Bus Rapid Transit

A Handbook for Partners

Caltrans

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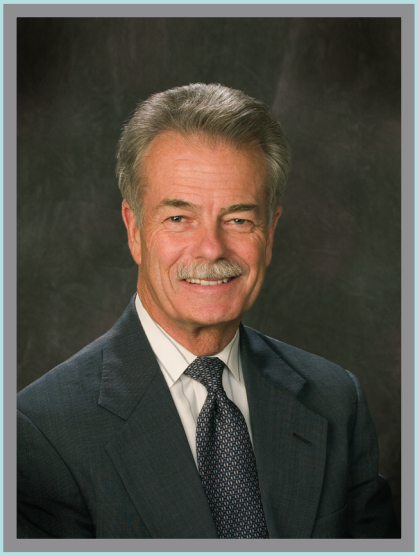
partnerships / efficiency / customer service



The Governor's Strategic Growth Plan envisions a world-class transportation system available to all of our State's residents. California taxpayers have invested tens of billions of dollars in our transportation system, and it is crucial that we maximize the usefulness and utility of these facilities. With new freeways virtually unaffordable and difficult to implement from an environmental and community impacts standpoint, we need to focus on enhancing capacity in the existing system.

It is our policy to transport the maximum number of people as efficiently and cost-effectively as possible through comprehensive, multimodal "system management." Of the declining number of options available, Bus Rapid Transit (BRT) is emerging as one of the most attractive investment choices especially since our State Highway System presents tremendous opportunities to quickly implement BRT services. With one of the most extensive networks of High Occupancy Vehicle (HOV) lanes in the world, California already has a foundation in place to support the development of BRT operations in our urban areas.

I am committed to fully integrate BRT as an investment alternative in our system and comprehensive corridor planning and project development processes. To carry out this commitment, I have directed Caltrans staff to work closely with local transit planning and development entities to innovate, advocate, and assist in the implementation of BRT projects.

This document provides examples of the flexibility of BRT and presents successful experiences. In every case, the objective is to maximize the movement of people, not just vehicles. BRT offers a potentially cost-effective means to increase the effectiveness of our highway and street system, and we at the California Department of Transportation are excited about the opportunities to advance affordable high-quality transit services.

WILL KEMPTON
Director

BUS RAPID TRANSIT:
A Handbook for Partners

Purpose of Document

This document describes the policy and role of the California Department of Transportation (Caltrans) to support the development of Bus Rapid Transit (BRT) projects and technology and, in that context, to strengthen partnerships, expedite project delivery, and improve the performance of California's transportation system. It also presents an overview of BRT and distinguishes it from traditional bus services.

The foundation for Caltrans' role in BRT development is a new Director's Policy, which is contained in full in Appendix A and excerpted on the following page. The policy underscores and clarifies Caltrans' role as a full partner with transit operators, and transit planning and development agencies, in support of this innovative transit mode. A joint Deputy Directive will provide details of the implementation of the policy. For additional information on BRT, contact the local Caltrans District BRT Coordinator.

This is not a technical manual. Rather, this document strives to inform Caltrans staff and others what elements constitute a BRT system, while addressing Caltrans' role with its partners considering BRT features as an alternative on the State Highway System.

Caltrans coordinates with local planners and transit operators in a BRT partnership that now operates in a broader, systemwide context. This document is intended for use by Caltrans professionals, elected officials, local jurisdictions, transit operating and planning agencies, and the general public to understand Caltrans' role in BRT development, both on and off the State Highway System.

BRT is a maturing mode with proven operational experience in many parts of the world. The United States experience in implementing BRT, in its fullest form, is more limited but promises exciting new developments in the coming years. BRT is universally accepted, offers a potentially cost-effective transportation mode that bridges a capital cost gap between regular bus service and light rail transit, and can deliver services with features that normally are found only with rail service. Many systems have been evaluated within the United States and from around the world. This document draws on those experiences and pulls them together to clarify the service and infrastructure characteristics that define BRT.

Technical information about many BRT and rapid bus projects in California is included in Appendix B; international experiences are included in Appendix C. Appendix D provides a list of transportation terms and acronyms used in this document.

California Department of Transportation Policy Statement on Bus Rapid Transit Implementation Support

"The California Department of Transportation recognizes and supports the concept and implementation of Bus Rapid Transit (BRT) as a potentially cost-effective strategy to maximize people throughput, reduce traveler delay, increase capacity, and foster energy savings on the California State Highway System as well as on conventional streets and highways. To reach the full potential of this transportation mode, Department staff is directed to work closely with local transportation planning agencies, transit operators, and other stakeholders to innovate, implement, and advocate BRT systems."

Excerpt from Director's Policy, DP-27, 2007. The full departmental policy statement is included in Appendix A.

Defining Bus Rapid Transit

Because the design and operation of BRT systems vary widely, a succinct definition is difficult to come by. However, the following descriptions together provide a good understanding of the scope of BRT.

"Bus Rapid Transit can best be described as a combination of facility, systems, and vehicle investments that convert conventional bus services into a fixed-facility transit service, greatly increasing their efficiency and effectiveness to the end user."

Federal Transit Administration, Bus Rapid Transit Demonstration Program, December 2002.

BRT typically includes bus services that are, at minimum, faster than traditional "local bus" service and, at a maximum, include grade-separated bus operations.

Although the infrastructure, vehicle, and service features of BRT vary, the objectives of fully developed BRT reflect a high-quality, rail-like transit service that provides an elevated level of customer satisfaction by:

- **Reducing transit travel time**
- **Increasing trip reliability**
- **Improving transit connections and providing more direct service**
- **Decreasing station stop dwell times and waiting times**
- **Enhancing system identity**
- **Increasing travel comfort**
- **Enhancing safety and security**

"Bus Rapid Transit...[is] a flexible rubber-tired rapid-transit mode that combines stations, vehicles, services, running ways, and Intelligent Transportation System (ITS) elements into an integrated system with a strong positive identity that evokes a unique image. BRT applications are designed to be appropriate to the market they serve and their physical surroundings, and can be incrementally implemented in a variety of environments."

Transportation Cooperative Research Program (TCRP), Report 90, Bus Rapid Transit, Vol. I, 2003.

To achieve these objectives, certain basic features and attributes of a full BRT system need to be part of the capital and operating plan (see Table 1).

Table 1 Basic Features and Attributes of Full BRT

Running Way	• Dedicated running ways, exclusive bus lanes • Distinctive pavement treatment
Stations	• Level boarding and alighting • "Branded," consistent with appearance of BRT vehicles • High-quality, attractive, functional amenities
Vehicles	• Easy-to-board (level with platform) • Multiple-door boarding and alighting • "Branded" exteriors that are distinctive and consistent with appearance of stations • High capacity • Pleasant interior conveniences • Quiet • Low or zero emissions
Service	• Frequent all-day service • Short headways (10 minutes or better) • Wide station stop spacing
Route Structure	• Simple route layout • Convenient transfers • Station locations coordinated with land-use plans • Service to major activity centers
Fare Collection	• Off-vehicle fare collection • Emphasis on prepaid fares
Intelligent Transportation Systems (ITS) and Technology	• ITS technologies (for example, real-time "next bus" arrival information signs at stations, "next stop" signs on board buses, smart fare payment media and technology, traffic signal prioritization, and traffic management) • Automated guidance features for precision operations and docking

Transit Cooperative Research Program, Project A-23, 2001

A low-cost, basic BRT system would have some of the features in Table 1. An enhanced BRT system, reflecting full rapid transit objectives, would include all these features.

A particular challenge for transportation professionals is to develop a BRT project without sacrificing the quality of any of these features. It may be prudent to develop a project incrementally, where an initial investment would put some of these features in place and others would be added in subsequent development stages. A key advantage of BRT is that the infrastructure and service can be implemented in phases over time, with full BRT service as the long-range goal.

Therein lies the challenge: developing, at low cost, a BRT system that provides sufficient quality of service to achieve BRT objectives. Table 2 shows the range in possible deployment options and enhancements, moving from an initial stage through an intermediate stage and finally to a full BRT operation. While full BRT may not be feasible in every case, a certain minimum number of features must be present in order to achieve the higher quality of service envisioned with BRT. In practice, each BRT project will vary from others and be designed around the physical characteristics offered by the specific corridor and limited by the available funding sources. Typically, planners will need to customize solutions that use

various features from the three stages shown in Table 2 at different locations in the project's corridor. However, some projects, such as the Orange Line in Los Angeles, could be designed to be a full BRT service from the outset. The purpose here in Table 2 is to show the significant flexibility that exists in the development of BRT where the individual attributes can be incrementally implemented if funding and right-of-way conditions govern such an approach. Types of projects which might be part of an eligible BRT combined project are listed on page 17 under "Federal Transit Administration."

