

BUS RAPID TRANSIT MASTER PLAN

(DRAFT)

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Prepared for:



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Table of Contents

Table of Contents

Chapter 1 – Introduction

- 1.1 Bus Rapid Transit Master Plan Motivation and Overview**
- 1.2 Fresno Area Express**
- 1.3 Bus Rapid Transit**

Chapter 2 – Regional Planning Context

- 2.1 Market Characteristics**
- 2.2 Existing Transit Services**
- 2.3 Downtown Transportation and Infrastructure Study**

Chapter 3 – Stakeholder and Public Participation

- 3.1 Stakeholders**
- 3.2 Stakeholder Interviews**
- 3.3 Community Open House**

Chapter 4 – Proposed Rapid Transit (BRT) Network

- 4.1 Planning Parameters and Goals**
- 4.2 BRT Corridor Identification and Selection**
- 4.3 Proposed Bus Rapid Transit Network**
- 4.4 Ridership Assessment of Potential Corridors for Early Implementation**
- 4.5 Proposed Corridor for Initial Implementation**

Chapter 5 – Ventura Avenue/Kings Canyon Road BRT Implementation Plan

- 5.1 Corridor Characteristics**
- 5.2 Proposed Alignment and Station Locations**
- 5.3 Conceptual Station Improvements**
- 5.4 Corridor Improvement Concepts**
- 5.5 BRT Vehicles**
- 5.6 Probable Operating and Capital Costs**
 - 5.6.1 Operating Cost Estimates
 - 5.6.2 Capital Costs Estimates
 - 5.6.3 Probable Cost for Proposed Ventura /Kings Canyon Corridor
- 5.7 Next Steps for BRT Implementation**

Chapter 6 – Funding Mechanisms for Implementing BRT

- 6.1 Local Funding Options**
 - 6.2 State Funding Programs**
 - 6.3 Federal Funding Programs**
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Chapter 1 – Introduction

The Council of Fresno County Governments (COFCG) has retained the firm of Kimley-Horn and Associates, Inc., along with subconsultants Wilbur Smith and Associates, and Cambridge Systematics, to develop a Bus Rapid Transit Master Plan (BRT Master Plan). The BRT Master Plan has been prepared in association with the Technical Advisory Committee (TAC), comprised of staff members from COFCG, Fresno Area Express, City of Fresno, City of Clovis, and Caltrans.

This report is divided into the following chapters:

- Chapter 1 – Introduction. Provides brief introductions of the BRT Master Plan, Fresno Area Express, and Bus Rapid Transit.
- Chapter 2 – Regional Planning Context. Provides current planning conditions in the Fresno region and their potential impact on the BRT Master Plan.
- Chapter 3 – Stakeholder and Public Participation. Provides a summary of outreach to community leaders in Fresno with regards to BRT in Fresno and public comments/recommendations from the Community Open House.
- Chapter 4 – Proposed Rapid Transit (BRT) Network. Identifies potential corridors in the Fresno/Clovis metropolitan area for BRT implementation both in the short- and long-term. Provides recommendation for initial BRT implementation in Fresno and eventual build-out of a full BRT network.
- Chapter 5 – Ventura Avenue / Kings Road BRT Implementation Plan. Provides description of a potential corridor for initial BRT implementation and proposed stations along the corridor. Also describes improvements to the corridor, BRT stops/stations, and vehicles to improve access to key destinations and minimize travel time for riders.
- Chapter 6 – Probable Capital and Operating/Maintenance Cost Estimates. Provides probable cost estimates for various forms of BRT implementation in Fresno.
- Chapter 7 – Funding Mechanisms for Implementing Bus Rapid Transit. Identifies funding mechanisms to support the proposed capital and operating costs associated with a BRT system.

1.1 Bus Rapid Transit Master Plan Motivation and Overview

The Bus Rapid Transit Master Plan provides a new perspective on rapid transit service in the Fresno/Clovis metropolitan area. The COFCG has been studying the implementation of rapid transit services in Fresno with rail modes as the proposed means of transportation. Unfortunately, due to high costs of implementing rail modes, it has been difficult to justify local investment in rapid transit. Today however, with the introduction of the bus rapid transit (BRT) concept, implementation of rapid transit is now more of a reality for many metropolitan areas from communities wanting a rapid transit network, like Fresno, to communities expanding their transit network such as Los Angeles or Boston.

Fresno is expected to grow and develop at a high rate over the next twenty years. As experienced over the last ten years, growth can bring both opportunities and challenges to the region. With the increase in employment and housing opportunities there is an increase in traffic congestion on both local roads and highways and the related increase in air pollution. Traffic congestion and air

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

pollution are serious issues for the Central Valley, particularly air quality in Fresno and Clovis. These issues have led to community groups emphasizing the mitigation of poor air quality through improved transit.

The overall vision of the BRT Master Plan is to demonstrate how improved efficiency, speed, and service can attract new transit ridership, improve customer satisfaction, and benefit the broader community by providing a quality of service similar to light rail systems through the use of bus technology.

This master plan will assess the potential implementation of bus rapid transit in Fresno with the following goals to support the above-mentioned vision:

1. **Service Level** – FAX will provide public transportation service to a maximum number of people in the Fresno-Clovis Metropolitan Area. This goal includes 90% coverage of the population within one-half mile of a FAX route; a maximum headway of 60 minutes and service seven days a week.
2. **Service Quality** – FAX will provide quality, convenient public transit service. This goal describes reliable service, clean and attractive vehicles and facilities and system safety.
3. **Provide Efficient and Effective Service** – FAX will operate an efficient and effective bus system. This goal describes a minimum farebox recovery ratio of 28% and minimum productivity of 40 passenger boardings per hour of bus service.
4. **System Image** – FAX will promote its service and image in the community. This goal describes marketing and community relations efforts.
5. **Private Sector and Citizen Involvement** – FAX will provide opportunities for citizens and private business to participate in public transportation operations.
6. **Integrated Multi-modal Transportation** – FAX will provide integrated multimodal transportation which facilitates the movement of people. This goal is targeted at connecting FAX services with the airport and passenger rail station.
7. **Coordinate Transportation, Land Use and Air Quality Policies.** This goal describes support for transportation investments that work towards accomplishing air quality goals, optimize utilization of land and encourage a stable economic base.

1.2 Fresno Area Express

Fresno Area Express (FAX) is the City of Fresno's public transit system. FAX operates both fixed bus routes and paratransit service seven days a week. The system consists of 21 bus routes carrying over 12 million passenger per year. Many routes currently operate on 30-minute headways in the peak hour; however, recently several routes have been increased to 15-minute headways due to passenger demand.

Three of FAX's routes currently serve more than 4,500 passengers on each route on a daily basis. Route 28 is approaching 8,000 passengers per day and is quickly filling the higher frequency buses of every 15 minute peak hour service recently implemented by FAX. The system has experienced significant peak loads on these higher frequency routes; FAX anticipates that these routes will

continue to grow substantially over the next five to ten years and will need innovative and cost effective ways to address the increased demand.

1.3 *Bus Rapid Transit*

Definition

“Bus Rapid Transit” (BRT) is an integrated system of facilities, equipment, services, and amenities that improves the speed, reliability, and identity of bus transit. BRT is, in many respects, rubber-tired light rail transit (LRT) with greater operating flexibility and potentially lower costs. The BRT mode is quickly becoming an effective way to move people efficiently and in a cost effective manner—in terms of both capital and operation costs.

Why BRT as a rapid transit option?

There are many reasons why the COFCG should consider BRT as a rapid transit option for the region:

1. BRT can be implemented much quicker than rail modes and can be done in phases as the passenger demand dictates. This provides the greatest flexibility in meeting transit demand.
2. BRT provides flexibility for extending a line or developing branched services with the existing road infrastructure.
3. BRT provides operating flexibility since it can operate on arterial streets; in freeway medians, on freeway shoulders and alongside freeways; or in railroad and other separate rights of way.
4. It can effectively provide express and local services at a single transit facility.
5. Due to improved speed and reliability, BRT can provide the same levels of service as LRT. In some cases, BRT can provide the same capacity as light rail transit.
6. It can be significantly less costly to implement than a rail transit line while providing similar benefits—especially in locations where right-of-way increases are constrained.
7. It can be effectively integrated into the surrounding environment and can generate significant urban development benefits.

Elements of BRT Systems:

Bus rapid transit is a mode of transportation offering a great deal of flexibility. That flexibility is brought about through the myriad of options in various elements of BRT systems. These elements consist of:

- Running ways (exclusive transitways, HOV lanes on freeways, dedicated transit lanes, transit malls, mixed traffic, or bus only queue jump lanes at congested intersections.
- Accessible, safe, secure, and attractive stations from sheltered stops to stations with raised platforms and encompassing structures.
- Easy-to-board, attractive, and environmentally friendly vehicles
- Efficient (i.e., off-vehicle, on-board through any door) fare collection
- ITS applications to provide real-time passenger information and transit signal priority for improved travel times
- Frequent, all-day service
- Distinctive system identity such as branding of vehicles/station or unique design elements
- Flexibility in route structure from a single linear route to a route with branching to local (or suburban) destinations.

The above list of BRT features should be regarded as a menu from which features can be selected to suit local requirements. Typically BRT systems include most, but not all, of the features listed.

Three BRT Investment Alternatives

For planning purposes, three levels of BRT investment were considered to simplify the evaluation of corridors for the master plan. These tier or investment alternatives are not meant to be restrictive of the BRT options—this is contrary to the BRT concept— but instead the alternatives are intended to show how varying levels of investment can impact capital & operating costs, ridership, and implementation feasibility. These investment alternatives are defined as follows:

1. Basic Investment

Commonly known as “Rapid Bus”, this level of investment is considered a minimum investment to achieve the benefits of BRT. This investment alternative includes:

- Substantial transit stations or shelters. These are generally larger than standard bus shelters and usually architecturally designed to contribute to the “branding” of the line.
- Traffic signal priority and signal coordination for improved travel times.
- Off-board fare collection to allow passenger to enter and exit through any door consequently reducing time at stations/stops.
- Low-floor vehicles and level boarding – minimizes the amount of dwell time at stops by facilitating passenger entry into the vehicle, with particular benefit for passengers with special needs such as wheelchairs or walkers.
- Branded vehicles and stations providing a unique identity for BRT service—allows for casual transit users to identify the system easily.
- High frequency (every 10 minutes in the peak hour / 15 minutes off-peak) – provides a higher level of service and ensures that the BRT is implemented on corridors that can support the minimum level of investment. This has also been established by FTA as the minimum frequency that allows patrons to arrive randomly without having to consult a schedule.
- Queue jumper lanes where necessary—this allow BRT vehicles to bypass traffic queues at intersections to improve travel time reliability. Buses move to the front of the queue in a dedicated lane, and then receive an advance signal allowing them to proceed in front of other traffic.

For system operators wishing to obtain federal New Starts or Small Starts funding, all of the above features with the exception of off-vehicle fare collection and queue jumper lanes are mandatory project elements. For this level of investment, most or all of the BRT alignment operates in mixed flow within general traffic lanes.

2. Moderate Investment

This level of investment focuses on incremental improvements to both right-of-way for vehicles and passenger amenities at stations:

- Dedicated side-running lanes for BRT vehicles – this minimizes the amount of time BRT vehicles are delayed by general traffic.
- Enhanced station investment such as landscaping, special paving, or way-finding signage.
- Real time arrival information system (e.g. Next bus technology)
- Larger stations to accommodate more passengers with additional seating and amenities such as bicycle parking.

