Planning Guidelines for Transitway Access

KEVIN A. HABOIAN

With the problems inherent in preserving freedom of movement in rapidly developing urban areas, many agencies are advising the use of transitway facilities to provide exclusive guideways for buses, carpool, and vanpools in congested freeway corridors. Vehicles wishing to gain access to the earlier high occupancy vehicle (HOV) facilities were required to weave across heavily traveled, general-purpose freeway lanes. However, in recent years, the need for direct access to these facilities has been recognized. For example, in Orange County, California, a system of transitways 19.4 miles long is being proposed for the major freeway corridors. With this priority system, a network of direct access locations is being linked to the surrounding arterial system. In designing this network, a set of planning guidelines was developed to select the best individual access locations to be included. This paper describes these planning guidelines, involving growth trends, infrastructure issues, and design considerations, which should be useful to transportation planners and engineers in analyzing transitway access locations.

As urban areas become increasingly more populated, transportation planners and engineers face the challenge of preserving ease of movement in a highway system that is often near or over capacity. Transitway facilities for buses, carpools and vanpools, are becoming popular as an approach that can enhance the people-moving capacity of major travel corridors. The Orange County Transit District (OCTD) is developing a 19.4 mile bidirectional transitway system within its major freeway corridors with direct access from the arterial system (Figure 1). This approach is unique in that it represents a network of transitway access locations which will connect with the major activity centers and the local arterial system. Other transitway facilities across the country (e.g., Seattle, Miami, Los Angeles, and Washington D.C.) provide isolated access locations with an adjacent arterial or park-and-ride lot, but access is provided mainly from the general-purpose freeway lanes.

OCTD is investigating development of a network of direct access locations for three reasons:

1. Transitways assume a high-speed level of service during peak commuting periods and offer travel time savings as an incentive. Direct access ramps ensure this time savings by eliminating the need for vehicles to weave across heavily traveled freeway lanes when exiting the facility. Without these direct access locations, vehicles must exit the facility into the highly congested freeway lanes, typical of central Orange County, which may negate the travel time benefit.
2. The implementation of a commuter lane on SR 55 (see Figure 1) resulted in many complaints and safety concerns from commuters. The perception was that many unnecessary accidents were occurring on the freeway as a result of vehicles weaving in and out of the high-occupancy facility. Direct access ramps provide safer traffic operation by precluding these weaving movements, resulting in fewer accidents and responding to the public's safety concerns.
3. A preliminary cost effectiveness analysis was performed to find out whether direct access ramps would be feasible. Preliminary capital costs, demand usage, and travel time savings estimates were used to determine whether the potential benefit of a direct access ramp exceeded the dangers of not doing so. Results of this analysis indicated that direct access ramps were practicable at several locations.

The reasons discussed above led OCTD to engage in more detailed planning to incorporate a transitway access network.

The questions that faced the transportation planners and engineers in the initial stages of the design process in Orange County were numerous. What objectives should be considered in developing a transitway access network? What were the factors that make one potential location better suited for transitway access than another? Clearly some form of planning approach or guidelines were needed to respond to these questions. This paper describes planning guidelines that were developed and applied in Orange County to describe the best transitway access network. These guidelines were grouped into three general categories—growth trends, infrastructure issues, and design considerations.

GROWTH TRENDS

An absolute requirement for establishing a transitway access network is understanding the growth trends of the areas to be served. The design team is responsible for this understanding, but local jurisdictions are responsible for coordinating their land use activities with the proposed transitway system to protect and enhance system benefits. Specifically, understanding encompasses identifying the major activity centers to determine whether their projected growth supports the need for transitway access (*1*). Attention must also focus on adjacent land uses to ascertain whether the current and proposed development patterns will ensure mobility for people commuting to the major activity centers.

Major Activity Centers

An activity center is usually defined as an area of intense, increasing development of office and commercial activities (*2*). In Orange County the major activity centers were identified by the geographical area served, employment activity,

Parsons Brinckerhoff Quade & Douglas, Inc., 505 South Main Street, Suite 900, Orange, Calif. 92668.

