# TRANSPORTATION CORRIDOR PLANNING: A MODEL AND CASE STUDIES

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**ABSTRACT**

As transportation and transit corridors have become increasingly common as focal points for urban design, corridor development has emerged as one of the more interesting and complex issues in transportation planning. Problems with corridor development are always large: they need to ensure access to transportation, provide high quality transportation, develop livable communities and provide for economic development along the corridor. These problems are exacerbated and new problems are created when a corridor crosses jurisdictional boundaries.

There is a need for a model that addresses the major problems in corridor planning and management. This paper develops such a model that is based upon 5 major areas of the corridor development process: governance, economic impacts, financing, design and citizen preferences. The prescriptive abilities of this model are tested through analysis of 3 case studies of transportation corridor improvements. Finally, lessons learned from the application of the model are presented at the end.

## TRANSPORTATION CORRIDOR PLANNING: A MODEL AND CASE STUDIES

Corridor development is one of the more interesting and complex issues in transportation planning. Problems with corridor development are always large - the need to ensure access to transportation, provide high quality transportation, develop livable communities and provide for economic development along the corridor. One could develop a long list of potential corridor development problems. However, these problems are exacerbated and new problems are created when a corridor crosses jurisdictional boundaries. When there are multiple jurisdictions involved, there can be marked difficulties in planning and developing corridors. There is a need for a model that describes the major problems in corridor planning and management. The goal of our research is to develop a qualitative model of the decisionmaking process in transportation corridor planning. Our model will be used to form theories that lay out the relationships between areas of corridor planning decisionmaking. We will then begin the process of testing the theories by examining case studies of different corridor implementations.

## DESCRIBING THE MODEL

An initial problem with analyzing transportation corridor improvements is in defining a transportation corridor. There is a need to differentiate discrete corridors from more general system wide improvements. For this work, the authors take a spatial approach in defining corridors. We define a transportation corridor as a geographic area between two points, linking multiple centers, and moving people and freight. This definition includes both the transportation infrastructure (e.g., the roadbed, rails and stations) and the new and existing development that surrounds that infrastructure.

The model developed here has roots in previous studies carried out by the State and Local Policy Program at the Hubert H. Humphrey Institute of the University of Minnesota (*1 – 3*). One of the reports from those efforts sketched the framework for similar transportation planning and management efforts. (*2*) A formal model of the corridor planning and management process is shown in Figure 1. Figure 1 shows that there are 5 major areas of decisionmaking with regard to the implementing a transportation corridor: governance, economic impact, financing, design and citizen preferences. Each of these areas impacts the other area, but the impacts are not entirely predictable *ex ante*. It is important to research the various relationships that might arise, for a problem in one area may require a different strategy in another area. Implementers of corridor projects may seek to optimize the implementation in all areas, but often times must ‘satisfice’ because of constraints imposed in one or more areas.

### Governance

One of the major new problems that arise in the planning of transportation corridors is in the area of *governance*. No longer can a single jurisdictional agent exert control over corridor development. Now many parties come to the problem of developing the corridor, each with their own needs and desires regarding design, construction, maintenance and operations of the transportation infrastructure, and with varying amounts of influence. These consist of the local, regional, state and federal stakeholders and the institutions they represent.

**Economic Impacts**

There are several ways in which governance issues might affect the outcomes of the corridor design process. One of the most important is that the design of the corridor may not produce the highest possible *economic impact* for the corridor and its related jurisdictions as a whole. For example, if one city is able to exert significant enough pressure on the governing entity to produce their preferred design alternative, this may create a negative economic impact for other areas along the corridor that might outweigh the benefits to the city's citizens. The notion of spillover effects of tax and spending decisions is well established in the economics literature. (*4*) Corridors need to move people and freight efficiently, or else quality of life and the environment suffer, and millions of dollars are lost to traffic congestion, wasted time and fuel. To help focus the discussion on corridor wide impacts, economic impact analysis should be conducted to weigh potential costs and benefits of various corridor design scenarios. There are many different types of economic impact analysis, ranging from complex benefit-cost analysis to easier to understand qualitative discussions of the ranges of potential costs and benefits.

**Financing**

Both the governance problem and economic effects of corridor development have a bearing on the ease and method of *financing* a proposed solution. There are several different sources of funds available to finance a transportation infrastructure investment. However, some if not most require at least implicitly a governing body for the corridor that can be a sole authority. Also, the range of potential economic impacts and their monetary implications for the governing authority will help determine the range and types of financing available for the initial capital investment.