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

3. High Investment

The high level of investment takes into consideration a full light-rail concept but with BRT vehicles.

- At-grade median running dedicated lanes that are horizontally separated from general traffic conditions. Grade separation may be considered at railroad crossings.
- Full signal pre-emption at intersections to maintain a minimum operating speed.
- Major station investment to accommodate large pedestrian traffic and passenger loads.
- More amenities for passengers such as information kiosks, newspaper racks, wireless access, or other amenities not common to bus transit.

The above levels of investments are not the only three options of BRT but provide points of reference in the wide range of possible BRT systems that can be implemented and improved upon. The advantage of implementing a BRT system is the ability to phase the investment and transition from a “low” to a “higher” BRT. However, in the case of Fresno/Clovis area where BRT is being considered as *the* rapid transit mode, it is important that the implementation of BRT avoids the resemblance of an ordinary bus service already being provided by FAX. The goal of BRT as a rapid transit alternative to rail based service is the ability to attract new transit riders to the system in a cost effective manner.

Chapter 2 – Regional Planning Context

2.1 *Market Characteristics*

Population and employment distribution information in the metropolitan area is maintained by the Council of Fresno County Governments (COFCG) for planning purposes. They also project distributions for the Year 2030. As population and employment are two major determinants of travel demand, these distribution features are helpful in understanding potential markets for public transit services. It should be noted that the land use and population inputs to the traffic model reflect where local agencies anticipate growth to occur and this distribution is subject to land use policy changes. For example, if development of high capacity transit service is seen as an efficient and environmentally friendly strategy to support growth, current land use and development policies can be amended to distribute more growth into the transit corridor(s). **Figure 2.1** displays the current vision of 2030 population distribution within the region. Noteworthy in this depiction of growth are the high proportion that is occurring in fringe development areas and the lack of pronounced development along major transit corridors.

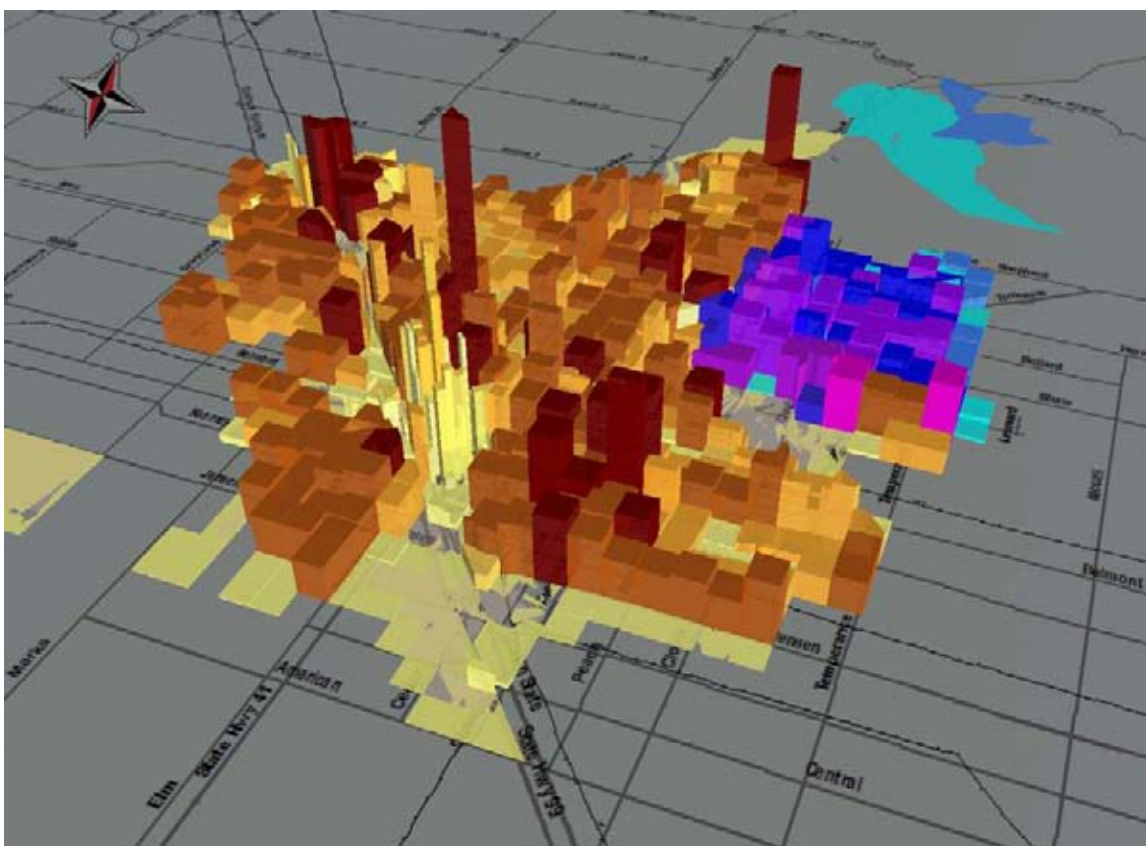


Figure 2.1 - Projected 2030 Population Distribution

Substantial growth is envisioned for the southeast growth area of the city. This area is generally bounded by Temperance Avenue, Shields Avenue, Highland Avenue and Jensen Avenue. It is located about one mile east of the Fancher Creek development. Large scale development of the Southeast Growth Area is not envisioned for another ten years.

There are a number of trip types and trip-makers that do not lend themselves to transit use or have no inclination to use public transit. This element of the travel market is generally referred to as the auto captive market. There are other trip-makers that do not have access to a car and have no choice but to use public transit. This element of the market is typically referred to as the transit captive segment. A third segment of the market would use transit under the “right” conditions. This is the choice rider market segment. Currently most FAX riders are transit captives. Attraction of more choice riders requires provision of a better transit product, better pricing, disincentives to car use or some combination of these measures. A primary purpose of BRT is to attract choice riders with an improved product. It should also be noted that travel patterns are not independent of features of the transportation system. Good features not only can change the geographic distribution of trips, but they can increase the number of trips made. Improved transportation services can result in latent demand for travel being transformed into new trips.

2.2 Existing Transit Services

Fixed route local public transit services in the metropolitan area are provided by Fresno Area Express (FAX) and by Clovis Stage Lines. These operators generally provide services within their own municipal boundaries. The FAX network of bus routes is shown in **Figure 2.2**. Of the 20 routes FAX operates, 12 serve downtown Fresno. The structure of FAX’s route network is grid-like which simplifies passenger understanding of the service and tends to maximize opportunities to transfer between bus routes. Many communities operate this type of “modified grid” bus route network. What is unusual about the Fresno bus network is that the downtown is not near the center of FAX’s service. As development has continued to spread northward, the downtown transit hub has slid towards the edge of the FAX service network. Almost all of FAX’s bus routes are interlined downtown (connected to another bus route rather than terminating downtown). While this is good practice, it does complicate isolation of the performance of each “leg” of bus routes and also it has implications for structuring BRT services.

FAX bus service operates seven days a week from generally 6 am to 10 pm. On weekdays, service frequencies on the bus routes is generally 30 minutes, with buses on routes 28, 30, 34, and 38 operating on 15 minute headways. Uniform headways make it easier for passengers to remember the schedules and facilitates coordination of schedule pulses for bus routes to allow passengers to transfer between lines. On weekends, the service frequencies for Routes 28 and 30 increase to 30 minutes and the headways for routes 20, 22 and 26 increase to between 45 and 60 minutes.

Basic descriptors of FAX service are:

- Annual operating costs of \$22 million
- Annual fare revenues of \$6.4 million
- Annual subsidy need of \$15.6 million
- Annual bus-hours of service operated 295,000
- Annual passenger boardings of 12,400,000
- Average speed 13.4 mph

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

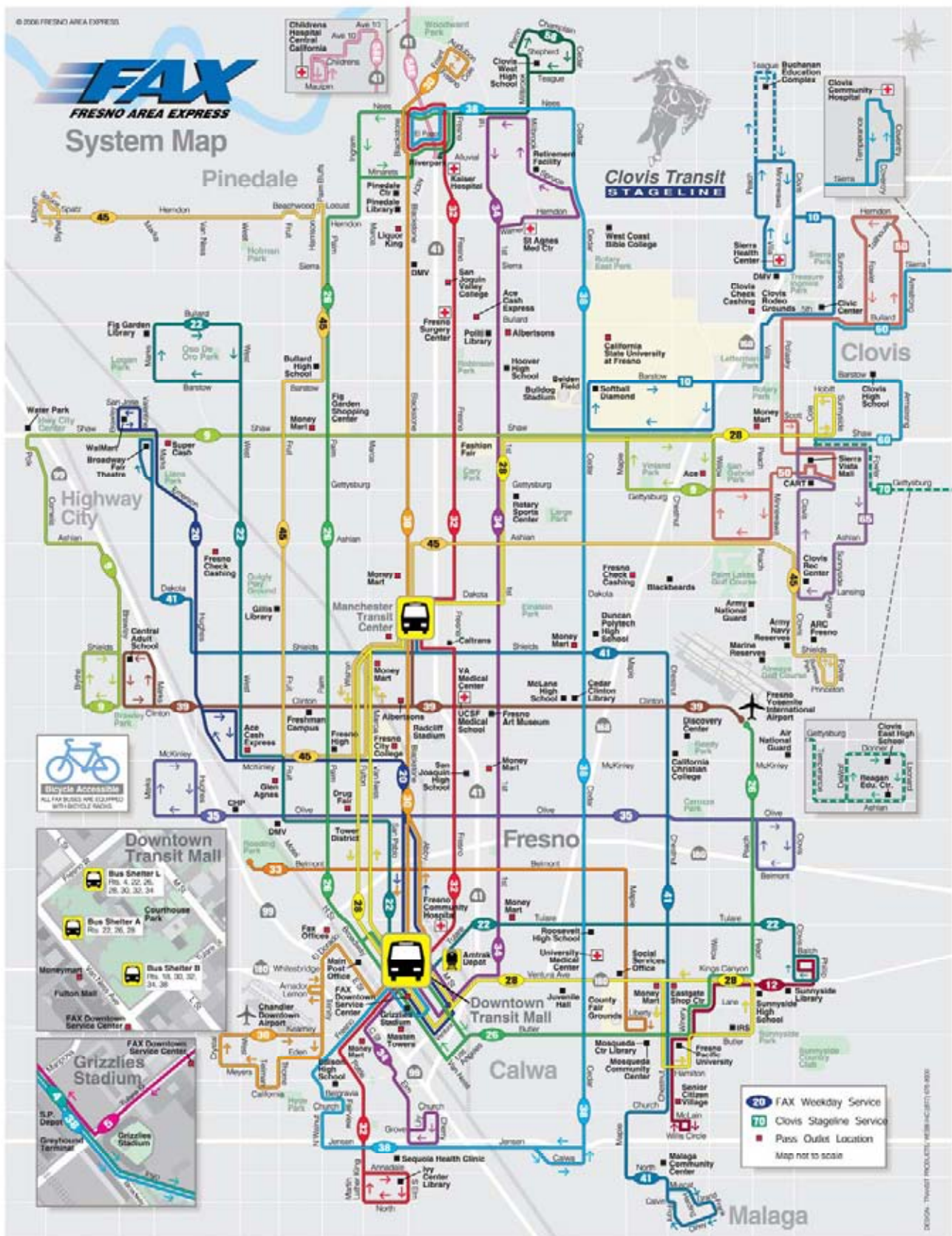


Figure 2.2 Fresno Area Express System Map

Figures 2.3 and 2.4 from FAX's Long Range Transit Master Plan describe the most heavily patronized bus routes and the most productive (measured in boardings per bus hour). Bus stop spacings for local service is reported to be about three stops per mile, which is fairly normal in the bus industry.

