parties on how land use planning and development can be used to help improve air quality. The information contained in this report is advisory and intended to assist local agencies in considering air quality criteria when making transportation and land use decisions. California State law prohibits air districts from infringing on existing local government land use authority. (Cal. Health and Safety Code Section 40716(b)).

In this research project, various transportation-related land use strategies have been examined to determine their potential effectiveness in altering travel behavior and reducing motor vehicle emissions. The amount of motor vehicle emissions reductions that could potentially result from implementing combinations of such strategies in urban, suburban, and exurban communities was estimated using available data. The strategies examined in this study are intended to work in combination with other air quality programs designed to decrease reliance on single-occupant vehicles, reduce vehicular emissions, and control stationary sources of pollution. Although transportation-related land use strategies are not expected to achieve attainment of ambient air quality standards by themselves, they can be an important part of the overall effort to improve air quality.

This project did not include an evaluation of strategies that are primarily transportation incentives and disincentives and that do not include a land use-related component. Examples of strategies not evaluated include: employer-based transportation demand management (TDM) strategies, small or incremental increases in transit service, and pricing programs.

2.2 OBJECTIVES

The specific objectives of the research project were as follows:

- Provide a comprehensive review of the literature and existing databases as they pertain to the relationships among land use, transportation and air quality.
- Identify transportation-related land use strategies that are effective, realistic, and implementable for a given situation (e.g., type of community, air quality problem).
- Define different levels of performance goals for urban, suburban, and rural (exurban) communities that local governments, air quality districts, and others can use in determining the appropriate performance goal for their situation.
- Recommend appropriate combinations of strategies that could assist in reaching the performance goals.
- Describe implementation mechanisms that can be used to implement the transportation-related land use strategies identified within existing local government policy-making structures for land use decisions.

The results from this project provide a better understanding of relationships among land use, transportation, and air quality, and will aid the California Air Resources Board (ARB) and local air districts in assisting communities in their efforts to achieve and maintain air quality attainment goals. These strategies may also help achieve additional goals such as creating more livable communities, providing housing, reducing infrastructure costs, reducing traffic congestion, preserving open space, and conserving natural resources.

An Advisory Committee was formed to provide guidance throughout the study, review the progress of the study at key points, assist in the selection of the case study sites, and review the analytical approach. Members of the Advisory Committee met over a two-year period and included representatives from air districts, metropolitan planning organizations, cities and counties, and the building and development industries.

2.3 SUMMARY OF TASK DESCRIPTIONS

A number of specific tasks were defined by the ARB to guide the research performed. A brief description of each of these tasks is provided below.

Task 1. Review of Literature. An extensive review of reported information, studies, and available data sources on the implementation of transportation-related land use strategies was conducted. The review

included an inventory of available and applicable data on the relationships between land use, transportation systems, travel behavior, and reductions in vehicle use and pollutant emissions. The literature review focused on information available in California, the nation, and other countries, such as Canada.

Task 2. Identification of Potential Effects. The information gathered in the literature review was used to divide a selection of California communities into three categories of land use and transportation characteristics for each of the three community types: urban, suburban, and exurban.

Task 3. Development and Description of Strategies. Based on the literature review and input from ARB staff and the Advisory Committee, transportation-related land use strategies were identified for examination in this research project. The focus of the strategy identification was on those strategies that are community-wide in scope, and not site-specific in nature. Detailed descriptions of the characteristics of each of the strategies were also developed.

Task 4. Assessment of Strategy Effectiveness. The information developed in the previous tasks was used to identify estimates of the potential effectiveness of various strategies. A preliminary identification was then performed to determine which strategies could most effectively achieve the levels of travel reduction for each of the three community types (urban, suburban and exurban).

Task 5. Specification of Performance Goals. Performance goals were developed for each of the three community types to provide guidance on reasonable and achievable levels of travel and emissions reductions that can be attained through transportation-related land use strategies. Levels of performance goals were developed to be applicable to the general characteristics of each type of community, and to reflect the specific conditions in California.

Task 6. Recommendation of Strategies. Combinations of transportation-related land use strategies were identified that could be implemented to achieve the different levels of performance goals in each type of community. Descriptions are presented in matrix form.

Task 7. Identification of Implementation Mechanisms. Mechanisms were identified that could be used to implement the recommended strategies. Organizational and institutional methods and processes suitable to implement the strategies were evaluated and summarized.

Task 8. Preparation of the Final Report. This Final Report documents the objectives of the research project, the procedures used for collecting and analyzing data, and the major results and recommendations.

Chapter 3. TRANSPORTATION-RELATED LAND USE STRATEGIES

An important component of this research project was the identification of transportation-related land use strategies that could potentially impact travel behavior and reduce resulting motor vehicle emissions. A literature review was conducted to assist in the identification of a list of strategies. The strategies to be examined in this project were then selected and described. Based on the quantitative information contained in the literature review, preliminary estimates of individual strategy effectiveness were also developed. This information is summarized in Chapter 3.

3.1 LITERATURE REVIEW

To gain an understanding of the impact of land use strategies on travel behavior, an extensive review of literature documenting local, national and international research was performed. The focus of this review was on literature that quantified the impacts of transportation-related land use strategies. There are many additional sources discussing the benefits of various land use strategies, but that do not support the discussion with empirical or modeled data. Those sources are not summarized in detail in this research project.

An important function of the literature review was to provide information on land use and transportation characteristics that have been effective in creating and supporting successful public transit systems and pedestrian-accessible communities. The use of this information to identify recommended strategy "packages" and their characteristics is described in Chapter 6 of this report.

The main points of the literature reviewed are highlighted in Section 3.4, organized by types of land use strategies appearing in the literature. A summary table of the quantifiable findings, and an annotated bibliography of the reports and articles reviewed, are provided in Appendix B.

3.2 SELECTION OF POTENTIAL STRATEGIES

The JHK Team, in consultation with ARB staff and with input from the Advisory Committee, developed a set of eleven transportation-related land use strategies for detailed analysis in this research project. The strategies selected all have the potential to reduce vehicle travel to indirect sources and the associated emissions, and entail actions that are within the usual scope of power of local jurisdictions in California (cities and counties). As mentioned previously, the focus of the strategy selection was on those that are community-wide in scope, rather than those that are site specific.

An initial set of strategies was proposed for study by the JHK Team at the outset of the project. This initial listing included transportation-related land use strategies that, based on the experience of ARB staff and JHK team members, had a realistic chance of reducing vehicle trips (VT), vehicle miles traveled (VMT), and increasing the ratio of person trips to vehicle trips in California if implemented in coordination with a multi-modal transportation system. Strategies focused solely on expanding transportation facilities, such as the addition of single transit routes, were not included in the scope of this research project. The importance of the provision of transportation services was incorporated into this research project by describing the specific transportation services that need to be provided for an effective impact on travel behavior for each land use strategy.

The literature review conducted for this research project was used to further define specific strategies. An effort was made to include all types of land use strategies currently being proposed with some frequency to relieve transportation and air quality problems. Overall, the strategies consisted of measures that make related land uses more mutually accessible by means other than the automobile.

A preliminary list of strategies was presented to the Advisory Committee. Discussions led to further revisions to the list of strategies, as well as the addition of "interconnected street networks" as a distinct strategy. The final list of potential transportation-related land use strategies considered in the study include:

- Transit-Oriented Design
- Density Near Transit Stations
- Density Near Transit Corridors
- Mixed-Use Development
- Infill and Densificaiton
- Concentrated Activity Centers
- Strong Downtowns
- Jobs/Housing Balance
- Pedestrian Facilities
- Interconnected Street Networks; and
- Strategic Parking Facilities.

In Chapter 6 of this report, the recommended strategies from this list are presented and described.

There is some overlap between strategy elements due to the fact that most of the strategies are packages of related elements. For example, in terms of physical design and land use policies, *Transit-Oriented Design* includes mixed-use development, increased density near transit, and provision of

pedestrian facilities. *Mixed-Use Development* is an individual strategy that reaches full fruition in the enhancement or creation of *Concentrated Activity Centers*. Such overlap is appropriate for this study, since it is aimed at defining and evaluating land use strategies that can be implemented by the full range of local jurisdictions in California. Some communities have or will have rail transit stations surrounded by developable land; these communities might reasonably pursue *Transit-Oriented Design* (TOD). Other jurisdictions do not have frequent transit service, nor even a realistic prospect of obtaining it. These jurisdictions would not be able to implement TOD, but if they had large tracts of developing land, they could pursue a pedestrian-oriented development related to *Pedestrian Facilities*. Similarly, not all jurisdictions have significant downtown or suburban activity nodes that can be developed into *Concentrated Activity Centers*; nonetheless, they could still pursue *Mixed-Use Development* on a smaller scale throughout their community.

3.3 DESCRIPTIONS OF POTENTIAL STRATEGIES

Tables A-1 and A-2 in Appendix A characterize the potential strategies in considerable detail. Table A-1 indicates what collateral transportation services are necessary to ensure effective implementation of each strategy, and also indicates qualitatively the expected impact of each strategy on various transportation modes and two variables that critically affect air quality: vehicle miles of travel (VMT) and vehicle trips (VT). Table A-2 provides the expected, non-quantified air quality effects of each strategy. Table A-2 also lists limitations, implementation barriers, non-transportation benefits, and other issues relevant to each strategy.

In the following sections, definitions and descriptions of each of the eleven final potential strategies examined in this research project are provided. For consistency with recent ARB work, many of the definitions are derived directly from the ARB report *The Linkage Between Land Use and Air Quality* (1994), authored by Terry Parker, an Associate Air Pollution Specialist with ARB. The definitions specified for this research project draw out important elements of the strategies and illustrate how the strategies differ from and relate to one another. These definitions are used in the analysis of strategy effectiveness.

Potential Strategy #1: Transit-Oriented Design (TOD)

Transit-Oriented Design (TOD) is a deliberate alteration of post-World War II suburban patterns. It assumes a sizeable parcel of developing/redeveloping land (at least one-third of a mile in radius) centered on a current or planned major transit station. Parker defines TOD as a concept that incorporates an intentional orientation to transit and pedestrian travel, clusters services and other uses in a 'town center.' Like the POD (see below), TODs provide a range of housing densities and mix of land uses." A TOD has been described as:

> A mixed-use community within an average of one-quarter mile walking distance of a transit [station] and core commercial area. The design, configuration, and mix of uses emphasize a pedestrian-oriented environment and reinforce the use of office, open space, and public uses within comfortable walking distance, making it convenient for residents and employees to travel by transit, bicycle or foot, as well as by car. [1]

Although autos are accommodated within TOD, a high level of auto facilities is incompatible with TOD. Also, while TOD is often considered a strategy for newly developing areas at the metropolitan periphery, it may be even more effectively implemented as redevelopment within an urban or suburban area.

As noted in the *Linkage* report, "[t]ransit-oriented development is receiving serious attention in California. Plans for a new development south of Sacramento, 'Laguna West,' attempt to cluster higher-density housing surrounding a neighborhood commercial and service center that is more convenient for walking, biking and transit. Similar projects have also been proposed in San Diego, the San Francisco Bay Area, and other parts of California."[2] Similar projects are also underway in the Washington D.C. area, Florida and New Jersey. However, no new project including all of the elements of TOD has been fully built and occupied.

Potential Strategy #2: Density Near Transit Stations

This strategy consists of efforts to intensify land uses around high-capacity rapid transit stations. Typically, it is characterized by infill and partial redevelopment rather than full implementation of a comprehensive, idealized TOD. Unlike TOD, mixed use is not a necessary element. This strategy consists of a more incremental program for making the best use of both the transit system and the limited land supply near major stations. Such a program has the following goals:

- promoting land uses that generate the most transit and pedestrian trips near stations;
- locating these uses in close proximity to transit station entrances; and
- providing higher density land development around stations.[3]

As noted in the *Linkage* report: "[l]and use decisions for the areas around transit corridors are critical due to the fixed nature of rail transit,"[4] the large capital cost represented by rail, and the limited amount of land within easy walking distance (one-third to one-quarter mile) of rail stations. In such a setting, land use "decisions need to be made with a long-term view, as they will last for many years to come."[5] The wrong land uses or site designs can "impede the development of subsequent, more transit-supportive projects in the future. Land use measures to support alternative travel modes and reduce automobile use are available on both the community (or metropolitan) and local (neighborhood) levels."[6] Adequate pedestrian facilities are an important component of this strategy.

Potential Strategy #3: Density Near Transit Corridors

This strategy consists of efforts to intensify land uses within walking distance of a transit corridor. A transit corridor is envisioned as a surface transit route (bus or perhaps streetcar) rather than a major multi-modal center as is typically found at a major rail station. As defined here, transit accessibility is less than at a rapid transit station or within an idealized TOD. In most other respects, this strategy is similar to the preceding strategy. Typically this strategy is characterized by infill and partial redevelopment rather than full implementation of a comprehensive, idealized TOD.

Potential Strategy #4: Mixed-Use Development

Mixed-use development fosters integration of "compatible land uses, such as shops, offices, and housing," and encourages them "to locate closer together and thus decreases travel distances between them. Mixed-use development, if properly designed and implemented, can reduce VMT and VT and can help increase transit ridership, especially during the off-peak (non-commute) periods. For example, a mixed-use area containing restaurants, a museum, a theater and retail stores has a greater potential to generate transit ridership than an area with retail stores alone."[7] Regardless of how persons arrive at such a center, they will be able to make many trips by walking once they arrive at such a mixed-use center; such trip linkage would not be possible in a single-purpose area. The addition of residential uses can further increase pedestrian tripmaking.

"Mid-day trips from work for lunch or to run errands can also be influenced by mixed-use strategies."[8] Employees already on-site can supplement the buying power of nearby residents, reducingä the minimum market area required for a given type of establishment to be profitable. As defined here this strategy is a cumulative set of project- and site-level measures that can be applied to both new development and redevelopment.

Potential Strategy #5: Infill and Densification

The *Linkage* report succinctly characterizes the potential of this strategy:

> The infill, redevelopment and reuse of vacant or underutilized parcels within existing urban areas can help to decrease vehicle traffic, reduce walking distances and support better transit systems. This strategy also has other benefits: lower infrastructure costs, more efficient delivery of services, increased economic viability of cities, and reduced conversion of agricultural land and open spaces to urban or suburban development...
>
> Infill and redevelopment that is located within walking distance of transit service has greater potential to shift travel away from personal vehicles. The design, quality, mixture and compatibility of residential and other types of infill projects are factors that must be carefully considered to enhance their acceptability to neighboring residents and businesses, especially in the case of higher-density infill and redevelopment projects.[9]

Potential Strategy #6: Concentrated Activity Centers

This strategy seeks to combine higher-density development appropriately into concentrated nodes to take advantage of transit and opportunities for pedestrian and nonmotorized travel.

> The locations of these nodes may be urban or suburban. If a variety of activities (such as shops and services, offices, other employment sites and residences) are clustered, they can become lively 'activity centers.' A network of such centers, or "nodes," can more easily be linked by a transit network to other similar centers and to the central business district.
>
> Activity centers served by transit located in suburban areas can also provide accessibility to transit service for surrounding residential areas. Activity centers or nodes are also referred to as 'Urban Villages' or 'Suburban Business Districts.'[10]

Potential Strategy #7: Strong Downtowns

Downtowns, also referred to as central business districts, are a special kind of *Concentrated Activity Center*. Some of the functions of downtowns can be summarized as follows:

> Strong central business districts that include substantial amounts of both employment and housing have historically had the best quality transit service and the highest rates of transit use. Transit use tends to be higher in downtown sites for many reasons, including: there are a concentrated number of land uses located within walking distance of transit stations (such as jobs, shops, public facilities and retail services), higher parking costs, greater traffic congestion, limited parking availability, and better access to transit at both trip ends.

> Central business districts of many major cities in the U.S. tend to have a number of high-rise buildings, with some restaurants, shops and other services, but little activity after business hours or on weekends.[11]
>
> Higher density housing in the downtown and nearby areas can contribute to safer and more lively central cities, and reduce the commute for those residents who live and work downtown.[12]

Residents of downtown also tend to use transit more often and for more purposes than other metropolitan residents because downtowns are generally focal points of the regional transit system.

Potential Strategy #8: Jobs/Housing Balance

Another strategy that was considered was *Jobs/Housing Balance.* This strategy is intended to encourage employers to locate in areas where there are significantly more residents than jobs and add housing development near employment centers. It was not possible to draw any definitive conclusions about the ability to increase emission reductions as a result of government policy interventions designed to affect the ratio of jobs per household within an given geographic area. Quantitative studies on this topic are limited, and the literature is contradictory in its conclusions. For example, a study by Cervero concludes that a "balance" in the jobs-to-household ratio is associated with a three- to five-percent increase in travel by walking, cycling, and transit.[13] However, research conducted by The Planning Institute concludes that such intervention does not produce any enforceable quantifiable travel-related benefits.[14] It should be recognized that jobs/housing ratio intervention as an emission reduction strategy is dependent upon factors that are often beyond the direct control of individual counties, regional planning agencies, and air districts. As such, this strategy has not been recommended in Chapter 6. One such factor is that jobs must be compatible with the skill-levels and income expectations of nearby residents.

Potential Strategy #9: Pedestrian Facilities

The provision of pedestrian facilities and the similar concept of Traditional Neighborhood Design (TND) represent a development strategy "that emphasizes pedestrian accessibility and the orientation of houses towards narrower, tree-lined, grid-pattern or [otherwise] integrated streets." It combines, on a relatively small, neighborhood scale, "mixed uses and integrated street patterns to create a land use pattern that makes it easier for residents to walk between their houses, jobs, and commercial services."[15]

An area that focuses on the provision of pedestrian facilities, as defined for this project, or TND:

> incorporates a small downtown, or 'town center,' within walking distance of homes, and generally has a higher overall density than in typical suburban neighborhoods. 'A majority of housing units are located within

> a five- to ten-minute walk of the town center, where commercial services and offices are concentrated.'[16] A larger number of townhouse and other multi-family units are provided to meet this objective of locating residences within one-quarter mile (walking distance) of the town center.
>
> Single-family houses are placed somewhat further out from the town center, on somewhat smaller (compared to standard suburban) lots, with front porches closer to the sidewalk and garages typically placed behind the houses, often along alleys. 'Granny flats,' or second units, are sometimes built above the garages.[17]

Table 3-1 compares the characteristics of pedestrian-oriented developments to conventional suburban development. It should be noted that these design features apply also to TODs (Strategy #1); a TOD town center, however, is dominated by a major transit station and intermodal transfer facility. Because of the relatively smaller scale and lack of high-capacity transit, the density of uses, especially employment uses, tends to be lower than in a TOD project.

Table 3-1
FEATURES OF TRADITIONAL NEIGHBORHOOD VS. CONVENTIONAL SUBURBAN DEVELOPMENT[18]

TRADITIONAL NEIGHBORHOOD DESIGN	STANDARD SUBURBAN DEVELOPMENT
° Integrated Streets	° Hierarchical Streets
° Narrower Streets	° Wide Streets
° On-Street Parking & Parking Structures	° Off-Street Surface Parking Lots
	° Parking Lots in Front of Stores
° Shallower Setbacks	° Deeper Setbacks
° Shopping on Main St.	° Strips/Malls
° Mixture of Uses	° Single Uses
° Traffic Calming	° Auto Traffic Flow Optimized

Potential Strategy #10: Interconnected Street Networks

Regarding this strategy, the ARB *Linkage* report notes:

> During the past 20 years, the typical street circulation pattern in developing suburban areas has consisted of a hierarchy of local streets leading to collector streets, and then to major arterials that interconnect sections of a community to each other and to freeways.
>
> Collector and arterial streets, which often provide the only connections between different sections of suburban communities, tend to be quite wide to allow vehicles to travel faster. The typical suburban circulation pattern decreases the number of available routes between trip

> origin and destination points, and places many vehicles on major streets and at signaled intersections during peak hours....
>
> In contrast to the typical suburban street hierarchy, an integrated street pattern provides multiple routes to destinations, reducing the distances between two points. Overall vehicle travel times in integrated street patterns are comparable to the faster-moving arterials due to the shorter distances between various origin and destination points....
>
> Typically found in many older neighborhoods and small towns, integrated street networks have several advantages over typical suburban-style street patterns. They provide a number of route choices, more direct routes for pedestrians and bicyclists as well as cars, and they help to slow vehicle speeds. Slower vehicle speeds create a much safer and more interesting environment for pedestrians and bicyclists to share, and reduce noise impacts from vehicles.[19]

Traffic calming measures--street narrowing, vehicle diverters, pavement treatment to slow traffic--may be an important complement to interconnected streets to ensure that vehicle speeds are not high.

Potential Strategy #11: Strategic Parking Facilities

This strategy actually consists of two measures which may be developed independently or in conjunction with one another.

Parking Supply

This measure entails limiting the amount of parking available to motorists. The purpose of this strategy is to both encourage the use of non-auto modes and to reduce the actual and perceived difficulty of walking between nearby land uses. Restriction of parking needs to be implemented concurrent with alternative transportation options. It is generally recognized that most suburban areas oversupply parking, because they require each use to provide parking at close to its maximum need, and assume little use of non-auto modes. Combined with the fact that each development in suburban areas is generally required to provide its own parking on-site, total parking supply in suburban areas can be nearly twice as great as the peak number of spaces actually utilized.[20] With the shorter walking distances and greater feasibility of transit and other modes that parking supply restrictions would help bring about, the need for parking would be further reduced.

Preferential Parking

This measure consists of reserving parking close to buildings for carpool and vanpool vehicles. Typically it is implemented at major employement sites where the cost, scarcity and distance of parking are

factors that affect employees' commute choice. The visibility of the preferential parking for high-occupancy modes also serves as a marketing tool for such modes. Where a charge for parking exists, carpools and vanpools can be provided with a reduction or elimination of the parking charge. Requirements for the provision of carpool and vanpool spaces should be based on realistic expectations for their use to avoid overallocation and wasting space.