Table 2 : Incremental Development of BRT

	Initial BRT Stage	Intermediate Stage	Full BRT Operation
→→→	***Increasing Capital Investment and Effectiveness***		→→→
Running Way	Shared lanes in mixed traffic, some preferential treatments, peak hour dedicated or HOV lanes	Dedicated lanes or HOV lanes for a majority of the corridor length (with direct access ramps to stations where located along freeways), queue jump segments in congested areas	Dedicated running ways, exclusive bus lanes Distinctive pavement treatment HOV drop ramps
Stations	Improved shelter, special signage, transfer centers	Additional passenger information, fare vending machines, other amenities	Level boarding and alighting "Branded," consistent with appearance of BRT vehicles High-quality, attractive, functional amenities
Vehicles	Exterior and interior aesthetics, enhanced ride and comfort, low-floor, low-emissions, sleek styling	Real-time on-board information, higher capacity, multiple doors for loading and alighting	Easy-to-board (level with platform) Multiple-door boarding and alighting "Branded" exteriors that are distinctive and consistent with appearance of stations High capacity Pleasant interior conveniences Quiet Low or zero emissions
Service	Improved frequency, integrated regional coordination, extended station/stop spacing, faster travel	High frequency all day, further speed enhancements	Frequent all-day service Short headways (10 minutes or better) Wide station stop spacing
Route Structure	Various route structures (multiple routes, branching routes, single route)	Simplified route structure, branding or color coding by BRT line	Simple route layout Convenient transfers Station locations coordinated with land-use plans Service to major activity centers
Fare Collection	Increase prepaid fare sales	Multi-modal or multi-agency Smart Card system, multiple fare vending machines	Off-vehicle fare collection Emphasis on prepaid fares
Intelligent Transport Systems (ITS) and Technology	Automated vehicle location (AVL), bus priority at traffic signals, real-time passenger information at stations	Adaptive traffic signal priority to minimize traffic impacts and manage headways	ITS technologies. Examples include: real-time "next bus" arrival information signs at stations, "next stop" signs on board buses, smart fare payment media and technology, traffic signal prioritization, traffic management and automated guidance features for precision operations and docking.

Case studies of four California BRT projects, included in Appendix B, show varied levels of development. A tabular summary of other BRT projects, currently under development in California, is also included in Appendix B. Overviews of selected international BRT and busway experiences are included in Appendix C.

Caltrans' rapid transit project experience extends back to 1973, when the Interstate 10 El Monte Busway opened for service, followed by light rail transit (LRT) projects in San Diego, Sacramento, Santa Clara and Los Angeles. These experiences led to general guidance that should be considered when developing cost-effective BRT operations, the eventual goal for a transit project.

The development process has three essential aspects further explained in the pages that follow:

1. Planning and design of the alignment, stations, and operating conditions
2. Operation and maintenance of the eventual BRT service
3. Institutional arrangements, that is, state-local partnerships that are critical to saving costs and optimizing effectiveness

1. Planning and Design

The planning and design portion of the BRT project development process has been a challenge for the transportation community. As BRT is rapidly being developed in California as a cost-effective strategy to address growing congestion and mobility needs, Caltrans is working to fully integrate BRT as an investment alternative into system and comprehensive corridor planning documents and project development processes. Planning and design solutions must integrate and balance community, aesthetic, historic, and environmental values with transportation safety, maintenance, and performance goals.

Actions taken during planning and design will accumulate and significantly influence the eventual cost-effectiveness of subsequent transit operations. Issues such as funding feasibility, maintenance feasibility, impacts on affected routes, impacts on safety, and relevant laws, rules, and regulations must be addressed. Where State highways are being considered for all or part of BRT operations Caltrans should be directly involved with the local transit operator to take into account the operational needs and consequences of project actions from initial planning through design of a BRT project. This involvement is crucial as a way to positively influence the operational cost-effectiveness and needs to be a two-way commitment between Caltrans and the local transit operating and development entities.

The following lessons from California experiences apply to the planning and design phases:

- **Bus Priority:** BRT can have many forms, but the common, and most important, trait is to give bus operations priority over general traffic. While transit users benefit from reduced travel times en route, an unintended result may be worsened levels of service for some auto users. Planners must balance the competing needs between transit and traffic objectives. In terms of increasing person-throughput capacity in a given corridor, transit priority measures, combined with high-frequency service, should be factored into the analysis. Finding safe and efficient ways to give buses priority requires significant cooperation between the infrastructure owner (Caltrans or a city/county) and the transit operator.

- **Easily Accessible Stations:** To achieve attractive, efficient, high-speed BRT operations, arterial and freeway stations should be located on, or immediately adjacent to, the facility and connected with high-speed direct access. Arterial and freeway BRT stations should provide safe and easy pedestrian access.

- **Cautions Regarding Transferability:** Not all BRT strategies are transferable and applicable to California, particularly those from overseas locations. Although many technical and operational elements of BRT applications can be adapted successfully, institutional partnerships may be the key to whether they will work locally with the same effectiveness.

- **Capital Costs:** It can be expected that the more exclusivity given to buses in a BRT system, the higher the customer benefit will be, but with a higher unit cost of construction.

- **Conflicts between Costs and Effectiveness:** Lowering capital costs by sacrificing BRT features to fit a budget can be risky and could diminish a BRT project's benefits to a level below an acceptable operating cost effectiveness.

- **Service Attributes:** As the amount of bus priority along a route declines from 100 percent, then the other attributes of BRT service become more important (e.g., station amenities, ride comfort, fare collection convenience, real-time information for passengers and waiting patrons).

- **Adaptability:** BRT should be designed to take advantage of the inherent flexibility of buses to use the different running way opportunities available in the particular local situation.

- **System Integration:** No matter how it is designed, to be effective, BRT must be operated as an integrated part of the overall regional transit network.

- **Service Simplicity:** To enhance BRT customers' understanding and use of the service, the individual BRT route structure should be as direct as possible—that is, emulating the service nature of a rail rapid transit line.

2.
Operation and Maintenance

The transit operator establishes fare pricing and structure, transfer policies, and service levels for its operations. Caltrans may use standard agreements for specific traffic operational components relating to BRT within State right of way.

Where BRT capital infrastructure elements (for example, running way, traffic control devices, stations) are located on State and local rights-of-way, a formal, multiagency, multidisciplinary team may expedite evaluation of project design features. Each feature must be evaluated with respect to State highway design standards in regard to safety and maintenance issues. This evaluation process may lead to some design practices being modified for purposes of BRT. For these reasons, it is essential that development of a partnership agreement be started early in the planning process. Guidance on such agreements is discussed more fully in the following section.

If the transit entity owns the running way (as might be the case with a dedicated busway), maintenance responsibilities would rest with the owner, obviating the need for a partnership agreement.

3. State-Local Partnerships

BRT and LRT project experiences, as seen from the point of view of both Caltrans and the local transit development entity, offer several lessons:

- **Coordinated Pre-Project Planning:** All BRT proposals or project alternatives are an outcome of the system and comprehensive corridor planning that is performed to identify and address major transportation needs. Before project-level planning and design can begin, a feasibility study may be needed to verify that BRT is a viable or practical option in a given corridor (see discussion regarding "Bus Priority" on page 10).

- **Joint Ownership of Project Goals:** All partners must commit to sharing the common project goals and objectives. Past experiences have shown that when all partners do not share "ownership" of project goals, there will be unanticipated increases to the project budget and schedule, diminishing the overall project effectiveness.

- **Timely Responses:** The saying "time is money" applies to BRT development. It is important to adhere to schedules, particularly since numerous Caltrans functions are involved in plan and report reviews. Strong project management is required to shepherd the project through multiple review stages on time to prevent eventual budget overruns.

- **Issue Resolution:** Partners must quickly identify and resolve issues when they arise. Caltrans has extensive experience with this process when it comes to construction projects (for example, partnering agreements). Where appropriate, sufficient authority should be delegated to the Caltrans project manager in the local District to resolve disputes. Where this authority is exceeded, a process should be in place to elevate the issue within the District to minimize delay to the project.

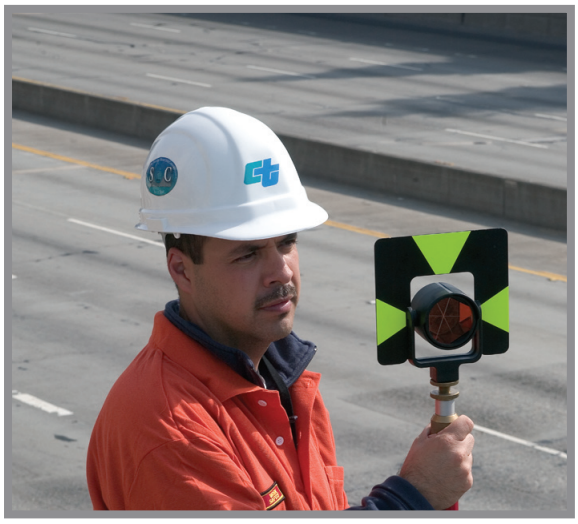
- **Consistent Project Management:** Continuity of a project team is necessary throughout a project's implementation to keep it on schedule and budget. The Caltrans District Director needs to have a succession plan ready in advance for any project management changes that may become necessary.

- **Creative Advocacy:** BRT planning and design will often test the project team's ability to develop innovative solutions, often on a block-by-block basis for a BRT project on an arterial street, or mile-by-mile for one on a freeway. All partners need to investigate possible solutions through changes or waivers to warrants and standards, without having an adverse impact on safety.

- **Agreements:** The best way to share project ownership is through formal agreements with the BRT development entities, such as a Memorandum of Agreement (MOA), Memorandum of Understanding (MOU), or Cooperative Agreement. In some cases, a less formal "charter" may suffice; in others, a more formal agreement would be preferable. The appropriate document will be determined for each case, but each ratified document will cover key areas of the partnership, such as:

  - Pre-project feasibility study, including data collection and analysis required to determine the viability of a BRT proposal.
  - Project budget, including (as appropriate) a specific funding amount for Caltrans.
  - Project schedule, with all parties "owning" the commitment to adhere to the schedule.
  - Budget and schedule management and a consistent way of tracking Caltrans and project expenditures in real-time.
  - Dispute resolution provisions that identify the individuals who have authority to make decisions and an overall process that promptly escalates issues and moves to resolve conflicts.
  - Resource commitment, delineating the specific District staff resources (person hours) being committed to the project and identifying the Caltrans Project Manager for the BRT project.
  - Intelligent Transportation Systems (ITS) architecture compatibility to ensure interoperability among all Caltrans and local ITS component systems. To remain eligible for federal and statewide ITS architecture and standards, including those contained in the Final Rule and Final Policy as outlined in 49 CFR Parts 613 and 621 (enacted by Federal Highway Administration (FHWA) in Section 940 and by Federal Transit Administration (FTA) in Section 5206(e)).
  - Asset management responsibilities to ensure early consideration of the ongoing maintenance of the capital (nonvehicle) facilities, such as running ways, traffic control devices, stations, and ITS. For BRT to remain attractive to customers and achieve its full operation goal, it must meet high quality standards that do not waver over time. The variable, ongoing costs of doing this must be addressed early in the preparation of an agreement. Negotiating long-term maintenance is essential and deserves substantial time where the transit entity does not own the running way.