FAX buses are maintained and stored overnight at their facility located on G Street near Divisadero. This facility has a capacity to support about 150 buses; however, parking is limited to about 100 buses. These facilities are currently at capacity regarding parking. The facilities also are not designed to support maintenance of articulated buses. Thus, parking constraints and limitations to service articulated buses are key factors affecting early implementation of an expanded service plan featuring BRT service. FAX is looking for a second operating base to support expanded service and to reduce its deadhead costs. Deadhead costs result from unproductive shuttling of buses into and out of service from the garage each day. The optimum location for this second garage appears to be the SR-41 corridor somewhere near Shaw Avenue in a compatibly zoned area. Opportunities to upgrade the current garage to service articulated buses have not been identified, but probably exists.

2.3 Downtown Transportation and Infrastructure Study

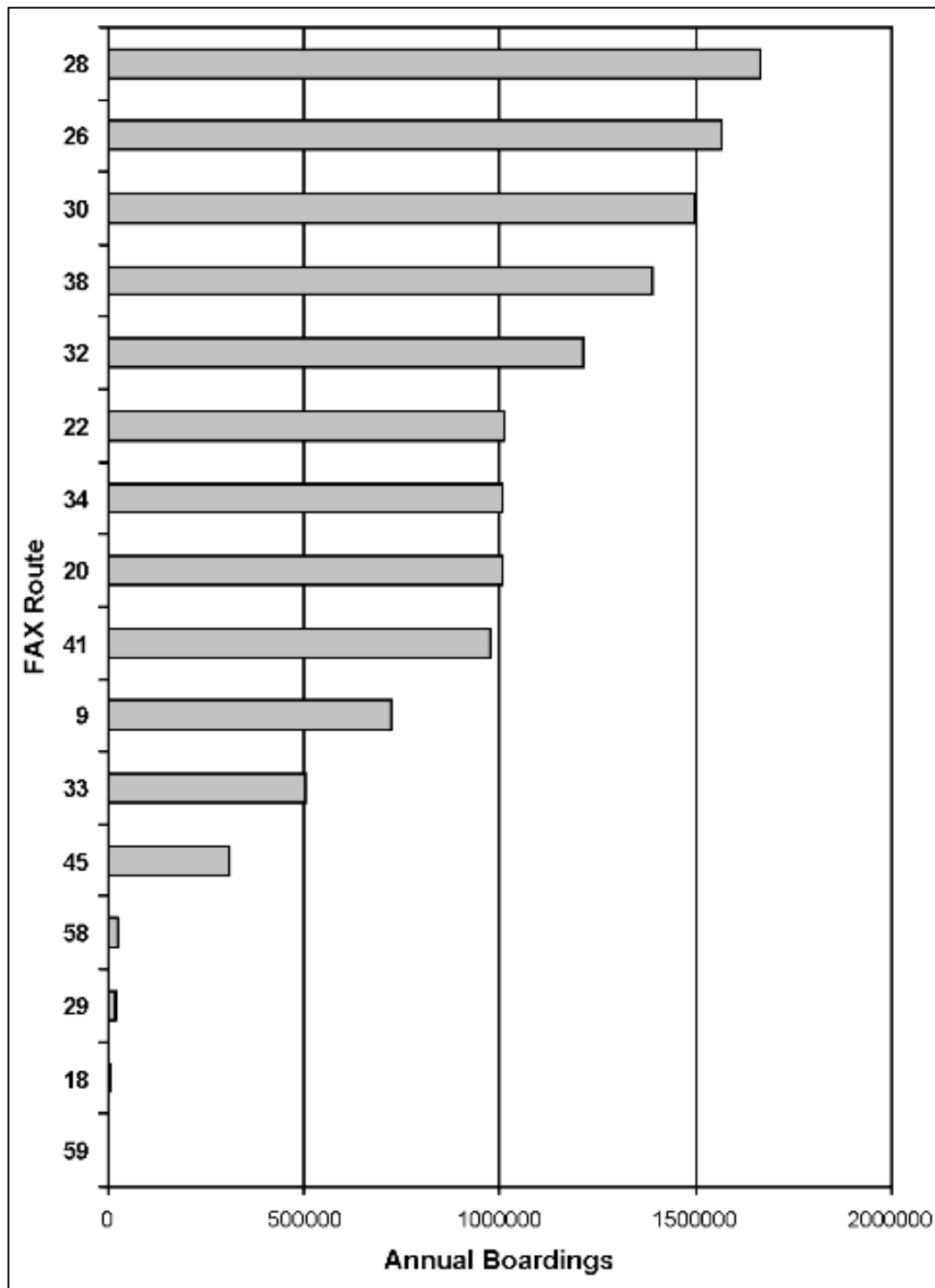
The City of Fresno is nearing completion of its Downtown Transportation and Infrastructure Study (DTIS). As the downtown is a major market for potential BRT services, this plan is very important to planning BRT services. Key recommendations of the DTIS include:

- Increasing the importance of public transit as an access mode to downtown via the establishment of policy transit capture targets. BRT would help achieve these targets and therefore is supportive of the DTIS plan.
- Transitioning away from the current Courthouse Transit Center pulse operations to a more urban transit street corridor with bus stops on both curbsides of Van Ness Avenue. This recommendation would eliminate the need for BRT to make circuitous turns to use current transit center passenger bus stops.
- Support for relocating the BNSF service onto the UPRR corridor. This would help to minimize train delays to BRT services that cross the BNSF tracks.
- Reduction of downtown bus layovers by interlining services.
- Support for transit priority treatments, improved pedestrian facilities and improved wayfinding in the downtown area.

BUS RAPID TRANSIT MASTER PLAN

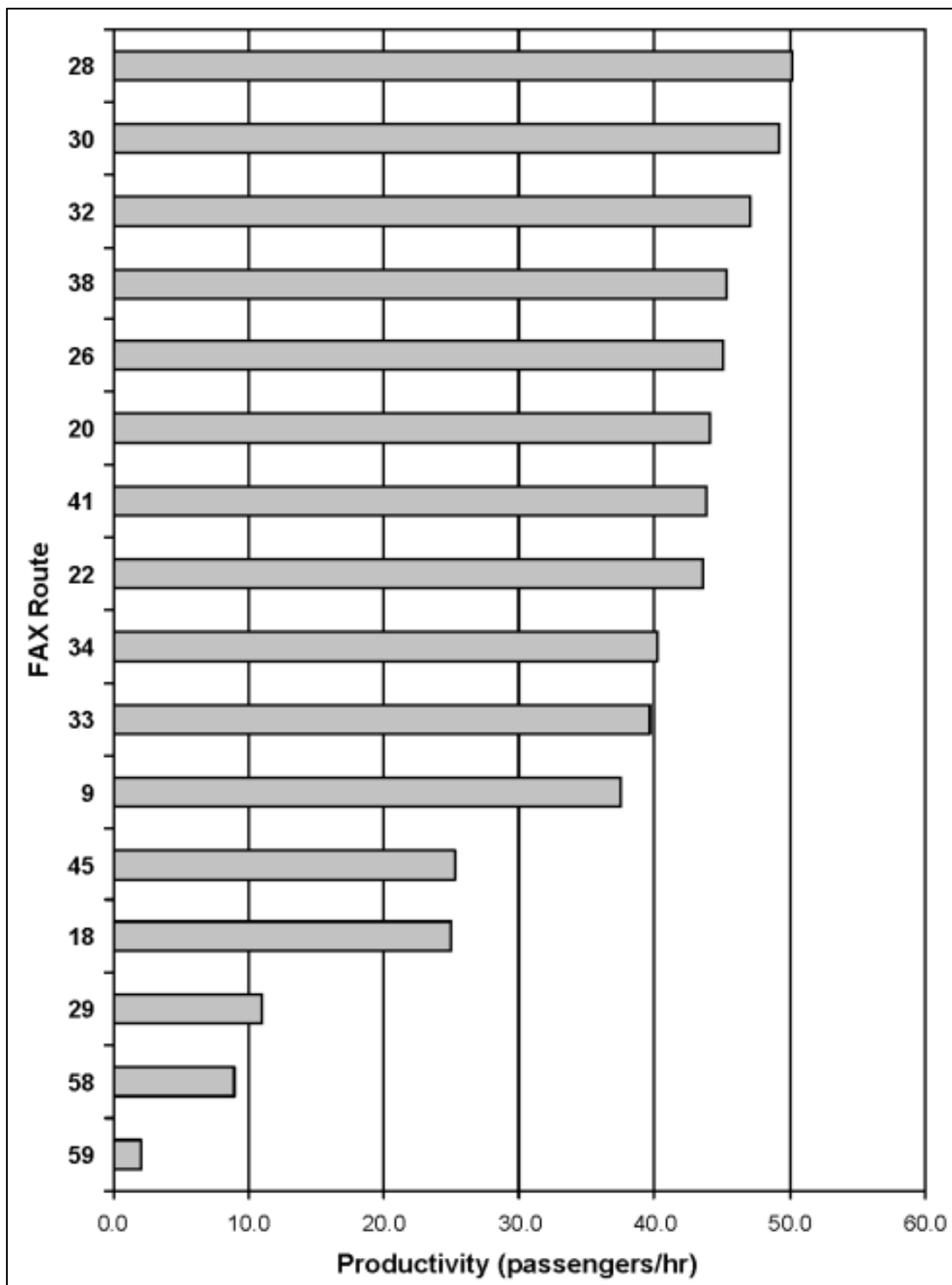
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Figure 2.3 FAX Passenger Boardings by Route FY 2000/2001



Source: City of Fresno Long Range Transit Master Plan Final Report

Figure 2.4 FAX Productivity by Route FY 2000/2001



Source: City of Fresno Long Range Transit Master Plan Final Report

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

Increase Transit Market Capture

The Downtown Transportation Infrastructure Study (DTIS) recommended adopting targets for transit capture for the region as well as for the downtown. Downtowns are generally the major markets for high capacity transit services and therefore are of particular interest for planning transit improvements.

Daily trips to, from and within Downtown by all modes of travel are forecast to increase 52 percent between 2006 and 2030, based on planned development. Some of today's current capacity is unused and might be available to accommodate a portion of the projected demand increase. It is also true that as development density in the downtown area increases, a high proportion of new trips will be captured by public transit. The DTIS targeted transit capture rate of 6 percent by 2030, combined with the increase in the total trips by all modes, would result in a 120 percent increase in the number of transit trips to, from and within Downtown. By 2050 the number of trips served by transit to, from and within Downtown is targeted to increase fourfold from today's usage. The capacity to serve this increased demand could come in a variety of forms including increasing the frequency of service on existing bus routes, deploying larger buses (articulated buses), and/or introducing new bus routes.