3.4 INDIVIDUAL STRATEGY EFFECTIVENESS

Table B-1 in Appendix B details the quantitative impacts of strategies as provided in the land use and transportation literature. This section provides an assessment of methodologies in the literature studies and an overview of study findings, and suggests which findings warrant the most or least confidence.

The research methods employed in many land use studies do not always fully support definitive conclusions. One reason is that it is difficult to develop, test, and control separate land use strategies to the degree required by rigorous experimental design methodologies. For example, it is hard to find perfectly comparable employers, parking, transit service and employees for a mixed-use site and a comparison site for purposes of studying the unique effects of mixed use development. Multivariate statistical analysis has been used in most studies. Without comparable controls, however, there is no certainty if the land use strategy or some other variables are bringing the observed travel results. Other important variables include traveler characteristics (gender, age, income, etc.) and destination characteristics (parking supply, price, congestion, safety, etc.).

There are other reasons to view land use studies in the literature with some caution. In many cases strategy effectiveness is projected by a model rather than assessed from experience. While models give us some confidence in projected results, they are not completely reliable. Furthermore, sometimes the literature features results of a particular effective case study site. Whether the case study results would be replicated if carried out in other cases, sites or situations is not clear. Finally, there sometimes is a considerable range of results reported for a certain individual strategy. Reasons for the variation are not clear, but likely relate to the setting in which the strategy was implemented, the exact means of implementation or the presence/absence of important supporting variables such as quality of transit service or parking availability and price. For all these reasons, it is best to be cautious in interpreting the results of the literature, especially in projecting likely effects of individual strategies applied separately or on a site-specific basis. At best, the literature suggests potential ranges of effects and identifies variables important to determining outcomes.

One approach for developing the performance goals (described in Chapter 5) that was explored in this study was the use of a literature review of the effectiveness of various individual site-specific land use

strategies. It was concluded that the simple application of travel reduction factors for individual site-specific strategies may be excessively optimistic if used to assess the potential cumulative effectiveness of land use strategies on a community-wide scale. Issues that arose in considering this approach were:

- reduction in impacts if more than one strategy is implemented, due to competing influences on travel behavior;
- published studies tend to focus on the most successful examples and the impacts may be difficult to achieve on average over an entire community; and
- the geographic area examined in the literature may be smaller than the entire area covered by a local jurisdiction, and the strategy would not have the reported impact over the entire jurisdiction.

After examining these issues, it did not seem to be a sound methodology to use the travel reduction factors for individual site-specific strategies from the literature in developing community-scale performance goals. However, the literature review was useful in providing a background regarding what individual strategies could achieve under certain conditions. It is especially important to note that a detailed understanding of what has been reported in other communities is essential to the development of credible strategy recommendations.

Transit-Oriented Design (TOD)

The literature indicates that providing convenient access to transit at residential and commercial developments will result in greater transit use to and from that development. For example, in the San Francisco Bay Area, an analysis was conducted of two neighborhoods located near BART (heavy rail) stations to compare their travel modes for commute and shopping trips.[21] The neighborhoods had similar per capita incomes and about twenty percent of commuters used BART in both neighborhoods. However, the neighborhood with a transit-oriented design (TOD), that had higher densities and a mixture of uses within walking distance of the transit station, had a twenty percent lower drive-alone mode share for commute trips. In addition, less than fifteen percent of BART passengers drove to the BART station.

In regional evaluations, TODs have been found to result in lower VT and VMT. In the LUTRAQ (*Making the Land Use Transportation Air Quality Connection*) study, a model-based forecast was developed for the Portland Metropolitan Region to estimate the impacts of regional and subregional TODs.[22] Regionally, the analysis indicated that TODs could produce a reduction of VT by 7.7 percent and VMT by 13.6 percent, compared to a standard suburb in the region. Within the TODs, the model predicted twenty percent fewer home-based vehicle trips and ten percent greater transit usage in comparison to the standard

suburb in the region. In Central New Jersey, a study of a hypothetical "transit construct" (mixed use centered on a major rail or bus stop) implemented throughout a region indicated that per person vehicle use would decrease by almost thirty percent in the peak periods and twenty-five percent in the off-peak periods compared to the standard suburb.[23] A study of neighborhood design and density using a transportation model in Melbourne, Australia, concluded that reductions of between thirty to fifty percent in neighborhood vehicle travel could be achieved from TOD design.[24]

Compared to modern developments, many areas developed before World War II were more oriented towards transit systems. Studies indicate that there is more transit use and less auto use in these developments. For example, an evaluation of neighborhoods in the San Francisco Bay Area indicates that households in pre-war neighborhoods average twenty percent fewer trips and twenty-five percent fewer auto-driver trips than households in neighborhoods that developed in the post-war era.[25] Although this study did not control for household size, auto ownership, or income (which is twenty-three percent less in the older neighborhoods), it does suggest the possible impact of orienting development patterns to the transit system. A matched-pair analysis of work trips in pre- and post-war neighborhoods in the San Francisco and Los Angeles regions controlled for income, density and transit service, to differentiate the unique effects of land use and street patterns. The study found that transit-oriented neighborhoods have a higher transit mode share in Los Angeles (1.3 percent) and in San Francisco (5.1 percent) than do conventional neighborhoods. Walking and bicycling shares were also higher in Los Angeles (3.3 percent) and San Francisco (6.6 percent).[26]

Overall, it appears TODs reduce solo driving mode shares or vehicle trips within the TOD area by twenty percent to fifty percent at the neighborhood level compared to conventional development patterns. Of course, stronger or weaker effects may actually occur, depending on implementation particulars and site characteristics, the location of the neighborhood within a metropolitan area, and the availability and level of transit service.

Density Near Transit Stations

One element of a TOD is an increased amount and density of development near existing and planned transit stations. (A transit station refers to a rail transit stop or a transit center that is served by numerous bus lines. A bus stop for single routes is not considered a transit station.) A number of studies have found that a factor that leads to greater transit use is the proximity of both the residence and employment site to rail stations.[27] Within walking distance of a rail station, transit use is significantly higher than for the surrounding region or for areas within driving distance of the rail station. Transit share declines as the

distance from rail station increases over 1,000 feet.[28] Density is important to transit use. For example, in two urban areas of Canada, it was found that residents of high-density areas are thirty percent more likely to use transit than other residents located the same distance from the transit station.[29] A survey of housing preferences of high-tech workers in Silicon Valley found that sixty-five percent of the respondents said that they would use rail transit if it was located within one-half mile of both their home and employment site.[30]

The studies are quite uniform in their findings and conclusions. Cervero, JHK & Associates, and Stringham found higher transit use in both residential and employment centers closer to transit.[31] More transit use is also associated with higher density developments when distance from transit is controlled for. While the studies do not control for type of development, traveler characteristics or parking situations at the transit destination, the findings seem to apply across a great variety of developments, which lends some confidence to the results.

The literature suggests a range of increases in transit use can be expected from the strategy. Cervero finds up to about thirty percent of trips among residents near BART are non-auto. Further from BART, the proportion of non-auto trips ranges from a few percent to perhaps fifteen percent depending on the residential area.[32] JHK found residential use of transit declines by 0.65 percent by every 100 feet in distance from transit, and office use declined by 0.75 percent for every 100 feet of distance.[33] Stringham finds that high density residents are thirty percent more likely to use transit at the same distance from rail stations as low density residents; however, the study did not control for characteristics of the residents.[34]

Density Near Transit Corridors

There is less quantitative data on how increasing densities near transit corridors affects travel behavior. (A transit corridor is an arterial or higher level roadway with a series of transit nodes that are no more than 1/2 mile apart and that are served by multiple bus routes and/or light rail lines.) Most prior research efforts have focused on corridor and areawide density associated with high use of rail transit or bus service.[35] An empirical study of the relationship between urban form and transit use found that transit usage triples for each doubling in density.[36] However, these studies did not control for other possible influences on transit use and therefore are more suggestive than conclusive.

Mixed-Use Development

Most studies of mixed-use developments do not control for employee characteristics, parking and other important determinants of travel behavior, so results can not be attributed solely to mixed use. Nevertheless, the studies are quite consistent in suggesting less vehicle trip making associated with mixed use. The Institute of Transportation Engineers finds eight percent trip reduction associated with mixed land uses.[37]

Ewing finds that mixed-use communities generate between 2.3 and 2.8 vehicle hours of travel compared to 3.4 for auto oriented suburban communities.[38] JHK found a major mixed-use suburban activity center had seven percent transit use and twenty-five percent midday walk trips, which is significantly higher than typical suburban centers which had one percent transit and sixteen percent midday walk trips.[39]

A study by the Urban Land Institute does not directly address vehicle trip rates, but does indicate a high proportion of trips generated at mixed-use developments are amenable to non-auto use. In suburban settings, twenty-eight percent of trips from mixed-use developments were to nearby services and shopping, as compared to nineteen percent for non-mixed-use developments. In mixed-use developments in CBDs, sixty-one percent of trips were to nearby uses (compared to twenty-nine percent in non-mixed-use developments).[40] These findings suggest mixed use generates many more trips amenable to walking and cycling than non-mixed uses. Overall, it appears that a reduction on the order of eight percent might be possible at a site or within a neighborhood.

Infill and Densification

Prior research suggests that an increase in density can have an impact on travel behavior even if the increase in density is not within TODs or transit corridors. Several sources indicate that increasing residential density or increasing employment density will result in less auto travel per person and household.[41] In a study of San Francisco Bay Area communities, a doubling in residential density was associated with twenty to thirty percent less VMT per household.[42] A study of households in five neighborhoods in the San Francisco Bay Area found that higher densities were positively correlated with the percent of trips made by non-motorized modes of travel.[43] Similar results were found in an analysis of the 1990 National Personal Transportation Survey, but indicated that density increases at the lowest levels (e.g., from 1,300 to 2,700 persons/square mile) had no effect.[44] Much less use of single-occupant vehicles was found at employment densities greater than seventy-five employees/acre and at residential densities greater than fifteen persons/acre.[45] Overall, we may be reasonably confident that this strategy reduces vehicle trip making. Density can be a surrogate for urban characteristics such as mixture of uses, availability of transit services, and average income, to name a few.

Concentrated Activity Centers and Strong Downtowns

Because of the many similarities between these two strategies, much of the literature on activity centers applies to both concentrated activity centers and downtowns. They are therefore combined for discussion here. Studies have shown that developing activity centers and strong downtowns with a mixture of uses can result in significant reduction in vehicle use for internal trips. One study of six large-scale, multi-use suburban activity centers found that the larger the center, the greater the percentage of internal trips.[46]

However, the compactness of the development and pedestrian design features impact the mode of travel for internal trips. The clustering of land uses was found to significantly reduce vehicle trip generation by up to sixty-five percent for non-residential uses and forty-five percent for residential uses.[47] In a study of employee travel, mixing of uses increased the use of nearby facilities by nine percent in suburban areas and over thirty percent in the downtown.[48] Overall, developing activity centers can increase the percentage of trips that are internal to the center, but, to significantly reduce vehicle travel, the center must be compact with clustered, mixed uses that are pedestrian accessible. Activity centers can also act as a node or transfer center for transit service.

Jobs/Housing Balance

There are limited and somewhat contradictory quantitative studies in the literature on this topic making it difficult to draw any definitive conclusions. For example, one study of fifty-seven areas concludes that a balance in jobs/housing is associated with three of five percent greater share of travel by walking, cycling and transit.[49] However, other research concludes that the strategy does not bring any significant travel-related benefits.[50] Jobs/Housing balance encompasses factors that are often beyond the direct control of cities and counties within their individual jurisdictions.

Pedestrian Facilities

The literature indicates that locating services and/or residences within walking distance of each other and providing adequate pedestrian facilities is associated with a greater walk mode share.[51] A study of pedestrian-oriented neighborhoods with similar per capita incomes located near BART stations in the San Francisco Bay Area found that twelve percent walked to supermarkets, fifteen percent fewer people drove to BART, and there were twenty percent fewer drive-alone trips.[52] The "walking construct" model developed by the Middlesex-Somerset-Mercer Regional Council projected eighteen percent fewer daily vehicle trips in PODs.[53] An empirical study of American walking behavior found that a pleasant/interesting environment can perhaps double the distance people are willing to walk.[54] A study of "pedestrian environment factors" in the Portland metropolitan region found that the pedestrian environment is a significant factor in explaining auto use.[55] Overall, the strategy might bring as much as twenty percent less use of autos within a particular development or neighborhood, though confidence in the finding must be tempered by the scarcity of controlled studies.

Interconnected Street Networks

Studies of this strategy are limited. The available research includes only modeling exercises or empirical studies without controls; however, the literature does suggest that providing an interconnected street network, such as a gridded street pattern, rather than cul-de-sacs and dead-end streets, can result in lower

VMT due to access to more direct routes of travel. Friedman finds twenty-five percent fewer auto driver trips per household comparing pre-World War II and post-World War II neighborhoods, but fails to control for household or traveler variables.[56] Kulash predicts a forty-three percent reduction in VMT at the community scale, but the results are drawn from a model study that compares grids with cul-de-sacs.[57] Until more controlled studies are conducted for this strategy, it will be difficult to reach conclusions with confidence about the magnitude of effectiveness. Current work indicates the range of effect might be up to a forty-three percent reduction in VMT in the immediately affected area.

Strategic Parking Facilities

A number of studies have found that parking supply impacts mode shares and the amount of vehicle travel.[58] One study found that when a parking lot was closed in an urban area in the Netherlands, there was a shift from single-occupant vehicles to transit and carpooling. In the short run, however, there was also an increase in emissions and VMT as a result of vehicles searching for parking.[59] Another study found that when alternate travel modes were available and relatively easy to access, vehicle use was reduced and therefore less parking is needed.[60] In a study of parking supply and parking pricing at hospitals in San Francisco, the amount of parking supplied was about one-third as important in predicting mode share as the cost for parking.[61] When parking supply was decreased and parking fees were increased at a school campus in Massachusetts, it was found that most of the impact on parking demand came from the reduction of parking spaces.[62]

3.5 CHAPTER ENDNOTES

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[5]. Ibid.

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Chapter 4. EXISTING LAND USE AND TRANSPORTATION CONDITIONS

To provide a basis for developing the performance goals (described in Chapter 5), a number of sources of information were used. These included travel and land use data for California communities, case study evaluations of selected California communities, and travel and land use data for non-California communities.

4.1 DESCRIPTIONS OF COMMUNITY TYPES

The results of this research project are designed to be applicable to a wide variety of situations, rather than solely for a specific project or community. For this reason, three community types were identified and analyzed separately throughout the research project: urban, suburban, and exurban/rural. While there is significant variation in the characteristics of communities within each of these community types, the availability of data on strategy effectiveness did not allow for further stratification of the community types. This is an area that would benefit from additional research.

A summary description for each of the community types is provided in Tables 4-1 through 4-3. These descriptions are provided as general guidelines and do not have to be rigidly applied in determining a community type, which is somewhat subjective for each jurisdiction. This is especially true for a locality that may be in transition from one community type to another (e.g., from suburban to urban). In addition, some jurisdictions may contain both urban and suburban subareas. The timeframe being examined could impact the community type selected for such a transitional community, e.g., a 20-year timeframe vs. a 5-year period.

There are places that do not precisely match the characteristics described for each community type. In these cases, the function of the communities should guide the selection of the appropriate community type rather than size, centrality, density, or age of the community. Function refers to the type and complexity of uses found in the community and reflects whether the uses serve regional or local needs. Urban communities contain multiple, complex uses that serve regional needs, regardless of their size or density. In comparison, a suburban community may be a similar size and density to an urban community, but contain primarily residential uses and local-serving uses. Centrality refers to the location of a community relative to a central city and/or metropolitan area.

Table 4-1
DESCRIPTION OF AN URBAN COMMUNITY

FUNCTION:
- Full-range of uses, especially region-serving "high-order" functions in business and government; complex social, economic, and political life

SIZE:
- 50,000 population (Census threshold for MSA Central City);* or
- 200,000 population contiguous metropolitan area (ISTEA)

CENTRALITY:
- Primary and secondary central cities

DENSITY:
- Usually 10 dwelling units/net residential acre** or more

AGE/ERA DEVELOPED:
- World War II, in the central city

Table 4-2
DESCRIPTION OF A SUBURBAN COMMUNITY

FUNCTION:
- Limited range of uses compared to an urban community. Residential uses are predominant and most retail and public land uses serve local needs, although some region-serving retail and employment may be present

SIZE:
- Under 50,000 population (Census); or
- 50,000 - 200,000 population contiguous area (ISTEA)

CENTRALITY:
- Located within a Metropolitan Area centered on an urban area (as defined above)

DENSITY:
- Usually less than 10 dwelling units/net residential acre

AGE/ERA DEVELOPED:
- Post-WW II

Table 4-3 (continued)
DESCRIPTION OF A RURAL/EXURBAN COMMUNITY

FUNCTION:
- Limited range of uses, with agriculture, extractive industries, and open space predominant ("rural");
  °In some areas, recreational, retirement, and residential uses are growing, even dominant aspect of local economy ("exurban")

SIZE:
- Scattered settlements ² 2,500 population (Census); or
- Under 50,000 population contiguous area

CENTRALITY:
- Outside of a Metropolitan Area

* MSA = Metropolitan Statistical Area

** "Net residential acre" excludes streets, open spaces, commercial and other non-residential uses.

Sources: 1990 U.S. Census; ISTEA: Intermodal Surface Transportation Effiency Act Efficiency Act; Advisory Committee; JHK & Associates.

One criterion for community classification is density. There are many ways to measure density when examining a community. Density for residential areas can be expressed for population or households, and can be measured according to gross acres (total land area) or net acres (not including open spaces, streets and non-residential uses). A comparison of density measurements, on average, for some California communities is provided in Table 4-4.

4.2 EXISTING CONDITIONS IN CALIFORNIA COMMUNITIES

Travel characteristics for twenty-six California communities that were examined in a study conducted by John Holtzclaw are used as representative examples for this research project. The communities described represent urban, suburban, and exurban communities and are located in the San Francisco, Los Angeles, San Diego, and Sacramento Areas. The data presented were taken from a study that examined odometer data (from the California Bureau of Automotive Repair) according to a number of detailed neighborhood descriptors[1].

Three of the four neighborhood descriptors provided in this report are summarized in Table 4-5: residential density, pedestrian accessibility, and transit service. Residential density is the number of households per net residential acre, excluding vacant units. (A net residential acre includes land for residential uses and excludes streets, open space, and commercial uses.) Pedestrian accessibility is a measure of neighborhood qualities that make a community inviting and safe to walk in. This index varies between zero and one and the qualities evaluated include the fraction of through streets, fraction of roadway with less than a five percent grade, fraction of the blocks with sidewalks, fraction of the streets that are traffic controlled, and average building setback from the sidewalk. The transit service index measures the number of transit vehicles and seats within walking distance of dwellings on a twenty-four hour basis. An index of neighborhood shopping, a measurement of the percent of residences with at least five critical local commercial establishments within one-quarter mile walking distance, was not summarized. The development of the qualitative ratings criteria is described in Appendix C.

Table 4-4
COMPARISON OF AVERAGE DENSITY MEASUREMENTS

	POPULATION DENSITY (Population Per Acre)	NET POPULATION DENSITY (Population Per Residential Acre)	NET HOUSEHOLD DENSITY (Households Per Residential Acre)	RESIDENTIAL DENSITY (Dwelling Units Per Residential Acre)
URBAN COMMUNITIES				
northeast San Francisco	49	200	101	110
central City of Sacramento	8	42	22	24
San Francisco (entire city)	24	114	48	52
central Berkeley	12	34	16	16
southwest Bevery Hills	19	27	14	14
Rockridge (Oakland)	8	21	10	10
east Sacramento/North Land	7	17	8	8
Park	15	28	15	16
southern Santa Monica	16	70	24	26
southern Long Beach	14	24	12	13
Uptown San Diego				
Urban Average	**17**	**58**	**27**	**29**
Average Ratio to Population Density	**1**	**3**	**2**	**2**
SUBURBAN COMMUNITIES				
Alameda	10	29	12	13
south central Pasadena	14	22	10	11
Daly City	15	47	15	16
south Sacramento	9	19	7	7
central Downey	11	17	7	7
Alhambra	17	25	9	9
Escondido	2	11	4	4
Walnut Creek	5	11	5	5
Lafayette	2	6	2	2
Clairemont	9	16	6	7
northern Riverside	5	15	5	6
San Ramon	2	8	3	3
Los Altos/Los Altos Hills	2	5	2	2
Moreno Valley	4	12	4	4
La Costa	2	10	4	4
Suburban Average	**7**	**17**	**6**	**7**
Average Ratio to Population Density	**1**	**2**	**1**	**1**
EXURBAN COMMUNITIES				
Morgan Hill	2	7	2	2
Exurban Average	**2**	**9**	**3**	**3**
Average Ratio to Population Density	**1**	**4**	**1**	**1**

Source:John Holtzclaw, *Using Residential Patterns and Transit to Decrease Auto Dependency and Costs*, June 1994. Grouped and annotated by consultant team and ARB staff.