**Design**

The fourth major area of concern for corridor planning and management is the *design* of the corridor. This obviously has an impact on the economic impacts of the project. For example, a grade separated rail system may produce smoother, more efficient travel for passengers. However, a boulevard type roadway improvement is more likely to produce economic development along the entire length of the corridor. This difference in impacts also will translate into the most likely source of cash flows to the system that can be used for capital construction and maintenance of the system. Grade separated rail systems must be largely paid for through farebox revenue, subsidies from government units, and development revenue and property value increases derived around station nodes. Roadway improvements may produce gains in property value throughout the corridor that can be captured as a revenue stream for the corridor authority. Finally, governance may impact directly the choice of design in the corridor, having an effect on economic impacts and financing. The design of the corridor must reflect all of these diverse interests while sticking to a budget and financing scheme. The design is the final product of a collaborative approach that has integrated the other four components. An important potential constraint in the area of design is environmental impacts. The best implementation from an economic or citizen preference vantage may conflict with the best environmental solution to a project. Environmental problems may require the expenditure of more resources (affecting financing and economic impacts), the redesign of a corridor, or other changes that will produce better solutions in the absence of environmental issues.

### Citizen Preferences

The last piece of the corridor planning and management model is *citizen preferences*. Citizen preferences are the foundation for all of the other pieces of the planning and development process. Who is participating, when in the process they are participating, and how people are participating are three questions that should be of concern to corridor development teams. There are several ways in which these preferences can affect the rest of the process. In the area of governance, for instance, if citizens do not respond well to special districts (there are several reasons why this could be the case, from a feeling of loss of accountability to no experience in dealing with special districts) then even if the optimal institutional structure for administering the corridor is a special district, this recommendation is sure to meet with resistance. In the area of financing the preference problem can be marked. Though all of the citizens of the jurisdictions mentioned above are likely to benefit from implementation of an infrastructure improvement, it is unlikely to get support if tax increases are necessitated by implementation.

## APPLYING THE MODEL: CASE STUDIES

This study attempts to evaluate, enhance, and refine the corridor-planning model by examining case studies of major urban transportation corridor implementations. To identify these corridors, the research team cast a broad net, beginning with the definition stated above, and considering corridors developed for freight movement as well as passenger, and also corridors that serve multiple or single modes.

Ultimately, the team settled on three corridors that it viewed as "successful," that is, that accomplish the goals for which they were originally established. While these goals typically include reducing congestion and its externalities, and/or serving as an anchor for development, the team learned that these corridors also were the result of planners' abilities to integrate and balance these five components, including recognizing when it was appropriate to sacrifice parts of one component to ensure successful implementation of others.

The corridors chosen represent a broad range of experiences with which to test our model. The corridors are listed in Table 1, with some descriptive data. As one can see, the corridors studied represent a broad range of periods (from Boston in the 1970s to the current implementation of Denver's T-Rex corridor), scales (from less than 5 miles in Boston to nearly 20 miles in Denver), jurisdictional scope (from neighborhood scale in Boston to counties in Denver), and land uses (predominantly commuter roadway space in San Diego to urban residential in Boston). This diversity should give a broad range of contexts with which to evaluate how corridors are developed. The case study approach does introduce issues of generalizability of results, but with such a large range of experiences, we are more confident that our results can be extended to other areas.

**Boston Southwest Corridor**

The Boston Southwest corridor is an example of how citizen preferences can influence the development of a corridor, and an example of how positive governance can facilitate interaction between public and private stakeholders. The southwest corridor project was initially designed in the 1960's as an expressway project aimed at linking I-95 to Boston. In 1972, however, even though the land had already been cleared, the government of Massachusetts stopped the highway plan in response to residents' rejection of highway construction. Studies commenced on alternatives to highway construction, with the studies incorporating large amounts of citizen participation. The plan that emerged from these studies was for a new depressed rail right-of-way. In the meantime, the governor of Massachusetts championed shifting funds to transit use under the Interstate Transfer Provisions of the Federal Highway Act of 1973. (*5*) Since both the land and money were in place, the project moved ahead as a transit project. Heavy construction ensued between 1980 and 1987, with continuous involvement from the local neighborhoods and community. The 4.7-mile corridor serves 3 distinct neighborhoods, which compose nearly a quarter of Boston's population. Also contained in the project are 3 railroad lines, a new rapid transit line, a 52-acre linear urban park, 9 stations with adjacent neighborhood facilities, a new cross-town boulevard and 143 acres of land ready for development. (*6*)