FIGURE 1 Transitway and commuter lane system.

LEGEND
1 ANAHEIM STADIUM
2 ANAHEIM RECREATION AREA
3 THE CITY CENTER
4 NORTH MAIN STREET
5 SANTA ANA CIVIC CENTER
6 SOUTH COAST METRO
7 IRVINE BUSINESS COMPLEX NORTH
8 IRVINE BUSINESS COMPLEX SOUTH

FIGURE 2 Major Orange County activity centers.

and changes in development policies. Eight activity centers, shown in Figure 2, are the major destinations for employees in Orange County, and provide the greatest potential for carpool and transit usage. These eight centers, each within one mile of the major freeway corridors in the area, all depend on freeways for their primary access. Moreover, all eight centers contain major proposals for intensifying development of either office complexes, industrial uses, or regional shopping centers. Linking these activity centers to the transitway by a network of transitway access locations promotes the principal objective of a transitway program: to increase mobility while saving travel time. After the major activity centers have been identified, employment projections are needed to estimate the transitway use expected for each activity center and for use in designing the most responsive transitway to serve each center. The design team can then determine whether the employment projections justify transitway access consideration.

Based on plans adopted for each activity center, forecasts of jobs for each center were estimated and are shown in Table 1. The employment forecasts for these centers account for more than 25 percent of all Orange County employment throughout the projection period. The employment estimate for each activity center in the year 2010 ranged from 16,700

TABLE 1 ORANGE COUNTY MAJOR ACTIVITY CENTERS: CITY STAFF GENERATED EMPLOYMENT PROJECTIONS

Activity Center	Projected Employment		
	1985	2000	2010
Anaheim Stadium	34,192	71,504	95,640
Anaheim Recreation Area	25,089	29,114	31,788
The City Center	12,167	15,934	16,700
North Main Street	17,960	24,978	29,691
Santa Ana Civic Center	23,876	26,759	30,109
South Coast Metro	40,048	60,323	67,053
Irvine Business Complex North	40,000	72,384	75,306
Irvine Business Complex South	46,792	55,240	59,776
Total	240,124	356,236	406,063
Total Orange County	1,130,700	1,436,600	1,570,500
Percent Activity Center of Total Orange County	21%	25%	26%

to 95,640 with total employment for the eight centers estimated at more than 406,000. These employment forecasts were then used to develop transit and HOV usage estimates for the year 2010 (Table 2).

Two sets of HOV estimates were produced for the forecast year: one based on the assumption that transitways would be open to vehicles with two or more persons, and a second that assumes transitways would be restricted to vehicles with three or more persons. The transitway system is projected to carry approximately 3,000 HOV trips in the morning peak hour, using an eligibility of three or more persons per vehicle. A much higher estimate of approximately 11,000 HOVs results if two-person carpools are allowed to use the transitways. Express transit service on transitways is projected to carry 22,100 daily riders in the year 2010. Approximately 140 buses would be needed during the peak hour. Maximum forecasted demand for any one segment is 6,100 directional transit and HOV person trips in the morning peak hour, equivalent to the capacity of the number of person-trips that can be accommodated by three general-purpose freeway lanes. The design team reasoned that employment and transitway usage projections justified consideration of transitway access locations with the activity centers.

Adjacent Land Use

Establishing a transitway system together with a network of access locations represents a major public capital investment, but is only part of the solution for ensuring personal mobility for employees and visitors to the major activity centers. The characteristics of adjacent land uses also play an important role. During the planning stage of a transitway access network, the design team must consider the nature of current land use when recommending individual access locations. These considerations can range from the type of development near the proposed access locations, to the feasibility of including the access location in the arterial system. However, it is the responsibility of the local jurisdictions to coordinate their future land use activities to take full advantage of the benefits of the access location. Specific local activities which can offer benefits to, as well as receive benefits from, a transitway access location are as follows:

1. Focusing new land use developments and public street improvements where they can offer best access to the transitway and ensure convenient, safe travel between the transitway access location and individual employment sites.
2. Promoting programs that support rideshare modes in current developments and requiring rideshare programs as a condition of development for new land use proposals.
3. Providing HOV preferential treatment facilities between the transitway access location and the activity centers. Preferential treatment can include bus turnouts, parking areas reserved for HOVs, signal preemption, improved signs, or even exclusive HOV lanes leading from the transitway ramps to employment sites.