Table 4-5
CHARACTERISTICS OF SAMPLE COMMUNITIES IN CALIFORNIA

COMMUNITY and LOCATION	RESIDENTIAL DENSITY	PEDESTRIAN ACCESSIBILITY	TRANSIT SERVICE
URBAN COMMUNITIES			
northeast San Francisco (Nob, Russian and Telegraph Hills; Chinatown; North Beach and Fisherman's Wharf [central S.F. near downtown])	highest in the state	extremely high	extremely high
central Sacramento (near downtown)	medium	moderate	high
San Francisco (entire city) (Central city of the Bay Area region)	high overall	high	extremely high
central Berkeley East of San Francisco (East Bay)	medium	very high	very high
southwest Beverly Hills (6 miles west of downtown Los Angeles)	low to medium	extremely high	moderate
Rockridge (Area of North Oakland/South Berkeley)	low to medium	very low	very high
east Sacramento and north Land Park (Adjacent to central city, to the south and east)	low	moderate	low
southern Santa Monica (15 miles west of downtown Los Angeles)	medium	very high	high
southern Long Beach 20 miles south of downtown Los Angeles	medium to high	extremely high	high
Uptown San Diego Pedestrian-oriented development near downtown San Diego	overall medium	moderate	moderate
SUBURBAN COMMUNITIES			
Alameda (west of Oakland)	medium	high	low
South Central Pasadena (9 miles northeast of downtown Los Angeles)	low to medium	moderate	low
Daly City (Just south of San Francisco)	lower	very low	moderate
south Sacramento (5 to 10 miles south of downtown Sacramento)	low	extremely low	extremely low
central Downey (10 miles southeast of downtown Los Angeles)	low	low	very low

Table 4-5 (continued)
CHARACTERISTICS OF SAMPLE COMMUNITIES IN CALIFORNIA

COMMUNITY/LOCATION	RESIDENTIAL DENSITY	PEDESTRIAN ACCESSIBILITY	TRANSIT SERVICE
Alhambra (6 miles east of downtown L.A.)	low to medium	high	low
Escondido (25 miles north of downtown San Diego)	low	very low	very low
Walnut Creek (10 miles east of Oakland)	low	very low	high
Lafayette (Adjacent to and just west of Walnut Creek)	overall low	extremely low	moderate
Clairemont (5 miles north of San Diego)	low	very low	very low
northern Riverside (50 miles east of downtown Los Angeles)	low	very low	extremely low
San Ramon (10 miles south of Walnut Creek)	very low	very low	extremely low
Los Altos/Los Altos Hills (10 miles west of San Jose)	very low	extremely low	very low
Moreno Valley (Immediately east of Riverside; 50 miles east of downtown LA)	very low	low	extremely low
La Costa (27 miles north of downtown San Diego; southeast corner of City of Carlsbad)	low	extremely low	extremely low
EXURBAN COMMUNITIES			
Morgan Hill (20 miles south of downtown San Jose)	low	low	very low

Source: John Holtzclaw, *Using Residential Patterns and Transit to Decrease Auto Dependency and Costs*, June 1994, Appendix Tables 5 and 6.
Grouped and annotated by consultant team and ARB staff.

Notes: The qualitative ratings criteria presented in this table are described in Appendix B-1.

4.3 CASE STUDIES OF CALIFORNIA COMMUNITIES

To more closely examine the relationship between travel behavior and land use characteristics, eight communities in California were examined as case study sites. The data presented for these case studies were obtained from phone interviews with city planners at each community, travel survey data available from the regional metropolitan planning organization (MPO), odometer data, and personal knowledge of the communities by members of the consultant team. The development and transportation/parking characteristics for each of the case study communities are described below. The use of the case study information in the development of the strategy recommendations is described in Chapter 6 of this report.

Northeast San Francisco

Development: Northeast San Francisco includes the communities of Nob, Russian and Telegraph Hills, North Beach, and Fisherman's Wharf. It is the highest density area in the San Francisco region and functions as a residential, cultural, and social center. Infill and densification have increased over the past twenty years as the city both revitalized and densified areas around transit stations when the rapid rail system (BART) was developed in the 1970s. Northeast San Francisco is within easy walking distance to the downtown business and commercial center.

Transportation/Parking: The street network is in a grid pattern, but some are steep or discontinuous at hillsides. Residents of this area average roughly 5,500 VMT per household (HH) per year. Pedestrian facilities include wide sidewalks, sidewalk level building entrances and crosswalks with pedestrian-actuated signals. Parking charges range from $3.00 to $10.00 per day, based on monthly parking rates. One-day parking charges are as high as $14.00 to $18.00. The area is well served by a regional rapid rail system (BART), the city transit system (which includes trolley buses and cable cars), and transit services (including ferries) from other counties in the region.

Greater San Francisco

Development: San Francisco is the primary city in the metropolitan region and has an overall density of 9.7 dwelling units (du) per gross acre. Commercial uses line many of the transit corridors and residential units fill areas between these corridors. Most residences are within a half-mile of schools and neighborhood businesses. Setbacks are small in residential areas and non-existent in commercial areas. Shopping districts are located in concentrated activity centers throughout the city. Because the city is built out, new construction takes the form of redevelopment, intensification or infill. Office, commercial and residential uses are replacing older industrial uses. The city has significantly more jobs than housing.

Transportation/Parking: The entire city street pattern is a connected grid with pedestrian walkways connecting discontinuous streets. Travel surveys indicate there are about 1,270 VT and 5,950 VMT per

HH per year, and 40 percent auto-driver mode share. A network of transit routes connects city residents and transfers commuters to employment centers throughout the city. There are a number of BART stations in the city. Parking in residential areas generally is controlled by preferential permit programs.

Oakland

Development: Oakland is a business and government center, with many regional, state, and federal offices. It is also a social and cultural center. Oakland's overall density is 4.3 du per gross acre and density is higher than this average near transit corridors and stations. Residential uses are adjacent to commercial areas and, in some cases, within the same blocks as commercial and industrial uses. The city has several activity centers outside of the downtown, but is also attempting to strengthen its downtown with the development of City Center, an office-retail complex around a rapid rail (BART) station. The city is developing middle-income housing next to City Center and is working to retain industrial uses employing residents of older neighborhoods. The city is built out, so most development is in the form of redevelopment, re-use or infill. There is an even balance of jobs and housing citywide.

Transportation/Parking: The city is connected by an integrated network of streets. The street pattern is a mixture of radiating arterials from downtown combined with a grid pattern. The downtown features wide sidewalks, pedestrian-actuated signals and building entrances off sidewalks. There are roughly 1,710 VT and 10,770 VMT per HH per year, and 55 percent auto driver mode share according to travel surveys. The downtown is well served by BART and a regional bus system (AC Transit). Parking prices downtown range between three and seven dollars per day on average.

Southern Long Beach

Development: Southern Long Beach provides business and social functions for the region. Much of the commercial activity is well distributed along major streets. The city is surrounded by the ocean and other developed areas, so new development is in the form of infill, densification, or redevelopment. The city's southern portion has a net residential density of 25.5 du per net residential acre (residential areas only, not including streets), and medium to high density housing is widespread throughout the community.
Transportation/Parking: The city street pattern is a regular and complete grid. It is one of the most pedestrian-oriented communities in the Los Angeles area, and most streets have sidewalks with few hillsides. According to odometer reading data, there are 15,252 VMT per household per year in Southern Long Beach. The community is served by local and regional bus routes,[2] and a light rail line connects Long Beach to downtown Los Angeles.

Daly City

Development: Daly City primarily serves as a residential suburb of San Francisco, although some business, employment, and region-serving retail are present. Overall density for the city is 17 du per gross

acre and single family housing predominates. Lots are small (some as small as 2,500 to 3,000 square feet) and many units have been converted to accommodate two or three households. Some development is mixed use with retail on the ground floor and apartments above. In some blocks, a shopping center is located at one end with condominiums at the other. Two regional malls and several smaller malls are located in the city. The city is surrounded by the ocean, parks and developed areas, so new development is in the form of infill, densification or redevelopment. The city has more housing than jobs as it serves primarily as a residence for people working in San Francisco or at the San Francisco Airport.

Transportation/Parking: The city street pattern is in the form of a grid. The city has wide sidewalks and pedestrian activated signals. City plans include addition of landscaping, street furniture and signs to improve pedestrian amenities downtown. Travel surveys indicate that there are approximately 1,920 VT and 14,500 VMT per HH per year, as well as a 59 percent auto-driver mode share. Parking is priced through meters on the main commercial thoroughfare, but elsewhere is free. Supply is ample at shopping malls but tight on the main commercial thoroughfare.

Richmond

Development: The city is not a major employment center and more people live in the city than work there. The city is nearly built out, so most development is infill, densification or redevelopment. Overall density for the city is 8 du per gross acre, with denser development concentrated near transit stations and corridors. Commercial and residential districts border each other and most residents live within a mile of shops and transit routes. A mall and strip commercial areas within the city and Richmond has obtained designation as a federal enterprise zone.

Transportation/Parking: The downtown and older portions of Richmond have a grid street pattern. Winding streets and cul-de-sacs are found at waterfront and hillside developments. The downtown and other older portions of town have wide sidewalks and crosswalks. According to travel surveys, there are about 1,930 VT and 14,540 VMT traveled per HH per year, and 63 percent auto-driver mode share. Free or low cost parking is provided downtown and in the strip commercial areas. The regional shopping mall provides ample free parking.

Alhambra

Development: This residential community located six miles east of downtown Los Angeles is primarily low to medium density. Most of the shopping activity is concentrated in the older downtown, in a regional shopping center, and along two main arterials.

Transportation/Parking: The street system is not interconnected with the southern area of Alhambra cut off by the San Bernardino Freeway. Other areas have curvy and dead-end streets. Pedestrian access is made difficult in places by the absence of sidewalks, long blocks, and the lack of four-way stop signs or stoplights at many intersections. The community is served by thirteen bus routes.[3] According to odometer data, each household averages 21,660 VMT annually.

Mill Valley

Development: Mill Valley is a residential suburb. More people live in the city than work there, with most residents commuting to San Francisco or to nearby towns. The overall density is two du per gross acre, with downtown apartment density at 29 du per acre. Mixed use is not prevalent. The downtown is the primary shopping area but is not a major employment center. The city is surrounded by public open space and other development. Infill, densification and redevelopment are the only forms of development.

Transportation/Parking: Downtown streets form a grid pattern, while outside downtown, roads wind up canyon areas. Pedestrian facilities are good downtown and are connected to areawide hiking trails. Travel surveys indicate that there are about 1,700 VT and 14,150 VMT per HH per year, and 60 percent auto-driver mode share. Downtown parking is metered and the parking supply appears adequate, but not excessive compared to demand.

Fairfield

Development: Fairfield functions as a residential suburb. More people live in the city than work there. A local military base employs many people but access between it and residential areas is limited. Density is 1.3 dwelling units per gross acre and density does not vary much by proximity to transit. Residential and commercial uses are separated with most residences located more than a mile from shops. The downtown is not a major employment center. Commercial uses are located downtown and in suburban style centers. The city is not built out and much of the new development is in newly developed areas. However, the city has joined with neighboring cities and Solano County in adopting a greenbelt plan separating city developments.

Transportation/Parking: The city has a connected street grid system. The downtown has spacious, tree lined sidewalks and buildings oriented toward the street. According to travel surveys, there are roughly 2,500 VT and 19,980 VMT per HH per year, and 72 percent auto-driver mode share. Parking is inexpensive downtown and free elsewhere in the city.

Moreno Valley

Development: Moreno Valley functions as a residential suburb. More people live in the city than work there. Most residents commute to Irvine, Los Angeles or employment along regional freeways. Overall density is 1.1 du per gross acre and only half of the city's 52 square miles are developed. Mixed use is rare, and residents are more than a mile from commercial uses. Sunnymeade (the older downtown) is a two-mile, auto-oriented retail strip. Residents of Sunnymeade are within a half mile of stores, but pedestrian access is difficult. Plans are underway to allow residential uses on the commercial boulevard and to create mid-block connections between the boulevard and residential areas. The city contains a regional mall and community shopping centers. The city has room to grow and little incentive to build adjacent to existing development.

Transportation/Parking: Sunnymeade and the two older neighborhoods have grid streets. Sunnymeade has no sidewalks and long blocks make pedestrian access difficult between residential and commercial areas. According to odometer reading data collected by John Holtzclaw,[4] there are approximately 28,700 VMT per household per year in Moreno Valley. Newer neighborhoods have meandering streets, cul-de-sacs, and sidewalks. Parking is free and plentiful.

4.4 COMMUNITIES OUTSIDE OF CALIFORNIA

Travel and land use data were examined from communities outside of California to provide a basis of comparison for the characteristics found in California. Portland, Oregon, and some Canadian cities were selected as a focus because there are similarities to California communities in the age of the cities and in their development patterns. However, Portland and many Canadian cities have maintained higher transit use and have achieved higher densities of development. Therefore, they serve as potential models of improvement for California communities.

The travel and land use characteristics for Portland and several cities located in eastern Canada are described in this section. The reported travel characteristics for the Canadian cities are based primarily on the report *The Implications of Demographic and Socioeconomic Trends for Urban Transit in Canada: Case Studies Technical Appendix* prepared by Tranplan Associates for the Canadian Urban Transit Association, December 1991. Included are the two largest metropolitan areas in Canada: Toronto and Montreal. In general, Canada followed the U.S. trend away from public transportation and toward the

private automobile during the middle portion of this century, but Canadian cities had the opportunity to observe the impacts of extensive freeway building and less dense development sprawl. The unpopularity of freeway projects, and increased awareness of environmental impacts, led to renewed interest in public transit and transportation/land use interaction.

The Canadian cities described in this section were selected based on the ready availability of data. In each case, the geographic boundary for a location was based upon the service area for the primary public transit provider. As such, all information provided is for the area within the transit service area, and not necessarily the entire metropolitan region. A summary of the key travel and land use characteristics for these locations is presented in Table 4-6. A description of each city is presented below.

Portland

The Portland metropolitan region is the largest urban area in the State of Oregon. In 1988, the population of the Portland metropolitan region was approximately 1.3 million with an average of 2.5 persons per household.[5] The region has areas with high residential density and areas with low residential density. Portland has a strong downtown that is an employment and retail center and is well served by transit. There is a transit mall in downtown Portland that is serviced by buses and light rail, and transit use is free within the downtown.

Table 4-6
LAND-USE AND TRAVEL CHARACTERISTICS FOR SELECTED CANADIAN CITIES

CITY	COMMUNITY TYPE	POPULATION (1986)		DAILY PER PERSON VEHICLE TRIP RATE
		TOTAL	DENSITY (PER SQ. MILE)	
Montreal Island	Urban	1,734,156	9,000	1.0
Quebec City	Urban	460,000	2,900	1.4
Toronto	Urban	2,192,721	9,000	1.5
Ottawa-Carlton	Urban/Suburban	567,409	4,100	1.8
Suburbs of Montreal:				
South Shore	Suburban	336,000	3,700	1.4
Laval	Suburban	284,000	3,300	1.5
Mississauga	Suburban	359,948	3,300	1.5
London	Suburban	276,000	4,000	1.8
St. Catherines	Suburban	140,000	3,400	1.9

Source: Tranplan Associates, *The Implications of Demographic and Socioeconomic Trends for Urban Transit in Canada: Case Studies Technical Appendix*, prepared for the Canadian Urban Transit Association, December 1991.

In a study of pedestrian accessibility issues,[6] the pedestrian friendliness of an area was measured using "pedestrian environment factors" that range from 4 to 12. The pedestrian environment factor was uniquely defined for this study and values were assigned to each traffic analysis zone in the region, with 12 representing the most pedestrian-friendly areas. (These values do not correspond to the values developed by John Holtzclaw). A comparison of the travel characteristics between those areas with a pedestrian environment factor of 12 and the total region is provided below.

	VEHICLE TRIPS PER HOUSEHOLD PER YEAR	**VMT PER HOUSEHOLD PER YEAR**
Pedestrian Environment Factor = 12	1,500	6,200
Portland Region	2,000	10,600

The areas with a pedestrian environment factor of 12 include downtown Portland and the downtowns of some of the older cities in the region. These areas tend to have the highest densities, the most mixture of uses, and the best transit service. In the downtown, about forty percent of the person trips are by auto drivers during peak commute hours.

Montreal

The Montreal region is the second largest urban area in Canada and is located in the Provinceä of Quebec. Montreal Island is located within the banks of the St. Lawrence River and encompasses approximately 500 square kilometers (sq. km.). The City of Montreal is the focal point of the Island, although twenty-seven additional municipalities are located on the island. Montreal has a large and vital downtown core that is the main employment focus in the Greater Montreal Area. In 1986, the population of Montreal Island was estimated to be over 1.7 million with an average population density of 3,475 persons/sq. km (9,000 persons/square mile). Densities on the Island, however, vary significantly: from less than 400 persons/sq. km. (1,040 persons/square mile) in the western portion of the island, to as high as 35,880 persons/sq. km. (93,000 persons/square mile) in the central districts of Montreal city. Interestingly, the average household size is much higher in the western districts than the central districts.[7]

Montreal Island is served by an extensive bus system and heavy rail service (a subway with limited commuter rail service). Public transportation carries approximately 34 percent of the daily person trips in the region. Based on the reported rates for the number of trips by a motorized mode and assumed average vehicle occupancy, the average daily per person vehicle trip rate was calculated as 1.0. The high transit use and low vehicle trip rate are reflective of the low auto ownership rate, compared to the United States, of

under 370 vehicles per 1,000 people and a parking availability rate of less than 80 spaces per 1,000 jobs in the central area. The auto ownership rate in the United States in 1990 was 690 vehicles per 1,000 people.[8]

Quebec City

Quebec City is also located in the Province of Quebec along the St. Lawrence River. The reported data for Quebec City include the city and its environs that are served by the Quebec Urban Community Transit Commission. The population of the Quebec City area was approximately 460,000, with an average density of over 1,120 persons/sq. km. (2,900 persons/square mile). The average daily per person vehicle trip rate for Quebec City was 1.35 VT per person. Transit accounts for 18 percent of the daily person trips.[9]

Toronto

Toronto is the largest urban center in Canada, serving as its most important commerce and trade center. The population of the Toronto urban area served by the primary public transit provider is approximately 2 million. The population of the entire Toronto metropolitan area is closer to 3 million. Toronto is often viewed as a model of how transit and land use can be effectively integrated. Urban density and transit use are high by North American standards. Between 1960 and 1980, Toronto increased population density and transit use, quite contrary to the trends experienced in U.S. and Australian cities. The average density of the Toronto urban area is 3,500 persons/sq. km. (9,000 persons/square mile), and census tracts within the central core of Toronto have densities as high 54,500 persons/sq. km. (141,000 persons/square mile). Densities of population and employment are approximately three times higher in Toronto's suburbs than in the suburban areas of the U.S.'s ten largest metropolitan areas.[10]

Metropolitan Toronto is served by an integrated transit system of buses, trolley coaches, streetcars and subway routes. The Greater Toronto area is also served by commuter and light rail service. This transit system serves approximately 28 percent of the daily trips in the Toronto area. The downtown core of Toronto has approximately 7 percent of the metropolitan area's population, and 31% of the jobs. Parking availability in the downtown core is only 210 spaces per 1,000 jobs. Over 80 percent of all trips into the downtown core area are by transit. At retail centers located near suburban rail stations, about 24 percent of all customers arrive by modes other than automobile. Vehicle use is comparatively low, despite auto ownership levels as high as in Australia and many U.S. cities (493 vehicles per 1,000 people). The estimated daily vehicle trip rate is 1.50 VT per person.

A 1986 travel survey conducted in the Greater Toronto Area also provides information on distances traveled by automobile.[11] By converting kilometers to miles, it was estimated that average daily vehicle travel by residents of central Toronto is 5 VMT, and by residents of outer suburban Toronto is 11 VMT

per person. In comparison to American suburbs, Toronto suburbs experience half as much VMT per person.[12]

Ottawa

Ottawa is the national capitol of Canada with a strong downtown core focused on federal government activities. The combined region of Ottawa/Carleton had a population of 567,409 in 1986. The central area has a compact urban form, while the newer suburban municipalities are characterized by auto-oriented subdivisions and shopping malls. Densities in the central core are as high as 11,500 persons/sq. km. (30,000 persons/square mile), while those in the outlying areas fall below 500 persons/sq. km. (1,300 persons/square mile). The average density for the region is 1,589 persons/sq. km. (4,100 persons/square mile). There is extensive bus service to the region, including express service on exclusive busways. Twenty-one percent of the daily trips are by transit. The average daily trip rate for the region is 1.9 VT per person.[13]

South Shore

South Shore includes the suburban communities south of Montreal that are served by the STRSM transit service. The South Shore area includes some key activity centers, such as Longueuil, but Montreal is the urban focal point for the entire region. In 1986, the area's population was 336,000. The areas closest to Montreal have high densities, but these get progressively lower as development spreads southward. Population densities varied from 120 to 19,500 persons/sq. km. (310 to 50,000 persons/square mile), with an average of just over 1,400 persons/sq. km (3,600 persons/square mile). Transit service is primarily provided via a bus system, although heavy rail service into Montreal is available. The average daily vehicle trip rate is 1.4 VT per person.[14]

Laval

Laval is a suburban community located just north of Montreal. In 1986, the area's population was 284,000. The average population density for the area was 1,268 persons/sq. km. (3,300 persons/square mile), varying from 30 to 9,300 persons/sq. km. (80 to 24,000 persons/square mile). Transit service is primarily provided via a bus system although heavy rail service is provided into Montreal. The average daily vehicle trip rate is 1.5 VT per person.[15]

Mississauga

Mississauga is a suburban area located just west of Toronto. In 1986, the area's population was approximately 360,000. Population densities varied from 50 to 11,200 persons/sq. km. (130 to 29,000 persons/square mile), with an average of just over 1,260 persons/sq. km. (3,300 persons/square mile). Transit service is primarily provided via a bus system although heavy rail service is provided into Toronto. The average daily vehicle trip rate is 1.5 VT per person, the same as that for neighboring Toronto.[16]

London

London is located approximately 200 kilometers southwest of Toronto. The London Transit service area had a population of 276,000 in 1986, with an average density of 1,560 persons/sq. km. (4,000 persons/square mile). Densities varied from 300 to 6,050 persons/sq. km. (780 to 15,700 persons/square mile). Transit service is provided via a bus system and accounts for 10 percent of daily trips. The average daily vehicle trip rate is 1.4 VT per person.[17]

St. Catherines

The City of St. Catherines is located about 10 miles from Niagara Falls on the south shore of Lake Ontario, across from Toronto. The population of St. Catherines was 140,000 in 1986. Population densities varied from 45 to 3,470 persons/sq. km. (120 to 9,000 persons/square mile), with an average of just under 1,300 persons/sq. km. (3,400 persons/square mile). The bus-based transit service accounted for 5 percent of the area's daily trips. The average daily vehicle trip rate was 1.5 VT per person.[18]

4.5 CHAPTER ENDNOTES

ISTEA: Intermodal Surface Transportation Efficiency Act

1 John Holtzclaw, *Using Residential Patterns and Transit to Decrease Auto Dependence and Cost,* prepared for the Natural Resources Defense Council, June 1994.