There is a desire to reduce the proportion of future trips by car for environmental, highway/interchange capacity and livability reasons. Thus the challenge is not to accommodate a mere 50 percent proportional growth increase in usage, but rather to target a 50 percent higher capture rate by transit. This would translate to more than a doubling of transit trips to, from and within Downtown. From today's base of about 17,000 daily transit trips, 2015 would experience an increase to 28,000 daily transit trips, 2030 would increase to 37,000 daily transit trips and 2050 to 68,000 daily transit trips. These projections represent a minimal vision for development and transit service growth in the downtown area. Thus, DTIS's vision would be to increase daily transit usage to/from downtown by 11,000 trips in 2015, by 20,000 trips in 2030 and by 41,000 trips in 2050. Introduction of BRT and other service enhancements would help to achieve these targets.

Downtown Transit Center Transitioning to Urban Street Passenger Stops

The current Downtown Transit Center provides a number of functions. For passengers, the centralized location provides a comfortable, secure place to transfer between lines and due to its central location it also provides a convenient place to start and end trips to Downtown. The current FAX route structure reduces the need for transfers for most trips to the downtown area. This structure also simplifies operations for the bus operator. The current Courthouse Transit Center suffers from a number of problems and its capacity limitations do not permit full pulsing of all bus routes. Wait times between the three shelter locations at the Transit Center make it difficult for many passenger transfers to be made within the pulse time period (several minutes). A full pulse of buses would also adversely impact downtown intersections. Thus the current Downtown Transit Center has its strengths and its weaknesses.

To support the target transit capture for downtown trips, bus service frequencies will increase with perhaps several new routes added for downtown service. Service frequencies are likely to be 10 minutes or better for BRT. The capacity limitations of the Downtown Transit Center will not support major increases in bus volumes. This suggested to the DTIS that normal curb loading along both sides of Van Ness Street would be a more effective concept for passenger loading.

The best downtown alignment for BRT services seems to be Van Ness Avenue, which is near the center of Downtown and is at the heart of other bus services. Formalizing bus lanes on Van Ness Avenue might be desirable to support a higher quality of bus service. Other options include N

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

Street, M Street, and H Street. N street is too remote from the Fulton Mall. Use of M Street would further confuse the circulation system and is also not close to the Fulton Mall. H Street is on the edge of the downtown core and therefore not very attractive.

Consolidation of BNSF Rail Services to the UPRR Corridor

The DTIS supports plans to relocate BNSF and Amtrak service to the UPRR corridor. It also recommends trenching the UPRR corridor to serve the increased level of conventional rail service and accommodate planned high speed passenger rail service. These recommendations have two important bearings for BRT planning. First, they would eliminate at-grade rail crossings downtown as well as outlying BNSF crossings. These at grade crossing currently adversely impact bus schedule adherence and would complicate reliable BRT schedule adherence. Second, with the relocation of rail traffic from the BNSF corridor, an opportunity would arise for operating high capacity transit services in this corridor. Public sentiment is understood to favor use of this corridor as a multiuse trail rather than as a transit corridor, but an opportunity might exist for transit use of the corridor. It is unlikely that the relocation will occur within the next ten years. It is also unlikely that high speed rail will be constructed in the next ten years. Thus for the next decade, buses will need to continue using at-grade crossings.

Interlining of Buses Downtown

Almost all FAX bus routes currently are through routed downtown, with very few laying over at an end of line terminal downtown. FAX buses do however pause at the Downtown Transit Center for two to five minutes to adjust schedules and facilitate passenger transfers. With the anticipated increase in bus volumes and possible introduction of 60 foot articulated buses problems will increase downtown. DTIS recommends that all bus routes to/from downtown be through routed with time only to board and alight passengers. Thus BRT service should be through routed and not terminate downtown.

Transit Priority Treatments

The DTIS traffic circulation and parking elements attempt to re-direct traffic to the perimeter of downtown, without denying traffic the use of core area streets. Transit priority treatments (undefined) are suggested for Van Ness Street, Fresno Street and other key transit streets. Among the recommendations from the DTIS for downtown traffic control are to maximize the use of short two phase signal cycles which are pedestrian, bicycle and transit friendly and not use left turn phases and long cycles which are car oriented.

Chapter 3 – Stakeholder and Public Participation

This report encompasses the metro area of Fresno/Clovis, which includes a wide variety of community groups. To effectively understand the issues affecting these communities with respect to public transportation and the BRT concept, a stakeholder outreach to leaders of these community groups and a city-wide community open house was undertaken. The following is a synopsis of stakeholder interviews and the community open house.

The key objectives of the public outreach were to:

- Gauge the current pulse of the community with respect to transit and mobility needs in the Fresno region.
- Introduce the concept of Bus Rapid Transit and ask their opinion on the feasibility of BRT in Fresno.
- Elicit specific stakeholder perceptions of how transit is working in the community today and their vision of what transit should be like in the future.
- Determine what corridors would be most suited for rapid transit, specifically BRT.

3.1 Stakeholders

The following is a list of community leaders who were personally interviewed for this report:

Community Leader	Agency
Steve Geil, President & CEO	Fresno Economic Development Corporation
Al Smith, President & CEO	Fresno Chamber of Commerce
John Hernandez, Executive Director	Hispanic Chamber of Commerce
Julie Hornbeck, Executive Director (including five staff members)	Fresno County Employment and Temporary Assistance
Ashley Swearingin, Director	Office of Community and Economic Development, CSU Fresno
Harry Armstrong, Chairman	Fresno County Transportation Authority Member, Clovis City Council
Lupe Perez, Sr. Project Coordinator (including one staff member)	City of Fresno Redevelopment Agency
Bob Boyd, Director (including two staff members)	CSU Fresno, Facilities Management,
Keith Kelley, President/CEO	West Fresno Coalition for Economic Development

3.2 Stakeholder Interviews

This section provides a summary of the community stakeholder interviews listed in the previous section. The interviews, done with each individual community stakeholder, were intended to gauge the current political and community sentiment for implementing BRT in the Fresno/Clovis area. While their answers were oriented towards the community the stakeholders represent, it was clear that there was a prevailing response of improving mobility (through travel time savings on transit) across the metropolitan area was imperative especially for home to work based trips. The following summary reflects the majority of comments received during the stakeholder interviews.

Fresno Transit/Mobility Needs

Transportation is a high priority.

Stakeholders were supportive of public transit. Stakeholders had an overall perception that public transit in our community today is well designed to meet basic transportation needs, particularly for those who are transit dependent. However, the overall perception is that public transit's role will become increasingly important for the mobility needs of Fresno. Consequently, there were two areas of improvement emphasized by stakeholders: 1) improving the frequency of service and travel time reliability for existing customers—especially those dependent on the service for work based trips; and 2) provide a service (other than local bus) that overcomes the negative perception sometimes associated with public transportation that attracts additional riders to the transit system and serves a new type of Fresno customers with the system.

Travel time must be competitive with automobiles.

The stakeholders feel that public transit's challenge in the community is competing with the personal automobile, since it is still relatively easier and quicker than public transit. Many felt that transit trip times must be reduced to effectively compete for non-captive riders and that increased bus frequencies are needed.

Thinking outside of the conventional bus with transit.

Stakeholders mentioned that using more innovative or more attractively designed vehicles and improved technology would be advantageous. Some feel that we need to “get out of the box” with a new and exciting concept and with an emphasis on amenities and service quality. Several alternative public transit concepts were mentioned, including monorail, Personal Rapid Transit (PRT) technology, BRT, and feeder vans. Those who suggested these alternatives, however, generally were not familiar with what it would cost to implement them. One community leader stated that it was more important to “do it the right way,” not rush implementation, and not let cost dictate the decision.

Specific Agency Transportation Needs

Reliable transit can help improve employment reliability.

Two stakeholders commented that access to reliable transportation is a very high priority for their clients. The Fresno County Employment and Temporary Assistance Department helps low-income and unemployed clients find jobs and improve their quality of life. This agency stated that public transportation is the lifeline for many of its clients and a transit system that is unreliable leads to inability to maintain consistent employment. Their clients would benefit greatly from increased FAX bus frequencies and increased hours of operation, including non-traditional work hours, to provide more effective and reliable access to their employment centers. Both employee and employer would benefit from improved public transportation.

Reliable transit is important to the region's short- and long-term economic development.

The Office of Community and Economic Development, CSU Fresno, leading a consortium of over 600 companies and non-profit groups, found that the greatest barrier to employment is the lack of

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

adequate transportation--childcare being the second highest barrier. Effective public transportation is one of the keys to the success of their five-year plan to create jobs and economic vitality in the Fresno region.

BRT in Fresno

Bus Rapid Transit is a relatively new transportation concept in the United States, thus stakeholders were not familiar with BRT technology. An overview of BRT was provided, including an explanation of the different levels of BRT implementation, lower costs compared to more expensive rail modes, use of specialized BRT vehicles on existing roadways or guideways, level platform loading, advance payment systems, etc., to efficiently transport riders to their destinations.

BRT can be Fresno's rapid transit mode.

The majority of stakeholders supported the concept of BRT implementation in Fresno. Stakeholders agreed that rapid transit would improve mobility in the region, particularly when a larger rapid transit network is established. BRT can be the mode to implement rapid transit service in Fresno.

Corridor recommendations for Bus Rapid Transit.

Stakeholders were asked to comment on specific corridors that have been identified in previous FAX studies and plans as high-capacity transit priority corridors---including Blackstone Avenue, Cedar Avenue, Shaw Avenue, and Ventura Avenue/Kings Canyon Road---and to identify other streets they perceive to be feasible transit corridors. Many stakeholders agree with the four identified key corridors, commenting that the Ventura Avenue/Kings Canyon Road corridor would be a reasonably favorable corridor on which to initiate BRT. This was particularly true given lower property values relative to other areas, higher density of low-income residents who would readily utilize the service, and relatively easier implementation within the existing road configuration and infrastructure. Some stakeholders, however, mentioned Herndon Avenue, Clovis Avenue, Peach Avenue, and Tulare Street as important thoroughfares. Most stakeholders were in favor of developing a phased BRT network with both Ventura Avenue/Kings Canyon Road corridor and/or Blackstone Avenue corridor as the first phase of implementing a BRT network.

Focus on destinations along with corridors.

Some stakeholders recommended the need for transit service “destinations” to complement the “corridors”. Examples of such “destinations” were: Fresno Yosemite International Airport possibly via Peach Avenue and to two large employers---Pelco and the GAP, on Clovis Avenue; call centers are located on Herndon Avenue at North Palm and in Southeast Fresno; Fresno City College, and CSU Fresno.

Political and Institutional Barriers to BRT in Fresno

When asked about potential political and institutional barriers to implementing BRT in Fresno, stakeholders agreed that key leaders must be engaged in the process. There is general consensus that public outreach is critical to this process and that it needs to be both positive and powerful.

Stakeholders believed an effective public outreach campaign must be launched making BRT “top of the mind.” They favored newspaper articles on BRT early in the process and continuously through the planning and implementation of the BRT system. They emphasized the need to focus on the positive aspects of BRT, such as improved travel time, marketing (branding), and facilities, and to allow the private sector, such as developers and local businesses, to help drive partnerships.

3.3 Community Open House

On June 27, 2007, the Kimley-Horn Team and COFCG hosted a day of community and stakeholder outreach. The goal of the community open house was to formally introduce the BRT concept to the public. To provide a tangible element of a BRT system, the Kimley-Horn Team was able to provide a 60' Articulated BRT demonstration vehicle with the cooperation of North American Bus Industries (NABI) to allow residents of the Fresno/Clovis communities to experience a BRT vehicle in person—see **Figures 3.1 and 3.2**.