INFRASTRUCTURE ISSUES

Development of a transitway and a network of access locations in an urban setting will undeniably require a certain amount of reconstruction of the highway system. Selecting the access locations to reduce reconstruction to a minimum, to serve the major activity centers in fitting style, and satisfy all the agencies involved, is of the utmost importance in the planning stage. Arterial and freeway impacts, interagency coordination, and the ability to incorporate preferential treatment in the future, all involve key issues that must be addressed to successfully develop a transitway access network.

Arterial and Freeway Impacts

The principal objective of a direct access location is to connect the transitway facility, usually located within the freeway median, with the local arterial system. When selecting a location for direct access, the design team must assess the potential impact of the transitway ramp on both the local street and freeway facilities. For instance, the dimensions, orientation, or configuration of a local arterial may be ideally suited for a direct access ramp, but the freeway impacts associated with the ramp connection to the transitway may be less than the best. Such freeway impacts could include extensive right-of-way acquisition caused by having to widen the freeway cross-section, or impaired HOV access to other freeways. Consequently, the reconstruction and traffic flow impacts associated with arterial and freeway connection must be analyzed simultaneously, because the transitway ramp links each facility. To reduce arterial and freeway interchange impacts when selecting potential transitway access points, three factors must be considered:

1. Access points near freeway-to-freeway interchanges should be not be constructed because there would be insufficient distance to allow HOVs emerging from the transitway ramps access to each freeway. Moreover, the cost of building new

TABLE 2 TRANSITWAY DEMAND ESTIMATES FOR YEAR 2010

	High Occupancy Vehicles HOV's Restricted to:		Transit
	2 Persons or More	3 Persons or More	Public and Private Service Combined
SR 57/I-5/SR 55 TRANSITWAY			
o Daily Person Trips	123,600	52,700	22,100
o AM Peak Hour Vehicles			
- Total on Facilities	11,000	3,000	140 buses
- At Maximum Location in one direction	3,700	1,400	50 buses

facilities over or around freeway interchange structures would be high, possibly negating the feasibility of the project.

2. Care should be taken to avoid arterial locations where general-purpose freeway access is currently provided or proposed. Incorporating transitway ramps at these locations will usually require relocating or realigning the general-purpose ramps to accommodate the additional access. Also, the traffic distribution to accommodate vehicles entering the transitway and freeway facilities may require installing additional signals, resulting in lower-level service to HOV and general-purpose traffic flow.

3. Traditionally, there is lower demand with HOV ramps compared to general-purpose freeway ramps. In Orange County, the average a.m. peak-hour volume projected for each transitway access ramp is just under 500 HOVs, which corresponds to approximately 15 percent of the total demand at the HOV/local street intersection (*3*). This lower demand indicates that, ideally, transitway access locations should be built at collector or secondary arterials. These facilities traditionally have lower volumes, do not contain general-purpose freeway ramps, and could provide access to primary arterials by way of current signalized intersections.

Interagency Coordination

Coordinating with all agencies potentially affected by a transitway access ramp, and as well as those who may potentially benefit from it, is usually the critical factor in gaining acceptance of the access location. Some agencies need to be contacted early in the planning process to ascertain future plans for their transportation facilities. Discussion of these plans will usually arise during regularly scheduled meetings. Other agencies should be informed of the proposed transitway access location because its construction may help future planned city expansion or, in the case of a developer, a future project. It is important to realize that often there is no formal procedure to aid in this process; planning is usually an iterative process in which a consensus may be reached after several meetings. The consensus may incorporate a project that includes improvements desired by several agencies interested in funding or co-sponsoring the HOV access improvements with other general-purpose traffic improvements.