2 Ibid.

3 Ibid.

4 Ibid.

5 Cambridge Systematics, Inc. and Calthorpe Associates, *Existing Conditions,* Volume 2, Making the Land Use Transportation Air Quality Connection, prepared for 1000 Friends of Oregon, October 1991.

6 Parsons Brinkerhoff Quade and Douglas, Inc. with Cambridge Systematics, Inc. and Calthorp Associates, *The Pedestrian Environment,* Volume 4A, Making the Land Use Transportation Air Quality Connection, prepared for 1000 Friends of Oregon, December 1993.

7 Tranplan Associates, *The Implications of Demographic and Socioeconomic Trends for Urban Transit in Canada: Case Studies Technical Appendix*, prepared for the Canadian Urban Transit Association, December 1991.

8 Patricia S. Hu and Jennifer Young, *Summary of Travel Trends, 1990 Nationwide Personal Transportation Survey,* Center for Transportation Analysis, Oak Ridge National Laboratory, prepared for the Federal Highway Administration, March 1992, p. 6.

9 Tranplan Associates.

[10] Ibid.

[11] *The Transportation Tomorrow Survey: Travel Survey Summary for the Greater Toronto Area*, prepared by the Data Management Group of the University of Toronto/York University Joint Program in Transportation, June 1989.

[12] Tranplan Associates.

[13] Ibid.

[14] Ibid.

[15] Ibid.

[16] Ibid.

[17] Ibid.

[18] Ibid.

Chapter 5. PERFORMANCE GOALS FOR CALIFORNIA COMMUNITIES

The findings from this research project are reported in a way that allows local jurisdictions to use the information developed in a customized fashion for their particular needs. Local jurisdictions may choose to define their community types, select performance goals, and select strategies to implement. Within each of the three community types (urban, suburban and exurban), individual jurisdictions will vary in the amount of air quality improvement that they are trying to achieve from transportation-related land use strategies. The amount of air quality improvement will be based on a combination of the severity of nonattainment of the air quality standards and the contribution to air quality improvement that is expected from other strategies such as demand management measures, pricing strategies, and stationary source controls.

Three levels of travel activity have been developed in this project that can serve as performance goals for local jurisdictions. The three levels of performance goals are specified for each community type that reflect differing implementation of transportation-related land use strategies. The performance goals are expressed in average annual vehicle trips (VT), vehicle miles traveled (VMT), travel mode shares, and pollutant emissions per household. This chapter provides a summary of the methodology used to develop the three levels of performance goals for each of the three community types, and also provides the performance goals in matrix form.

To use the performance goals developed in this research project, a local jurisdiction would first need to define itself as being an urban, suburban or exurban community using the descriptions provided in Chapter 4. This definition could either apply to current conditions or to the type of conditions the community expects to evolve in the future. For example, a currently exurban community may be in the process of becoming suburban and so may wish to select strategies appropriate for a suburban community. After selecting a community definition, the jurisdiction would then develop an estimate of its current baseline travel characteristics to determine a starting point in comparison to the performance goals. Sources of that data include MPO or COG travel demand models, Caltrans, and other resources mentioned in Section 5.1. Depending upon the amount of air quality improvement desired from the transportation-related land use strategies, the jurisdiction would choose which performance goal level may provide the necessary amount of air quality benefit. Not all jurisdictions will necessarily need to achieve the highest level of performance goals stated. In fact, the highest level of the performance goals have been intentionally set to be a marked improvement over the existing conditions currently found in many areas of California.

5.1 METHODOLOGY FOR SETTING PERFORMANCE GOALS

The performance goals have been set as targets that many communities can reasonably achieve with a concerted effort to implement the recommended transportation-related land use strategies. The values selected for the highest level of performance goals represent an improvement over travel patterns that result from current land use development and transportation systems in California.

The development of the performance goals was based on the information collected, analyzed and reviewed for this research project. The review of the literature on the impacts of land use on travel behavior was used to examine the potential effectiveness of individual strategies and as a general resource throughout the research effort. Estimates of individual strategy effectiveness were one input examined in the development of the performance goals. Travel survey data and household odometer reading data from communities in California were used to provide a description of how existing travel conditions vary with differing land use patterns.[1] Because this research is part of an effort to achieve an improvement over existing conditions, data were also collected from communities located outside of California that provide examples of effective land use and transportation planning. In the remainder of this section, the process of developing the performance goals is described.

Baseline Data

The first step in developing the performance goals was to establish baseline travel data for California communities related to existing land use and transportation conditions. In selecting appropriate baseline travel data for community types, several potential data sources were examined, which are described below. One potential resource was the Highway Performance Monitoring System (HPMS) developed by the U.S. Department of Transportation. This system is intended to bring together data at a national level to assess the status of the Nation's highways. Volume counts are collected for all freeways and a sample of other major highways, but arterials and lower classes of roadway facilities are not generally included in the HPMS. It was determined that the HPMS was not an adequate data source for this project because the volume count data could not be directly translated to VT, VMT, or mode share. In addition, it is not possible to separate personal and commercial travel, and a significant portion of the vehicle travel in an area is not included in the HPMS.

Travel survey data collected between 1981 and 1991 were also examined to identify existing travel conditions for communities in California. The travel data examined included daily VT per person, daily VMT per person, and travel mode share. While an initial effort was made to use the travel survey data in setting the performance goals, the consultants and ARB staff determined that it was not adequate for the purposes of this study. Travel survey data tend to be biased towards those respondents most likely to fill out the survey, and do not always capture all travel in a household. Also, travel by commercial vehicles is

also often underrepresented. In addition, most local jurisdictions do not have easy access to travel survey data.

Another option considered was BURDEN, which is one of several computer programs used by the ARB in the estimation of on-road vehicle emissions for counties and air basins in the state. Included in BURDEN are travel data derived from information provided by the MPOs, Department of Motor Vehicles, CalTrans, and other transportation agencies. Sources of information include regional travel demand models, the Caldrons Statewide Travel Survey, and Caldrons State Highway Traffic Volumes. Unfortunately, it was not possible to use the BURDEN activity data in the development of the performance goals because these data are reported only by county, many of which contain a combination of community types, and not by specific communities. Using the BURDEN activity data, therefore, would not have allowed an accurate segmentation by type of community within a metropolitan area. A summary of BURDEN vehicle activity data for VT and VMT per person per year by county is provided in Appendix F. In addition, mode-of-travel data by region (from the *1991 Statewide Travel Survey*)[2] are provided in Appendix G. This information is provided as baseline data for local jurisdictions, although local jurisdictions are encouraged to use their own data if available. (note: a methodology to convert daily travel values to annual values comparable to the Performance Goals is provided in Appendix E.)

Holtzclaw Study

Dr. John Holtzclaw recently conducted a detailed examination of vehicle odometer data from twenty-eight sample California communities, along with other land use and transportation characteristics. The odometer data was provided by the California Bureau of Automotive Repair (as a result of the State's smog check program).[3] The purpose of this study was to examine sample neighborhoods and determine whether certain land use and transportation characteristics are associated with lower rates of automobile use. The study's evaluation of average annual VMT for households in selected communities throughout California is relevant to this research project.

Holtzclaw examined both annual average VMT per person and VMT per household (per HH). For this research project, the consultants and ARB staff selected VMT per HH because the relationship between density and annual VMT is more closely statistically correlated with households than with population.[4] In general, annual odometer readings are more directly related to the household's annual travel than to an individual person. Odometer data includes longer recreational trips that contribute VMT outside of the region in which the household is situated, which tends to inflate the data somewhat as a measurement of daily travel. However, it was decided that odometer data would be used for this project because it avoids some of the deficiencies associated with other sources of travel data, and (importantly) because it is

accompanied by quantified information on land use and transportation characteristics for the same sample communities in California in which the odometer data was collected.

Holtzclaw found a significant correlation between travel behavior and certain land use and transportation characteristics. A thorough statistical analysis of the study results revealed a significant relationship between community density and the annual average household VMT. However, Holtzclaw's findings were not conclusive about the importance of income and demographics in relation to travel mode behavior. A recent study of travel in five neighborhoods in the San Francisco Bay Area conducted for the ARB concluded that demographic and socio-economic attributes were not the primary explanatory variables of differences in travel behavior. It found that "differences in neighborhood characteristics--in particular residential density, public transit accessibility, mixed land use ... and the presence of sidewalks--are significantly associated with trip generation by mode and modal split."[5]

Consultants and ARB staff (Terry Parker) examined Holtzclaw's data on average VMT per HH per year as well as the other land use and transportation characteristics of the sample communities to determine reasonable segmentations into performance goal levels. The first step in this process was the identification of community types for each of the case study communities in Holtzclaw's study. The definitions described in Chapter 4 of this report were used to differentiate between the urban, suburban and exurban communities that Holtzclaw studied.

Table 5-1 provides a summary of the travel, land use density, transit availability, mixture of land uses and pedestrian accessibility of twenty sample California communities, grouped by community type. As described in Chapter 4, household density is the number of housing units per net residential acre (excluding streets, open spaces, commercial uses, etc.) The "transit accessibility index" measures the number of transit vehicles per 24-hour period that are accessible to a community's residential population. This index varies from a low of 1 to a high of 90. "Mixed Use" quantifies the portion of households within a 1/4-mile walking distance of neighborhood commercial services, and varies from a low of <0.1 to 1. Finally, the "pedestrian accessibility index" also varies from <0.1 to 1, with '1' representing better access for walking and bicycling. It measures factors such as an interconnected street pattern, sidewalks, convenient building entrances, safe traffic speeds and gentle street slopes. (Please refer to Appendix D for a more detailed description and more complete listing of these measurements.)

Table 5-1
COMMUNITY CHARACTERISTICS

SAMPLE COMMUNITY*	VMT PER HOUSEHOLD PER YEAR[1]	HOUSE-HOLD DENSITY [2]	TRANSIT SERVICE [3]	MIXED USE [4]	PEDESTRIAN ACCESS [5]
URBAN COMMUNITIES					
San Francisco (northeast)	5,500	101	90	1.0	.7
central Sacramento	10,100	22	20	.2	.4
San Francisco (entire city)	11,300	48	70	.8	.5
central Berkeley	12,500	16	49	.2	.6
Beverly Hills (southwest)	13,000	14	13	.7	.7
Rockridge	14,300	10	27	.2	.1
Santa Monica (southern)	14,700	15	20	.7	.6
Long Beach (southern)	15,300	24	19	.6	.7
Uptown San Diego	15,500	12	9	.5	.4
SUBURBAN COMMUNITIES					
Alameda	17,000	12	7	.2	.5
Pasadena (south central)	17,300	10	6	.4	.4
Daly City	19,300	15	13	.2	.1
Downey (central)	21,400	7	2	.2	.2
Alhambra	21,700	9	5	.2	.4
Escondido	21,700	4	2	<.1	.1
Walnut Creek	22,300	5	21	.1	.1
Lafayette	22,300	2	11	.1	<.1
Clairemont	22,700	6	2	.1	.1
Riverside (northern)	23,700	5	1	.1	.1
EXURBAN COMMUNITY					
Morgan Hill	28,400	2	3	.1	.2

Source: Dr. John Holtzclaw, *Using Residential Patterns and Transit to Decrease Auto Dependence and Costs*, June 1994. Grouped and annotated by consultant team and ARB staff. (please see Appendix D for additional information)

** (Descriptions are provided on the next page)*

Table 5-1 (continued)
"COMMUNITY CHARACTERISTICSî

Notes to Table 5-1:

1. Average annual vehicle miles of travel per household within each community from vehicle odometer data, provided by the California Bureau of Automotive Repair.

2. Number of households per net residential acre (excluding streets, open space, commercial uses, institutions, etc.).

3. Measure of the number of transit vehicles per hour available within 1/4-mile walking distance of dwellings on a 24-hour basis.

4. Portion of households within 1/4-mile walking distance of five or more key local commercial services (e.g., market, restaurant, drugstore). (note: Original data has been rounded to the nearest 10th.)

5. Measure of neighborhood qualities that make a community inviting and safe for pedestrian travel, including: level terrain (<5% grade), sidewalks, convenient building entries, frequent intersections, and traffic signals. (note: Original data has been rounded to the nearest 10th.)

Selecting a Community Type

For some communities, selection of the appropriate community type is straightforward (e.g., San Francisco is an urban area). For other communities, there can be disagreement about community type depending upon the definitions of a community, especially when individual community quantitative characteristics do not fit precisely into the guidelines described in Chapter 4 (Tables 4-1, 4-2, and 4-3). For this project, a number of factors were used to define each of the community types: function, population, centrality, density, and age. The function of a community and its location relative to other urban and suburban communities are the primary factors used in determining its type. For example, Alameda is a city in the San Francisco Bay Area that has a population density (12 households (HH) per net residential acre) that is greater than the suggested definition of 10 HH per net residential acre for suburban areas. However, it functions as a suburb to other central urban communities (Oakland and San Francisco), and so it is classified as suburban rather than urban. Allowing some flexibility in the density and population characteristics when defining community type will provide the opportunity to recommend appropriate strategies.

Setting the Performance Goals

JHK and ARB staff first classified the sample communities according to community type, with special emphasis on the function of the community within the region. Next, available information on the case study communities, including the data listed in Table 5-1, was used to rank the communities according to their land use and transportation characteristics. Sample communities in each community type were then listed in ascending order of average annual VMT per household. Next, ranges for the performance goal levels were identified based on what appeared to be reasonable break points in the data. The results of this analysis are summarized in Table 5-2, which provides a listing of the communities divded into levels within each of the three community types. The performance goal ranges are provided in the right-hand column of Table 5-2. The ranges reflect variations at each level for each of the three types of communities. Only two levels were set for exurban areas because of the limited baseline data available.

Although there is no lower bound specified for Level 1 (so as not to restrict what a jurisdiction **could** accomplish), a jurisdiction at some point may transform from exurban to suburban or from suburban to urban. Not all of the sample communities examined from Holtzcalw's study are included in Table 5-2. Because Level 3 is set to be an improvement for some communities, there are some sample communities that are below Level 3 (e.g., San Ramon and Los Altos with a VMT per HH per year of 28,200 and 26,100 respectively). Therefore, those communities with average per-household VMT that is higher than Level 3 are not included in the performance goal levels.

Table 5-2
DEVELOPMENT OF PERFORMANCE GOALS

SAMPLE COMMUNITY	REGIONAL LOCATION	AVERAGE VMT Per Household Per Year	PERFORMANCE GOALS: Average VMT Per Household Per Year
URBAN COMMUNITIES			
San Francisco (northeast portion)	San Francisco (SF) Bay Area	5,500	**Urban Level 1 <10,000**
Sacramento (central)	Sacramento	10,100	**Urban Level 2 10,000 to 13,000**
San Francisco (total)	SF Bay Area	11,300	
Berkeley (central)	SF Bay Area	12,500	
Beverly Hills (southwestern)	Los Angeles	13,000	
Rockridge District (Oakland)	SF Bay Area	14,300	**Urban Level 3 13,001 to 16,000**
Santa Monica (southern)	Los Angeles	14,700	
Long Beach (southern)	Los Angeles	15,300	
Uptown San Diego	San Diego	15,500	
SUBURBAN COMMUNITIES			
Alameda	SF Bay Area	17,000	**Suburban Level 1 <20,000**
Pasadena (south central area)	Los Angeles	17,300	
Daly City	SF Bay Area	19,300	
Downey (central)	Los Angeles	21,400	**Suburban Level 2 20,000 to 22,000**
Alhambra	Los Angeles	21,700	
Escondido	San Diego	21,700	
Walnut Creek	SF Bay Area	22,300	**Suburban Level 3 22,001 to 25,000**
Lafayette	SF Bay Area	22,300	
Clairemont	San Diego	22,700	
Riverside (northern)	Los Angeles	23,700	

Table 5-2
DEVELOPMENT OF PERFORMANCE GOALS
(continued)

EXURBAN COMMUNITIES			
(No case study communities available for this level)			**Exurban Level 1 <28,000**
Morgan Hill	SF Bay Area	28,400	**Exurban Level 2 28,000 to 30,000**

Sources: JHK & Associates, 1995, Table 5-2. Source of community data: Dr. John Holtzclaw, *Using Residential Patterns and Transit to Decrease Auto Dependence and Costs,* June 1994. (Community data was grouped and annotated by JHK & Associates and ARB staff.)

The data available from the Holtzclaw study was useful in setting performance goals for VMT. However, vehicle trip (VT) and travel mode share information cannot be obtained from odometer readings. To supplement the odometer data, travel survey data for those communities for which odometer reading data were also available were used. The travel survey data included VT per person, VMT per person and mode share between auto drivers and others (i.e., auto passengers, transit users, bicyclists, pedestrians). A summary of the travel survey data is provided in Table 5-3. Daily travel survey data on a per-person basis and annual odometer reading data on a household basis are not directly comparable, even when the travel survey data are converted to annual or per-household values.

To use the travel survey data as a basis for specifying the VT performance goals, a ratio of VT to VMT was estimated for each of the California communities. This ratio was developed using two approaches. In the first approach, the ratio of the VT to VMT values was calculated for each community and an average was taken of these ratios. The average ratio was 0.16. In the second approach, the VT over all of the communities was first summed and then the VMT over all of the communities was summed. The ratio of the summed VT to the summed VMT was estimated (a weighted average) and the resulting value was 0.16. Because both approaches resulted in the same average value, 0.16 was selected to be the ratio of VT to VMT. Assuming that the ratio of VT to VMT is similar for travel survey data and odometer data, this ratio was then applied to the VMT performance goals to develop the VT performance goals. Mode share data were used directly from the travel surveys. Where there were not sufficient data for each area type and performance goal level, mode shares for communities outside of the sample were used.

The final step in verifying the reasonableness of the performance goals was to compare the Level 1 values to the travel data from communities outside of California that have efficient land use and transportation patterns. The data available for Canadian cities are primarily daily VT per person obtained from travel surveys. Although these data are not directly comparable to the performance goals, some general comparisons were made. Based on the travel survey data, the VT per person per year for Montreal Island and Quebec City is below the VT per person per year for San Francisco and Berkeley.

Also, the VMT per person per year for central Toronto is comparable to the VMT per person per year for downtown San Francisco. The suburban Canadian communities examined in Chapter 4 all have a VT per person per year that is approximately ten to thirty-five percent lower than the VT per person per year for Daly City. This provides some verification that the Urban Level 1 and Suburban Level 1 performance goals are achievable with certain transportation-related land use strategies in place. Suburban residents of Canadian cities average roughly half as much VMT per household as do suburban residents of the sample California communities.

Average emissions goals were estimated by ARB staff for the travel-based performance goals using emissions factors from EMFAC7F1.1 and BURDEN7F developed for statewide fleet averages for light and medium duty vehicles and motorcycles for 1995. (The calculation procedure used is provided in Appendix H; the emissions values listed are the vehicle emissions on a per household per year basis, but do not account for emissions from increased use of public transit or carpool vehicles, or access trips.)

Table 5-3
Travel Characteristics of Selected Communities Based on Travel Survey Data

COMMUNITY	VT PER PERSON PER YEAR	VT PER HOUSEHOLD PER YEAR *(estimated)**	VMT PER PERSON PER YEAR	AUTO DRIVER MODE SHARE[5]
Downtown San Francisco[1,2,3]	210	481	1,560	NA[6]
San Francisco[1,2,3]	555	1,610	2,600	40%
Berkeley[1,2,3]	695	1,800	3,300	45%
Oakland[1,2,3]	660	1,709	4,160	55%
Daly City[1,2,3]	730	1,898	5,500	59%
Walnut Creek[1,2,3]	900	2,376	6,940	66%
Toronto[4]	520	NA	NA	NA
Central City	NA		1,740	NA
Outer Suburb	NA		3,800	NA

Sources:

1. California Department of Transportation, *1991 Statewide Travel Survey: Summary of Findings*, November 1992.

2. Deakin, Harvey, Skarbadonis, Inc., Tabulations of the *1981 Bay Area Travel Survey*, March 1991.

3. Hu, Patricia S. and Jennifer Young, *Summary of Travel Trends, 1990 Nationwide Personal Transportation Survey*, Center for Transportation Analysis, Oak Ridge National Laboratory, prepared for the Federal Highway Administration, March 1992.

4. *The Transportation Tomorrow Survey: Travel Survey Summary for the Greater Toronto Area*, prepared by the Data Management Group of the University of Toronto/York University Joint Program in Transportation, June 1989.

Notes: 5. Percent of Person Trips
6. NA - Not Available

* Annual VT per person data converted to "estimated" per household data using *1990 U.S. Census higher California Population and Housing Estimates*, April 1990; "average persons per household by county."