California Department of Transportation



When BRT systems were first introduced in California, Caltrans role in Bus Rapid Transit evolved around the state on a project-by-project basis. To ensure consistency and commitment, the Director's Policy contained in Appendix A was developed. With this policy, Caltrans will be an active and constructive partner in the development of BRT where the State's facilities are involved.

As Caltrans plans for improvements to the State Highway System, it is important to preserve the option for BRT operations. To ensure that no viable BRT potential is overlooked, Caltrans will integrate BRT fully as an investment alternative in State Highway System planning, comprehensive corridor planning, and project development processes. This will include the consideration of transit alternative mitigation measures for impacts to the State Highway System determined through the intergovernmental review process. California will participate in pre-project planning activities to include: preparation and/or review of traffic analyses and feasibility studies to determine project viability, and the development of technical guidance and policy on BRT-specifc features. Project initiation documents for capacity increasing projects in urban areas will consider, address and, if appropriate, integrate BRT into the preferred alternative for the project. Thus, the full range of alternatives will be considered during the planning process, providing the people of California with a full range of transportation options. To reach the full potential of this public transportation mode, the Director's Policy instructs Caltrans staff to work closely with local jurisdictions, regional transportation planning agencies, transit operators, and other stakeholders to plan, develop, implement, and advocate BRT systems. Caltrans will provide clear, consistent information to staff professionals of city and county agencies, Metropolitan Planning Organizations (MPOs) and elected officials.

BRT Coordinators are designated in each Caltrans District Office that has existing or planned BRT systems, and leadership and guidance will be provided by the Division of Mass Transportation and the Division of Traffic Operations in Sacramento Headquarters. The

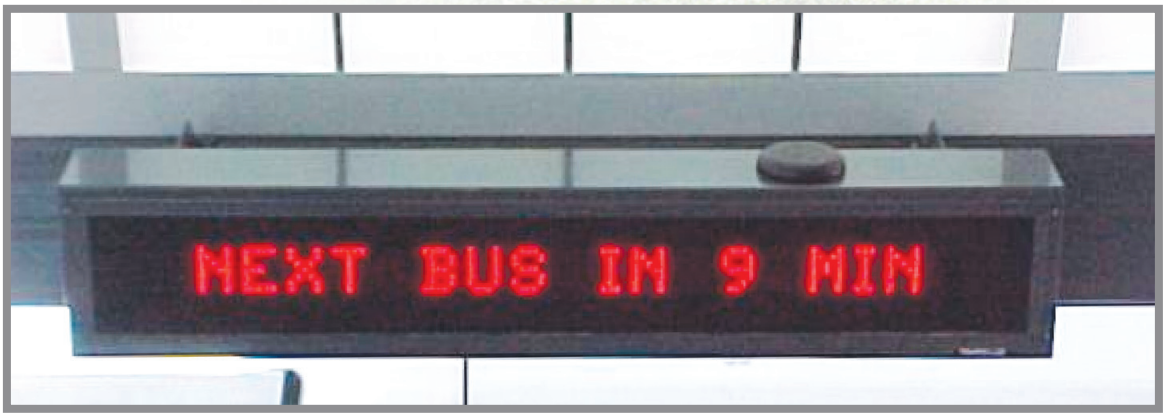
BRT Coordinators need to be positive and skillful in communicating the success and benefits of BRT.

The difference between success and failure of a BRT system can hinge on the Coordinator's patience, flexibility, commitment, knowledge of BRT systems, and status within the District organization. District appointments of BRT Coordinators will be made with these essential skills in mind for the successful implementation of BRT projects. Important networks for project development will come from liaison between transit system operators and Caltrans District Traffic Operations, also led by the BRT Coordinator.

The Director's Policy on BRT Implementation Support (Appendix A) sets the tone for Caltrans to work in partnership in implementing BRT projects with the transit development entities. To reinforce this shared ownership, a Deputy Directive will be issued specifying the roles and responsibilities for Caltrans to better assist local and regional entities and guide staff in the implementation of BRT strategies on the State Highway System and within State rights-of-way.

Caltrans will also conduct research, develop operational techniques, and promote use of ITS technology to enable safe and efficient deployment of BRT. Procedural documents will be revised to facilitate the application of BRT solutions.

The nature of the partnership role that Caltrans will play in BRT projects depends largely on the nature of the particular project. A real partnership will embrace joint ownership of project goals and objectives as reflected in the associated planning documents, project budget and schedule.



Metropolitan Planning Organizations

The long-range Regional Transportation Plan (RTP) provides the foundation for all state and federal funding investments in urban areas. It is developed and approved by an urban region's MPO. Because the MPOs largely control capital funding for these transportation projects, it is crucial for MPO staff to be involved at the earliest stage of BRT plans and proposals.

MPOs are responsible for comprehensive regional planning, including setting priorities and assessing trade-offs and proposals submitted by many entities within its jurisdiction, including Caltrans, Congestion Management Agencies (CMAs), transit operators, cities, and counties. The MPO submits its priorities to the State in its Regional Transportation Improvement Program (RTIP). Projects in the RTIPs are included for funding in the State Transportation Improvement Program (STIP), approved by the California Transportation Commission (CTC).

Transit Operators and Transit Development Entities

Transit operators are the focal point of BRT projects. In most cases, they are responsible for successfully implementing and operating the systems. The transit operator is responsible for determining if the operating costs, capital costs, and operations of a BRT project are feasible. Caltrans' role is to evaluate BRT potential in its comprehensive planning and project development processes. Identifying the impacts (positive or negative) of a BRT system on the State Highway System and providing oversight to determine if BRT is operationally feasible is central to the State's role. This is where mutual accommodation, cooperation, and partnership are expected to yield common agreement.

Local Agencies

BRT systems will traverse through many neighborhoods, cities, and unincorporated communities, each with its own identity, values, and needs. BRT project team members must be flexible to satisfy these varying local requirements and still propose a BRT project that will be part of a larger coordinated transit network. Cities, CMAs, or similar organizations often want to see a prototype or limited pilot project to determine if BRT is a benefit before making major commitments. Forming project development teams that include the affected cities and county communities early on, will enhance the potential for agreement to system parameters. Members of BRT project teams should be prepared to address city council meetings and community groups to inform, educate, help resolve conflicts, and ultimately gain project support. This involvement will also help to identify local officials who could champion the project.

Federal Transit Administration

Safe, Accountable, Flexible, and Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU) was signed into law in August 2005. This law authorizes funding for Fiscal Years (FY) 2005 through 2009 and is a primary source of federal funds for BRT projects.

Capital intensive BRT projects fall under the category of "New Starts" in SAFETEA-LU. The Act also has a provision for "Small Starts," where the total project cost is under $250 million and the federal share would be below $75 million. To be eligible for such funding, the BRT must be a fixed guideway project defined in SAFETEA-LU as follows: "a substantial portion of the project operates in a separate right-of-way dedicated for public transit use during peak hour operations." It is noteworthy that the definition of what is meant by "substantial" remains to be determined by the FTA.

A project without any exclusive bus lane operations might be eligible for New Starts and Small Starts funding if project expenditures represent a substantial investment in a defined corridor as demonstrated by features such as...

- **Park-and-ride lots**
- **Transit stations**
- **Bus arrival and departure signage**
- **ITS technology**
- **Traffic signal priority**
- **Off-board fare collection**
- **Advanced bus technology**
- **Other features that support long-term corridor investment**
- **High Occupancy Vehicle (HOV) Drop Ramps**

While this definition clearly is meant as an opportunity for federal funding of deserving BRT projects, the FTA will be issuing implementation guidelines.

Private Business Sector

The positive impact that private business organizations and private developers can have on BRT, and vice versa, is sometimes overlooked. Many urban areas have densely populated business zones that can be ideal BRT destinations. BRT planners should be in contact with existing organizations representing downtowns and business parks. These groups can be well organized to advocate for their own issues and needs. Early coordination and regular contact with these organizations will enhance the potential for success of BRT projects. It is in a business's self-interest to seek transportation improvements for its employees and customers, and some businesses have provided capital financial support for transit systems. Business leaders can also become effective project advocates during competition for federal, state, and local funding.

Land developers and other property owners also can help by participating in funding and maintenance agreements for BRT station facilities. Properties adjacent to BRT stations benefit by having transportation options nearby. Businesses can save on direct and indirect parking costs and can offer attractive transportation advantages to their employees. It is often in property owners' best interest to have and help maintain a high-quality environment near their buildings. Some may even want to secure naming rights for the stations. Thus, early in the development process, the transit operating entity should evaluate each station area for opportunities to share the capital and maintenance costs of the adjacent station.

Final Word

Mobility is critical to the well-being of Californians, and Caltrans is committed to improving mobility across the State. We will forge strategic partnerships to provide mobility choices, including innovative modes such as Bus Rapid Transit to optimize people throughput, and provide dependable and reduced travel times as well. Caltrans will work in partnership to fully integrate BRT as an investment alternative into system and comprehensive corridor planning documents and project development processes.