In Orange County, such a consensus was reached with three separate entities: OCTD, California Department of Transportation (Caltrans), and the City of Santa Ana. Caltrans was developing freeway (I-5) widening plans and the City of Santa Ana was planning local arterial and freeway access improvements when OCTD, responsible for the transitway program from its inception, organized several meetings with these agencies. The meetings resulted in a consensus that incorporated the proposed transitway within Caltrans I-5 widening plans and provided direct access between the transitway and local street system at two locations in Santa Ana.

Orange County transitway planning activities also provided an example as to how a transitway access location can act as a catalyst in future city/developer plans. The SR 55 freeway essentially forms a city boundary separating the cities of Santa Ana and Irvine. A transitway is proposed along this facility, with arterial access ramps envisioned at several locations. One arterial access alternative, Alton Avenue, is a proposed freeway overcrossing which would connect the arterial on each side of SR 55, thereby joining two rapidly expanding cities. This proposed overcrossing could provide access to the planned office and industrial developments in both Santa Ana and Irvine. Developers planning projects in the vicinity of Alton Avenue would support the idea, since the planned access would facilitate city approval of their projects. Consequently, rather than having to persuade the cities and developers of the merits of the proposal of transitway access, these very same entities begin advocating its implementation to the community and surrounding cities. This support, in turn, aids in developing the transitway access network. It is important to realize that no one specific reason or formal process can obtain such an outcome. Support will arise during planning activities in which close coordination, frequent meetings, and understanding of differing viewpoints transpire with the entities involved.

Extending HOV Preferential Treatment To Local Streets

One of the key benefits of developing a transitway system is saving travel time and it has been estimated that travel time savings of at least one minute per mile is required for people to shift modes from cars to buses or carpools. After users leave the transitway, it is desirable to extend travel time savings to the local street system where feasible. Thus, when selecting transitway access locations, attention should also be directed to the arterial system to ensure that future arterial HOV improvements can provide the same saving of travel time.

Arterial HOV improvements can be separated into both high capital and low capital cost treatments. High capital treatments involve exclusive use of lanes and streets, and consist of concurrent flow lanes, contraflow lanes, median/center lane facilities, and reserved roadway facilities. Because of the right-of-way requirements necessary to implement high capital treatments, studies to determine whether implementation is feasible should be conducted early in transitway planning activities. Low capital measures usually involve minor alterations to streets and modifying the operation of traffic control devices. Such improvements as pavement striping, signal progression and signal preemption, bus turnouts, and improved signs can be made as needed after the transitway system begins operation.

DESIGN CONSIDERATIONS

In establishing a network of transitway access locations, it is important to realize that the design of each individual access point will be site-specific. The special characteristics of each site will make it difficult to ascertain whether one potential access location is better than another based on design criteria used in the planning stage. However, the following sections describe several general design considerations which can be used to develop feasible transitway access locations.

Minimize Right-of-Way Acquisition

Care should be taken to use freeway right-of-way where available (*4*). This not only includes right-of-way at the perimeter

of each direction of travel, but within the median as well. Right-of-way acquisition can be publicly unpopular as well as environmentally sensitive, and may require significant mitigation measures (soundwalls, etc.). Often in an urban area, there may not be any available right-of-way and acquisition is unavoidable. Such a situation occurred in Orange County and the amount of right-of-way necessary to construct a transitway access ramp varied depending on the characteristics of each site. In an attempt to compare the right-of-way impact associated with each proposed access location, acquisitions were separated into minor and major categories. Minor right-of-way takes did not affect any present or proposed buildings and were usually small acquisitions of less than 20 linear feet beyond the right-of-way boundary. Major right-of-way takes typically affected present or proposed buildings and involved obtaining large parcels of land. These categories allowed the design team to compare the right-of-way acquisition impact to select the best access locations.