5.2 PERFORMANCE GOALS

Using the methodology described above, together with significant input from ARB staff (Terry Parker), performance goals were developed for three levels for each of the three community types. A summary of the performance goals is provided in Table 5-4. Within each community type, the average per-household annual rate of motor vehicle use decreases from Level 3 to Level 2 to Level 1. This translates into a decrease in VT per HH per year, VMT per HH per year, and auto-driver mode share of person trips. Mode shares for transit, walking, and car/vanpooling increases from Level 3 to Level 1. The amount of change in each travel characteristic is not necessarily the same between levels.

These goals are intended to be general guidelines. A community may meet or exceed one or more of the performance goals listed, but fall somewhat short in another category. Each area of the state has different combinations of travel characteristics that may not result in the precise relationship between vehicle trips, VMT, and mode share expressed in the performance goals.

Some jurisdictions in the state would improve their air quality by achieving any of the levels of performance goals listed for their community type. For those jurisdictions that want to maximize their air quality improvement from transportation-related land use strategies, Level 1 has been set so that it represents an improvement for almost all areas of the state (Northeast San Francisco being the exception). However, all jurisdictions will not achieve Level 1 for their community type. Instead, these performance goals, and the subsequent strategy recommendations described in Chapter 6, are meant to encourage local jurisdictions to strive for that level that is challenging yet achievable.

In examining Table 5-4, within each community type, there is an improvement in the amount of vehicle emissions moving from Level 3 to Level 2, and from Level 2 to Level 1. For example, if a suburban jurisdiction were to move from the midpoint of the range for Level 3 to the midpoint of the range for Level 2, it is estimated that the reduction in vehicle emissions would be about ten percent for each of the pollutant emissions. Going from the midpoint of Level 2 to the upper boundary for Level 1 would result in an estimated pollutant emission reduction of about five percent. Using Urban Levels 2 and 3 as another example, VT per HH per year for Level 2 is approximately twenty-five percent lower than Level 3 and VMT per HH per year is approximately thirty percent lower. In this case, fewer vehicle trips are taken in Level 2 and the trips that are taken are shorter than those in Level 3. Also, there is no reason to assume continuity within one level and across area types. For example, if a suburban area develops into an urban area, the level that it would have achieved would not necessarily be expected to stay the same (e.g., Level 1 Suburban to Level 1 Urban).

The ARB has adopted vehicle emissions standards for new motor vehicles that will result in cleaner air. Because of these standards, the air quality benefits from reduced use of motor vehicles will decline over time. Therefore, the emissions rates provided in Table 5-4 should not be used to forecast future emissions reductions associated with the performance goals. Future years' vehicle emission factors are provided in Appendix H.

Achievement of the performance goals will be difficult for local jurisdictions to monitor. Emissions benefits are especially difficult to monitor. Some guidelines for monitoring changes in travel patterns are described in Appendix I.

5.3 CHAPTER ENDNOTES

1 John Holtzclaw, *Using Residential Patterns and Transit to Decrease Auto Dependence and Cost*, prepared for the Natural Resources Defense Council, June 1994.

2 California Department of Transportation, *1991 Statewide Travel Survey: Summary of Findings*, November 1992.

3 Holtzclaw.

4 John Holtzclaw, *Explaining Urban Density and Transit Impacts on Auto Use*, presented by the Natural Resources Defense Council and the Sierra Club to the State of California Energy Resources Conservation and Development Commissions, April 19, 1990.

5 Ryuichi Kitamura, Patricia Mokhtarian and Laura Laidet, *A Micro-Analysis of Land Use and Travel in Five Neighborhoods in the San Francisco Bay Area*, prepared for the California Air Resources Board, November 1994.

Chapter 6. TRANSPORTATION-RELATED LAND USE STRATEGY RECOMMENDATIONS

In this chapter, a list of strategies that can assist local jurisdictions in attaining transportation and air quality performance goals are presented (Section 6.1). This chapter also summarizes how the recommended strategy packages were developed (Section 6.2); discusses factors that affect strategy implementation (Section 6.3); and describes the strategy package recommendations and how they may be used (Section 6.4). An individual package of detailed strategy recommendations is presented for each of three types of communities: urban, suburban exurban. These strategy packages provide suggestions regarding the details of strategy implementation that can assist communities in achieving the transportation and air quality performance goals (that were presented in Chapter 5).

6.1 RECOMMENDED STRATEGIES

These strategies are recommended for implementation:

- **Strengthen Downtowns**
- **Develop Concentrated Activity Centers**
- **Encourage Mixed-Use Development**
- **Encourage Infill and Densification**
- **Increase Density Near Transit Corridors**
- **Increase Density Near Transit Stations**
- **Provide Pedestrian Facilities**
- **Develop Interconnected Travel Networks**
- **Provide Strategic Parking Facilities**

However, not all of these strategies are recommended for each community type (urban, suburban or exurban) or performance goal level. **Detailed strategy package recommendations are provided in separate files: Table 6-1 (for Urban Communities); Table 6-2 (for Suburban Communities); and Table 6-3 (for Exurban Communities).** These charts include recommended densities and intensities of implementation, suggested mixtures of uses, and necessary supporting factors. Details regarding these charts and how to use them are described in more detail in sections 6.3 and 6.4 of this chapter.

Examples of locations where the recommended strategies listed above have been implemented are summarized in Table 6 below.

Table 6

EXAMPLES OF STRATEGY IMPLEMENTATION

RECOMMENDED STRATEGY	APPROPRIATE LAND USE TYPES	EXAMPLES OF LOCATIONS WHERE STRATEGY HAS BEEN IMPLEMENTED
1. Strengthen Downtowns	Commercial and Retail Development, Public Uses, Residential	San Francisco, Walnut Creek, El Monte, Pasadena, Pomona, Anaheim; Bellevue, WA; Portland, OR; Toronto, Canada
2. Develop Concentrated Activity Centers	Commercial and Retail Development, Residential, Restaurants, Public Uses, Light Industrial	Bellevue, WA; Tysons Corner, VA; Orange County, Santa Ana
3. Encourage Mixed-Use Development	Commercial and Retail Development, Residential, Public Uses, Restaurants, Schools, Light Industry	San Francisco, Oakland, Daly City, Inglewood, Rancho Cucamonga
4. Encourage Infill and Densification	Commercial and Retail Development, Residential, Public Uses, Restaurants, Schools, Light Industry	San Jose, Oakland, Daly City, Richmond, Mill Valley, Lancaster, San Luis Obispo
5. Increase Density Near Transit Corridors	Commercial and Retail Development, Residential, Public Uses, Restaurants, Schools, Light Industry	Portland, OR; Richmond, Los Angeles
6. Increase Density Near Transit Stations	Commercial and Retail Development, Residential, Public Uses, Light Industry, Schools, Hospitals, Restaurants	Portland, OR; San Francisco Bay Area; Vancouver, Canada; Los Angeles
7. Provide Pedestrian Facilities	All land uses	San Francisco, Davis, Pasadena, Thousand Oaks, Chula Vista
8. Develop Interconnected Travel Networks	All land uses	San Francisco, Oakland, Daly City, Richmond, Mill Valley, Moreno Valley
9. Provide Strategic Parking Facilities	All land uses	Downtown: San Francisco, Santa Ana; Portland, OR

6.2 DEVELOPMENT of STRATEGY RECOMMENDATIONS

The strategy recommendations were based on an extensive literature review conducted for this project. Information regarding individual strategies at site-specific locations was examined to determine whether the information could be used in a quantifiable methodology. However, information for strategies implemented at an individual site or in a specific area may be accurate for those study areas, but it may not be accurate to conclude that these impacts are consistent across an entire jurisdiction. For example, increasing the density of development near transit stations usually results in travel impacts near the transit station, which would not occur throughout the jurisdiction. Therefore, information on each individual strategy was carefully considered (please refer to Chapter 4 for more information).

Two of the strategies that were originally considered as possible recommended strategies were not included in the final list of recommendations: *Transit-Oriented Design* and *Jobs/Housing Balance.* They were not recommended in part because the beneficial aspects of each is incorporated in the other strategies. For example, the individual characteristics in the strategy *Transit-Oriented Design* are reflected in the recommendations: *Increase Density Near Transit Stations, Increase Density Near Transit Corridors, Encourage Mixed-Use Development,* and *Provide Pedestrian Facilities.* The productive aspects of the jobs/housing balance strategy are embodied in the concept of *Encourage Infill and Densification,* which promotes increasing employment and housing opportunities on underutilized or vacant parcels. In addition, proximity to residential areas is a supportive factor for the strategy *Develop Concentrated Activity Centers.*

In developing the final strategy package recommendations, the case studies of California communities provided by the study conducted by John Holtzclaw (summarized in Chapter 4) were reviewed to determine what strategies are in place in those sample communities and how their implementation corresponds to observed travel behavior. The strategy package recommendations incorporate this analysis. They were also based on information regarding densities, intensities and mixtures of land use typically used by the development and design professions. A detailed explanation of how these recommendatations were developed is provided in Appendix J. This methodology provides verification that the recommendations are reasonable for other areas.

6.3 FACTORS AFFECTING STRATEGY IMPLEMENTATION

The strategies in the packages presented in Tables 6-1, 6-2, and 6-3 differ based on the community type and the level of performance goal. The recommended characteristics are intended to be general guidelines and not meant as standards because local officials typically must also take into account many factors when making land use decisions, including: existing characteristics of a neighborhood, surrounding land uses, public opinion, natural features, available infrastructure, and impacts on public services.

Implementing the recommended combinations of strategies can help reduce or avoid vehicle travel by providing people opportunities to use alternate modes of travel rather than driving. However, other factors also may impact or reduce the effectiveness of transportation-related land use strategies. These could be addressed through other activities, programs and policies. Examples include:

- the lack of high quality transit service, which would impact the number of travelers that have ready access to transit;
- safety and crime concerns that may impede the use of the transit system and pedestrian areas.
- the relatively low cost for auto travel in general, including gasoline prices, licensing fees, and tolls, which help to make driving an inexpensive mode of travel.

Another issue to be considered is the timeframe in which strategies are implemented. In general, the strategies recommended in this report tend to have a long-term effect. (Long-term could mean five, ten, twenty years or longer.) Each situation will be unique depending upon the amount and type of existing development, the expected growth rate for future development the amount of air quality improvement that is targeted. A local jurisdiction should consider the time required for implementation when projecting benefits from transportation-related land use strategies.

Additional factors that may affect how the recommended transportation-related land use strategies are implemented are provided below for each of the strategies. (More detailed descriptions of the strategies may also be found in Chapter 3.)

- **Strengthen Downtowns**

This strategy may apply to an already-existing downtown or to a primary commercial and employment center that may become a downtown. This strategy makes it easier to provide transit service and for customers and employees to travel by carpool or vanpool. Efforts to strengthen a downtown by making it a primary employment and cultural center are likely to depend on infill, densification, and potentially redevelopment efforts. This strategy would be implemented differently in stand-alone communities than for communities that are surrounded by other communities within a major metropolitan area. Not every jurisdiction necessarily would require a strong downtown if it is located within a major metropolitan area where, from a regional perspective, it makes more sense to develop fewer strong downtowns. This is not to say that there cannot be multiple downtowns that act as primary places of employment and cultural centers, but the number that a large metropolitan area can reasonably support must be examined.

- **Develop Concentrated Activity Centers**

The purpose of developing concentrated activity centers is to focus primary employment, shopping and other activities in relatively few compact locations, in comparison more scattered land uses. This strategy makes it easier to provide efficient transit service and for customers and employees to travel by carpool or vanpool by creating "nodes" that can be more easily connected. Concentrated activity centers could be considered one form of infill and densification, but with an emphasis on the ability to attract regional travel. This strategy would be implemented differently in stand-alone communities than for communities that are surrounded by other communities within a major metropolitan area. In a stand-alone community, the local jurisdiction has control over the number and extent of the development of activity centers. However, in a major metropolitan area, the number and function of activity centers should be examined in a regional context. If each local jurisdiction develops one or more concentrated activity centers, or locates the centers in a way that they compete with other centers to their detriment, then the effectiveness of this strategy could be reduced.

- **Encourage Mixed-Use Development**

This recommended strategy for urban and suburban areas includes a mixture of housing, commercial uses, and public uses. The minimum percentages suggested in the strategy packages for mixtures of land uses vary for urban and suburban areas. This reflects the expectation that suburban areas have a greater portion of residential land uses than do urban areas, which are likely to have a higher concentration of commercial and employment. Providing a mixture of uses is especially

important in those suburban communities in which residential land uses predominate, where residents must otherwise travel long distances to other communities for shopping and recreation as well as employment. Jurisdictions should attempt to attract businesses to the community that match locally-available labor, and commercial uses should provide services that are required by the nearby housing. For example, if the housing includes families with smaller children, a daycare center would be an appropriate commercial use, as would retail oriented to children.

- **Encourage Infill and Densification**

The compactness of development (e.g., the density of residential uses and intensity of commercial uses) is typically greater in urban or metropolitan areas than in suburban or exurban communities that are not situated within a major metropolitan area. In urban areas, the primary emphasis for infill and densification is typically within the city center and in centrally located developed areas, preferably those that have existing or anticipated transit service. In suburban or exurban areas, it may not be apparent where pockets of more compact development should be located. In these cases, locations should be chosen that have the best potential for improved transit service, are within walking distance of stores, parks and schools, and/or that are centrally located.

It is important to accompany an infill strategy with reduction in remote suburban development (that requires long trips to employment in city centers), and to cluster density so that it can be served more efficiently by transit. Most communities allow a certain number of multi-family units (e.g., apartments, townhomes and condominiums). In order for a reduced level of vehicle travel to be feasible, denser areas should be strategically located and clustered so that they are accessible to services and can be served efficiently by transit. Examples of the types of residential units that can be built at a variety of densities are illustrated in Figure 6-1, "Character of Residential Density."

- **Increase Density Near Transit Corridors**

The implementation of this strategy may require coordination with the transit service provider to optimize the location of certain land uses in relation to transit stops. The location of specific types of land uses will vary based on the level of transit service and the distance between transit stops. The most transit- and pedestrian-oriented land uses should be located closest to existing or future transit stops. If there are locations along the corridor where transit stops are farther than 1/2 mile apart, the focus of compact and intense development (e.g., a multi-story building that combines residential and commercial uses) should be as close as possible to the transit stops..

- **Increase Density Near Transit Stations**

Transit stations that are designed to serve a mixture of origins and destinations should be surrounded by a variety of commercial, employment and residential land uses that are transit-oriented. Each transit station should be examined to determine whether it serves, or could serve, the origin end and/or the destination end of most of the trips to the station. If a transit station is located in a primarily residential area where most of the trips served are origins, then residential development and commercial services that support that residential development should be the primary focus of any new, dense development. If a transit station is located where most of the trips are destinations, such as a major employment center, then the focus of new development should be greater densities for the destination types already present. Mixed-use development near a transit station that encourages the use of the station for both the origin and the destination ends of trips can help to avoid one-way peak commutes that waste transit capacity. Also, complementary land uses should be included in the new development. For example, if the transit station primarily serves an employment center, commercial land uses that serve employees should be included, such as a dry cleaners, a cafe, or a newsstand.

- **Provide Pedestrian Facilities**

Pedestrian facilities and good access for pedestrians are important components of nearly all of the other strategies. This strategy should be implemented in all areas where there are land uses that are amenable to pedestrian use. However, in isolated or rural areas with a limited need for pedestrian access, amenities such as wide sidewalks and pedestrian priority at signalized intersections will probably not provide a significant change in travel behavior.

- **Develop Interconnected Travel Networks**

An interconnected street network, often a gridded pattern, is one in which the streets are interconnected and there are few areas with dead-end streets or clusters of streets that can only be accessed from one direction. This strategy is much easier to incorporate in new developments. It may be difficult, if not impossible, to change the structure of already existing streets. Where this is the case, the emphasis should be placed on providing pedestrian and bicycle paths that directly link the streets. It is also much more likely that an already-existing integrated street network will be present in areas that were developed before World War II, which were predominantly built around gridded street networks.

- **Provide Strategic Parking Facilities**

The emphasis of this strategy should be on not oversupplying free parking because it acts as a disincentive to using transit and as a physical barrier to pedestrians. However, any changes to existing parking policy must be made considering all components of the parking facilities at the same time. For example, it would not make sense to limit parking supply at specific developments and than allow an excess of parking within easy walking distance. In that case, all that would be achieved is to shift where people park, not the mode that they use to travel. Neighborhoods surrounding commercial or employment areas are particularly sensitive to the potential for parking overflow onto their neighborhood streets. The amount of parking that should be supplied will vary depending on the types of land uses present (e.g., many types of retail have high parking demands), the availability and quality of transit service, and accessibility for pedestrians.

6.4 DESCRIPTION of RECOMMENDED STRATEGY PACKAGES

Detailed recommended strategy packages are presented in **Table 6-1 for Urban communities; Table 6-2 for Suburban communities; and Table 6-3 for Exurban community types.** This section provides a description of how the recommended strategy package tables are organized, how to use them, and ways that land use and transportation strategies may vary with different jurisdictional characteristics. Each of these tables corresponds to a set of transportation and air quality performance goals. Per-household vehicle travel performance goals for each community type and level are listed at the top of each table (these correspond to the Performance Goal charts found in Chapter 5).

The strategies listed in Tables 6-1, 6-2, and 6-3 include a description, a list of strategy characteristics, and supporting factors. The "description" is a brief summary of the strategy as it is being recommended. (Note: general strategy descriptions are also provided in Chapter 3.) The "characteristics" column provides any quantitative descriptions of the strategy recommended for that community type and level of performance goal. The characteristics also include primary concerns or requirements related to the strategy. These are general in nature and are not meant to be restrictive. For example, some of the strategies include residential density as a characteristic. The proposed densities are recommended minimums rather than targets that should not be exceeded. (Note: a description of the information on which the recommendations regarding densities and mixtures of uses were based is provided in Appendix J).

The final column in the Strategy Recommendations tables is a listing of supportive factors that are necessary for the strategy to achieve its full effectiveness. As an example, a strategy that is predicted to increase walking, such as mixed-use development, would not be as effective if adequate pedestrian facilities are not also available. Similarly, transportation-related land use strategies will clearly not be effective in encouraging the use of transit service if there is little or no transit service available or expected in the future.

Another supportive factor included in the tables is the discouragement of auto-oriented land uses in certain locations. It is important to recognize that not all land uses can be served by alternate travel modes, and that there are some land uses that are inherently oriented to automobile use. Examples include automotive repair shops and large-package retail stores. Large parking lots, walls, fences, and other barriers interfere with pedestrian travel and access to transit. These types of land uses may be present and necessary in a community, but should not be located near a transit- or pedestrian-oriented area in place of another land use that may benefit from the availability of alternative modes of travel.

Each package of strategy recommendations presented in Tables 6-1, 6-2, and 6-3 is based on a reasonable (but conservative) estimate of the effectiveness of individual strategies and combinations of strategies in providing travel options that reduce vehicle emission levels. There may also be situations where the performance goals can be achieved by implementing fewer strategies, a less stringent implementation of the individual strategies, or both. The strategy packages have been recommended to enable local jurisdictions to achieve the performance goals, if other non-land-use factors do not inhibit alternate mode use. This approach will help to ensure that the recommendations will be useful to a wide range of jurisdictions.

- **How to Use the Strategy Packages**

To use the strategy packages presented in Tables 6-1, 6-2, and 6-3, a jurisdiction would first determine what type of community it is (e.g., urban, suburban or exurban). Definitions provided in Chapter 4 of this report may be used for this purpose. Then, the jurisdiction would select the performance goal (described in Chapter 5) that best meets its needs. The community may then choose the package of recommended strategies that corresponds to its community type and selected performance goal level. Strategies that have already been implemented in the jurisdiction may be identified, and a list of additional strategies can be generated that will help achieve the desired performance goals.

The transportation-related land use strategy recommendations are grouped according to whether they are primarily implemented at a neighborhood/district level, or at a community-wide level. Two groupings of strategies are also listed that are not recommended as necessary, but which may be pursued if certain conditions are present. There is no priority or importance assigned to specific strategies in each package because it is recommended that all of the strategies listed in each table be implemented to achieve the indicated performance goals. Additionally, these recommendations do not include minimum requirements for the size of a jurisdiction to effectively implement the transportation-related land use strategies, although the extent of the area in which strategies are implementated would impact their effectiveness.

The strategy packages also include strategies that should be pursued, or at least considered in overall planning efforts, to prepare for the progression to a higher level of a performance goal in the future. However, it is not expected that every jurisdiction will strive to achieve the Level 1 performance goal for its community type. Some jurisdictions will be able to anticipate a need to progress to a higher level in the future than is currently required. As an example of these strategies, *Strengthen Downtowns* is not included as a necessary strategy in the recommendations for the performance goals for Urban Level 3. It is included, however, for both Levels 1 and 2 for Urban areas. Therefore, if a local jurisdiction foresees the desire to achieve the Level 1 or 2 performance goals in the future, it will be best prepared by considering the need for a stronger downtown. In particular, it is important to ensure that intermediate policies are not enacted that will inhibit the development of a strong downtown.

The final grouping in the strategy packages indicates which strategies, while not required, should be pursued if the basic infrastructure exists for strategy implementation. The strategy recommendations were based on the expected conditions for each of the community types. For example, many areas do not have transit stations (a single bus stop is not necessarily considered a transit station), but this is not necessarily a requirement to achieve the Level 2 or Level 3 performance goals.