Director's Policy

Number: DP-27

Effective Date: February 2007

Supersedes: NEW

TITLE Bus Rapid Transit Implementation Support

POLICY

The California Department of Transportation (Department) recognizes and supports the concept and implementation of Bus Rapid Transit (BRT) as a potentially cost-effective strategy to maximize people throughput (emphasizing the movement of people, not just vehicles), reduce traveler delay, increase capacity, and foster energy savings on the California State Highway System (SHS), as well as on conventional highways. The Department will work closely with local jurisdictions, regional transportation planning agencies, transit operators, and other stakeholders to plan, develop, implement, and advocate for BRT systems.

This policy is consistent with existing directives to reach context-sensitive solutions through a collaborative, interdisciplinary approach involving all stakeholders in the development of the transportation infrastructure. This policy supports the Department's goal of Mobility – Maximize transportation system performance and accessibility.

"BRT can best be described as a combination of facility, systems, and vehicle investments that convert conventional bus services into a fixed-facility transit service, greatly increasing their efficiency and effectiveness to the end user." [Cited from the Federal Transit Administration, BRT Demonstration Program, December 2002.] BRT typically includes bus services that are, at a minimum, faster than traditional 'local bus' service and, at a maximum, include grade-separated bus operations. Features of BRT systems may include transit signal priority, dedicated lanes, High Occupancy Vehicle (HOV) drop ramps, faster passenger boarding, faster fare collection, and a system image that is uniquely identifiable. BRT represents a way to improve mobility at relatively low cost through incremental investment in a combination of bus infrastructure, equipment, operational improvements, and technology.

INTENDED RESULTS

The intended result of this policy is improved mobility options through the full integration of BRT as an investment alternative into system and comprehensive corridor planning documents and project development processes. BRT will provide any person in California with a degree of mobility that is in balance with other values. The intent of this policy is to clearly establish a corporate expectation for conducting business between the Department and local BRT agencies as follows:

- To quickly optimize BRT on Department facilities to increase person throughput and capacity, and reduce traveler delay on State highways efficiently and affordably.
- To allow flexibility in applying design standards consistent with the operational and safety needs of other modes of highway traffic.
- To establish an internal process to resolve issues and conflicts that may arise when proposals utilize or intersect with Department facilities.
- To formally partner with planning and transit agencies, usually in the form of a Memorandum of Understanding, Memorandum of Agreement, and/or Cooperative Agreement, when integrating BRT with Department facilities.
- To provide training opportunities for departmental personnel on the successful integration of BRT as a modal alternative on the SHS and within State rights-of-way.
- To develop a process that identifies and advocates innovative and inclusive approaches that reflect BRT as an emerging technology.

RESPONSIBILITIES

Director:

- Promotes BRT implementation.
- Recognizes and highlights individuals, teams, and projects that advance the goals of this policy, and encourages staff to conduct and participate in internal and external meetings, and conferences to expand their knowledge of BRT solutions.

Chief Deputy Director:

- Implements and coordinates policy in a timely manner.

Deputy Directors for Planning and Modal Programs, Project Delivery, and Maintenance and Operations:

- Collaborate in issuing a joint Deputy Directive to establish a process for the Department to facilitate the implementation of BRT strategies on the SHS and within State rights-of-way.
- Establish an administrative process to implement BRT strategies and resolve any conflicts between BRT needs and established standards.
- Issue guidance to Districts to consider BRT as a viable alternative when warranted, as a part of the Districts' comprehensive corridor and system planning and improvement strategies for all urban State routes.

District Directors:

- Ensure coordination with local planning and operating agencies for the purpose of identifying BRT potential.
- Ensure environmental scans and Concept Reports for corridor plans include current and future BRT issues and concerns, as applicable.
- Recognize that consistent with BRT flexibility, planning and operating agencies across the State approach BRT very differently with some concentrating on surface streets, while others focus on major freeway projects.
- Ensure initial District reviews take into consideration overall multimodal system benefits for the various regions; as well as community goals, plans and values.
- Appoint a BRT Coordinator to be the single point-of-contact for District BRT activities, in those Districts that have existing or planned BRT systems.
- Ensure the BRT Coordinator has sufficient knowledge of BRT systems and status within the District to effectively represent the District in meetings with external agencies.
- Consider BRT or transit-related mitigation measures to address impacts to the SHS that are determined through the Intergovernmental Review process.
- Ensure that project initiation documents for capacity-increasing projects in urban areas consider, and, if appropriate, recommend BRT as the preferred alternative for the project.
- Assign resources, as needed, for the successful implementation of this policy in their respective Districts.
- Empower the BRT Coordinator to liaise between District Traffic Operations (Freeway Operations/HOV) and transit operators to leverage transit utilization of existing facilities.

Chiefs, Divisions of Mass Transportation and Traffic Operations:

- Take a leadership role in advancing the knowledge and acceptance of BRT within the Department, and take additional steps to institutionalize and advance this technology.
- Develop a BRT Handbook to illustrate the Department's policy and support for BRT.
- Ensure the BRT Handbook is widely distributed to elected officials, city and county staff, local planning and transit agencies, and the public.
- Take a leadership role in developing, training and implementing transit model technology to be applied on corridor level of service analysis.
- Assign resources, as needed, for the successful implementation of this policy in their respective divisions.

Chief Counsel, Legal Division:

- Designates legal staff to assist other departmental staff in addressing BRT issues and legal aspects of BRT implementation, including statutes that may require change.

Chief, Division of Research and Innovation:

- Conducts research, develops operational techniques, and promotes use of Intelligent Transportation Systems technology to enable safe and efficient deployment of BRT.
- Revises procedural documents to facilitate the application of BRT solutions.

Chief, Division of Training:

- Coordinates BRT training, with input from planning and transit agencies, and considers local and national training programs to implement this effort.

Employees:

- Assist the Department in providing quality and timely products and services to the people of the State of California. Every employee is responsible for meeting the Department's commitments.

APPLICABILITY

All departmental employees involved in the planning, design, construction, maintenance, and operations of the transportation system. All BRT projects within State-owned rights-of-way, projects that may affect the operations of State facilities.

WILL KEMPTON
Director

2-14 07
Date Signed

BRT Projects in California

Case Study 1: Los Angeles MTA Rapid

The Los Angeles County Metropolitan Transit Authority (MTA) has implemented the Metro Rapid Program, which is a low-cost BRT system on surface streets in Los Angeles County. The Metro Rapid projects fall toward the basic end of the BRT spectrum outlined in Table B-1.

This was a demonstration project, with planning started in 1999 and a Spring 2000 startup. Two lines were selected for the demonstration:

- Line 720, Wilshire-Whittier (very-high-passenger-demand urban corridor connecting through the Los Angeles Central Business District)
- Line 750, Ventura (high-passenger-demand suburban corridor serving the Metro Red Line)

Table B-1 summarizes the two Metro Rapid lines as compared to the seven main features of BRT. Although the operation is in mixed traffic, numerous features are on the high-quality end, such as the distinctive branding of the buses, the shelters, and ITS elements.

Table B-1 Summary of Los Angeles MTA Rapid Project

BRT Features and Project Characteristics		
	Wilshire-Whittier	Ventura
Running Way	• Mixed traffic • Arterial streets	
Stations	• Enhanced shelters with distinctive branding to coincide with vehicles	
Vehicles	• NABI 45-foot • Low-floor	• NABI 40-foot • Low-floor
Service (Headways)	• 2.5- to 5-minute peak • 10-minute midday	• 5-minute peak • 10-minute midday
Route Structure	• Simple • Linear	
Fare Collection	• On-board	
ITS and Technology	• 70% signal priority • "Next bus" signs at stations • AVL • APC	• Total signal priority • "Next bus" signs at stations • AVL • APC
Length	23 miles (37 km)	16 miles (26 km)
Number of Stations	30	15
Capital Cost	$28.6 million	$10.3 million
Cost without Vehicles	$5.0 million	$3.3 million
Ridership (Daily)	43,200	10,100
Caltrans (CT) Involvement	None; no CT transportation facilities impacted	
Travel Time Reduction (over existing/prior bus operations)	29%	23%
Year service started/planned	2000	

This was a proof-of-concept demonstration that, in addition to the numerical results, had to satisfy 23 cities along routes traversed.

With this successful demonstration, MTA is now planning to expand the concept to include high-capacity buses, exclusive/bypass lanes, multiple-door boarding, and integration with a feeder network. At the same time, additional lines will be added to capitalize on the success of the Wilshire-Whittier and Ventura projects.

This project is an excellent example of initiating a simple, low-cost system, with some basic features of full BRT, and, where warranted, expanding the concept with respect to hardware, road improvements, and route coverage.

Case Study 2: AC Transit Rapid Bus and BRT

Alameda-Contra (AC) Costa Transit will implement the International-Telegraph Road BRT project in phases, but some operational changes are already in place. The Rapid Bus system is scheduled to be in operation by June 2006. Full BRT implementation is scheduled for June 2009. The project traverses the cities of Berkeley, Oakland, and San Leandro, covering a distance of 16 miles.

A summary of AC Transit's project, separated into the Rapid Bus and BRT phases, is shown in Table B-2. This table shows the planned enhancement from basic Rapid Bus to enhanced BRT that is envisioned between 2006 and 2009. When complete, nearly 90 percent of the operation will use exclusive, dedicated median lanes. This project illustrates how enhanced infrastructure improvements increase capital costs.

Final implementation of the BRT will use bus-only lanes on arterials along with some mixed flow with special pavement delineation and mountable curbs. No grade separations are provided. Stations will be located approximately 0.5 mile apart. Fare collection will be a proof-of-payment concept with a flat fare structure, using cash, cards, or passes. Headways will be at 5-minute intervals as opposed to the 10 to 12 minute intervals to be employed on the Rapid Bus system on the same route. There will be a green extension signal system with real-time, next-bus-arrival passenger information at kiosks and shelters. Dedicated vehicles are committed to this system.