The project was designed to provide high-level public transportation to a large number of transit-dependent Boston residents, as well as to revitalize the fragmented ethnic communities and to prevent negative gentrification. In accomplishing this goal, the Orange Line extension of this corridor enjoyed a 54% increase in ridership and contributed to a 26% drop of the crime rate in the project areas after the first year of service. During various planning stages, more than 1000 public meetings were held under the federally required environmental review process. Citizens were able to decide issues as detailed as fences, lighting fixtures, construction disruption, placement of curbing, a special needs garden, and the design of parkland. Also notable is that the active citizen involvement has been sustained through 20 years of the project's initiation, negotiation, construction, changing priorities, and maintenance.

In terms of economic effects, the location and design of the Southwest Corridor made it an attractive area for business development. The corridor has seen a growth in mixed-use development, with single and multi-family residential tracts alongside small business developments. This development was aided by the strong ridership seen on the line. Within one year of its opening, transit ridership on the Orange Line had increased from 30,000 to 47,000. (*7*)

**Denver TREX Project**

Denver's Transportation Expansion (TREX) project is one of the most recent transportation corridor improvements, and one of the most ambitious. Serving 3 counties and 6 cities in the Denver Metro Area, the T-rex project covers 19.12 miles of new light rail transit line and 16.55 miles of highway improvements to I-25 and I-225. The corridor is one of the most heavily in the Denver Metro Area with more than 230,000 vehicles per day driving it everyday (*8*). It connects the two main business districts, the Denver Central Business District (CBD) and the Southeast Business District. About 180,000 people work within the two districts, with an additional 30,000 along the corridor. This area, (southeast Denver) is one of the fastest growing areas in the United States and is expected to add 150,000 jobs in the next 20 years. (*8*)

From a governance perspective, Denver was relatively well suited to enter into a large-scale corridor project. The area has a very strong MPO in the Denver Regional Conference of Governments (DRCOG). The state department of transportation (CDOT) has a history of working with DRCOG and the six county Regional Transportation District (RTD) to implement transit solutions. However, citizens (or at least their elected representatives) were only minimally supportive of the notion of a transit solution for the corridor. In fact, FTA and other funding agencies were skeptical about supporting a project in an area that seemed to be not wholly supportive of transit. CDOT worked together with DRCOG and RTD to develop an innovative financing plan. Under the plan, the project was able to put together the state and local sources of funding prior to seeking federal funds. The funding plan required two sets of votes. One was a statewide vote for CDOT to issue bonds to finance corridor projects throughout the state. This vote helped to solidify statewide support for corridor improvements. After that, the RTD had to have a vote of residents in the Denver metropolitan area to issue bonds specifically for the transit portion of the project. With the overwhelming passage of this vote, public support of the project was demonstrated and the various partners could approach FTA for a full funding grant agreement for the federal portion of the transit project with evidence of community commitment to the project. A key factor in generating support for the transit portion of the project was tying it to roadway improvements. Overall the project was financed with no new taxes, no increased taxes and saved money by using the design build construction technique.

In terms of economic effects there is little evidence that economic considerations played a substantial role in the planning process. As stated earlier, in this corridor there was already a high level of development. The vast majority of the northern third of the corridor consists of existing industrial and commercial properties. Existing single and multifamily residential uses dominate the middle third of the corridor, with notable exceptions at major crossroads. There is some undeveloped land in the far southern areas of the corridor, and just north of this there is a large regional mall and further north the Denver Tech Center business area. In large part, the economic argument for the construction of the project lay in the mitigation of congestion and pollution externalities. There were no considerations to try to affect the economic mix of the area, though the transit implementation might have development externalities surrounding a handful of stations. It is fair to say that in economic terms, the T-REX project was an enhancement to an already vibrant corridor.

A similar strategy of enhancement characterizes the design aspect of the T-REX project. There was little attempt to change the nature of the corridor from a regional expressway. However, the project did attempt to add a multi-modal element, with the new LRT line and improved pedestrian and bike access. These elements will give area residents improved access to the corridor. There are also plans for high-density employment transit oriented development with structured parking at the major transit nodes.