To achieve the performance goals associated with Urban Level 1, Urban Level 2, and Suburban Level 1, all of the strategies listed in Section 6.1 are recommended in varying intensities and configurations. The degree of suggested implementation tends to be reduced as the performance goals become less strenuous and depending on the type of community. For example, for Urban Level 3, only the strategy *Strengthen Downtowns* is not recommended, because urban areas can be expected

to achieve the stated performance goals without having a strong downtown core. *Strengthen Downtowns*, however, is listed as a strategy to be pursued if a progression to Urban Level 1 or 2 would be desired in the future.

Not all suburban areas have transit stations located within their jurisdictions. Therefore, the strategy packages for Suburban Levels 2 and 3 have been developed without a reliance on the strategy *Increase Density Near Transit Stations*, although it is recommended that this strategy be pursued if a local jurisdiction does have one or more transit stations. For Suburban Level 2, all of the remaining strategies have been recommended. The strategies *Develop Concentrated Activity Centers* and *Strengthen Downtowns* are not included for Suburban Level 3, but they are recommended if the local jurisdiction has determined that it may wish to reach a Level 1 or 2 in the future. *Develop Strategic Parking Facilities* is also not recommended for Suburban Level 3 because the performance goals can be met without having to reduce the parking supply.

Most exurban areas do not possess significant transit service, so *Increase Density Near Transit Stations* is recommended only if a transit station does exist (this may include a train depot). For those exurban areas that do have transit corridors, *Increase Density Near Transit Corridors* should be pursued if progression to Exurban Level 1 is desired in the future. For Exurban Level 1, the remaining strategies are included as a recommendation, but to a lesser degree than in the urban and suburban areas. For Exurban Level 2, *Develop Strategic Parking Facilities* and *Develop Concentrated Activity Centers* are not recommended because they would be extremely difficult to implement in most exurban areas.

The packages of strategies recommended in Tables 6-1, 6-2, and 6-3 are not necessarily the only combinations of strategies that could successfully achieve the performance goals. Each jurisdiction possesses unique characteristics that may require customizing the strategies as needed. Also, not all of the strategies are included in the strategy packages for each community type and performance goal level. However, this is not meant to discourage the implementation of any of the recommended strategies. Rather, the strategies that are presented are those that can reasonably be implemented and that can be expected to eventually achieve the desired results. They are one approach to achieving the performance goals. Jurisdictions may have circumstances that preclude them from implementing all of the recommended strategies. Where this is the case, additional strategies should be substituted, or a strategy should be implemented more intensely than indicated (e.g., a higher number of dwelling units per acre), or over a larger portion of the community.

Chapter 7. IMPLEMENTATION MECHANISMS FOR TRANSPORTATION-RELATED LAND USE STRATEGIES

This chapter suggests a tools that jurisdictions can use to implement the transportation-related land use strategies recommended in Chapter 6 of this report. This chapter focuses on seven main topics, each in an individual section:

7.1 - **Policies** that jurisdictions can adopt to implement the recommended strategies.

7.2 - **Policy documents** that can be updated or created to implement the strategies.

7.3 - **Administrative actions** that jurisdictions can take to implement the strategies.

7.4 - **Organizational tools** available to local governments to assist in implementing the strategies.

7.5 - **Resources** available to help finance strategy implementation.

7.6 - **Barriers** and uncertainties associated with the implementation tools; and ways to minimize or resolve these problems.

7.7 - **Monitoring mechanisms** to track results of implementation.

Many of the strategies and actions recommended in this report are compatible with existing programs and goals of California's communities. Several recommendations listed in Chapters 6 and 7 of this report can also help cities and counties meet existing goals and requirements in the areas of housing provision, mobility, and congestion management.

For example, higher-density housing near transit stations can help meet housing goals and provide increased mobility to residents, especially in congested metropolitan areas. Requiring pedestrian and transit access in site plans, and zoning for mixed uses, can help increase walking and encourage economic development. Providing additional through connections in the street network can help reduce traffic congestion on major arterial streets. The actions described in this chapter, therefore, not only help meet the need to minimze vehicle emissions and contribute to improved air quality; they can also assist jurisdictions in achieving other local and regional priorities as well.

7.1 POLICIES THAT CAN BE CREATED OR CHANGED

This section examines the policies that cities and counties could adopt to help implement the transportation-related land use strategies. Policies are part of plans adopted by a City Council or County Board of Supervisors. Table 7-1 indicates which policies are directly related to each of the recommended strategies. The table indicates that a number of policies support several of the strategies. *(included in printed report)*

Of particular importance are five policies listed as "Top Priority" in the first part of this section. Implementing these policies in a way that reflects local conditions is the most effective first step toward minimizing automobile trips and motor vehicle emissions.

Top Priority Policies:

If a city or county wants to begin moving in the direction of providing multiple transportation options, it may not know where to begin. These top priority items reverse the direction of most existing policy documents or common practice, and apply to a city or county as a whole. These items would therefore be the most effective actions a county or city can take to begin moving in the direction of supporting a variety of transportation options.

Policy #1: Set Densities to Reflect Proximity to Transit and Activity

Traditionally, local land use policy has focused on the maximum density of development that can occur in an area. Because development patterns that reduce automobile dependence require relatively high densities, land use polices that also emphasize higher densities near transit stations and corridors and around activity areas will reduce vehicular trips.

Minimum Densities. The most effective way to encourage density is to set *minimum densities* for residential, retail and employment generating uses in central areas and around transit. Santa Cruz County, for instance, requires development within the zoning density range.

"No Net Loss" Policy. For residential developments, another approach is to require that no new development result in the loss of housing units. For example, the Sacramento General Plan requires "no net loss" of housing units.

Wording of Density Requirements. For all densities, stating densities as a number of square feet of land per dwelling unit, rather than a minimum lot size, indicates an openness to clustering as a matter of course. The Santa Cruz County General Plan and Zoning Ordinance use this phrasing.

Policy #2: Create Mixed-Use Zones

Mixing commercial and residential uses makes it easier for people to walk from their homes to the places where they work, shop and participate in civic life. Building housing downtown can make the downtown livelier. Unfortunately, many general plans and zoning ordinances prohibit mixed use. This requirement stems partly from the rise of noisy, polluting industrial plants next to residential areas in the late 1800's and the first part of this century. This prohibition is no longer necessary in most cases, because most modern employment-generating uses are compatible with residential uses.

Allowing Mixed Use. A city or county can begin by ensuring that mixed use is allowed in its central and transit-oriented development areas. In San Jose, for example, properties along the new light rail corridor are designated "Transit Corridor High-Density Residential." This zone allows some commercial uses.

Requiring Mixed Use. A jurisdiction can go a step further by requiring mixed uses with a certain percentage of housing, public and commercial uses in a district in target areas. The Sacramento and San Diego transit-oriented development guidelines take this approach. Policy documents can also specify how uses are arranged in a mixed-use district. For example, many mixed-use areas require retail or other uses that attract foot traffic on the ground floor, with offices or residences above.

Special Districts. Jurisdictions can create special land use and zoning districts with mixed land uses where transit availability or activity makes them desirable. An area containing several historic buildings and places can be declared a historic district. Development within the district can be required to be consistent with the historic character of the area. Historic buildings within the Historic District are eligible for federal Historic Preservation Tax Credits, which are described in the Resources section of this report. Larkspur's downtown Historic District has become a key component of the Downtown Specific Plan, which emphasizes pedestrian and bicycle access and pedestrian-oriented design.[1]

Fine-Grained Use Zones. A variation on mixed-use policy is fine-grained land use designation and zoning. For example, the West Berkeley Specific Plan replaced a large industrial district with a mosaic of zones. Light industrial and retail zones were used to buffer residential zones from heavy industrial uses. The zones are small enough that residential zones are within walking distance of heavy industrial zones.

Mixed-Use Overlay Zones. Overlay land use and zoning districts are a method for adding a second use to an area that is primarily in one use. San Jose uses a General Commercial overlay in residential areas where some commercial use is desired, such as arterial streets that serve as major bus corridors.[2] Portland, Oregon and Hartford, Connecticut use residential overlays in commercial zones to require housing as a part of commercial development projects.

Conflict Resolution through Performance Standards. Performance standards are rules limiting environmental impacts, such as traffic, noise, visual effects and air pollutant emissions. Performance

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1 Brady and Associates for the City of Larkspur, *Larkspur Downtown Specific Plan*, 1992.

2 City of San Jose, *Mid-Town Specific Plan*, 1992.

standards minimize the impacts of industrial and commercial uses on adjacent residences. This makes it possible for cities and counties to zone for commercial uses near residential uses. To reduce noise impacts, Santa Cruz County sets noise limits at the adjacent property line, for example.

Exceptions. Of course, some uses cannot be sited in mixed-use settings because they are unattractive, noisy or even dangerous. For example, State law requires residences, child care centers, hospitals and schools to be located at least 2,000 feet from properties where significant disposal of hazardous waste has occurred, or where hazardous waste is transferred, stored or treated.[3] This law makes it impossible to locate such facilities within walking distance of residences.

Policy #3: Award Density Bonuses for Projects Furthering Jurisdiction Goals

Allowed densities can be increased, and other incentives given, for projects that provide transit-or pedestrian-oriented amenities such as housing and child care near commercial uses and pedestrian-oriented design. California's Density Bonus Law already requires local governments to grant 25-percent density bonuses plus other incentives (such as reduced parking requirements) for low-income, very-low-income, and senior housing.[4] State law also allows jurisdictions to grant a 25-percent density bonus for developers of housing within a half mile of transit stations.[5] A third state law allows cities and counties to give floor area ratio bonuses for commercial and industrial uses that provide child care facilities.[6] New York City increases the floor area ratio for new projects with direct connections to transit stations. Near the Bellevue, Washington station, a developer may build an extra four square feet of office space for each square foot of residential space provided in an office complex. Near the Ballston station in Arlington County, Virginia, the office floor area ratio is doubled if ten percent of the floor space is residential.[7] All of these methods are effective at enticing developers to build high density, mixed-use projects near transit and activity centers. In addition, the Second Unit Law allows second unit development to be promoted as an infill development strategy.[8]

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3 Health and Safety Code Section 25221 and 25232 and County Hazardous Waste Management Plans required under AB 2948 (Tanner).

4 Government Code Sections 65913.4, 65915 and 65917.

5 Government Code Section 65913.5.

6 Affordable Housing: California Government Code Section (CGCS) 65915. Housing Near Transit: CGCS 65913.5. Childcare: 65917.5.

7 Robert Cervero, "Jobs/Housing Balance as Public Policy," *Urban Land* (Urban Land Institute), October 1991.

8 Government Code Section 65852.2.

Policy #4: Focus Growth Within Urban Areas

All of the recommended strategies are oriented towards concentrating higher density development near transportation and activity centers. This overall approach is supported if communities create incentives that increase appropriate development density within existing urban areas.

Communities can create conditions and incentives that make urban development and infill near transportation and activity centers more attractive and profitable. For example, local redevelopment agency activities and incentives to attract development to existing urban areas can focus on infill and redevelopment projects that are served by transit and easily accessible to pedestrians.

Infrastructure to serve infill and redevelopment projects (such as water, sewer, streets, etc.) is often already in place in existing urban areas, thus reducing the costs to local governments and utility companies of providing such services. However, if infrastructure is not available or of sufficient capacity, this constraint may significantly increase the cost of infill and redevelopment projects and reduce their economic feasibility. In comparison, new development in outlying areas often requires new infrastructure and services that can increase total costs to local governments, transportation agencies, and public utilities.

Policy #5. Revise Street Standards to Make Streets Pedestrian-Friendly

Many jurisdictions' street standards require wide streets and wide turning radii, which are designed to accommodate high volumes of automobile traffic. The high traffic speeds and volumes that wide streets allow are not compatible with pedestrian activity. Wide streets also cover large areas of land, so they limit the density that can be attained in a given area. Many local streets built today are also designed as cul-de-sacs, with limited access for pedestrians and bicycles to surrounding facilities.

To answer these problems, cities and counties can revise their street standards to require connected, narrower streets with trees and sidewalks, and bicycle lanes and bus stops on larger streets. Traffic calming devices could be required or at least allowed in residential and commercial areas that would promote pedestrian and bicycle activity and transit use. Traffic calming devices can include: narrower streets, tighter curb turning radii, textured paving at crossings, frequent intersections with pedestrian-activated traffic signals, traffic circles or "roundabouts," and landscaping

within designated parkways. Rancho Cucamonga requires street trees, sidewalks, and a bicycle lane if the new street is in a location designated for a bicycle lane.[9]

Other Policies:

Policy #6: Allow Transfer of Development Rights Within or To Target Areas

Transfer of development rights is a strategy that is used to preserve existing open space, agriculture, and other low-density uses, and to increase densities in areas where this is desired. When the allowable density on the land is reduced, a set of credits can be set up based on the potential use of the land. Developers in the area where the jurisdiction wishes to increase density can buy the credits, which become density bonuses for them.[10]

Use in Central Districts. Within and near downtown, a jurisdiction may wish to preserve residential or historic buildings that are less dense than the allowed density on their sites. The city or county can allow the owners to sell unused development rights to developers within the same or other target areas. In Seattle, the owner of land with low-density housing may sell development rights to the owner of another parcel downtown. The Seattle Housing Resources Group sold unused development rights above an apartment building to the developer of another building downtown, and used the proceeds to renovate the apartment building.[11]

Use in Peripheral Areas. Transfer of development rights is also used to preserve agricultural land and privately held open space at the periphery, thus funneling growth into developed areas. When the amount of allowed development is reduced in fringe areas, the owner receives development credits for the difference between the original development rights and the new reduced rights. The owner may not use these credits on his or her land, but may sell them to a developer in an area targeted for increased density. The buyer can use the credits to build at a higher density than the zoning code would otherwise allow. The Land Conservancy of San Luis Obispo County, for instance, administers a Transfer of Development Rights program to avoid development on steep slopes with Monterey pines east of the developed areas.[12]

Policy #7: Reduce Requirements for Setbacks, Lot Sizes and Lot Shapes

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9 Scott Murphy, Associate Planner, City of Rancho Cucamonga, fax January 10, 1995.

10 Steve Weissman and Judy Corbett, *Land Use Strategies for More Livable Places*, Sacramento, CA: The Local Government Commission, 1992.

11 Susanna McBee, et. al., "Downtown Development Handbook," *Urban Land* (Urban Land Institute), 1992.

12 Frank Heinsen, Planner, City of San Luis Obispo, conversation, January 12, 1995.

Large setbacks tend to separate buildings from pedestrian life. Setback requirements can be reduced, or maximum setbacks can be established, to create a stronger connection between buildings and sidewalks. Large minimum lot sizes and dimensions and prohibition of certain lot shapes can prevent the attainment of specified densities. They also make it difficult to cluster buildings and to provide a greenway and pedestrian and bicycle facilities. One of the purposes of lot regulations is to prevent the creation of lots that can't be built on; however, the regulations may go beyond what is required to achieve this. Setback, lot size and lot shape requirements can be reduced in the zoning code, or on a case-by-case basis during negotiation of development agreements. Rancho Cucamonga reduces these requirements in exchange for open space and pedestrian amenities provided by developers.

Policy #8: Require Pedestrian, Bicycle and Transit Access in Site Plans

Cities and counties can require developers to provide such amenities as pedestrian and bicycle pathways, bicycle parking, showers, bus shelters, and parks. A jurisdiction must compile a quantitative report on the relationship between development and the need for these facilities, and ensure that the requirements imposed on each project are proportional to the size of the project, as stated in the recent court case, Dolan v. City of Tigard.[13]

Policy #9: Require Signs To Be at Pedestrian Scale in Pedestrian Areas

Signs that are designed to be viewed by high-speed traffic at some distance are inconsistent with the human scale that defines pedestrian areas. The sign ordinance can require pedestrian-scaled signs in transit station areas, transit corridors and pedestrian-oriented activity centers. For example, Huntington Beach requires pedestrian-scale signs in its downtown.[14]

Policy #10: Revise Parking Standards to Reward Design Supporting Alternative Travel Modes

In some areas, parking standards require more parking than is normally used. These standards can lead to the construction of parking lots that interfere with transit and pedestrian access, and reduce the density of land use that can be achieved within a certain building height. Parking requirements can be lower in downtowns and other transit hubs, parking minimums can be reduced for projects that provide features encouraging alternate travel modes, parking maximums can be set in transit- and pedestrian-oriented areas, and preferential parking for car pools can be required. Shared

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13 *Dolan v. City of Tigard,* No. 93-518, 114 S.Ct. 2309.

14 Brian James, Planner, City of Huntington Beach, fax, January 11, 1995.

parking reduces the number of spaces needed per square feet of commercial space or residential unit, especially if uses are mixed. The parking standards can reflect this by requiring fewer spaces for shared parking and for mixed uses. Mountain View's downtown parking standards are generally 90 percent of city-wide standards. The standards for retail and restaurant uses were reduced as part of the 1992 Downtown Precise Plan, and standards are lower for businesses in a shared parking assessment district.

7.2 POLICY DOCUMENTS

All of the policies discussed above can be implemented through existing planning processes, including updates of the General Plan and the Zoning Ordinance. Some of the policies can also be expressed in other documents, and all of the policies can be expressed in Specific Plans. The documents discussed in this section are plans and ordinances that can be adopted by a City Council or County Board of Supervisors. Policies that can be incorporated into the described policy documents are illustrated in Table 3-2.

One approach a jurisdiction could take would be a "pedestrian and transit-oriented code update." This update could consist of updates to the General Plan, Zoning Ordinance and Subdivision Regulations, along with a set of Design Guidelines and a Master EIR. Making these revisions together can streamline approval of the changes and of subsequent projects. It is best to consult with the Public Works Department, the transit agency, and transportation planning organization (RTPA) on this update. It could begin by eliminating policies that lead to high vehicular emissions, such as low, uniform intersection level of service standards; low-density single-family housing designations in areas served by transit or near other uses; prohibitions against mixed-use development; and parking standards that exceed actual needs. To replace these policies, each jurisdiction can select options from the policies listed above.

Top Priority Documents:

Document #1: The General Plan

General Plan elements can be coordinated to provide and support more efficient multi-modal transportation facilities related to appropriate land uses, to enable people to walk, take transit or bicycle to some of their destinations. Land use, transit and public works planners should work together to develop a cohesive plan. State law requires each General Plan to include seven elements: land use, circulation, housing, conservation, open space, noise and safety. Some jurisdictions have

also adopted air quality and other elements. The policies discussed in this report can be implemented through the Land Use Element, and should also be coordinated with the Circulation and Housing Elements. "Transfer of development Table 7-2rights" can also be included in the Conservation and Open Space Element(s), and some performance standards could be placed in the Noise Element. As part of Inglewood's General Plan update process, the city is considering a mixed-use district within a quarter-mile radius of its downtown transit hub. Within this district, high residential densities may be allowed, and planners may have the flexibility to reduce parking requirements for shared parking.[15] Santa Ana is integrating circulation provisions into its land use, urban design and education elements.[16] Any changes to the General Plan must be reflected in the Zoning Ordinance and the Subdivision Regulations. A summary of how the General Plan Elements can support this report's recommended strategies is provided below:

Land Use Element. A land use element sets the locations, mix and densities of land uses. It can increase densities and require mixed uses near transit stations, along transit corridors and in activity centers where transit lines converge. The Land Use Element can also incorporate policies to focus development in existing areas; civic or historic districts; performance standards to facilitate mixed use; density bonuses to help preserve historic, housing and open space uses; reduced setbacks and flexible lot standards; a requirement for pedestrian, bicycle and transit access facilities on development sites; pedestrian-oriented sign policies; and reduced parking requirements. The 1992 Pasadena Land Use Element, for example, includes a Mobility section designed to complement the Mobility Element.

Circulation Element. The circulation element can include facilities for transit, bicycles and pedestrians as well as automobiles. Pedestrian trails and bicycle paths can link residential neighborhoods to activity centers. Ample sidewalks, bicycle lanes, bicycle racks and street trees can improve pedestrian and bicycle access within the activity centers. In updating circulation elements, Ontario, California has added bike ways, Rancho Cucamonga identified transit routes and options, and Thousand Oaks is developing a pedestrian master plan. The City of Davis requires all new development to provide bicycle/pedestrian paths that connect to the existing pathway system.

Coordination between the locations of transportation facilities and land use mix and density is key to making a place accessible by walking, bicycling and transit. One way to support pedestrian circulation is to avoid

15 Mike Calzada, Planner, City of Inglewood, conversation, January 11, 1995.

16 Melanie McCann, Air Quality Planner, Santa Ana, conversation, January 10, 1995.

placing major arterial streets or highways between residential areas and nearby business districts, and to provide pedestrian-activated traffic signals at appropriate locations.

Housing Element. State law requires that General Plans designate land for sufficient amounts of overall housing and affordable housing to meet a jurisdiction's regional housing need allocation as identified by the regional Council of Governments. The Housing Element must set forth a plan to remove constraints to the construction of adequate housing; identify sites that could be used for housing, including high-density sites for low-income housing; and include a five-year schedule for implementation of housing programs.[17] Inclusion of high-density housing in downtowns and near transit stations and corridors can meet these requirements while also acting to reduce vehicular trips. El Monte, for example, allows downtown residential densities of up to 50 units per acre for family housing and up to 100 units per acre for senior housing.

Air Quality Element: An air quality element is not required, but can provide a unified strategy that includes land use, housing, transportation and recreational aspects. Glendale adopted an air quality element in 1994,[18] and Inglewood is preparing one for adoption in 1995, among other jurisdictions.

Conservation and Open Space. The conservation and open space elements (which are combined in many General Plans) define where development will and will not occur. If open space areas are designated away from transit[19] corridors, this could have the effect of directing development toward transit corridors and stations. The Conservation and Open Space Elements can also include walking trails, street trees and small parks in pedestrian-oriented activity centers, and bicycle paths linking residential and business areas. Ontario, California's recreation element addresses bicycle and pedestrian circulation.[20] The recreation element can include policies about making recreational facilities accessible by walking, bicycling and transit.