This is a good example of a transit agency starting with a Rapid Bus system, now being implemented in the corridor and, while maintaining this system, constructing the more advanced BRT system that is outlined here.

INTERNATIONAL BOULEVARD AT 98TH AVENUE - EXISTING

INTERNATIONAL BOULEVARD AT 98TH AVENUE - PROPOSED

Table B-2 Summary of AC Transit Rapid Bus and BRT Projects

BRT Features and Project Characteristics		
	Planned Rapid Bus	Planned BRT
Running Way	• Mixed traffic • Arterial streets	• 16 miles (26 km) dedicated median lanes (89%) on arterial streets
Stations	• Shelters with distinctive branding to coincide with vehicles • Wider station spacing	Plus: • "Rail-like" raised platforms • Special architecture • Coordinated with land-use policies
Vehicles	• Three-door • Low-floor	
Service (Headways)	• 12-minute all-day	• < 5-minute
Route Structure	• Simple • Linear	
Fare Collection	• On-board	• Proof-of-payment • Off-board sales or hybrid
ITS and Technology	• Signal priority • AVL • "Next bus" signs at stations	Plus: • Precision docking at stations • Automated guidance
Length	18 miles (29 km)	
Number of Stations	35	50
Capital Cost	$25 million	$200 million
Cost without Vehicles	$25 million	$200 million
Ridership (Daily)	28,100 (2025)	49,250 (2025)
Caltrans (CT) Involvement	• Owns or controls majority of signals • Coordinates for signal priority	• CT owns Right Of Way for half the corridor • Reviews environmental and engineering • Establishes roadway design standards
Travel Time Reduction (over existing/prior bus operations)	16%	35%
Year service started/planned	2006	2009

The full BRT system is well into the planning and design stages, with full implementation scheduled for 2009. Cooperative funding is provided from a number of sources, including a regional bridge toll increase and county voter approved transportation measures, all indicating a firm commitment to this type of system.

The BRT system will use 16 miles of dedicated lanes that will displace certain traditional traffic patterns, including some on-street parking and traffic diversions. As BRT systems displace these traditional patterns, sensitive business community, political problems, and other public relations issues arise, requiring close and constant communication with the cities along the route.

The AC Transit project is a good example of how BRT planning bridges the expertise of fixed-guideway planning and traditional bus-route planning. Moving forward by phase (Rapid Bus to BRT) instead of by route segment is one example of this hybrid approach. Agencies pursuing BRT will be challenged to balance the permanence of the BRT's fixed-guideway with the inherent flexibility of buses.

Case Study 3: San Diego I-15 Managed Lanes/BRT

This San Diego Interstate 15 (I-15) project will provide a freeway-based BRT service. Although it does not provide dedicated lanes, the Managed Lanes in the north part of the corridor and HOV lanes in the south part of the corridor will ensure that free-flow conditions are provided for high-speed BRT operations. In other respects, it includes most of the other full BRT features.

The project is 35 miles in length. As shown in Table B-3, different running way configurations will characterize its operations: Managed Lanes (20 miles), HOV lanes (10 miles), dedicated lanes (4 miles), and mixed traffic (1 mile).

The involved freeway, I-15, is expected to have 380,000 Average Daily Traffic (ADT) by the year 2020. If no transportation improvements are undertaken, this would result in delays of well over an hour during the peak commute hours. Consequently, Caltrans, the San Diego Metropolitan Transit System (MTS), the North San Diego County Transit District (NCTD), and the San Diego Association of Governments (SANDAG) are working together on a multimodal plan to mitigate this projected traffic growth.

The corridor traffic presently includes about 15 percent HOVs at the peak period, and it is intended both to increase this traffic segment and provide a high level of BRT service. With only five station stops along the northern 20-mile corridor between the junction of the State Route (SR) 163 freeway and I-15 and the SR 78 freeway, the average travel speed of the BRT service is designed to emulate commuter rail service.

When the north corridor Managed Lanes facility is fully operational in 2013, the all-day BRT service would begin service, using Managed Lanes to maintain high-speed operations, accessing the five stations via direct access ramps. Since the Managed Lanes and BRT stations will be opened in stages, starting in late 2007, the BRT services outlined below will be implemented in stages. An operations plan currently underway will provide more details on how this will occur. An analysis of south I-15 priority measures and stations is underway now, with freeway median transit lanes

Table B-3 Summary of San Diego I-15 BRT Project

	BRT Features and Project Characteristics
Running Way	• 20 miles (32 km) freeway Managed Lanes for HOV and FasTrak™ value pricing allows SOVs (SR 78 to SR 163) • 10 miles (16 km) freeway HOV; in short term, freeway shoulder lanes will be used (SR 163 to Friars Road, and I-805 to downtown) • 4 miles (6.5 km) dedicated median lanes (Friars Road to I-805) • 1 mile (2 km) dedicated arterial lanes being evaluated but mixed traffic short term (downtown)
Stations	• 5 off-line stations connected by direct access ramps for HOV/FasTrak™ ~ designed to LRT standards ~ parking facilities ~ bus bays • 2 stations in dedicated median lanes of freeway • 1 station to interface with Green Line LRT • 1 station's design not yet determined
Vehicles	• "Branded" BRT vehicle with highway coach ride quality • Commuter-rail-like interior conveniences
Service (Headways)	• 10 to 15-minute all-day service frequencies on trunk line • 15-minute, peak only, on point-to-point commuter services
Route Structure	• Combination trunk line (rail-like) • Multiple point-to-point services (connecting off-freeway neighborhoods with activity centers)
Fare Collection	• Off-board, self-service technology
ITS and Technology	• "Next bus" arrival information at stations • Smart Card fare technology
Length	35 miles (56 km)
Number of Stations	9, plus downtown stops
Capital Cost*	$355 million
Cost without Vehicles	$324 million
Ridership (Daily)	25,000 (forecast)
Caltrans (CT) Involvement	• CT is developer of freeway portions and SANDAG is responsible for the BRT station facilities, with joint planning of the Direct Access Ramps (SR 78 to SR 163) • Dedicated median lane portion (Friars Road to I-805) was designed and built by CT as part of the original I-15 improvement project • CT controls the planned bus-on-shoulder operation; with CHP input, CT and SANDAG have been negotiating to undertake a demonstration project
Year service started/planned	2007 (1st phase, 3 stations in the north I-15 corridor Managed Lane portion); 2013 for full north corridor Managed Lanes (two additional stations plus south segment dedicated lanes and Mid-City stations); after 2015 for other segments

* BRT is a portion of the overall I-15 Managed Lanes Project; thus, this figure represents the cost of the BRT stations, direct access ramps, and buses (including estimates of replacement buses within a 40-year period).

and stations through the mid-city area south of I-8 expected to be implemented by 2013, if not earlier. Other HOV lanes and stations between SR 163 and I-8, and between mid-city and downtown, would be implemented as longer-term improvements. Interim improvements, such as use of freeway shoulder lanes and stations along existing freeway off-ramps, could be implemented earlier.

The concept of Managed Lanes is based on the operational goal of providing a free-flowing facility (Level of Service C) for carpool and BRT services. Over the limits of this project, the eight-lane conventional freeway with ramp metering will be augmented with a four-lane bidirectional median facility on which the number of lanes in each direction can be adjusted based on travel demand over the course of the day by use of a movable barrier. Similar to today's operation on the I-15 HOV facility, the Managed Lanes will give preference to buses and carpools, but will "sell" any excess capacity to single occupancy vehicles (SOVs) through expansion of the current FasTrak™ value-pricing program. Caltrans and SANDAG are coordinating with the FHWA on allowing SOV use of the Managed Lane excess capacity for a variable fee based on prequalification and the level of congestion at the time of use.

Unlike exclusive busway facilities, such as the Los Angeles Metro Orange Line, the I-15 Managed Lanes/BRT facility is being designed with a multimodal accommodation, since it will be used by automobiles, vans, and buses. Direct access ramps (DARs) to and from the Managed Lanes will allow vehicles to bypass the ramp meter signals at the conventional freeway on-ramps and provide additional time savings over and above travel along the non-Managed Lanes. This time savings, combined with the free-flowing Managed Lane time savings, is the unique design aspect of this facility and is expected to attract users.

Table B-3 summarizes the characteristics of the I-15 BRT project. There are several unique concepts, one being the service plan that is envisioned. While a detailed BRT service plan is currently being developed, the initial conceptual plan is based on operating two types of service:

- **Trunk-Line Service.** A trunk-line service would operate along the I-15 freeway corridor between Escondido and downtown San Diego, designed as an all-day service with 10 to 15-minute frequencies ultimately. This line would be akin to a rail transit operation and serve all the planned BRT stations in the north I-15 Managed Lanes corridor. Transit centers with park-and-ride lots would be available at the five northern stations.

- **Point-to-Point Service.** This service is designed to facilitate home-to-work trips during the peak-period commute times by providing direct connections from north I-15 corridor residential neighborhoods to major employment centers (for example, downtown San Diego, Kearny Mesa, or Sorrento Mesa). Penetrating into neighborhood areas can maximize walking access to bus stops and minimize drive times to neighborhood park-and-ride lots. From neighborhood areas, these routes will use the Managed Lanes facility to travel to the employment centers with high-speed operations. In effect, the services function as feeder routes to and from the BRT stations as well.

SANDAG's plans entail the purchase of new state-of-the-art highway buses, with enhanced custom amenities that could include laptop computer stations, reading lamps, and reclining seats.

A unique aspect of SANDAG's project is the combination of different operating conditions that will be employed in order to use the entire 35-mile length for BRT operations, and several routes of varying service characteristics. This project shows how planners and engineers must search for the best solution to maintain full BRT quality, dependent upon the varying traffic and physical conditions of each stretch of the freeway and street.