Avoid Extensive and Complex Designs

Steep grades, insufficient right-of-way, overcrossings at existing railroads, freeway interchanges, general-purpose ramps, and limited weaving areas can all cause major structural modifications and complex access designs, and should therefore be avoided when possible. Preliminary studies in Orange County indicate that access locations where the transitway can be connected to an overpassing arterial street can be cost-effective and cause few impacts. With this configuration, shown in Figure 3, through transitway traffic continues to operate on the transitway at freeway grade level. Traffic desiring to enter or leave the transitway uses a ramp that connects the transitway to the grade-separated street.

Environmental Impacts

The environmental impact of building new facilities is always a major issue in the local community. For the design process in Orange County, an attempt was made to determine the environmental impacts associated with each potential access location. This action was not intended to substitute for an Alternatives Analysis or Environmental Impact Statement, but rather to gain some idea of the impacts that could be expected with each transitway access option. These impacts, rated as none, minimal, and significant, were a subjective estimation of noise levels to adjacent property, displacement of sensitive parcels, and facility aesthetics (i.e., large amounts of structure required for an access location would be rated as significant).

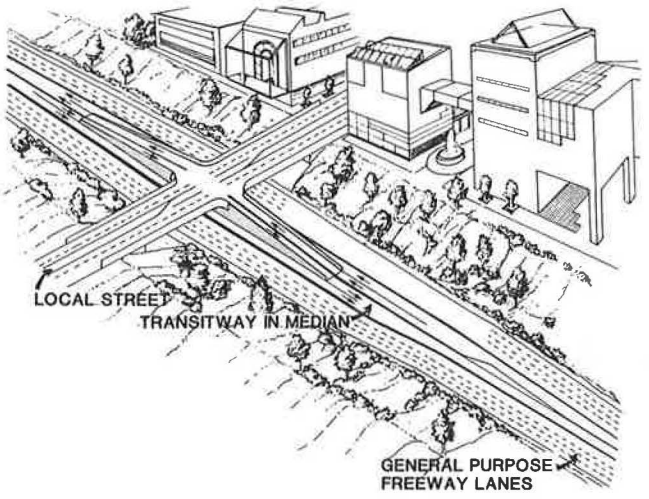

FIGURE 3 Drop ramps in median of two-way transitway.

Costs

The cost of building individual access locations, for the most part, will determine the feasibility incorporating that location into the transitway system. If the aforementioned issues concerning right-of-way acquisition, complex designs, and environmental impacts are followed, the cost of building a transitway access location should not be unreasonable. In Orange County, the cost of constructing a transitway access ramp similar to that shown in Figure 3.3 ranged from $3.3 million to $6.2 million.

USING THE PLANNING GUIDELINES: METHODOLOGY USED IN ORANGE COUNTY

There are many factors to consider in choosing the best place to incorporate an access point into a transitway access network. The planning guidelines presented in this paper cite specific issues to consider in developing such a network. On the basis of the Orange County experience, there is a procedure for identifying the best possible transitway access locations.

The first task was to identify the possible access points to the activity centers in relation to the proposed transitway system. The factors considered in identifying potential access points included the following:

1. Understanding present and future activity centers.
2. Nearness of the activity center to the potential access location.
3. Reducing the impact to existing interchanges and street systems.
4. Discussions with Caltran's staff to ensure that any proposed access would not conflict with future freeway modifications.

A complete list of all the potential access points along the proposed transitway alignment was identified using these four factors.