Figure 3.1: NABI 60' Stylized BRT Vehicle – Front View

The BRT vehicle was toured to three different sites in downtown to provide maximum exposure to Fresno City, FAX customers, and transportation stakeholders/advocates. People were allowed to board the vehicle and ask questions from Kimley-Horn, COFCG, and NABI representatives throughout the day. FAX customers were particularly impressed as to the amount of space in the vehicle since many were commenting on the crowding on buses currently. Stakeholders, interviewed in the previous section, were impressed by the vehicle and viewed it as a step in the right direction for the design of a transit system which can attract choice riders.

After touring the BRT vehicle through downtown, a community open house was held at Sunnyside High School to formally introduce the BRT concept and elements to the public. Furthermore, the forum was also opened for the public to comment on which corridors in the Fresno region should be included in the master plan and the order of implementation. These comments were incorporated in the following chapter.

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)



Figure 3.2: NABI 60' Stylized BRT Vehicle – Side View

Many people were intrigued by the idea of BRT being implemented in Fresno however there were several concerns:

1. “It is not a rail mode.” – Those commenting that BRT is not the same level of service as rail were informed of how BRT is being used in California and across the United States as an extremely cost-effective alternative to light- and heavy-rail modes. The elements of BRT are designed to reduce travel time—the number one factor for riding public transportation for choice riders—and can be designed to achieve the same benefits of rail modes without the high cost of a rail line. Fresno has long been discussing rapid transit in their city with light rail on Ventura Avenue/Blackstone Avenue; however, the cost and political barriers to implement light rail made the project infeasible at the time.
2. “Why BRT in Fresno?” – Because a BRT system can be designed to closely emulate rail level of service, this provides an opportunity to provide rapid transit service in Fresno. Currently on local buses it can take three to four times longer than driving to go from one point of town to another. A BRT network would significantly reduce that travel time making public transportation a more favorable choice for choice riders. More importantly, the BRT mode is extremely cost effective compared to rail—for the \$1-3 billion cost of one light rail, FAX and COFCG would be able to implement a full network of BRT lines in the Fresno/Clovis area.
3. “How soon can BRT be in Fresno?” – It was explained that implementation of BRT is very much dependent on the level investment the community wants. For example, a very basic form of BRT with minimal construction could be implemented within two years; however, a BRT with dedicated lanes could take three to six years depending on the environmental and design constraints. However, it was also mentioned that BRT can be implemented faster than light rail due to the significant constraints with constructing and operating trains in the middle of high traffic arterial streets. Also, light rail systems are under the jurisdiction of the California Public Utilities Commission, which imposes significant constraints on train movements and safety measures. BRT is not affected by the regulations for light rail systems.

Chapter 4 – Proposed Rapid Transit (BRT) Network

Recommendations for a network of BRT services and their relationships to the basic FAX local bus services are presented in this chapter. A service concept is described for the BRT services along with ridership estimates. This chapter begins with an overview of relevant public transit planning goals and concludes with identification of the most promising corridor for early implementation of BRT services. This process of defining the recommended BRT network and early implementation corridor built heavily on current FAX patronage profiles, inputs from the stakeholders and the public open house meeting as well as land use coordination opportunities in the region.

What is a network and why is it important for BRT implementation? FAX's current local bus routes operate as a system, making it easy for passengers to transfer between bus lines. This network approach substantially increases the number of passenger trip origins and destinations that can be made by public transit. The local bus network is structured in a "grid" with many transfer opportunities and most of the local bus lines also converge at their outlying terminus to afford transfer opportunities. For maximum success Fresno's future bus network needs to "knit" the BRT mode into the local bus network and desirably work towards a group of regional BRT services that allow passenger interchanges between these frequent and fast public transit corridors. As described in Chapter 1, there are many forms of BRT services just as there are many forms of light rail services. Over time lower forms of BRT service can transition into higher forms as demands warrant. The BRT network and the overall bus network therefore will likely change over time, but it is important that both modes maintain seamless transfer opportunities to maximize their potential travel market.

4.1 Planning Parameters and Goals

As discussed in Chapter 2, The Fresno-Clovis Metropolitan Area population is projected to grow to 1,000,000 in size by 2050. While some of this growth will occur as infill development much of it will be on the fringe of the current urbanized area. Thus, more trips will be made and many of these trips will be longer distance due to the expanding geographic area of development. This adds to more congestion and increases concerns about air quality. Public transit therefore will be asked to increase its role in the overall multimodal transportation system and will need to provide enhanced service to attract "choice riders". With the longer distance trips, speed will become more important for transit to be viable for developments in outlying parts of the region.

In order to maximize its potential to capture higher shares of the travel market, integration of public transit service planning with land use planning will be important. To the extent possible, growth should be located proximate to major transit corridors and pedestrian access elements of developments and transit stops should be closely coordinated.

The Downtown Transportation and Infrastructure Study (DTIS) set forth a target to increase transit ridership to/from and within the downtown by 400%. It seems reasonable to target similar increases for non downtown trips in the region, perhaps looking at an average two to threefold increase in current passenger boardings along principal transit service corridors. This might result in 15 minute headways on many of the current 30 minute headway routes and 10 minute or better headways on current 15 minute headway routes (FAX Routes 28 and 30). While moving from 30 minute to 20 minute or even 15 minute service rarely sustains current boardings per bus hour of service productivity levels, getting to less than 15 minute service begins to entice "choice riders" to the service. The extent of choice rider patronage benefits depends highly on regional parking policies and employer/school partnerships with transit service providers.

4.2 BRT Corridor Identification and Selection

Prior studies and plans developed for FAX and the City of Fresno have identified four promising corridors for implementing BRT or other high capacity transit services. These four corridors are:

- **Blackstone Avenue**
- **Shaw Avenue**
- **Cedar Avenue**
- **Kings Canyon Road / Ventura Avenue**

These promising corridors formed the starting point for the current Master Plan project, but did not limit corridors for consideration.

Transit Master Plan (1994)

The development process of selecting these corridors dates back to the 1994 Transit Master Plan. This document recommended that the City define transit-specific corridors and include them on their General Plan map. It also recommended that Principal Transit Corridors be established so future recommendations of high density development and major activity centers could occur. At that time, the major corridors for consideration were identified as:

- Kings Canyon Road – Ventura Avenue
- Shaw Avenue / Barstow Avenue
- Palm Avenue
- Blackstone Avenue
- Cedar Avenue
- Clovis Avenue, and
- Shields Avenue

Although the concept of BRT was not yet mainstream, Cedar Avenue and Kings Canyon Road were further identified as potential corridors for future light rail service. The future of the BNSF rail corridor was also raised for potential high capacity transit if the BNSF rail services are relocated to the UPRR corridor.

Transit Long Range Master Plan (2001)

The 2001 Transit Long Range Master Plan (TLRMP) called out three corridors as candidates for high frequency or BRT service. These corridors were selected based upon the density (population and employment) of the corridor or the potential for redevelopment and the input obtained from various stakeholders. The corridors were identified as Blackstone Avenue, Shaw Avenue (between Brawley and Clovis) and Ventura Avenue. Ventura Avenue was further identified as the best selection due to the demographics of the surrounding neighborhoods and the overcrowding that was experienced on FAX Route 28.

The concept of BRT was first introduced in this 2001 TLRMP following the published success of worldwide BRT examples in cities like Curitiba and Ottawa. The system was viewed as favorable for many communities because of the mobility gains achieved through low capital investments.

The 2001 TLRMP also identified similar corridors to be used for other high frequency service such as monorail and light rail. Although the plan did not describe the methodology for selecting these corridors, it did identify Blackstone Avenue as the location of the mainline with five east-west intersecting lines running approximately along:

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

- Kings Canyon Road
- Dakota/Shields Avenues
- Shaw Avenue
- Herndon Avenue (east and west)

The plan went on to state that many other corridors would be candidates for any type of rail service. These corridors were selected based solely on demand and did not consider the availability of right-of-way. The approximate order of these corridors based upon this demand potential was:

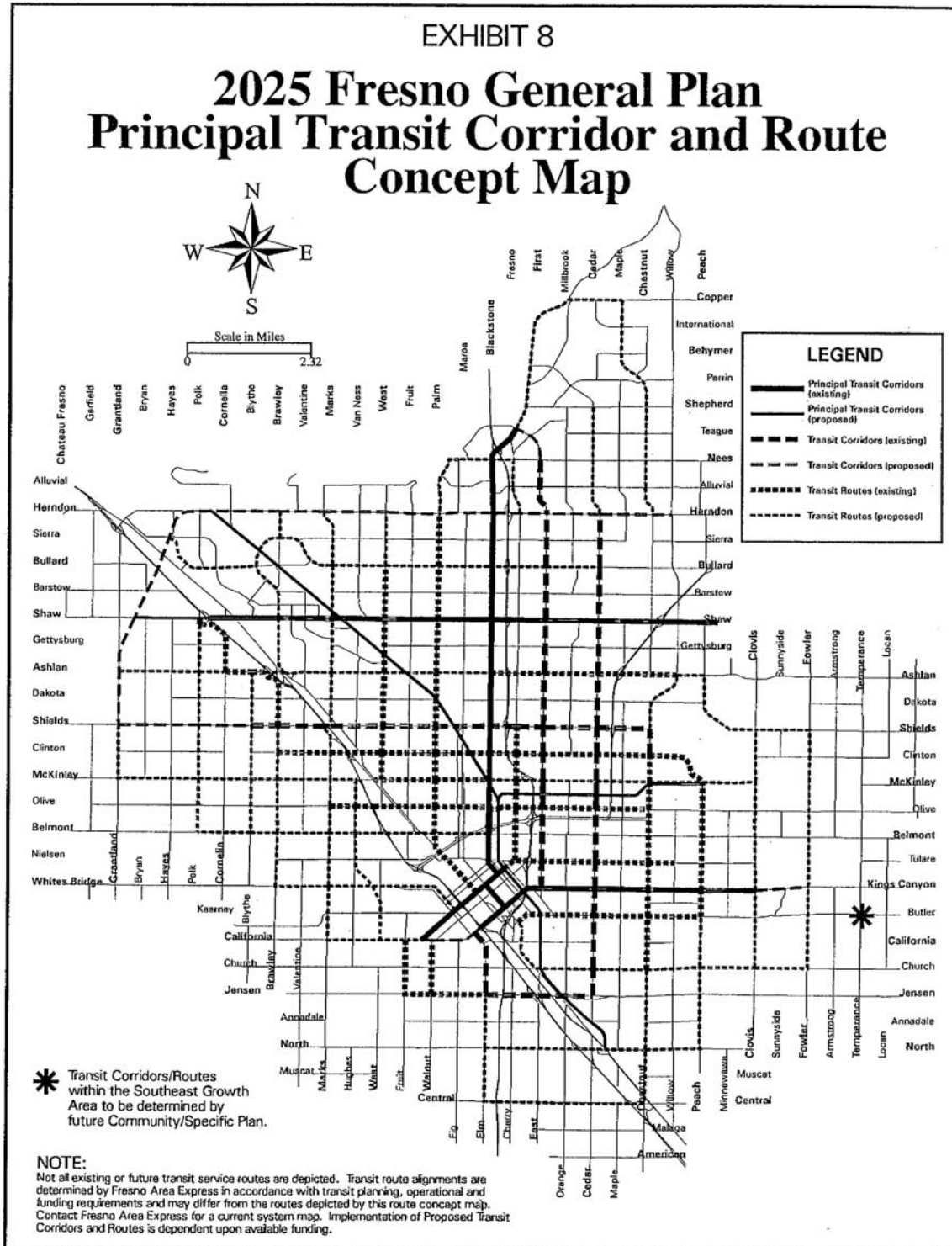
- Downtown to Blackstone & Nees via some combination of Blackstone and SR 41, possibly approaching downtown via the Tower District.
- A branch of the Downtown to Blackstone Line, traveling east on Shaw to CSU Fresno and perhaps Clovis.
- West Shaw from Blackstone to a new Regional shopping center at Shaw & Grantland (see General Plan).
- East Ventura Avenue/Kings Canyon Road to Chestnut, or eventually to Clovis Ave.
- Herndon Avenue east from Blackstone to Chestnut. (Unlikely as LRT, conceivable as monorail)
- Herndon Avenue west from Blackstone to Palm. (Unlikely as LRT, conceivable as monorail)

2025 Fresno General Plan (2002)

The 2025 Fresno General Plan incorporated the recommendations of the 1994 Transit Master Plan and specifically called out transit corridors/routes, and areas where increased development should be focused to encourage transit usage. **Figure 4.1** shows the principal and non-principal transit corridors and transit routes in Fresno that are identified in the General Plan. According to the map, the existing and proposed principal corridors in Fresno include Blackstone Avenue, Shaw Street (east of Polk), Kings Canyon Road (west of Clovis), Ventura Avenue, and Fresno Street (from Divisadero Street to California Avenue).