Case Study 4: Los Angeles MTA Metro Orange Line BRT

The best current California example of a full BRT project is the Metro Orange Line in the San Fernando Valley of Los Angeles, opened for service in October 2005. The El Monte Busway on Interstate 10 (the San Bernardino Freeway), established in 1973, has many attributes of a BRT facility, but it shares its lanes with HOVs and, therefore, does not have an exclusive or dedicated running way.

The Los Angeles County Metropolitan Transit Authority (MTA) is the owner-operator of this project. The facility, designated as the Orange Line, runs from the northern terminus of the Metro Red Line in North Hollywood for 14 miles to the Warner Center in Woodland Hills. This east-west line is operated over a landscaped 13-mile transit facility constructed in the former Southern Pacific Railroad right-of-way and one mile of city streets, using 60-foot articulated low-floor buses with low-pollutant power units.

Table B-4 provides a summary of the MTA's Orange Line Project. There are 13 stations along the line, spaced approximately one mile apart and generally serving major activity centers such as the Van Nuys Government Center, the Warner Center (the third-largest employment center in Los Angeles County), and two colleges. The stations feature signage displaying operating information and such amenities as public telephones, bicycle racks, ticket machines, security cameras, and distinctive original art. Five stations have park-and-ride lots, totaling about 3,000 parking spaces.

Besides infrequent stations and specialized vehicles, the service provides Traffic Signal Priority (TSP) on the city street portion; boarding and fare collection improvements; and improved stations with raised platforms, allowing faster bus loading and ITS technologies, which include the ability to maintain constant distances between buses and to provide passengers with visual displays telling them when the next bus will arrive. Peak period operation will provide seven- to ten-minute headways fully integrated with north-south feeder bus service.

Environmental considerations include sound walls and screening vegetation along the route. A bicycle and pedestrian path exists along most of the route.

At the Red Line North Hollywood Station area, the MTA plans to rehabilitate the old Southern Pacific Railway Station as a transit center and provide a direct underground connection between the Red Line rail system and the Orange Line BRT service. In addition, MTA staff will work with planning agencies and private developers to encourage transit-oriented development near its stations. The geometrics of the bus facility will allow conversion to a light rail facility if that is warranted in the future.

Table B-4 Summary of Los Angeles Metro Orange Line Project

BRT Features and Project Characteristics	
Running Way	• Exclusive roadway (13 miles former railroad ROW; 1-mile city street) • Separate bicycle/pedestrian path within ROW, parallel to busway • Fully landscaped ROW • Sound walls to mitigate bus noise impact
Stations	• Enhanced shelters, consistent in design to reinforce system identity • Located approximately one mile apart • Include amenities such as seating, enhanced paving, artwork, lighting, CCTV cameras, TVMs, emergency and public telephones, system and community map cases, bicycle racks, and lockers on a separate module • Level boarding platforms • All features ADA compliant
Vehicles	• Low-floor • Multiple doors • 60-foot articulated • Clean fuel compressed natural gas
Service (Headways)	• 7- to 10-minute headways in early years • Potential 2-1/2- to 5-minute headways
Route Structure	• Simple • Linear, rail-like
Fare Collection	• Off-board
ITS and Technology	• Signal priority with signal sensors • “Next bus” arrival variable message signs • GPS-based bus locator system • AVL • APC
Length	14 miles (22.4 km)
Number of Stations	13 (5 with parking for 3,000 vehicles total)
Cost per station	$2 million
Capital Cost	$329.5 million
Cost without Vehicles	$269.5 million
Ridership (Daily)	21,828 (as of 5/2006)
Caltrans (CT) Involvement	• Busway crosses under I-405 Freeway. CT involvement in coordinating planned freeway widening/column placement just prior to start of busway construction
Travel Time Reduction (over existing/prior bus operations)	• Annual savings over “no-build”: 439,000 hours (savings to TSM 154,000)
Year service started/planned	2005

Other California BRT Projects (October 2005)

Table B-5 provides a summary of other BRT projects that are in operation or in various stages of development throughout California.

Table B-5 Other BRT Projects in California (October 2005)

County	Transit Development Agency	Project Name	Description	Status
Alameda	Alameda Contra Costa Transit District (AC Transit	San Pablo Rapid	Operating in mixed traffic on 2x2 arterial; introduction of the service resulted in 17% travel time savings; 65% ridership growth and reduction of 1,100 daily auto trips in corridor (on section of State Highway 123).	In operation since 2003.
	AC Transit	International/Tele -graph Ave. Rapid Bus and BRT	Rapid Bus running in mixed traffic on 2x2 arterial is currently being implemented and will be fully operational in 2006; BRT in bus-only lane on arterial with some mixed flow operational in 2009 (on section of State Highway 185).	Fully operational in 2006; bus-only lane on arterial in 2009.
	AC Transit	Transbay BRT	Study of BRT corridor operating on arterials (MacArthur Blvd, Grand Ave, Harrison, 20th Street, West Grand Ave) & I-80 Bay Bridge; from Mandela Parkway to Toll Plaza buses would use the West Grand Ave-Maritime Structure.	Initial study in progress.
Los Angeles	Los Angeles County Metropolitan Transportation Authority (LACMTA) and Foothill Transit	El Monte Busway; various express and local/express services	First fully grade-separated busway in California extending over 12-miles on I-10 (Los Angeles-San Bernardino freeway) opened in 1973; 3-person carpools allowed in 1976; currently 3+ carpools during peak hours, 2+ during off peak hours; around 80 peak hour buses. Express and local/express bus services operate along the 3 bus stations (El Monte, University Station, Hospital Station); direct HOV connector access ramp at Del Mar Ave, direct bus connector at El Monte Station; P&R lots for 5,100 parking spaces oriented toward the busway. Metrolink rail system operates in the same corridor.	In operation since 1973; initially bus-only operation; currently 3+ carpools during peak hours, 2+ during off-peak hours permitted; around 80 peak hour buses.
	LACMTA	Metro Rapid	Currently 13 lines operating in mixed traffic, to be expanded to 28 lines by 2008; dedicated lanes recently introduced on parts of Wilshire/Whittier line; ridership growth in selected studied corridors: between 9–42%; travel time savings: 20%.	In operation since 2001; network of 28 lines by 2008 (450 service miles).
	City of Santa Monica	Rapid Blue	As part of LA County BRT network, mixed-flow BRT operation on 8-mile stretch of Lincoln Blvd - one of the area's busiest thoroughfares - from downtown Santa Monica to LAX and Metro's Green Line light rail station (on short sections of SR 2).	In operation since June 2005; part of LA County BRT network.

Table B-5 Other BRT Projects in California (October 2005) continued

County	Transit Operator/ Development Agency	Project Name	Description	Status
Los Angeles (continued)	LACMTA	Metro Orange Line	Fully grade-separated busway along 13-mile stretch of LACMTA right-of-way (plus one mile of mixed-flow operation on public street) from North Hollywood to Woodland Hills.	Opened for revenue service on November 1, 2005.
Orange	Orange County Transit Authority (OCTA)	Harbor Blvd BRT	Full "BRT" service in 2006 to incorporate upgraded shelters, Transit Signal Priority (TSP), distinctive buses, integrated marketing strategy with appropriate branding; (interface with I-5, I-405, SR 22 & 91); initially limited stop service. Other corridors being studied: Westminster Ave, Beach Blvd, Katella Ave.	Limited service in mixed traffic initially; fully operational in 2007.
Riverside	Riverside Transit Agency (RTA)	RapidLink	Initial BRT light to be operating in mixed traffic on Magnolia Ave starting in 2006, extension to Moreno Valley in 2010.	Starting in 2006, extension to Moreno Valley in 2010.
Sacramento	Sacramento Regional Transit (SacRT)	50 E-Bus	"Enhanced bus service" on Stockton Blvd Weekday service from Florin Mall to downtown Sacramento along the Stockton Blvd corridor.	In service since January 2004.
	SacRT	20 Year Vision for BRT	Identified four corridors to be studied in the upcoming Transit Master Plan (section of Sunrise Blvd, SR 65).	
San Bernardino	Omnitrans	San Bernardino Express (sbX)	San Bernardino and Loma Linda, CA E-Street transit corridor (interface with I-10 at Tippecanoe Ave).	Operational in dedicated lanes by 2010.
San Diego	SANDAG, MTS, NCTD	Rapid Bus Projects	Several corridors being evaluated as Rapid Bus services (intermediate BRT type services).	FY 06 study of traffic signal technology. Phases of Rapid Bus services could be implemented starting in 2006.
San Francisco	San Francisco Municipal Railway (Muni); also Golden Gate Transit (GGT)	Van Ness BRT	Van Ness Ave is the major north-south arterial on the western edge of the SF CBD, and is the route of US-101 for most of its length. Van Ness is a major transit route for both Muni and Golden Gate Transit. It is currently undergoing conceptual planning for "Full BRT" treatment, with initial construction anticipated in 2008-09.	An alternatives evaluation study for Van Ness is currently underway.