Noise Element. State law requires the noise element to show noise contours for all listed sources of noise. The noise element is an appropriate tool for protecting residences from highway and transit noise. Performance standards protecting residents from industrial, commercial and recreational noise can be placed in this element, facilitating mixed use development. Fullerton, for example, has noise standards for stationary sources.

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17 Linda Wheaton, California Department of Housing and Community Development, Memorandum, September 2, 1994.

18 David Bobardt, Planner, City of Glendale, fax, January 1, 1995.

19 Mark Persico, Planner, El Monte, fax, January 10, 1995.

20 Steve Cumblidge, Planner, City of Ontario, fax, January 10, 1995.

Safety. Policies regarding development in flood plains, geologic hazard areas and wildfire hazard areas affect the shape of the developed areas. Sometimes this element is combined with the conservation and open space elements.

Document #2: Zoning Ordinance

The Zoning Ordinance provides the specific regulations that implement policies in the General Plan. Zoning regulates the type and intensity of land use, signs, parking, setbacks, and the location and size of buildings, lots, yards, courts and other open spaces.[21] The zoning ordinance is the code that can specify higher densities, lower parking standards, pedestrian-scale signs and mixed-use or fine-grained variations in uses near transit facilities and in activity centers. To achieve a mix of uses downtown, the Portland zoning ordinance includes residential districts and stipulates that 60 percent of the buildings in the downtown must be in residential use.

Document #3: Subdivision Regulations

Subdivision Regulations are authorized under the California Subdivision Map Act to regulate the division of land. A part of the Municipal Code, subdivision regulations set standards for the size and shapes of lots, conditions for condominium formation, and design and dedication requirements for public facilities, including streets.[22] The California Subdivision Map Act expressly allows cities and counties to require sidewalks, bicycle paths, public transit lines, bridges, easements for public access to streams, and schools.[23] The Subdivision Map Act also allows jurisdictions to require any other design changes and dedications (collectively known as exactions) necessary to bring the subdivision into conformance with the General Plan. For example, the Chula Vista Subdivision Regulations authorize the Planning Commission to require pedestrian ways where necessary for access to schools, playgrounds, shopping centers, transportation facilities, other community facilities or unusually long blocks. Subdivision regulations include street standards for streets for subdivisions. The Subdivision Regulations can be revised to relax lot shape and minimum lot sizes; increase requirements for pedestrian, bicycle and transit facilities; and reduce required street widths and turning radii in order to support transit- and pedestrian-oriented development.

Document #4: Design Guidelines

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21 William Fulton, *Guide to California Planning,* Point Arena, Ca.: Solano Press Books, 1991.

22 Fulton

23 *Dolan v. City of Tigard* (No. 93-518, 114 S. CT. 2308), which originated in Oregon, requires a quantitative report supporting the need for exactions, and exactions commensurate with the size of the development.

Design Guidelines set standards for building placement and orientation, facade and roof treatment, parking locations, landscaping and streetscape improvements. Design Guidelines for transit- and pedestrian-oriented development can increase the accessibility, safety and attractiveness of buildings, pedestrian paths and streets.[24] The Guidelines can specify such building parameters as garage placement, porch requirements and setbacks, and can require site amenities such as pedestrian connections, street trees, street lights, bicycle racks and bus shelters. Design Guidelines can require facilities such as showers and bicycle lockers in office buildings and other employment centers. Design Guidelines can be developed for a city or county as a whole, or different guidelines can be developed for different areas. The General Plan can refer to the Design Guidelines, and they can be a chapter of the Municipal Code (either as part of the Zoning Ordinance or separately) or a Specific Plan. Design Guidelines can be mandatory, applying equally to all development in a certain district or use, or they can give planners the flexibility to require what is needed for each project. The City of San Diego uses its "Transit Oriented Development" guidelines in negotiating developer agreements.[25]

Document #5: Master EIRs

By preparing a Master Environmental Impact Report (EIR) for a Specific Plan or for a group of policy changes (such as a set of amendments to the General Plan, Zoning Ordinance and Subdivision Regulations), a jurisdiction can streamline the development application process for developers who comply with the new plan and regulations. A Master EIR assesses the impacts of a plan, a program, or a set of policy changes, and recommends mitigation measures.[26] Once a Master EIR is prepared for a group of policy documents, any project that is allowed by right in those and other documents, and that complies with all regulations, does not require a separate environmental document.

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24 California ARB, *The Linkage Between Land Use, Transportation and Air Quality*, Terry Parker, et.al., Office of Air Quality and Transportation Planning, 1994.

25 Peter Calthorpe and Shelly Poticha, *San Diego Transit Oriented Development Guidelines.*

26 Public Resources Code Section 21157.

Other Documents:

Document #6: Specific Plans

A Specific Plan includes regulations similar to those of a zoning ordinance for a particular focus area. A Specific Plan sets the distribution, location and extent of land uses and infrastructure; development standards; and implementation methods (regulations, programs, pubic works and financing). A Specific Plan must be consistent with the General Plan. Plan preparation can be paid for by a development fee in the Specific Plan area. A Specific Plan could be prepared for a transit corridor, station area, downtown, business district or neighborhood. An EIR would need to be prepared for the Specific Plan; development projects that are consistent with the Specific Plan would not necessarily require discretionary approvals nor project EIRs. One example of a specific plan is the Anaheim Downtown Plan, which specifies trees in the streets and other design features to slow traffic and encourage pedestrian uses of streets. Several San Jose specific plans overlap residential and commercial uses. Sacramento County has developed a number of specific plans for transit-oriented areas.

Document #7: Redevelopment and Housing Production Plan

A Redevelopment Agency must have a Redevelopment Area Plan and a Housing Production Plan. These plans can focus businesses and housing near transit stations and corridors. Redevelopment and housing production plans are especially appropriate tools for stimulating development of downtowns and activity centers, and for encouraging mixed-use and infill projects. (Redevelopment is also discussed as "Resource Tool #6" in Section 3.5 of this chapter.)

Document #8: Trip Reduction Ordinance

Many trip reduction ordinances contain only the provisions required by state law and air district regulations. These ordinances could include measures that private builders and employers must implement, and could include incentives as well as penalties. LaVerne's 1989 Trip Reduction Ordinance, for example, requires employers of over 100 people to provide van pools, subsidized bus passes, flex time, staggered hours and bicycle facilities. Commercial and industrial buildings in LaVerne with more than 75,000 square feet must provide an internal jitney, bus or taxi shelter.

Document #9: Capital Improvement Program

Priorities within the Capital Improvement Program can be ordered to emphasize transportation, lighting and landscaping projects that support alternate means of transportation; civic and cultural projects located in areas that are targeted for increased pedestrian activity; infrastructure

upgrades for areas near transit, business centers; and projects that would improve the mixture of uses. For example, Glendale's capital improvement program includes funding for a shuttle system and an intermodal transfer facility. Federal law requires a Major Investment Study for any major metropolitan transportation investment that uses federal funds and affects existing or planned housing.[27] Relocation and replacement housing can be located near transit, employment, civic uses, shopping and services.

7.3 ADMINISTRATIVE ACTIONS

Administrative actions are processes, operations or negotiations that city or county agencies can initiate. The agencies taking action could include the planning, public works, community development or economic development departments or the redevelopment agency.

How a jurisdiction implements planning documents and manages the development and redevelopment processes on a daily basis determines to what extent actual land uses will support alternative modes of travel. Streamlining the permit process for projects that promote walking, cycling and riding transit is the most important administrative action a city or county can take in this direction. A municipality can take these steps in guiding public economic development efforts as well as private development proposals.

Top Priority Action:

Action #1: Streamline the Permit Process for Desired Projects

Currently, the permit process in many jurisdictions is simpler for a single-use, automobile-oriented project that covers an entire parcel with private lots than it is for a clustered or mixed-use project. For example, a mixed-use or clustered project may require a master plan and a hearing, while single-family residential projects may be allowed by right. (The California Environmental Quality Act requires an Environmental Impact Report for any discretionary action that could have a significant adverse effect on the environment. In many cities and counties a hearing is held regarding the EIR, but the law does not require it.) The permit process could be changed to reward mixed-use, transit-oriented projects and projects in target areas. For example, approval criteria could enable staff to approve pedestrian-friendly or target-area projects up to a certain size without a hearing, while a hearing could be required for projects that do not meet transit-oriented or pedestrian-friendly design criteria. In Washington, D.C., for example, the Pennsylvania Avenue Development Corporation

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27 Wheaton

centralized the permit process for its redevelopment area and in some cases cut permitting time in half.[28]

Other Actions:

Action #2: Negotiate Development Agreements

State law allows cities and counties to negotiate developer agreements for proposed projects that require use permits or changes to adopted policy documents.[29] (Projects that are within the use and density allowed by the zoning code and comply with the other elements of the Municipal Code do not require such approvals.) The law specifies that the agreement must include the use, density, height and size of buildings and land dedications. A development agreement can specify a mix of uses, grant density bonuses (pursuant to ordinance), and require land for pedestrian, bicycle and transit facilities.

A developer and a local government decide many of the design features of a project while negotiating the development agreement. Design features that make high-density and mixed use projects enjoyable can be incorporated at this point. One example is a development in downtown Mountain View which features buildings that look like townhouses, with porches fronting on streets, and with underground parking.

Action #3: Modify Impact Fees and Exactions

Many cities and counties require developers to pay impact fees or provide in-kind provision of land, facilities, or services to meet the needs generated by a project. Infill projects may actually generate higher fees to support infrastructure needs even though the actual infrastructure costs may be lower than outlying development. Where this occurs, a community may consider exempting certain fees to attract development to areas near transit, downtowns, and activity centers.

Alternatively, there may be instances where infrastructure fees may be calculated to be higher for an outlying development than a more centralized development. Where this is the case, there would be an incentive for new development to occur closer to existing developed areas. Any development fee or exaction should be adopted only after thorough documentation to support

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28 McBee

29 Government Code Sections 65864-65869.5.

findings of the proportional relationship between the amount of the fee and the cost of impact that is directly attributable to the development on which the fee is imposed.

Fees. Many jurisdictions assess the development fees for transportation improvements necessitated by project traffic. If a project is oriented and designed to reduce vehicular traffic, these fees likely will be reduced. Transportation impact fees could also be reduced if appropriate housing is provided near an employment use.

Exactions. In-kind exactions may include transit and pedestrian facilities such as bus turnouts, sidewalks, bike racks, bike lanes, pedestrian connections to transit stations, and provision of transit information to home buyers. Exactions may be a trade-off for reduced requirements. For example, Santa Ana requires bike racks to reduce parking requirements.

Action #4: Attract Employers to Areas Near Transit and Housing

As a part of its economic development efforts, local governments can work to attract employers to areas close to transit corridors and stations, to downtowns and other activity centers, and to neighborhoods that house potential employees. Companies that employ a relatively large number of people per given area and require minimal truck access to highways are good candidates for location in transit corridors. For example, in Rancho Cucamonga, a food processing company is building a 300,000-square-foot facility near a new commuter rail station. The company has stated that proximity to transit was a major consideration in its choice of location.

Action #5: Establish Enterprise Zones in Older Activity Centers

An enterprise zone provides tax breaks and infrastructure upgrades for employers locating in the zone. A local government can apply to the U.S. Department of Housing and Urban Development to have an economically depressed area designated as a federal Enterprise Zone. Or a local government can create its own enterprise zone, giving local tax breaks to businesses in the zone. An enterprise zone can help to increase the density of business areas where there is not presently a strong real estate market. If the goal is to create a central area that can attract a large enough number of workers to support a rapid transit system, the type of jobs created is unimportant. If, however, the goal is to locate jobs near existing housing, it is important to specify that the subsidized uses would employ the types of workers who reside nearby. For example, Richmond has a federal Enterprise Zone. San Bernardino established its own Enterprise Zone, placing tax incentives in its Municipal Code. The incentives are available to new and expanding businesses in the zone, and for housing rehabilitation and infill housing construction.

7.4 ORGANIZATIONAL TOOLS

An organizational tool is a way to set up relationships among agencies and community groups to pursue common goals. This section addresses the question of who implements the policies, planning documents and administrative systems discussed above, and how these groups of people can most effectively work together. Increasing travel options will require increasing coordination among the City Council or Board of Supervisors, the Planning Department, the Public Works Department, the Metropolitan Planning Organization or Council of Governments, and some service providers within a municipal government. It will also require counties and cities to cooperate with service districts, transit agencies, local commercial and neighborhood organizations and other jurisdictions.

Organizational Tool #1: Combine Land Use and Transportation Planning

Transportation and land use planners have traditionally worked in isolation from each other in many municipalities. Many transportation planners work in the Public Works Department, while land use planners work in the Planning and Building or Community Development Department. Their training, goals, methods and language differ, making communication difficult. However, transportation and land use planners in many jurisdictions are learning to "speak the same language." The two departments working together can restore transit-and pedestrian-oriented communities, recommending land use changes that could improve transit, pedestrian and bicycle access and designing streets for play, social interaction and various forms of transportation. The two groups can cooperate to strengthen central business districts and other activity centers.

In many California cities and counties, transportation and land use planners are working together. In Thousand Oaks, the planning and public works departments work closely on development proposals.[30] In Glendale, the two departments are working together on the Circulation Element update. In Santa Ana, the two departments are working together on congestion management and bike ways. In Torrance and Berkeley, transportation planners are located in the planning department. The County of Sacramento coordinated extensively with the Regional Transit Agency in creating a transit-oriented General Plan.[31]

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30 Rick Burgess, Planner, City of Thousand Oaks, fax, January 11, 1995.

31 Terry Parker, Land Use/Transportation Planner, California Air Resources Board, comment, March 1995.

Organizational Tool #2: Involve Service Providers

Fire, police, sanitation and school agencies are concerned about a variety of issues associated with pedestrian- and transit-friendly design. It is important for land use and transportation planners to meet with these departments and agencies early in the planning process.

California jurisdictions have varying ways of involving service departments in the planning process. Santa Ana circulates plans as well as proposals to all city agencies. In Inglewood, the EIR process includes multi-agency review.

Safety. Police departments and sheriff's offices have concerns such as lighting and visibility of paths and entrances. Their input can be valuable in devising design criteria for a safe pedestrian and transit environment and bicycle parking.

Vehicular Access. Service providers who use large vehicles may be concerned about access. One way to meet this concern is to demonstrate that clearances would be adequate under the proposed standards. For example, developers of Laguna West in Sacramento County created a mock-up street and invited the sanitation and fire districts to try maneuvering their largest vehicles on the street; after the demonstration the service providers withdrew their opposition to the narrower residential streets.

Schools. School districts are currently in a quandary because Proposition 13 requires a 2/3 majority vote to raise school facilities funds through taxation, and state legislation sets developer fees based on the amount of area built for each residence or commercial project. The smaller residences that would be provided in denser developments generate lower school fees per dwelling unit than larger residences built under this formula. A school district objected to a Specific Plan prepared by the San Jose Planning Department for increasing residential density in a transit corridor for this reason. Some of the tools discussed in the Resource Tools section of this report could be used to address this problem.

Organizational Tool #3: Work with the Transit Agency

Most transit authorities are separate from city and county governments. To increase transit use, it is critical to involve them in planning for land use, street and path design.

Design Guidelines. A transit agency can provide design guidelines for bus stops and other transit connections in all areas, and for transit-oriented development. San Diego's Metropolitan Transit Development Board and the Sacramento Regional Transit District have published manuals on land use design for transit.

Corridor Selection. Transit agencies, counties and cities can work together to select corridors for transit improvements along with supportive land use strategies such as increased density and mixed use. The transit agency can also identify areas where through street connections and transit ways would be most useful. The transit agency could locate stations near employment uses and housing rather than (or in addition to) peripheral industrial areas where rail lines already exist.

Joint Development. A transit authority may undertake transit joint development: sharing costs with private developers to improve transit station areas and provide direct connections between the developments and the transit stations. A city or county can support transit joint development by giving density bonuses to developers who connect to transit stations, allowing transfer of air rights from above the stations to adjacent parcels, changing the zoning and parking requirements around the stations, giving high priority to infrastructure and civic projects near stations, and streamlining permit applications.[32] The San Francisco Bay Area Rapid Transit District (BART) sold development rights to adjacent land owners for development near the Pleasant Hill BART station in Contra Costa County, allowing for higher-density development near the station than could otherwise occur.[33] The transit agency can market air rights, coordinate with developers on the design of stations and buildings, assemble land and guarantee loans.[34]

Negotiating with Developers. Local governments and transit agencies can negotiate together with developers to include transit features in projects. For example, AC Transit and the Cities of Emeryville and Oakland in the East Bay recently negotiated with Catellus Development Co. for a transit center in the proposed East Baybridge retail and housing development.

Organizational Tool #4: Involve Business and Community Groups

Non-profit organizations, chambers of commerce, universities, insurers, neighborhood organizations, community development corporations, and small business development centers can play a role in improving, densifying and balancing neighborhoods in central areas and transit corridors. For example, the Milwaukee Redevelopment Corporation, a private non-profit corporation funded by membership dues, contributed to the development of several commercial, residential and mixed-use projects downtown. In Orlando, the Downtown Development Board, which included private and publicly appointed members, worked with the Orlando Redevelopment Agency to plan and complete public projects. The Redevelopment Agency purchased land and leased it to the Neighborhood Improvement Corporation for 50 years. In addition to city funds, loans from the state and local banks were used.[35]

Organizational Tool #5: Enter Into Agreements with Neighboring Jurisdictions

Adjoining jurisdictions may wish to enter agreements to create or improve alternative transportation facilities, to create economies of scale when purchasing clean-fuel vehicles, or to preserve open space. Cities in the South Bay Cities Association south of Los Angeles are pursuing all three of these goals together. Cities and counties have made agreements to preserve undeveloped

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32 James R. Gilson, and F. Michael Francis, "Planning for Joint Development in Los Angeles," *Urban Land* (Urban Land Institute), June 1993.

33 Jeff Ordway, Joint Development Director, Bay Area Rapid Transit, conversation, November 1, 1993.

34 Robert L. Knight and Lisa Trygg, "Evidence of Land Use Impacts of Rapid Transit Systems," *Transportation*, Volume 6, September 1977.

35 McBee

areas that overlap the boundaries of several jurisdictions. Such agreements can serve to funnel some growth into the developed portions of the cities (although some goes to other areas). Agreements could be made to increase the density, mix of uses and streetscape along a transit corridor, or to connect streets and paths. An agreement could be made to distribute funds among jurisdictions, even if only one directly benefits from development.

Organizational Tool #6: Establish a Joint Powers Authority

A Joint Powers Authority (JPA) is an entity formed by member jurisdictions to develop a plan, facility or program benefitting all of the jurisdictions. Each jurisdiction contributes opinions, time and money to the plan, project or program and shares in the use of it. Where a focus area overlaps jurisdictions, a JPA can be formed to prepare and implement a plan for an area, fund transportation improvements, develop a housing project or employment center, or build a civic facility. The cities of Orange and Santa Ana have a JPA for transportation improvements to serve mixed-use development at an activity center near the border between the two cities.

Organizational Tool #7: Use the Congestion Management Agency

State legislation requires a county-wide effort to develop and implement a Congestion Management Program (CMP) in each urbanized county. The law requires each urbanized county to set up a Congestion Management Agency (CMA) with representatives from all of the cities in the county. Local jurisdictions must inform the CMA of major land use decisions, so that the agency can project traffic increases. "Deficiency plans" are required for areas where congestion reaches certain levels. Deficiency plans can include any measures that will reduce traffic congestion, including transit, bicycle and pedestrian improvements, land use changes, and parking management as well as roadway improvements for vehicular traffic. The CMA provides a setting for coordinated efforts through meetings, information sharing and development of deficiency plans.

Some CMAs are developing area and county-wide deficiency plans. Los Angeles County's 1993 CMP includes a county-wide deficiency plan. The deficiency plan includes a list of strategies from which local jurisdictions may choose. The list includes land use, transit service, transportation demand management, transportation systems management, and capital strategies.[36] Local governments are assigned "debits" when they issue building permits, based on the automobile trips that the buildings would generate. Cities and counties receive credit for implementing strategies in the deficiency plan, based on the number of person-miles of travel demand accommodated or reduced on

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[36] Kendra Morries, Los Angeles Metropolitan Transportation Authority, conversation, March 5, 1995.

a typical weekday. The jurisdictions must implement enough measures from the "toolbox" in the deficiency plan so that their credits equal their debits.

7.5 RESOURCE TOOLS

A resource tool is a source of funding, service, or land. Funds are available for developing and implementing policies and programs, and for designing and building facilities, in support of the recommended strategies. Many of the sources can fund multi-purpose projects and programs, such as those designed to strengthen downtowns and other activity centers.

Resource Tool #1: Apply Through Your MPO for "ISTEA" Funding

Regional transportation commissions, known by federal transportation agencies as metropolitan planning organizations (MPOs), apply for federal funding under the Intermodal Surface Transportation Efficiency Act (ISTEA). Some ISTEA highway funds can be spent on facilities for travel modes other than automobiles. ISTEA also includes funding for scenic byways, recreational trails, and transportation planning. Funding for vehicular transportation projects includes a ten percent set-aside for transportation enhancements: bicycle-pedestrian facilities, acquisition of scenic easements and sites; enhancement of scenic and historic areas near highways; landscaping on transportation corridors (not just roads); historic preservation; and preservation of rail corridors for rail and/or pedestrian-bicycle use.[37] Funds are available for planning and implementing bicycle and pedestrian circulation systems. Tuolumne County and the cities of Modesto, Livermore, Lathrop and Manteca are embarking on bicycle planning projects using ISTEA funds. Scenic easements, landscaping and billboard control can help to implement pedestrian-friendly design.