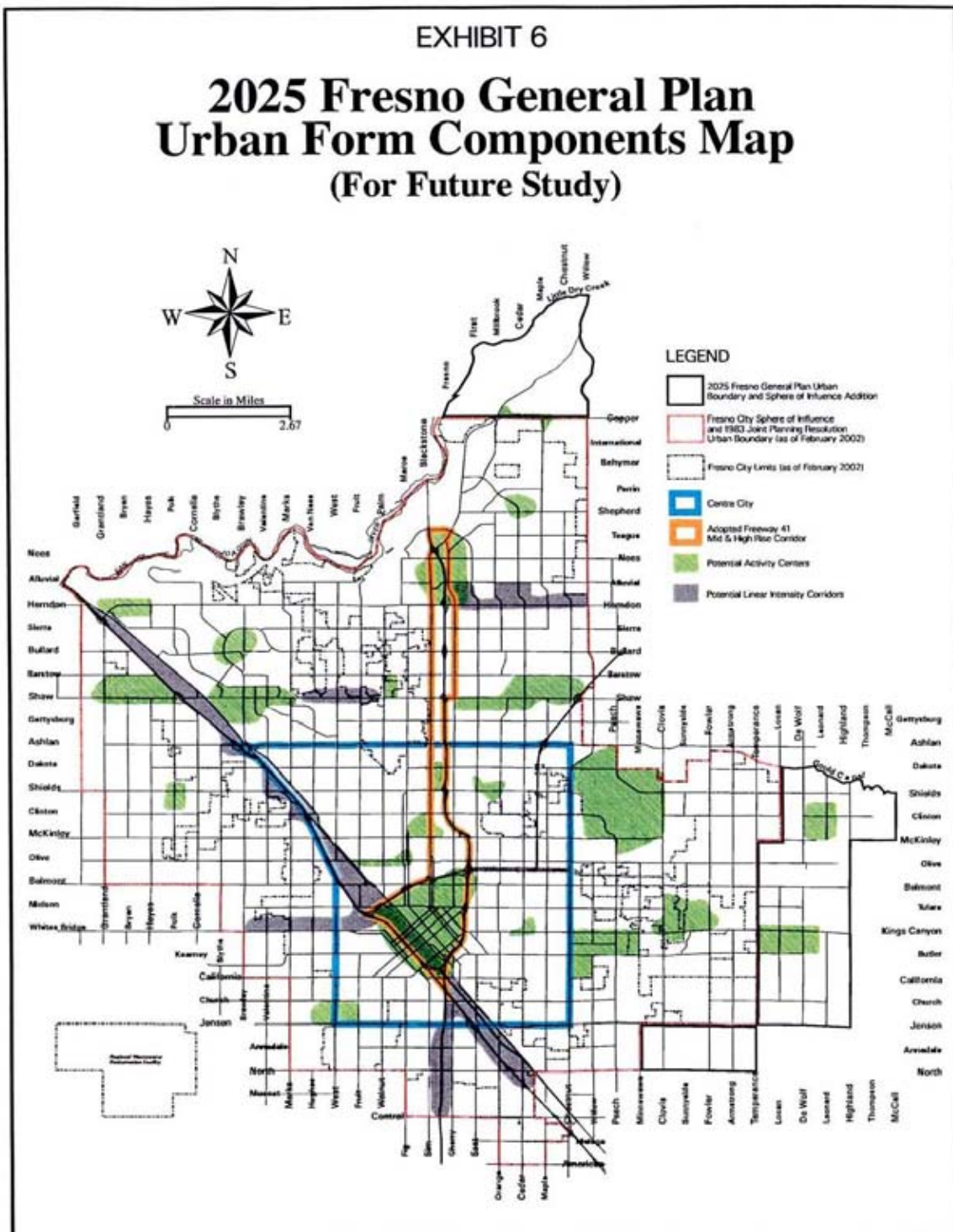
The land use element of the General Plan also designates the areas surrounding Highway 41 as an adopted mid and high rise corridor. **Figure 4.2** shows this designated area, as well as other activity center corridors that might lend themselves to enhanced public transit services. This area includes the properties along the Blackstone corridor and those within the downtown core. The Highway 99 corridor and the Shaw Avenue corridor are prominently highlighted in this map.

Figure 4.1



Source: 2025 Fresno General Plan

Figure 4.2



Source: 2025 Fresno General Plan

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

Fresno Alternative Mass Transportation Pre-MIS (2004)

The most thorough look at the designation of transit corridors was developed in the Fresno Alternative Mass Transportation Pre-MIS. This is the study that brought us to where we are today. The study used the findings from the 2001 TLRMP to identify four high capacity corridors to be studied in greater detail. These four corridors were Blackstone Avenue, Shaw Avenue, Cedar Avenue, and Kings Canyon Road/Ventura Avenue. Although Cedar was not directly pinpointed as a high-capacity potential corridor in the 2001 TLRMP, it was added due to the strong current transit ridership, the available right-of-way, the continuous north-south alignment, and the presence of several key trip generators including CSUF, two high schools, the University Medical Center, and a regional shopping center.

The study did not identify BRT specifically for these corridors but rather left it open to “high capacity transit” such as light rail, BRT, enhanced bus, and monorail. The objective of the study was to not only determine which of the four corridors is the most viable for implementation of “high capacity transit”, but also to identify the elements required to make the corridors more favorable for implementation. .

Current Ridership (Quantitative Assessment)

The designation of these corridors over the years by various plans and studies have been based on multiple factors including transit-supportive land use, roadway capacity and right of way availability, stakeholder input, and existing ridership. Ridership data from fiscal year 2006 supports the selection of the four corridors identified in the earlier studies. **Table 4.1** below shows that half of the top ten routes in terms of ridership – and three of the top four - run along one of the four proposed BRT corridors.

Table 4.1: Top Ten FAX Annual Ridership Routes - FY 2006

FAX Route #	FY 2006 Annual Ridership	Primary Corridors		
28	1,789,025	Ventura	Fulton/Van Ness	Shaw
26	1,367,566	Palm	Broadway	Butler
30	1,309,978	Blackstone		
38	1,204,772	Cedar	Jensen	Fresno
32	1,077,497	Fresno	MLK	
41	945,758	Shields	Chestnut	
34	903,298	1 st		
22	776,969	West	Tulare	
20	634,969	Blackstone	Hughes	
9	621,047	Shaw		

The routes generating the highest ridership tend to be those serving the major north/south corridors. This reflects the shifting land use patterns that have displaced jobs and residences to the north, away from the traditional downtown city center. There has also been an increase in capacity along many of these north/south corridors with the diversion of regional traffic to newly constructed Highway 41 and Highway 168 facilities.

Stakeholder Suggestions

As described in Chapter 3, stakeholders were interviewed to gain an understanding of their views on potential BRT services. These interviews led to a number of other corridors being identified for possible BRT services. In addition to the four basic corridors that were identified at the outset of Chapter 4 the following corridors were mentioned by stakeholders:

- Clinton-Peach Avenue
- Herndon Avenue
- BNSF rail corridor
- Palm Avenue
- Chestnut/Willow Avenue
- Clovis Avenue
- Highway 168

4.3 *Proposed Bus Rapid Transit Network*

Each of the promising corridors was field reviewed along with an analysis of current FAX patronage in these corridors. FAX currently does not provide any service on Highway 168, BNSF rail corridor, and Highway 99; and only provides short sections of service on Herndon, and Clovis Avenues. Our assessment of potential BRT corridors is summarized as follows (see **Figure 4.3 - Metropolitan Corridor Identification Map**):

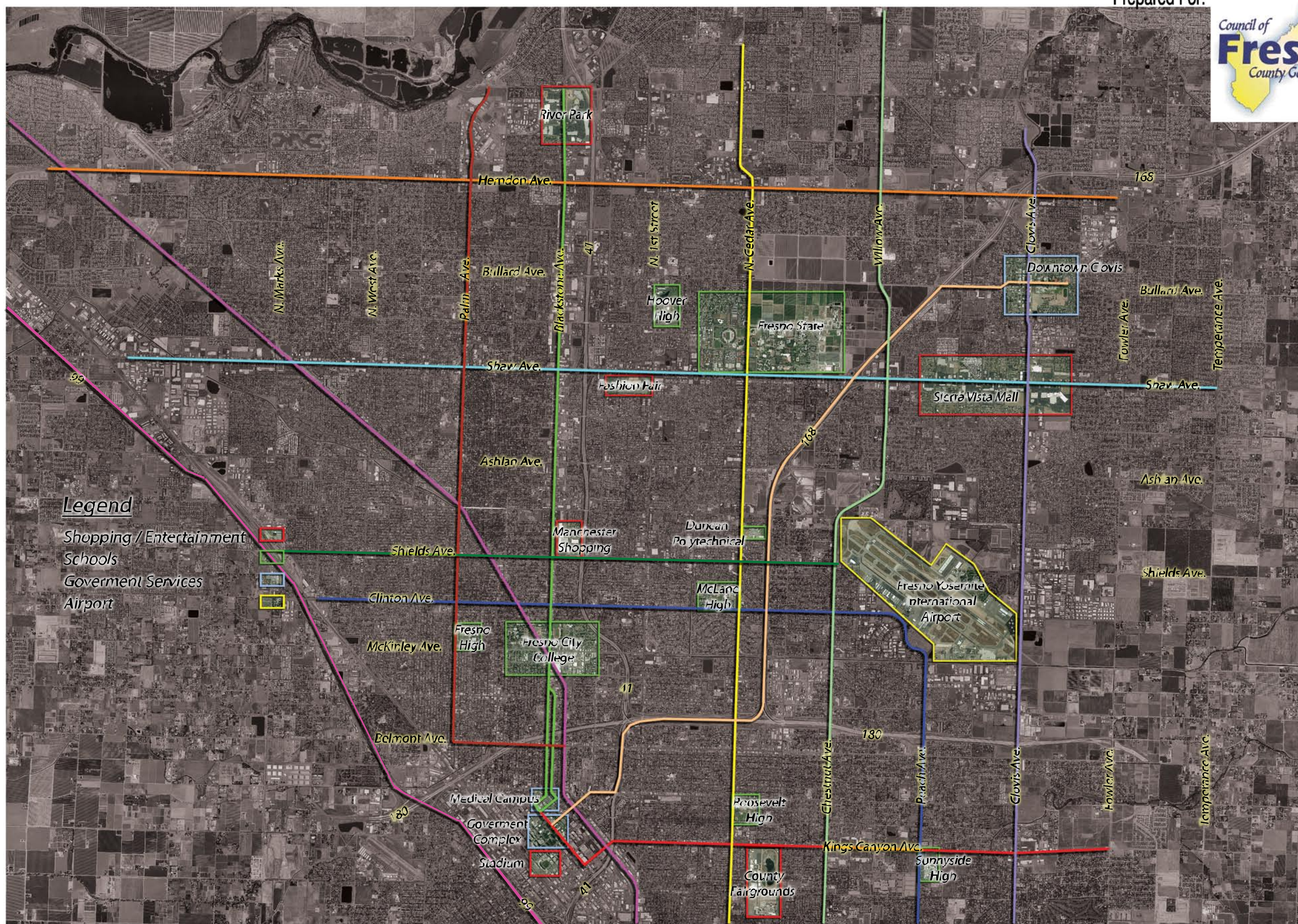
Blackstone Corridor – Downtown to Riverpark or Audubon.