The list was then screened to obtain the most effective system of ramps which would support the transitway system. This was accomplished by using negative screening criteria analysis. If an access point met any of these criteria, it usually was not considered for further analysis. However, certain access points met one of the negative criteria and yet were considered further because of ease of construction or proximity to activity centers. The fact that an access location was not analyzed further did not preclude it from future consideration. The purpose of the Orange County conceptual design was to identify potential feasible locations for transitway ramp

connections. Final approval of access locations will be based on a detailed Alternatives Analysis. The negative screening criteria used in the analysis were as follows:

1. Transitway demand related to activity center.
2. Arterial and interchange traffic impacts.
3. Extensive and complex design problems.
4. Proximity to freeway-to-freeway interchanges.

The first criterion was established because the transitway is primarily set up to serve the work trip and access points must be situated so that vehicles using the transitway ramp can gain access to the activity centers. Locations where the transitway access point would not efficiently serve the activity center were considered undesirable. The remaining three criteria were considered to be undesirable for the reasons stated earlier.

Table 3 shows the potential activity center access points considered and the evaluation of these access points using the negative screening criteria. With this screening process, 15 access points were identified for more detailed evaluation.

At this juncture, alternative conceptual designs were developed for each access location selected. For certain locations, several alternative configurations were developed, while the design constraints of other potential access points made only one configuration feasible. To ascertain the access locations best suited for inclusion in the transitway access network, the design impacts were assessed in light of the design issues previously defined. This assessment gives a general estimation of each access location's impact in terms of cost, right-of-way take, traffic flow on the transitway ramp and surrounding local arterials, and environmental concerns. Costs were separated into three categories, less than $10 million, between $10 and $20 million, and greater than $20 million, while the other design issues were rated subjectively. Table 4 presents this assessment for several potential transitway access locations.

Based on the foregoing considerations and implementation impacts, nine access locations shown schematically in Figure 4, were considered to be reasonable options for incorporation into a transitway access network. It should be noted that even though this methodology is relatively simplistic, it took approximately six months to obtain this outcome. If the plan-

TABLE 3 SCREENING EVALUATION OF POTENTIAL TRANSITWAY ACCESS POINTS

Route	Access Points Considered	Evaluation[1]
57	Ball Road	(1) (2)
57	Cerritos Avenue	*
57	Katella Avenue	(2)
57/River	Anaheim Stadium	*
57	Orangewood Avenue	(2)*
57	Chapman Avenue	(2) (4)
57/22/River	Metropolitan-Hospital Loop	(4)
57	LaVeta Avenue	(3)*
5	Chapman Avenue	(3) (4)
5	State College/The City Drive	(3) (4)*
5	Orangewood Avenue	(3)
5	Pacifico Avenue	*
5	Katella Avenue	(2) (3)
5	Flower Street	(4)
5	Broadway/Owens Drive	(3)*
5	Main Street (Santa Ana)	*
5	17th Street	(2)
5	Lincoln Avenue	(1) (3)
5	Grand Avenue	*
5	4th Street	(1)*
5	1st Street	(1) (2) (4)
5	Main Street (Tustin)	(1) (4)
55	McFadden Avenue	(1) (4)
55	Edinger Avenue	(1)
55	Warner Avenue	(1)*
55	Dyer Road	(2)
55	Alton Avenue	*
55	MacArthur Boulevard	(2)
55	Sunflower Avenue	*
55	Main Street (Irvine)	(4)
405	Bristol Street	(2)
405	Bear Street	*
405	Redhill Avenue	(4)
405	MacArthur Boulevard	(2)
405	Von Karman Avenue	*
405	Jamboree Boulevard	(2)

[1] If access point meets anyone of the negative screening criteria listed below, it usually was not considered for further analysis.

(1) Transitway demand related to the activity center
(2) Arterial and interchange traffic impacts
(3) Extensive and complex design problems
(4) Proximity to freeway-to-freeway interchanges

*Access points considered for further analysis.