**San Diego I-15**

San Diego I-15 corridor is most successful its ability to use a financing mechanisms to raise revenue and to manage congestion in limited space. The 8 mile long roadway runs from the junction of I-15 and State Route 163 north to Ted Williams Parkway, North County Area, applying different modes of carpools, vanpools, buses and motorcycles.

Originally designed as a conventional High Occupancy Vehicle (HOV) on I-15, the lanes did not operate at capacity, while the general lanes continued to suffer from congestion. Transit

also underserved the corridor in the early 1990's. As an effort to fill the excess capacity, while raising revenue for transit, the project was revised to employ "alternative congestion-pricing mechanisms [that] authorize and control the use of excess capacity on the I-15 HOV Expressway by single-occupant vehicles." This congestion-pricing (or value-pricing) mechanism has helped to maximize road capacity, improve transit and control congestion.

The accomplishment of the project goals can be demonstrated by the fact that traffic volume has increased but the travel times have gone down. The volume of traffic along the corridor has experienced a three-fold increase in the past decade and an 11-percent growth in the past two years. Currently, the Express lanes accommodate 250,000 vehicles per day at the south end, and 184,000 vehicles per day at the north end. During the first year of operation, however, the delay costs dropped by 33% from $5.2 million to $3.9 million. (*9)*

The I-15 project is unique among the corridors in our study in that the affected state agencies, and regional and local governments have come together to form a sub-regional organization, the I-15 Project Management Committee. While different aspects of day-to-day operation and maintenance are the specific responsibility of individual agencies, the project management committee provides oversight to the project and ensures that differing points of view can be heard, and resolved before the success of the project is jeopardized. Even more noteworthy is that the management committee evolved through continual involvement between the lead agencies (the San Diego Association of Governments (SANDAG), the California Department of Transportation (Caltrans), and the Metropolitan Transit Development Board (MTDB)) and affected communities. This relationship took form in the context of the existing community involvement process. Consequently, no formal written agreements exist. Instead, a sufficient level of trust was developed allowing input and consensus building to happen as the project was planned. For example, the project used a "mode-neutral" method of planning up until the Alternatives Analysis portion of the Environmental Impact Statement was completed. This method led to the selection of a busway mode in a city that already had light rail. Instead of being beholden to existing technologies, the process allowed the planners, and representatives of affected governments, to analyze and select the most appropriate mode for to the corridor.

The financing approach for the I-15 corridor improvements is primarily to use congestion charges in the HOV lanes. Extra revenues generated by the congestion charges will fund a BRT solution that will run in the HOV lanes. In economic terms, this will allow for a better matching of the costs and benefits both of the roadway improvements and of the transit implementation. In terms of design and economic impacts, the I-15 implementation is definitely a strategy of enhancing and working within the existing constraints of the corridor. The I-15 corridor is marked by low-density residential development, and costs to acquire land for changing the density or use mix are likely to be prohibitive. Therefore, any mixed use or TOD is likely to occur only around the BRT station stops.

## LESSONS LEARNED FROM APPLYING THE MODEL

Based on the case studies, and feedback received from related research efforts, we are able to make some conclusions regarding the model.

### 1. Use of citizen preferences encourages the use good governance, sensitive design, or subtle financing in corridor development plans

In the Boston case, citizen preferences at first derailed a proposed transportation project, but once decision makers recognized that citizens really wanted a transit project, things went well. However, even in this case of a strong preference match between citizen and designated representative, citizen input was crucial. There appear to be many junctions at which decision makers can "lose" a citizens support. In the Denver case, the public at first wanted little to do with a transit option for the Southeast corridor. However, through casting the project as just one project in a statewide effort to improve corridors, and through bundling transit with roadway improvements, community support was won. The initial public opposition to transit also had the consequence of forcing a different, more complex financing package to be created. In the long run, this may have the effect of weakening project support, as citizens are not as likely to understand how much they are really paying for the project. Transit options were also tied to roadway improvements in San Diego. The use of congestion charges undoubtedly helps the public's perception that they are able to get a relatively free transportation good. However, one could reasonably ask how long HOV lane users will be willing to pay to subsidize BRT riders.