Table B-5 Other BRT Projects in California (October 2005) continued

County	Transit Operator/ Development Agency	Project Name	Description	Status
San Francisco	San Francisco Municipal Railway (Muni); also Golden Gate Transit (GGT)	Geary BRT	Geary Blvd (paired with O'Farrell St. in the SF CBD) is a major east-west urban arterial with 50,000 daily Muni transit trips. The corridor is shared with limited use by Golden Gate Transit, which may increase in the future. Curb transit lanes in SF's CBD were recently upgraded to "Initial Stage BRT." Priority signals have also been provided in the western segments of the corridor. The Geary Corridor is currently undergoing conceptual planning for "Full BRT" treatment, with initial construction anticipated after 2010-11.	Initial Stage BRT currently includes widened transit-only lanes, curb parking restrictions, turn pockets, priority signals and differentiated local, limited and express services, loading bulbs at downtown limited stops. Full BRT design and service alternatives under development.
	San Francisco Municipal Railway (Muni)	Vision Plan Transit Preferential Streets (TPS) Network.	9 urban corridors have been identified for TPS/BRT treatment, in addition to Van Ness and Geary above. TPS/BRT treatments, which look at BRT techniques as a toolkit, are similar to "Initial Stage BRT" and will be developed on all or most of the remaining corridors. Some will include incremental enhancement to partial BRT treatment.	The 19th Ave corridor (SR 1) is currently under study. Almost all Muni transit routes into the CBD already include at least some TPS applications.
San Francisco, Marin, Sonoma	Golden Gate Transit (GGT)	Regional commuter express bus service	18 commute express bus routes from Marin and Sonoma Counties to San Francisco during morning peak hours and back during afternoon peak hours; 15 routes use HOV lanes on US 101 and several park-and-ride lots in Marin and Sonoma Counties. One route operates between Marin and Sonoma Counties. GGT uses intercity, air-conditioned coaches with airline-type seats, individual reading lights, baggage racks, and ADA lift. System carries about 4,000 commuters to and from work daily.	In operation since 1972; currently 18 routes.

Table B-5 Other BRT Projects in California (October 2005) continued

County	Transit Operator/ Development Agency	Project Name	Description	Status
San Francisco, Marin, Sonoma (continued)	Golden Gate Transit (GGT)	Trunk-line regional express bus service	3 routes operate between San Francisco, Marin, and Sonoma Counties on a daily basis. Bus fleet and ADA features are identical to commute service fleet. One route uses the HOV lanes.	In operation
Sonoma, Marin	Golden Gate Transit (GGT)	Trunk-line service.	5 routes operate in US 101 corridor daily. Bus fleet and ADA features are identical to commute service fleet. One route uses the HOV lanes.	In operation
San Joaquin	San Joaquin Regional Transit District (SJRTD)	To be determined	SJRTD and the City of Stockton are working on a BRT Master Plan outlining potential corridors for BRT implementation in the city and throughout the county (eventually on parts of I-5 and I-205).	Plan to implement a Transit Signal Priority pilot project in 2006.
San Mateo	San Mateo County Transit District (SamTrans)	Routes 390 and 391 (Name of new service to be determined)	Operational analysis underway to assess express bus/rapid bus service. ITS elements will include expansion of real-time passenger information to key loading points along El Camino Real (SR 82) and installation and implementation of an Adaptive Signal Light Prioritization system in central San Mateo County.	Implementation would occur within 2 to 3 years.
Santa Clara	Santa Clara Valley Transportation Authority (SCVTA)	Santa Clara BRT, VTA Line 522	Mixed-traffic BRT on 27 miles of El Camino Real (SR 82); also proposed 9.6 miles on Monterey Highway (SR 82) and on San Carlos/Steven Creek Blvd.	VTA Line 522 on El Camino Real in revenue service since July 2005.

International BRT and Busway Experiences

The 2004-2005 edition of the comprehensive and authoritative British publication, "Jane's Urban Transport Systems", comments on BRT and busways as follows:

Busways and Bus Rapid Transit (BRT) schemes have been very successful for many years in a number of areas around the world. There is also now a growing interest in new busways, with plans being made or construction already underway. The many advantages of busways and BRT are being recognised. Most importantly, busways are cost effective in terms of necessary financing and time required for completion. In addition, busways offer flexibility in the manner in which they can provide seamless service for the passengers. For instance, buses on busways do not require a change of vehicles at the end of the busway, for the buses can operate on existing streets and roads to serve various neighbourhoods. Deviations to other destinations at intermediate points along the busway can be programmed.

One of the major cost savings of a busway system is the fact that, in general, costly new maintenance facilities do not have to be built, such as in the case of light or heavy rail systems. Busway buses can operate on existing streets and be serviced through present maintenance facilities. Another advantage is that busway buses can use city-centre streets. This avoids heavy, disrupting construction if light or heavy rail is considered.

The publication further points out:

There are many different types of busways. The most effective and efficient busway is a dedicated roadway with no grade crossings and the dedicated roadway for buses can be a paved two-lane road with stations spaced at appropriate distances. The dedicated busway can also take the form of a guided track. In this application, the roadway is narrow but includes side barriers. Buses on this type of busway have small guidewheels at the sides of the buses to keep them within the confines of the track; these guide wheels protrude only slightly from the sides of the bus and, thus the buses running on a guided busway can operate normally on city streets and roads.

Busways can also take the form of a dedicated portion of a street wither with barriers to prevent intrusion by other vehicles or without barriers, but on marked portions of streets. Intrusion of other traffic must be strictly regulated. Busways which require buses to cross normal streets can feature special pre-empted traffic signals that can speed the buses along the busway.

Another type of busway involves sections along a busy street or road at so-called pinch points. This allows buses to speed past traffic while on the busway and then enter the street or road with other traffic. Again, pre-empted signals are an important feature.

Following is a selected listing of some of the world's major busway facilities as identified by "Jane's Urban Transport Systems". It is important to recognize that in many cases the busway is only part of the listed system, but is usually the dominant feature in the identified system, especially on a corridor basis.

Webb, Mary (ed.). Jane's Urban Transport Systems: 2004-2005. 23rd ed. Alexandria, Virg.: Jane's Information Group, 2004, p. 12.

Australia

Adelaide. The guided 12-kilometer, three-station busway established in 1986 using Mercedes-Benz O-Bahn technology has been well received and continues ridership growth in the northeastern corridor. Buses operate on concrete tracks with lateral guide wheels for automatic steering on the guideway. It provides over 7 million passenger trips per year with 113 articulated buses operating at up to 100 km/hr.

Brisbane. A Southeast Queensland busway network using the O-Bahn technology is in operation. Significant emphasis is placed on passenger amenities in the stations and aboard the vehicles. Buses operate at high frequencies and on completely separated rights-of-way.

Sydney. A suburban busway between Liverpool and Parramatta has recently been opened.

Brazil

Curitiba. This city's 50 kilometers of busways are the backbone of one of the most successful, award-winning, and extensive urban busway systems in the world. One of the keys to the success of this city's 1,100-bus system was the early establishment of a master plan for growth and its strict implementation over the years. The resulting bus system is characterized by the following features that enable the bus service to approach the speed, efficiency, and reliability of a much more costly subway system:

- **Integrated planning**
- **Exclusive bus lanes**
- **Signal priority for buses**
- **Preboard fare collection**
- **Easy boarding (raised platforms, multidoor buses, tube stations)**
- **Free transfers and discounted or free fares for the disadvantaged, elderly, etc.**
- **Large-capacity, wide-door buses (up to 270 passengers per bus)**
- **An overlapping system of bus services**

As a result of this system, about 70 percent of the area's commuters use transit for their work trip. The Curitiba urban area with its 2.2 million population enjoys congestion-free streets and pollution-free air where 1.3 million passengers ride the system daily.

Canada

Ottawa. A key feature of Canada's capital city is a 31-kilometer busway system begun in 1983 and now operating with three corridors, 24 stations, and 42 kilometers of exclusive bus lanes located on the freeway shoulder, which were added in 1998. In the central city, the buses operate on exclusive lanes.

Vancouver. Three BRT routes (B-Line) provide 40 kilometers of various levels of service. The B-Line features limited stops, frequent service, and low-floor buses with distinctive exterior styling and colors.

Ecuador

Quito. This capital city has three busways, with the first implemented in 1996 using trolleybuses on a dedicated street space. The other two busways use conventional articulated buses.

England

Leeds. The first unit of the North Leeds guided busway (called Superbus) was opened in 1995. Low-floor, single-deck and double-deck buses equipped with front-axle guidewheels operate on the guideway. A second unit opened in 2001 and a third in 2002.

France

Nancy, Rouen, Caen, and Clermont-Ferrand. All these cities have busway facilities. The Clermont-Ferrand system uses buses with optical guidance.

Germany

Essen. With funding from the federal government, an 8.9-kilometer guided bus system has been operating since 1980. It uses 18 articulated 1987 Mercedes dual-propulsion buses (diesel/trolley).

Holland

Haarlem. A 34-kilometer busway connects the Schiphol Airport and the city. Plans for its extension are under way.

Mexico

Mexico City, the State of Guanajuanto, and the City of Leon. These localities all have operating guideways. The Mexico City Metrobus service operates along a 12.5-mile reach of Insurgentes Bulivard, which is the city's main north-south street. The lanes next to the tree-lined median are devoted to bus use. Thirty-six modern stations are served by 80 articulated buses, each capable of holding 160 passengers.

United States

Busways using dedicated lanes were established on the Shirley Highway (Interstate 95) in the Washington, D.C., area in the early 1970s and on the San Bernardino Freeway (I-10) in the Los Angeles area in 1973. Both of these facilities subsequently were converted to allow HOV use. In this same 1970s time period, busway facilities were established on the I-495 approach to the Lincoln Tunnel in New Jersey, Highway 101 north of San Francisco, and a separate right-of-way in Pittsburgh. About the same time, bus lanes as part of transit malls were introduced in many downtown areas, including the Nicollet Mall in Minneapolis, the Portland Oregon Transit Mall, and the 16th Street Mall in Denver. Bus lanes on Madison Avenue in New York City in 1981 reduced bus travel times by 34 percent to 42 percent and increased ridership by 10 percent.