This is a strong transit corridor with good patronage and numerous activity centers. FAX operates 15 minute weekday service on its Route 30, so the corridor already has a high level of bus resources allocated to it. Significant opportunities for land use intensification exist and the location of the Manchester Center along the corridor enhances its connectivity with local FAX services. It does have one at-grade railroad crossing near McKinley Avenue. Traffic seems heavier on the segment north of Ashlan Avenue. The running time from Nees Avenue to downtown is scheduled at about 45 minutes, and therefore improved speed might attract more long distance riders. If a Route 30 BRT is implemented, it will be important to coordinate it with local Route 30 service, including the West Fresno leg. Blackstone Avenue seems a good candidate for BRT services. After the completion of the 41 Freeway, most of the high speed traffic diverted from Blackstone Avenue to the new freeway. The street is still heavily used, but it is mostly for locally destined traffic whose speeds are more compatible with transit and pedestrian activity.

Shaw Avenue – Highway 99 to Fowler Avenue.

The Route 9 service that provides service along Shaw Avenue is not one of FAX's stronger performing bus routes. It operates on a 30 minute frequency and its schedule reliability is reportedly a problem. Traffic conditions are largely the cause of reliability problems and the right of way in the corridor is fully used for traffic lanes. While Shaw Avenue is in many ways a linear auto oriented suburban downtown for North Fresno, it is not very pedestrian friendly. Crossing the street is not easy as the traffic signal cycle lengths are long and the high volumes of left turns at intersections limit the amount of signal time allowed for pedestrians. Bus riders need to cross streets at least once for most roundtrips on buses. Even the pedestrian links along the street and between developments is not particularly inviting. Our conclusion is that even though Shaw Avenue functions like a downtown in some ways, it is not a pedestrian oriented downtown that is supportive of public transit service. The location of the California State University campus along the corridor is a major positive factor and the potential to anchor the eastern end in pedestrian oriented downtown Clovis would also be a beneficial. Shaw Avenue seems a good candidate for enhanced Route 9 local bus service, using signal and minor traffic engineering tactics to expedite service and to improve running times as well as deployment of better passenger stop amenities.

Prepared For:



Legend

- Shopping / Entertainment
- Schools
- Government Services
- Airport



Kimley-Horn
and Associates, Inc.

METROPOLITAN CORRIDOR IDENTIFICATION MAP

Fresno Transit Master Plan

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

Cedar/Willow Avenue – Sheppard Avenue to near Butler Avenue. -----

FAX Route 38 serves this corridor (Cedar and Jensen) with 30 minute frequency service. It is the fourth best performing FAX route. In addition to the California State University campus, several high schools and middle schools are located along the corridor. It is not a strong retail or employment oriented land use corridor. Route 38 is circuitous in reaching its terminus in downtown adding about four miles to the route length (or 15 minutes for trips into downtown). A BRT service on along Cedar should either terminate at Cedar Avenue and Butler Ave or in downtown via Ventura Avenue providing service along the trunk of Route 38. Route 38 can remain as a local service overlay maintaining the existing local bus service on Jensen Avenue.

Kings Canyon Road/Ventura Avenue Corridor – Downtown to near Fowler Avenue. -----

FAX's Route 28 serves this corridor with 15 minute headways on weekdays. The entire route which continues north of downtown to Fresno City College, CSUF and Clovis's Downtown is FAX's most successful route. One way running time for the entire route is one hour and 40 minutes. Remarkably, the long route operates nearly 90% on schedule. Few people ride the entire route from end to end. The southern segment between Downtown and Winery Avenue/Kings Canyon is 35 minutes. The BNSF at-grade crossing near downtown adversely impacts schedule reliability. The Ventura Avenue/Kings Canyon Road leg of Route 28 serves the Fairgrounds, Sunnyside High School and a number of other activities. Substantial opportunities appear to exist for infill development and substantial development is envisioned for the Fancher Creek project and ultimately the Southeast Growth Area. Much of the traffic on Ventura Avenue and Kings Canyon Road has been siphoned off by the opening of the 180 Freeway, leaving opportunities for a more pedestrian and transit oriented use of the public right of way. Speeds are probably less critical than reliability, since the corridor is relatively short. Implementation of BRT services in the corridor also would help brand the corridor as a pedestrian and transit oriented corridor and help shape land use proposals to be more pedestrian and transit friendly. Implementation of BRT in this corridor appears to offer promise.

Palm Avenue – Downtown to near Nees Avenue. -----

This corridor is served by FAX's 26 line. It has the second highest passenger boardings (behind only Route 28), but the majority of the 4,800 boardings occur on the southern segment, which runs along Butler Avenue. It runs parallel to the Blackstone Avenue corridor, one mile to its west. Fresno High School and Bullard High School are both located along Palm Avenue. It is not as commercially developed as Blackstone Avenue and it does not seem to have as much opportunity for infill development as Blackstone Avenue. Thus nearby Blackstone Avenue is the more attractive BRT alignment within the North Fresno corridor. Enhancements to bus stops and service, however, are merited for the Palm Avenue Corridor.

Clovis Avenue – Downtown Clovis to Kings Canyon Road. -----

Very limited bus service is currently provided on Clovis Avenue south of Shields Avenue and the service on the northern segment is not continuous. South of Shields Avenue, Clovis Avenue functions as a high speed, high volume arterial road with no pedestrian emphasis. The section between Shields and Tulare Avenues also has little development along its east side from which to draw bus patrons. Thus, Clovis Avenue does not seem to be a very promising BRT corridor now. However, the lack of development along the corridor can be an opportunity for future transit and pedestrian oriented development. Advance planning for a BRT corridor could facilitate right-of-way for BRT to be set aside by the proposed development for future installation of BRT facilities. Also, with the development of the Southeast Growth Area east of Clovis Avenue, the corridor becomes a favorable alignment for integrating the developments north to south..

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

Shields Avenue – Airport to Highway 99.

This corridor was suggested in the 1994 Transit Master Plan as a potential high capacity corridor. FAX Route 41 presently serves the corridor with 30 minute headway service. In terms of patronage and boardings per hour, Route 41 is FAX's most successful non downtown bus route, with more riders than the Shaw Avenue bus route. The corridor is successful with local bus and with the airport as a terminal it may be a candidate for BRT (or express) service for potential customers on the north side of Fresno if Clinton is not selected as the corridor to access the airport from downtown or from the north.

Clinton/Peach Avenues

This corridor is a combination of two crosstown markets. Crosstown transit markets historically are weaker than service oriented to downtowns. FAX's Route 39 serves the Clinton Avenue corridor and the eastern end of Route 26 serves the Peach Avenue corridor. These routes currently operate 30 minute on headways on weekdays and on hourly headways on weekends. While this corridor exhibits low ridership, it does provide a connection to the Fresno Yosemite International Airport—an opportunity for additional ridership, especially with fast and frequent service to the rest of the city through the BRT network. The corridor may provide be an opportunity for transit oriented development along Peach and Clinton Avenues concurrently with the long term implementation of BRT service.

Herndon Avenue

FAX Route 45 provides the only substantial bus service on Herndon Avenue. This service is on the portion west of Blackstone Avenue. It is not heavily patronized. The road itself is a high speed auto oriented highway with limited pedestrian crossings and generally an unfriendly pedestrian environment. The corridor is likely to remain a highway oriented facility in the foreseeable future based on current planning. Since Shaw Avenue functions as the east-west urbanized corridor in northern Fresno, investments in BRT should be focused on it rather than Herndon Avenue.

Chestnut/Willow

FAX Route 41 operates on the Chestnut Avenue section of this corridor. No bus service operates on the Willow Avenue portion of the corridor. Service operates on 30 minute headways on weekdays and 50 minute headways on weekends. It does not have as many major activity centers as the nearby Cedar Avenue Corridor and therefore is less promising for BRT services.

BNSF Corridor

If and when the BNSF and Amtrak trains are relocated to the UPRR rail corridor, the BNSF rail corridor could be used for BRT or other forms of transit services. The corridor is in a high growth area and directly connects to downtown on an exclusive right of way that could support high speed transit services. It also directly serves City College and the Regional Medical Center. In summary it would make an excellent transit corridor. Its disadvantages are that relocation of BNSF trains is not within the control of COFCG and that the community might have other non-transit preferences for the corridor. Given the outstanding long-term potential of this corridor for transit, we recommend that it remain a candidate for future study should the railroad relocation become a reality, but that it should not be included as an early-action BRT corridor.

Highway 168

Highway 168 is the most direct connection between Downtown Fresno and Downtown Clovis, also passing near the California State University campus. These are the region's three largest pedestrian oriented activity centers. No bus service currently operates on this alignment. An illustrative service might originate in Downtown Fresno and terminate in Downtown Clovis via Fresno Street, Regional Medical Center, Tulare Street, Highway 41, Highway 180, Highway 168, Shaw Avenue, Save Mart Center, CSUF, Chestnut Avenue, and Bullard Avenue. The current option (route 28) to travel between the two downtowns requires one hour. A limited stop bus service with BRT-like stations might have merit if this corridor is not selected for full BRT implementation.

Highway 99

No bus services are currently operated along Highway 99, which is centrally located within a high growth corridor. Current market conditions do not appear to support a limited stop bus service in this corridor. It is possible that future development would strengthen the market for Highway 99 bus service perhaps extending into Madera County. At this point in time, the best strategy would be to monitor market demands and ensure that any redesign of Highway 99 interchanges provide for potential future express bus service in the corridor.