**2. Economic effects are not often emphasized in the planning process**

There is little if any evidence in our case studies to support the notion that economic effects play a large role in early planning. This may indicate that the economic effects of transportation projects are taken for granted. This would not be a particularly settling conclusion. Planners should at least consider the effect that proposed transportation projects will have not only on the design and sociological aspects of an area, but also on the economic development of an area. This is not only due to the relative ease of financing when projects create strong economic gains in an area (opening up the possibilities of joint development and other revenues), but also for the political and public acceptance of a project. Few citizens and almost no elected representatives want to hear that the project will be good at moving people from point A to point B, but through an economic wasteland. While we are not suggesting that economic development opportunities should drive corridor planning, they certainly should be a value that planners consider.

**3. There appears to be no strict formula for corridor planning.**

Sometimes satisfying all of the components to corridor implementation equally is not possible, or even appropriate. Local conditions vary, and local political, financial or other conditions can dictate which elements carry the day when they come into tension.

In the case of Boston, governance's initial failures to recognize the strength of community activism lead to a huge role for the residents in project development. As a result, less emphasis was placed on financing. This was indeed an appropriate move: over ten years after the land had been cleared for the highway, nothing had been built. With land acquisition costs already taken care of, but suspicious neighbors all along the corridor, receiving resident input and "doing it right" the second time around became greater priorities than saving additional dollars or speeding project completion.

Conversely, in the T-REX project in Denver, the project hinged upon demonstrating that the financial house was in order. The project needed a significant amount of federal support, and local match dollars were needed to secure this support. Consequently, planners took a two-pronged approach: emphasizing financial mechanisms to control costs, such as design-build, and emphasizing governance measures to demonstrate the revenue would be raised, such as the

Memorandum of Understanding that all but committed local entities to contribute towards the local match. In this process, citizen input was muted until the funding was in place. This trade off was appropriate, however, in that public support had already been demonstrated by the wide margin of victory for the transit funding referendum.

In San Diego, with the area already committed to transit (SANDAG has a dedicated ½ cent sales tax in the regional area) and well aware of the consequences of congestion, a design solution that promised both congestion reduction and transit enhancement in a spatially limited area became a necessity. Once that design was in place, the financing could proceed.

**4. Planning priorities can change as scale changes.**

The TREX project also demonstrates that while controlling costs and speeding completion can be key elements on a large scale, it might be more prudent to emphasize other elements, such as citizen involvement, on smaller scale projects. As mentioned above, the TREX project enjoyed significant citizen support when presented in funding referenda. However, it has encountered difficulties as citizens have objected to the station designs included in the design-build plan, raising the potential for expensive change-orders. This suggests that it may have been wise to keep these outside of the design-build plan. They are the most site-specific, most easily get the attention of project neighbors, and consequently could require greater amounts of time to achieve consensus and support. Also, given the potential successful station sites to generate revenue and development through creative zoning and public-private partnerships, controlling financial costs may be of less importance.

**5. Having a champion appears to be an integral part of governance.**

The most successful corridor projects are those that have a strong supporter behind them. Whether it is a politician, a contractor, planner or community group, projects to which the population can attach a name have far better chances than those that do not. Ever shifting staff and a lack of supporters show a low level of commitment. A project champion pushes the project at all times, dismisses false rumors, and puts their project in the spotlight. A project supporter with clout is ideal.

The perfect situation arises when the champion is not only recognized in the media, but on the personal level. In San Diego, a member of the city council built relationships with the existing neighborhood groups to build their support, as well as making the case on the larger scale and in the city council chambers. Such an effort obviously requires time and energy, but without the ability to "put a face" with a project, in a positive manner, the ability to build and maintain support for an innovative project is hampered.

**6. Context sensitive design with large amounts of public input is extremely important.**

While the preceding notes indicate that it would be foolhardy to prescribe an order for addressing the five areas, the case studies suggest that the design style or technology used (rail, bus, etc.) should not be chosen until at least public involvement and governance issues are addressed.