TABLE 4 TRANSITWAY ACCESS LOCATION DESIGN ISSUES ASSESSMENT

Location	Cost	Right-of-Way Take	Traffic	Environment
Grand Elevated Connection To Santa Ana Boulevard	$$$	Major	Good	Significant
Grand Tunnel Connection To Santa Ana Boulevard	$$	Minor	Good	Minimal
Broadway/Owens	$$	Major	Good	Significant
Main	$	Major	Fair	None
Anaheim Stadium	$$$	Major	Good	Significant
Cerritos	$$	Minor	Good	None
Orangewood	$$	Minor	Poor	Minimal

ning guidelines for transitway access had not been developed, it would have taken considerably longer to obtain the conceptual transitway access network.

CONCLUSION

The proposed transitway within Orange County's major freeway corridors exemplifies the type of HOV facility that can preserve mobility in rapidly developing urban areas. Reduced travel time is the key incentive offered by these facilities and obtaining the maximum time savings through good accessibility is essential. In response, Orange County is planning a network of direct access locations with the surrounding arterial system. The many factors and objectives influencing selection of the best possible access network resulted in the adoption of planning guidelines for use in evaluating growth trends, infrastructure issues, and design considerations. These guidelines factored critical characteristics into the selection of ramp locations during the transitway access planning process.

Although the Orange County experience can be considered unique to the circumstances of planning a transitway access network, several observations from this experience can apply to other jurisdictions. Employment forecasts are needed for the major activity centers to be served by the transitway facility because these estimates will be used to project usage of the proposed access locations. Local jurisdictions must be kept abreast of the transitway planning process so that their future land use activities will achieve maximum benefit from the planned access location. Moreover, transitway access designs should be as simple as possible to reduce costs and avoid public unpopularity resulting from right-of-way acquisitions of buildings and environmentally sensitive areas. Perhaps most important, the responsible agency must work closely with all agencies that may benefit from, or be affected by, a proposed transitway access ramp. Such coordination may result in a consensus by agencies with an interest in funding a transitway access location with other general-purpose traffic improvements.

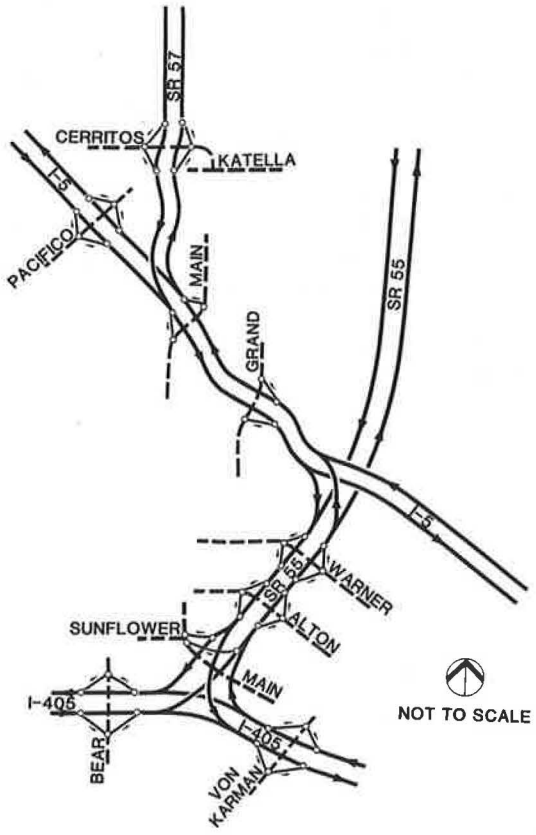

FIGURE 4 Transitway access locations.

REFERENCES

1. Orange County Transit District, Planning Department. *Orange County Activity Centers Employment Projections*. Garden Grove, California, October 1986.
2. *Transitway Access*. Working Paper No. B.3/5/6, Orange County Transitway Concept Design. Orange, California, July 1987.
3. *Traffic Flow and Circulation Requirements*. Working Paper No. C.5, Orange County Transitway Concept Design. Orange, California, July 1987.
4. American Association of State Highway and Transportation Official. *Guide for the Design of High Occupancy Vehicles and Public Transfer Facilities*. Washington, D.C. 1983.

Publication of this paper sponsored by Committee on Bus Transit Systems.