ISTEA Congestion Mitigation/Air Quality (CMAQ) funds are intended to help local governments implement the federal Clean Air Act Amendments of 1990. The Clean Air Act Amendments mandate the preparation of State Implementation Plans, which in turn are implemented through regional Clean Air Plans. Regional Clean Air Plans include land use provisions. For example, the Bay Area Clean Air Plan includes indirect source review, high-density zoning at transit stations and General Plan air quality elements. A jurisdiction could use CMAQ funds to implement any of these programs, ordinances or plans.

Resource Tool #2: Use Housing and Community Development Funds

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37 American Society of Landscape Architects, *What's In ISTEA for Landscape Architects?* Washington, DC: ASLA, 1992.

The California Department of Housing and Community Development (HCD) administers state and federal housing assistance programs. Prevalent financing programs available to local governments from the U.S. Department of Housing and Urban Development (HUD) and HCD include the federal Community Development Block Grant (CDBG) and Home Investment Partnership (HOME) programs, Housing Opportunities for People with AIDS (HOPWA), and Emergency Shelter Grants (ESG). To apply for these funds, a city or county must submit a Consolidated Plan to HUD. This plan must address housing and community issues in a coordinated way, and is part of a combined application for all four funding programs.[38] These four types of grants can fund staff and other expenses to increase densities in transit corridors and around stations, improve central business districts, and promote infill projects. Rancho Cucamonga is using HCD funds for building rehabilitation, sidewalks and street lights.

Federal housing and community development funds are administered locally or by HCD, depending on whether a jurisdiction is an "entitlement entity." CDBG's primary uses are infrastructure, community facilities and building rehabilitation. El Monte, for instance, is using CDGB funds for downtown facade restoration. Another major source of housing funds is the state and federal Low Income Tax Credit Program, which gives tax credits for investments in housing construction. Information about funding sources for housing is available from HCD's Clearinghouse for Affordable Housing Finance in Sacramento.[39]

Resource Tool #3: Establish a "Main Street" Program

The National Trust for Historic Preservation initiated the Main Street Program in 1986, and states are responsible for implementing it. Main Street programs are used to revitalize the downtowns of small cities (3,500 to 50,000 population) through economic restructuring, pedestrian-oriented design and improvements, promotion, and organization.[40] The California Main Street Program is operated by the State Department of Commerce Office of Local Development in Sacramento. It includes demonstration cities and maintains a lending library. To be a demonstration community, a community must hire a full-time coordinator for the program; thus, the program has a matching requirement. Even if a community does not become a demonstration city, it can use Program videotapes and literature for help in revitalizing its downtown. A Main Street Program can

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38 U.S. Department of Housing and Urban Development, *Vision/Reality: Strategies for Community Change*, 1994.

39 Wheaton (Clearinghouse phone number is (916) 323-3180).

40 John D. Edwards, "Traffic and Land Use Planning and the Decline of the Central Business Districts," *ITE Journal*, Institute of Transportation Engineers, December 1991, pages 19-23.

help to revive a downtown so it functions more effectively as a transit hub and activity center. El Monte has used the Main Street Program to revitalize its downtown. Ontario has used it to rehabilitate commercial structures and improve facades.

Resource Tool #4: Apply for Historic Preservation Tax Credits

A city or county can designate an area that has historic significance as a Historic District. Once this is done, building owners can receive Historic Preservation Tax Credits for renovation of historic buildings. The jurisdiction can use these tax credits to revitalize older areas that have a pedestrian environment and to strengthen downtowns. The City of Pomona, for example, established a mixed use Historic District as part of its Downtown Pomona Specific Plan.

Resource Tool #5: Use Motor Vehicle Registration Fee Surcharge Funds

In September of 1990, Assembly Bill 2766 was signed into law.[41] This legislation authorizes regional air quality management districts to impose an additional four dollars on local annual motor vehicle registration fees. The proceeds may be used to implement programs to reduce air pollution from mobile sources, pursuant to air quality management plans and the California Clean Air Act. The air quality management districts distribute a portion of the funds to cities and counties. Local governments can use these funds for programs in the regional or state air quality plan, including local planning efforts.

Resource Tool #6: Establish a Redevelopment Area

A redevelopment area uses tax increment financing. To establish a redevelopment area, a city or county must make certain findings to declare the area blighted. The jurisdiction then makes improvements in the area, which are intended to increase the economic activity in the area and thereby increase property values. The Redevelopment Agency uses the tax increment to pay for the investments made in the area. Tax increment funds can fund infrastructure, public pedestrian amenities and services as well as land assembly and joint development. Portland, Oregon, has redeveloped much of its central city, using tax-increment financing for low-interest loans, limited property tax abatements, revenue bonds and land write-downs for housing.[42] Pasadena's redevelopment program has significantly increased the downtown's prosperity. San Jose is having mixed financial results after large cash infusions into its downtown, although most of the public

41 Health & Safety Code Section 44220.

42 McBee

facilities attract users.[43] The Redevelopment Agency can assemble parcels near transit stations and pursue joint development with developers.44 A Redevelopment Agency could be used to revitalize a declining area that is rich in transit connections, or a single-use area with mixed-use potential. When the Bay Area Rapid Transit system, BART, was built, San Francisco established a redevelopment area, and the tax increment financing was used for plantings and other beautification efforts along Market Street.

State law requires each redevelopment agency to set aside 20 percent of its tax-increment revenue for moderate, lower and very low income housing. Many cities and counties use this Housing Fund in conjunction with other funds (described under Resource Tool #2) and in conjunction with the Housing Authority. Funded projects can be located near transit, work places, shopping and services. Market rate housing can attract professionals who work in downtown offices, possibly reducing automotive commuting into the central business district from the suburbs. The Southside Park Co-Housing Project in downtown Sacramento, an infill project including six moderate-income and 14 market-rate housing units, was built with partial financing from the Sacramento Housing and Redevelopment Agency on Agency property. All of the units were sold to the co-housing group members.[45]

Resource Tool #7: Set Up a Public-Private Partnership

Many redevelopment projects in central business districts are funded by multiple organizations. For example, funding sources for the renovation of the downtown Denver Dry Goods Building for mixed uses included developer equity and union pension funds, as well as state multi-family housing bond issues, city loans, a federal grant, sales of low-income housing units and historic tax credits. Other organizations that could provide financial or technical assistance include local businesses, insurers, community development corporations, Small Business Development Centers (one in each county), the California Conservation Corps (which trains youths in urban ecological restoration) and the Trust for Public Lands' urban gardens program. Oakland's City Center, an office-commercial complex including a plaza with a fountain and sculptures at the entrance to a BART station, was developed by a private corporation in conjunction with City redevelopment efforts.

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43 Scott Herhold, Mary Anne Ostrom and Jennifer La Fleur, "What Have We Built?" *San Jose Mercury News*, May 22, 1994.

44 Robert L. Knight and Lisa Trygg, "Evidence of Land Use Impacts of Rapid Transit Systems," *Transportation*, Volume 6, September 1977.

45 Chris Lazarus, "Co-Housing Project: An Affordable 'Kid Heaven'", *California Planner*, Sacramento: California Chapter of the American Planning Association, Volume VI, Issue 4, July / August 1994.

Resource Tool #8: Build on Public and Tax-Delinquent Land

Jurisdictions can use surplus property or sites that have been acquired through non-payment of taxes to develop transit stations and infill projects. Infill projects can locate jobs and housing near each other and increase density near transit service and in central business districts. For example, a mixed-use project near Caltrain in downtown Mountain View was developed on an old school site. Many tax-delinquent sites are abandoned, but many also have toxic contamination. A profitable new business use or a redevelopment project could help pay for cleanup.

Resource Tool #9: Establish Special Assessment Districts

A special assessment district is used to fund public improvements in an area of a city or county. It requires property owners to pay according to the benefit they receive, which is not necessarily the same for each property owner. State law expressly authorizes several types of assessment districts. One of these is a Lighting and Landscaping District, which could be used to make transit, pedestrian and bicycle facilities safer and more attractive. Downtown merchants sometimes use assessment districts to fund amenities designed to attract customers to the downtown. The City of Pasadena established a special assessment district comprised of the facades of shops on Colorado Boulevard in the downtown historic district. In Tulsa, Oklahoma, the Downtown Improvement District, a special assessment district, funded property development. Assessment funds complemented contributions from the Downtown Tulsa Unlimited, Inc., a membership organization funded by dues, city contracts and parking fees.

Resource Tool #10: Establish Mello-Roos Special Tax Districts

A law enabling cities and counties to set up Mello-Roos districts was passed in response to Proposition 13, which requires a two-thirds vote for most tax increases but only a simple majority for special, single-purpose taxes. A Mello-Roos district sets up a special tax to pay for a single-purpose set of improvements, and must be approved by a majority of the residents of the district. If projects in the district have not yet been built, the developer constitutes the majority of owners and the tax is passed on to future residents who buy land from the developer. The district can sell tax-exempt bonds to fund the public improvements.

In a Mello-Roos district, each parcel owner pays the same tax, and the payments may be used for operations and maintenance costs as well as capital improvements. A Mello-Roos district could be used to pay for transit, pedestrian and bicycle improvements or for infrastructure, civic buildings or beautification intended to draw people into an area. Long Beach is using a Mello-Roos District to

revive Pine Avenue downtown, one block from the Blue Line light rail transit. The City is also working to establish a theater complex, restaurants and shops in this area.[46]

Resource Tool #11: Use the General Fund

If money is available in the General Fund, and a planning or capital project is expected to result in changes that will increase revenues in the long run, it could be worthwhile to allocate money from the General Fund for plan preparation and implementation. General funds are used for day-to-day in-house planning work and for most General Plan update projects.

Resource Tool #12: Issue Bonds

There are two types of bonds: general obligation bonds and revenue bonds. General obligation bonds are sold to pay for capital improvements that do not generate income, such as schools. These bonds must be paid back from the General Fund; therefore, issuing general obligation bonds generally requires a tax increase. Under Proposition 13, a tax increase requires a two-thirds majority vote of the people. If a proposed effort is popular enough to garner a two-thirds vote, this could be an option.

Revenue bonds are issued to fund projects that will generate income such as civic centers, utilities and housing. The federal Tax Reform Act of 1986 severely limits the issuance of revenue bonds; however, if the local government can secure a portion of the state's small allocation, it can issue revenue bonds. For example, mortgage revenue bonds issued locally or by the California Housing Finance Agency are still a major source of financing for affordable housing in California.[47]

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46 Jack Humphrey, Advance Planning Officer, City of Long Beach, conversation, January 11, 1995.

47 Wheaton

7.6 PROBLEMS AND SOLUTIONS

Local jurisdictions are likely to encounter a number of local barriers and difficulties in implementing transportation-related land use strategies. This section outlines some of these potential problems, and it briefly suggests solutions to them. The problems referred to in this section are generally related to caution on the part of institutions and citizens who are not certain that transit- and pedestrian-oriented development will be profitable or desirable. Solutions include education and guarantees designed to increase the sense of security to those who are in a position to take risks regarding the form of development.

Of course, cities and counties also work within the context of state and federal policy, and policies at these upper levels of government could have a bearing on local implementation of transportation-related land use strategies. For example, the lack of regional governance, the structure of property taxes, the fiscal effects of Proposition 13, and the State's environmental laws all have some effect on local land use and development decisions. Similarly, federal policies such as income tax credits for historic renovation and multi-family housing, loan guarantees and transportation funding requirements can also influence local policy and development. These state and federal issues are not the topic of this report, since local governments can do very little about them directly. Instead, this section looks at the local issues and concerns that can arise when transportation-related land use strategies are implemented, and it suggests solutions to these local problems.

Most of these problems are based on people's perception that there may not be a strong market demand for pedestrian- and transit-friendly development. Some residents oppose higher densities nearby, most lenders are reluctant to fund mixed-use projects, and many retail corporations demand large parking lots. There is, in fact, a demand for pedestrian- and transit-friendly design, but many groups have not yet been convinced of this. Local governments can overcome some of this reluctance by providing information about this demand.

Problem and Solution #1: Public Opposition; Education and Public Improvements

Residential neighbors of land proposed for change may oppose that change. They may believe that the changes will ruin the appearance of their communities. For example, to many people, higher densities mean high-rise apartment buildings surrounded by parking lots. Planning with the residents is the key to successful change. One method is a visual preference survey. At a public meeting, planners can show slides of various places in the town or other towns and have residents rate the slides as to which places they prefer. These preferences can then be incorporated into the new plans.

Often residents see that the places they prefer are well-designed, pedestrian-friendly, mixed-use, and even higher density environments.

Citizens may also believe that high-density residential projects will reduce their property values or increase crime. The Cities of Fremont and San Jose and the County of Santa Cruz have prepared presentations to show neighbors the design and population characteristics of affordable housing, along with statistics on adjacent property values. Some available resources that showcase high-quality, higher-density development are a video from the American Institute of Architects and a slide show from BRIDGE housing corporation. Also, the Local Government Commission maintains a video library including these and other videos.

Residents may oppose high-density commercial or residential development because of anticipated increased traffic and associated noise and air pollution. Site-specific impacts can be mitigated to some extent or compensated for with public improvements, such as those listed above.[48] Residents and merchants may oppose removal of parking to make way for bicycle lanes; replacement parking may have to be developed to compensate for this loss. The public may object to the cost of alternative transportation facilities; publicizing the high cost of building and maintaining vehicular roadways can counter this objection. Objections to the cost of improvements in commercial areas can be overcome by a unified effort to improve the area. In Denver, a group of civic, neighborhood, business and government leaders campaigned for a bond issue for downtown infrastructure improvements. The bond measure passed and the downtown prospered.

Problem and Solution #2: Capital Reluctance; Education, Loan Guarantees and Local Funding

Banks and other financial institutions that make construction loans tend to be very conservative. Their loan policies are based on "tried and true" developments, and may lead to denied loans or higher interest rates for "experimental" projects. There is information about dense, mixed-use, and limited-parking projects that have been financially successful, which the lenders may not have. For types of projects where this is the case, educating the lenders can at least lead them to make a loan, even if it is at a higher rate than "conventional" project. For pioneering projects, a loan guarantee from a local agency or entity could be the only way to induce institutions to finance a project. Local lenders may be more likely to support local renewal efforts than larger institutions whose central offices are outside the area, because they benefit from local renewal. In Shelby, North Carolina, the local banks formed a tax exempt loan pool for Uptown renovation.

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48 Frank J. Popper, "Siting LULUs," *Planning*, April 1981.

The California Home Energy Efficiency Rating System, Inc. (CHEERS) encourages Energy Efficient Mortgage Programs. Under energy efficient mortgages, utility savings on energy efficient homes are subtracted from the principal, interest, and taxes in calculating the amount a homebuyer can borrow. A recent study[49] quantifies how neighborhood characteristics can reduce vehicle use and associated household costs. The neighborhood characteristics are residential density, transit and pedestrian accessibility, and neighborhood shopping. CHEERS is considering factoring these characteristics into the mortgage qualification formula for Energy Efficient Mortgage programs.

Problem and Solution #3: Uncertain Market; Market Studies and Marketing

Developers may be concerned as to whether there is a market for infill, mixed uses or pedestrian-oriented design. They may also be uncertain about the market for projects in central cities and near transit stations. Density incentives only elicit development if there is a market for higher density projects.

Market Studies. Each area is in a unique market position. Its location, existing uses, surrounding uses, and access all help determine what type of development and transportation tools would attract people to that location. It is important to conduct a market study before embarking on improvements to an area or a transportation system. A market study can not only help to determine whether there is a demand for the type of development and transportation facilities a jurisdiction is considering, but can also identify what types of uses and facilities are likely to draw people.

Marketing. A marketing program developed along with improvements in an area can inform potential residents, businesses, customers, walkers and riders about the improvements. A marketing coordinator can also advise businesses in targeted activity centers on how to improve their marketing.

Market Experience. Because many downtown, pedestrian-oriented, transit-oriented and mixed-use development projects are just being completed, the market evidence is anecdotal. Computer firms have located in downtown San Jose and at Laguna West, a pedestrian-oriented development near Sacramento. In a joint development project on land owned by the San Diego Metropolitan Transit Development Board, 100 apartments and a day care center built next to a suburban light rail station are full. A new residential project near a BART station in El Cerrito in the East Bay is drawing residential renters. The ground floor retail, however, is half empty after two years. This station is not in a pedestrian-friendly area; in this situation the small shops do not draw from foot traffic, even to the BART station. San Rafael's experience with retail in its commuter bus terminal suggests that more than 3,000 boardings per day are required to support retail in a transit terminal.[50] Residents of new traditional neighborhoods, where most houses have front porches and are within a five- to-ten-minute

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49 John Holtzclaw, *Using Residential Patterns and Transit to Decrease Auto Dependence and Costs*, 1994.

50 Peter Dyson, Transportation Planner, Golden Gate Bridge, Highway and Transportation District, conversation, November 2, 1993.

walk of a commercial-office center, reported high satisfaction; 84 percent preferred this type of community in a 1992 survey.[51]

Outreach to Developers. Luring developers to a downtown can take a concerted effort. The City of Columbus, Ohio, directed an educational effort toward the development community regarding the market for high-density housing downtown. After conducting a market study, the City identified 350 suitable parcels, mailed a survey to owners, and provided technical assistance in assessing the feasibility of potential projects and in cutting costs. A conference held downtown attracted 150 developers, lenders, architects, builders and realtors. Market data, a computer to run *pro formas*, and sessions on adaptive reuse, design and construction techniques, financing and marketing strategies, mixed use development and moderate-income housing were available at the conference. The City has continued to update development community members through a newsletter. These efforts, together with one-stop permitting for downtown housing, longer inspector hours, federally assisted loans, tax deferral, and capital improvements resulted in a fourfold increase in developer interest. The 321 residential units that were built between 1987 and 1992 may not seem like a high number for all that effort, but they have appreciated 190 percent.[52]

Problem and Solution #4: Developers Building Elsewhere; Multi-Jurisdictional Cooperation

If a jurisdiction places substantial requirements and restrictions on developers and employers, and these requirements are not offset by the advantages of locating within the jurisdiction's boundaries, developers may locate outside the boundary. A multi-jurisdictional area may have unique assets, such as a labor pool with unusual skills or a natural feature. If all the jurisdictions within the area adopt the same ordinance, most firms will not base their location decisions based on the ordinance's requirements. The Golden Triangle trip reduction ordinance, which was a forerunner of Congestion Management Programs, is an example of this kind of cooperation.

7.7 MONITORING METHODS

Monitoring refers to methods of ascertaining whether or not actions and changes are having the desired effect and moving the jurisdiction toward its goal. The monitoring methods described below are ways to measure the effectiveness of policies, planning documents and administrative actions in achieving the recommended strategies. This section address the question of how a jurisdiction can know whether land use, infrastructure and travel patterns are changing in the desired

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51 John Schleimer, *Market Perspectives*, cited in Sacramento Bee, *A Skeptic's Conversation: Doubter's Own Study Backs Neo-Traditional Development*, March 7, 1993.

52 McBee

directions. Most of these methods simply mean checking for another set of changes when performing monitoring tasks that many cities and counties already carry out.

Monitoring Method #1: Track New Development Projects

As a local jurisdiction's Current Planning office receives development project applications, it can enter them into a geographic information system (GIS) or a computer database. Each entry could state the type of use or mix of uses; the number of square feet or dwelling units; a score for transit, pedestrian and bicycle-oriented design; interior street type; number of parking spaces; and location. If the project is approved, staff would enter the approval date and any project changes. At the end of each quarter or year, a report could be printed showing how many development applications were located in the targeted areas and how many incorporated desired design options. The City of Redding and Shasta County have both instituted development tracking systems. Development can also be tracked on GIS for congestion management purposes, as it is in Long Beach.

To monitor the effect of policies on urban form, a jurisdiction could compare maps of the uses, densities and street forms of new developments before and after the policies are implemented. GIS are an efficient way to do this; although setup and learning take time, the long-term usefulness and savings can make it worthwhile. Councils of Governments, such as the Association of Bay Area Governments (ABAG), map land uses by parcel. Street maps would show whether connecting street patterns have been used in the new developments. A more difficult, but worthwhile, task is to map densities (dwelling units or commercial square feet per acre) before and after implementation of the new policies. This can indicate whether the policies are having the intended effect of increasing densities in certain areas.

Monitoring Method #2: Track New Development Projects Outside Jurisdiction

If a city or county is concerned that requirements or limitations placed on developers might lead developers to locate projects outside the jurisdiction limits, staff could track new developments in neighboring jurisdictions. If this trend appears to be occurring, the county or city could coordinate with the neighboring jurisdictions, especially within the same air basin, to make requirements uniform. If this is not possible, the jurisdiction could adjust its regulations.

Monitoring Method #3: Evaluate the Capital Improvement Program

A city or county could review the Capital Improvement Program in terms of the ratio of public infrastructure and transportation projects supporting private automobiles to projects

supporting other modes, denser development near transit hubs, downtown revitalization, infill and development of activity centers.

Monitoring Method #4: Conduct Ridership and Path Use Surveys

To measure the effect of land use and public improvements on transit ridership and use of pedestrian and bicycle facilities, a city or county could conduct surveys. Transit agencies do not normally track ridership by location of boarding and debarking, because drivers are occupied with driving and collecting fares. Survey workers could ride the routes in questions or stand at relevant transit stops and stations. The City of Thousand Oaks has conducted surveys on its transit system. Similarly, survey workers could count or interview pedestrians and cyclists on sidewalks, bike lanes and paths. This information is important for developing short- and long-range transit plans and evaluating methods of improving the efficiency and effectiveness of the transportation system.