The greatest success in this regard is the I-15 corridor in San Diego. In an area that already had a successful light rail system, the planners and elected officials avoided a "one-size-fits-all" approach and worked to understand the particular nuances of this corridor. As a result,

they were able to realize the opportunities created by the existing HOV lane in this corridor: rather than simply add another light rail line that would require additional funding from existing revenue streams, they are created a BRT line that uses the existing lane, and receive funding from tolls paid by single occupant users of the lane. The corridor has been so successful that it has led to a multi-modal strategic plan utilizing several different funding sources and identifying the most advantageous roles for each technology based on the places it would serve. (*10*)

The opposite situation can be seen in the initial attempt to build a highway in Boston's Southwest corridor. Although the planners did not have the benefit of hindsight available to those planning corridors that came later, they did make the mistake of assuming a freeway facility would be appropriate for the area, as they were expanding the freeway network throughout the metro area. Environmental concerns also impacted the design of the corridor, with citizens desires that the area be environmentally attractive and not become an inhabitable space.

**7. Planning and governance involves connecting with the regional transportation planning and funding process.**

Throughout the case studies, a common attraction to the corridors was their ability to galvanize interest around a specific spatially-bound set of improvements. And often, as in the case of I-15 and T-Rex, these improvements were set to occur in sub-regions that were experiencing growth and hence were playing to a natural local constituency. However, the broader framework of regional transportation planning and financing can work against corridor developments, unless careful steps are made to balance the corridor plan with other priorities throughout the region. Successful integration into an overall regional schema would help ensure that the corridor is not viewed as a "zero-sum" proposition--that is, taking from other parts of the region. Part of the reason that the T-Rex project was not derailed is due to the regional (statewide) corridor improvement process, which tied potentially disparate regions together. Rather, it can be viewed has present an innovative element to the regional plan. Moreover, to the extent this integration occurs, it will be easier to access federal and local funds that are allocated by state departments of transportation and metropolitan planning organizations.

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## FIGURES AND TABLES

**Figure 1**. Transportation Corridor Planning and Development Model

**Table 1**. Characteristics of the 3 Case Studies

**Figure 2**. Transportation Corridor Planning and Development Model

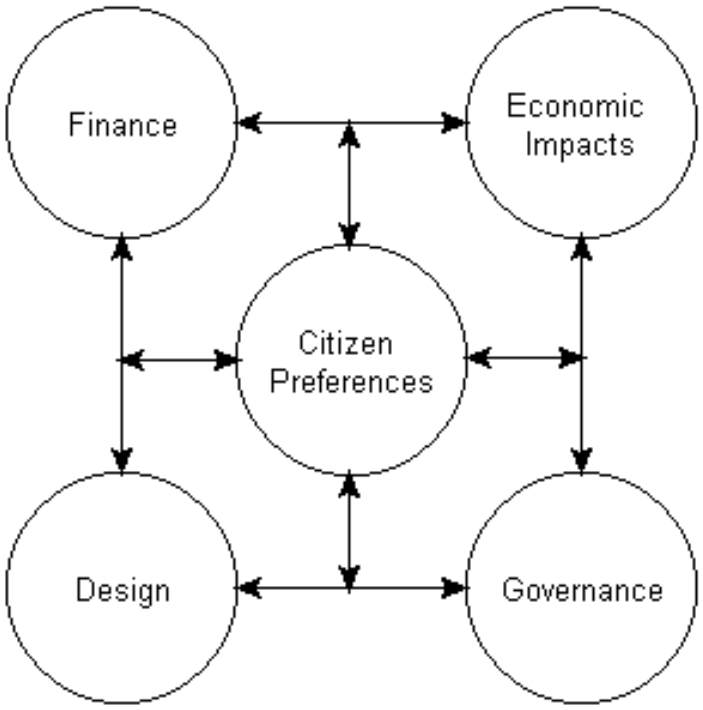

**TABLE 1**: Characteristics of the 3 Case Studies

| CASE | JURISDICTIONS | SCALE | MODE | YEARS OF OPERATION | LAND USE |
|---|---|---|---|---|---|
| **Boston** | 3 neighborhoods in Boston (encompassing 1/4 of the city population) | 4.7 miles | Rapid transit/ commuter rail | Design in 1970s, open in 1987 | Residential, Commercial, recreational |
| **Denver** | 3 counties, 6 cities, 2 large employment areas | 16.55 miles of improvements to 2 interstates, 19.12 miles of new LRT | LRT, highway | Complete by 2006 | Highway, employment center |
| **San Diego** | 2 cities (San Diego, Escondido) | 8 miles | BRT, highway | Open in 1988 as HOV, HOT in 1998 | Roadway |