Robust, high-quality bus services that include major busways exist in Pittsburgh, Pennsylvania; Seattle, Washington; and Miami, Florida. Such services also exist, or are under development in other U.S. cities, including Eugene, Oregon; Las Vegas, Nevada; Orlando, Florida; Boston, Massachusetts; Cleveland, Ohio; Chicago, Illinois; Honolulu, Hawaii; Houston, Texas; and Phoenix, Arizona.

Key Transportation Terms and Acronyms

49 CFR – Title 49: Transportation, Code of Federal Regulations.

AC Transit – Alameda-Contra Costa Transit.

ADA – Americans with Disabilities Act.

ADT – average daily traffic; average daily trips.

APC – automated passenger counting.

alighting/alight – to get off or out of a transportation vehicle. [TRB Glossary]

articulated bus – an extra-long, high-capacity bus that has the rear body section flexibly but permanently connected to the forward section. [TRB Glossary]

automated guidance – a mechanical or electronic system designed to control the guidance of a vehicle automatically.

AVL – automatic vehicle location system.

branded – characterized by an identity and image developed through advertising, logo, livery (paint schemes), etc.

BART – Bay Area Rapid Transit.

BRT – Bus Rapid Transit.

bus bays – a specially designed or designated location at a transit stop, station, terminal or transfer center at which a bus stops to allow passengers to board and alight; also known as a bus dock or bus berth. [TRB Glossary]

bus priority – a system of traffic controls in which buses are given special treatment over the general vehicular traffic (for example, bus priority lanes or preemption of traffic signals). [TRB Glossary]

Bus Rapid Transit (BRT) Coordinator – the person in a Caltrans District that has existing or planned BRT systems who will be charged with addressing that District's involvement in Bus Rapid Transit.

business park – a development principally occupied by businesses.

busway – a special roadway designed for use by buses.

Caltrans (CT) – California Department of Transportation.

Caltrans Project Manager – a Caltrans employee responsible for a major project or a series of projects.

CCTV – closed circuit television.

central business district – as defined by the Bureau of the Census, an area of high land valuation characterized by a high concentration of retail businesses, service businesses, offices, hotels, and theaters, as well as by a high traffic flow.

charter – an agreement with less formality than an MOU or MOA.

CHP – California Highway Patrol.

CMA – Congestion Management Agency.

cost-effective – producing optimum results for the expenditure (doing the right thing at the lowest cost).

CT – Caltrans.

CTC – California Transportation Commission.

DARs – direct access ramps.

dedicated busway – a special roadway designed for exclusive use by buses.

dedicated lanes – traffic lanes established for and restricted to specific types of vehicles.

Department – Caltrans.

District Director – the manager of each of the Caltrans Districts.

Deputy Directive – a Caltrans directive to staff establishing implementation procedures, usually signed by the Chief Deputy.

DMT – Division of Mass Transportation.

DTO – Division of Traffic Operations.

docking – placing a transportation vehicle in a dock, bay or berth.

efficiency – accomplishing a job with a minimum expenditure of time and effort; doing things right.

effective – producing the expected or intended result; doing the right things.

FasTrak™ – the San Diego Association of Government's program that allows single-occupancy vehicles to pay their way onto the I-15 high-occupancy vehicle facility.

FHWA – Federal Highway Administration.

Fixed Guideway - a public transportation facility using and occupying: (1) a separate right-of-way or rail for the exclusive use of public transportation and other high occupancy vehicles, or (2) a fixed catenary system usable by other forms of transportation. (Note: A dedicated busway or HOV lane is included under this definition of fixed guideway)

FTA – Federal Transit Administration.

Governor's Strategic Growth Plan – Governor's proposed 10-year transportation infrastructure action plan.

GGT – Golden Gate Transit

GPS – global positioning system.

headway – the time interval between the passing of the front ends of successive transit units (vehicles or trains) moving along the same lane or track (or other guideway) in the same direction, usually expressed in minutes. [TRB Glossary]

HOT lane – high-occupancy toll lane.

HOV – high-occupancy vehicle – a vehicle with more than one occupant.

HOV lanes (HOVL) – lanes dedicated to HOV use; usually also allow motorcycles and, in some cases, "deadheading" buses (out-of-service buses with only a driver). California offers permits to qualified hybrid vehicles that allow HOV use.

ITS – intelligent transportation systems.

Jane's – Jane's Information Group – a source of transportation information.

LACMTA – Los Angeles County Metropolitan Transportation Authority.

LAX – Los Angeles International Airport.

level of service (LOS) – a set of characteristics that indicate the quality and quantity of transportation service with a scale of six LOSs defined from "A" to "F;" with LOS "A" representing free flow conditions and LOS "F" representing congested conditions. LOS "C" represents operating conditions where speeds are at or near free-flow.

LRT – light rail transit – as defined by the TRB Subcommittee on Light Rail Transit, a metropolitan electric railway system characterized by its ability to operate single cars or short trains along exclusive rights-of-way at ground level, on aerial structures, in subways, or occasionally, in streets, and to board and discharge passengers at track or car floor level.

Managed Lanes – a program of SANDAG and Caltrans to optimize the lane usage of the HOV lanes on the I-15 freeway using flexible median barriers.

Metro Orange Line – Los Angeles MTA Bus Rapid Transit service in the San Fernando Valley.

MPO – Metropolitan Planning Organization.

Metro Rapid Program – Los Angeles MTA bus service precursor of Bus Rapid Transit.

Metro Red Line – Los Angeles MTA rail rapid transit.

MOU/MOA – memorandum of understanding/agreement.

MTA – Metropolitan Transportation Authority.

MTO – Metropolitan Transportation Organization.

MTS – San Diego Metropolitan Transit System.

Muni – San Francisco Municipal Railway.

NABI – North American Bus Industries.

NCTD – North County Transit District of San Diego County.

New Starts – a specific category of capital-intensive guideway transit projects identified and funded in SAFETEA-LU.

"next bus" signing – information signing at a station, usually by a changeable message sign, giving waiting patrons the time (in real-time) that the next bus is due to arrive.

OCTA – Orange County Transportation Authority.

off-board fare collection – fare collection occurring prior to vehicle boarding.

off-vehicle – activity occurring outside a vehicle.

Omnitrans – joint powers transportation authority in the San Bernardino valley.

P&R – park and ride

People throughput - moving people, rather than vehicles, through the transportation system.

precise berthing – the process of a bus approaching and stopping at a specially designed or designated high-level platform to maintain a consistent small gap.

proof-of-payment – a receipt of fare collection; a ticket.

rail rapid transit – transit using high-speed, electrically powered passenger rail cars operating in trains in exclusive rights-of-way, without grade crossings and with high platforms. [TRB Glossary]

Rapid Bus – AC Transit precursor of Bus Rapid Transit.

real-time – able to respond immediately to input data. [Oxford Dictionary]

ROW (RW) – right-of-way.

RTA – Riverside Transit Agency.

RTIP – Regional Transportation Improvement Program.

running way – the facility provided for the operation of a transportation vehicle.

SacRT – Sacramento Regional Transit.

SAFETEA-LU – Safe, Accountable, Flexible, and Efficient Transportation Equity Act–A Legacy for Users – the federal legislation for transportation for 2005-2009.

Sam Trans – San Mateo County Transit.

SANDAG – San Diego Association of Governments.

sbX – San Bernardino Express.

SCVTA – Santa Clara Valley Transportation Authority.

self-service [ticketing] – passenger use of ticket vending machines at the station or on the platform to purchase their ticket.

SHS – State Highway System.

SJRTD – San Joaquin Regional Transit District.

Small Starts – a specific category of new start projects (under $75 million in federal funds) identified and funded by SAFETEA-LU.

Smart Card – a technology used by TransLink [and others] to add and deduct value from an electronically encoded card when a rider passes it near a programmed reader on buses and at fare gates on BART. [AC Transit Glossary]

SOV – single-occupancy vehicle.

SR – state route.

STIP – State Transportation Improvement Program.

TCRP – Transit Cooperative Research Program.

TPS – transit preferential streets.

TRB – Transportation Research Board.

traffic signal prioritization – a system of traffic controls in which buses or LRT vehicles are given priority of the signals over general vehicular traffic.

TSM – transportation systems management.

TSP – traffic signal priority.

tube stations – a unique station design used in Curtiba, Brazil, to control and facilitate fast loading and unloading of bus passengers.

TVM – ticket vending machine (also referred to as fare vending machines).

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http://www.fta.dot.gov/

FTA Bus Rapid Transit Main Page
http://www.fta.dot.gov/7639_7662_ENG_HTML.htm

Caltrans Web sites

Design Information Bulletins, Highway Design Manual, Project Development
http://www.dot.ca.gov/hq/oppd/guidance.htm

Encroachment Permits
http://www.dot.ca.gov/hq/traffops/developserv/permits/index.htm

Traffic Manual and MUTCD, California Supplement
http://www.dot.ca.gov/hq/traffops/signtech/signdel/trafficmanual.htm

California BRT Operations

Alameda County - AC Transit
http://www.actransit.org/planning_focus/

Los Angeles County - MTA Metro Rapid
http://www.mta.net/metro_rapid.htm

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Santa Monica
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Orange County - OC Transportation Authority
http://www.octa.net

Riverside County - Riverside Transit Agency
http://www.rrta.com/

Sacramento County - Sacramento Regional Transit
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San Diego County - Metropolitan Transit System
http://www.sdcommute.com/

North Country Transit District
http://www.gonctd.com/

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http://www.dot.ca.gov/dist11/I15managed/15home.htm

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http://www.sfmuni.com/cms/mms/home/home50.htm

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http://www.sfcta.org/

San Joaquin County - SJ Regional Transit District
http://sj-smart.com/

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Institute of Transportation Engineers (ITE)
http://www.ite.org/

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http://PATH.Berkeley.EDU/SMARTBRT/Release

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