Summary of Recommended BRT Network

Two corridors stand out as the most promising corridors for introducing BRT services, the Ventura Avenue/Kings Canyon Road and the Blackstone Avenue corridors. Both of these corridors have benefited from the diversion of traffic onto freeways constructed parallel to their alignments. Thus, they tend to have retail oriented land uses associated with former state highways with somewhat reduced traffic congestion. Also, both corridors provide opportunities for coordinated development of pedestrian/transit oriented land uses in conjunction with provision of enhanced BRT transit services. Both of these two potential BRT corridors could eventually develop into branch BRT services. For example the Ventura Avenue/Kings Canyon Road corridor could start with a single BRT line terminating in or near Fancher Creek and upgrade with a future line continuing past Fancher Creek to serve the Southeast Growth Area. The Blackstone Avenue corridor might start with a single line operating between downtown and Nees Avenue and upgrade in the future with a second branch to CSUF.

4.4 Ridership Assessment of Potential Corridors for Early Implementation

Transit ridership and revenue forecasting were performed for three City of Fresno stand-alone BRT alternatives to facilitate the phasing of BRT implementation. The stand-alone alternatives include new BRT services in:

- Kings Canyon Road/Ventura Avenue/Blackstone
- Shaw Avenue
- Cedar Avenue

The scope and budget of this master plan permitted only a preliminary assessment of ridership on potential BRT corridors. Service enhancements were similarly broadly defined, and as such ridership forecasts for this master plan were to support overall project feasibility and to help screen the range of alternatives.

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

Assessment of Current FAX Ridership

Council of Fresno County Governments Travel Demand Model

COFCG's multimodal model was used for this study. This model system was documented in the 2003 report, *Fresno County Travel Model Mode Choice Update*, available from the COFCG. The model system has a Year 2000 base year and 2030 horizon year, and covers all of Fresno County.

Transit Ridership Data

Two types of transit ridership data were obtained from FAX: 1) automated passenger count (APC) program statistics of boardings and alightings at a stop, and 2) monthly patronage data for every month between 1999 and early 2007. The two sets of data were used to determine the weekday ridership totals per route.

Establishing FAX Ridership Trends

These data were very useful in establishing ridership trends – particularly when plotted against service hours and revenues. The monthly data were also summed to annual totals. Daily ridership was calculated using the available APC data by route and day of week to obtain weekday versus weekend ridership patterns.

Breaking out the weekday from weekend ridership patterns allowed for development of route-level annualization factors¹. Typical annualization factors for operators like FAX range from 280 to 310, and the FAX system average was calculated to be 282. Routes missing APC data were given the FAX average annualization factor. Given total annual ridership and the route-level annualization factors, weekday daily ridership totals were established. **Table 4.2** shows average weekday observed boardings per route for all years between 2000 and 2006.

Table 4.2 – FAX Observed Ridership by Route and Calendar Year – Top Ten Routes

	Average Weekday Daily Ridership						
	2000	2001	2002	2003	2004	2005	2006
Route 28	5,904	5,488	5,206	5,025	5,005	6,344	7,534
Route 30	5,204	4,712	4,446	4,260	4,162	4,645	5,214
Route 26	5,635	5,037	4,816	4,729	4,691	4,849	4,803
Route 38	4,908	4,365	4,258	4,085	4,105	4,272	4,340
Route 32	4,352	4,020	3,835	3,925	3,736	3,821	3,761
Route 41	3,519	3,239	3,151	3,119	3,236	3,354	3,546
Route 34	3,587	3,198	3,028	2,965	3,075	3,203	3,215
Route 22	3,546	3,097	2,805	2,788	2,720	2,755	2,765
Route 9	2,544	2,258	2,159	2,098	2,101	2,202	2,352
Route 20	3,601	3,386	3,219	3,008	2,886	2,252	1,732
Total All	44,800	40,801	38,925	38,005	37,721	39,702	41,268

BRT Ridership Forecasts

Alternatives within BRT Corridor: Fast Bus and BRT Investment Alternatives

The Fast Bus Alternative is a bus service that is faster than current local bus service through traffic signal priority only. The Fast Bus Alternative included a new bus route overlay (no other services

¹ An annualization factor is a multiplier or divider used to convert average weekday daily ridership to annual ridership. A route with weekday-only service has an annualization factor of 252, while a route with equal daily ridership on all seven days of the week has an annualization factor of 356.

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

were decreased or deleted) at 10 minute peak headways and 15 minute off-peak headways. In all cases, this additional Fast Bus service was a substantial improvement over existing service levels.

The COFCG model is not capable of modeling BRT amenities other than improved travel time. Consequently, *TRB's Transit Cooperative Research Program (TCRP) Report 118: Bus Rapid Transit Practitioner's Guide 2007* was utilized to generate ridership changes associated with BRT amenities not accounted for in the COFCG model. Ridership changes are based on actual experiences with other transit properties in the United States that have implemented BRT services.

The Master Plan project team devised a set of three BRT investment options – basic, moderate and high. Ridership forecasts were prepared each of these options along with the fast bus alternative for each corridor. The specific BRT investment packages are described in Chapter 1.

Methodology

A ridership adjustment methodology was devised for each of the Fast Bus Alternatives and then applied to the BRT Investment Alternatives. First, the existing route structure was analyzed to determine the extent to which all routes fall within each BRT corridor. A judgment-based approach was used. For example, for the Kings Canyon Road-Ventura Avenue-Blackstone corridor, six routes were identified where each operates between 33% and 75% within that corridor. Fewer existing routes operate in the Shaw and Cedar Corridors; however, those corridors are also smaller and do not serve Downtown Fresno (the hub of FAX's system).

It was then assumed that local bus ridership within and outside the BRT corridor under study was equal to the percent of the route within the corridor. For example, if Route 99 was determined to be physically 50% within a BRT Corridor, then it was assumed that 50% of the riders on Route 99 were also within the BRT Corridor. This assumes an even distribution of ridership across the stops along the corridor—this assumption can be refined in future analysis with updated origin-destination matrix from automatic vehicle location data collected by FAX. Corridor and non-corridor ridership was then summed for the Base Year and 2030 No-Project Alternatives.

An adjustment was made for the 2030 Fast Bus Alternative. Local bus ridership was similarly calculated with some exceptions. Total in- and out-of-corridor ridership growth was obtained from the model outputs. In the Kings Canyon Road-Ventura Avenue-Blackstone Corridor, local bus ridership changes were determined to be +18% within the corridor, and -3% out-of-corridor. These summary percentage changes were multiplied against the same line items in the 2030 No-Project alternative to determine total in- and out-of-corridor ridership changes.

Similarly, the individual within-corridor routes were adjusted based on model percentage change between the No-Project and Fast Bus Alternatives. These percentage changes for each route were multiplied against the Adjusted No-Project route-level boardings to determine the final local bus boardings under the Fast Bus Alternative.

With these calculations, total within-corridor local bus ridership and complete within-corridor ridership were both known. The difference between these two values was assumed to be the fast bus route.

This methodology produced fairly conservative results. The raw model predicted 12,561 Kings Canyon Road-Ventura Avenue-Blackstone fast bus riders, and with the model adjustments, fast bus ridership was reduced to 9,396, a reduction of over 25%—compared to Route 28 current 7,800 daily riders, this is only a 20% increase over 23 year period (an annual ridership growth of 0.8%).

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

For the three BRT investment alternatives, the BRT handbook was consulted for estimated ridership changes. One key change is noted, relative to the methodology for determining fast bus ridership. Under the fast bus alternative, total within-corridor ridership changes were calculated. For the BRT alternatives, ridership changes are attributed only to fast bus or BRT route. Ridership on all other routes – both those inside and outside the corridor – is assumed to remain constant across the remaining alternatives².

Table 4.3 presents total systemwide ridership and within corridor ridership by route for all alternatives and BRT investment packages.

Key Findings Ridership

Table 4.3 -Within Corridor and Systemwide Ridership by Alternative and Investment

	Year 2000	Year 2006	2030 Adj	Fast Bus	Basic BRT	Mod. BRT	High BRT
Kings Canyon Road-Ventura Avenue-Blackstone							
Route 20	1,188	572	1,567	1,302	1,302	1,302	1,302
Route 22	1,170	912	1,552	1,230	1,230	1,230	1,230
Route 26	2,818	2,402	3,398	2,571	2,571	2,571	2,571
Route 28	4,428	5,651	5,575	4,858	4,858	4,858	4,858
Route 30	3,903	3,911	5,312	2,501	2,501	2,501	2,501
Route 32	2,176	1,881	3,024	2,313	2,313	2,313	2,313
Fast Bus/BRT	0	0	0	9,396	12,638	17,251	18,803
In corridor total	15,683	15,329	20,428	24,171	27,412	32,025	33,578
Other Routes	30,286	31,532	48,328	46,784	46,784	46,784	46,784
Total	45,969	46,861	68,756	70,955	74,197	78,810	80,362
Shaw Avenue							
Route 9	1,908	1,764	2,765	1,369	1,369	1,369	1,369
Route 28	1,476	1,884	1,858	1,190	1,190	1,190	1,190
Fast Bus/BRT	0	0	0	5,758	7,745	10,572	10,572
In corridor total	3,384	3,648	4,623	8,318	10,305	13,131	13,131
Other Routes	42,585	43,213	64,133	63,458	63,458	63,458	63,458
Total	45,969	46,861	68,756	71,776	73,763	76,590	76,590
Cedar Avenue							
Route 34	897	804	1,138	960	960	960	960
Route 38	3,681	3,255	5,707	3,086	3,086	3,086	3,086
Fast Bus/BRT	0	0	0	6,400	8,608	11,750	12,808
In corridor total	4,578	4,059	6,845	10,446	12,654	15,796	16,854
Other Routes	41,391	42,802	61,911	59,570	59,570	59,570	59,570
Total	45,969	46,861	68,756	70,016	72,224	75,366	76,424

Source: COFCG Travel Model, TCRP Report 118, Cambridge Systematics

Overall, the Kings Canyon Road-Ventura Avenue-Blackstone Corridor has the highest ridership. This is explained by two factors. First, existing in-corridor local bus boardings are much higher

² See Appendix A for a detailed summary of the ridership benefit assumed with each specific BRT amenity along a corridor.

than for the Shaw and Cedar Corridors; second, this Kings Canyon Road-Ventura Avenue-Blackstone Corridor is longer, thus providing more opportunities for travelers to use the BRT/Fast Bus service.

4.5 Proposed Corridor for Initial Implementation

The first phase BRT implementation is proposed along the Ventura Avenue/Kings Canyon Road corridor beginning at Fancher Creek and interlining through Downtown Fresno to FAX's Manchester Center transit center for connections with FAX routes 28, 30 (local), 31, 32, 41, and 45. Further study is required to determine the best routing for the start up service north of Downtown. However, Fresno City College is the next major destination north of downtown Fresno and the fastest alignment may be a combination of Blackstone Avenue, the right-of-way adjacent to the south of BNSF tracks, and utilizing the new underpass under the tracks to the east of City College to return to Blackstone Avenue.

Chapter 5 – Ventura Avenue/Kings Canyon Road BRT Implementation Plan

As part of the Master Planning effort, the Kimley-Horn team evaluated the potential for establishing BRT service along Ventura Avenue and Kings Canyon Road as an early implementation element of the overall Master Plan. This task included performing field investigations to identify suitable locations for BRT stations and recommendations for corridor improvements representing a range of investment levels.

This corridor was identified for additional study because in addition to being part of the most promising BRT corridor (see conclusion of Chapter 4), it also serves the site of the proposed Fancher Creek development, a major master-planned community. With Fancher Creek and downtown providing anchors for potential ridership at the ends of the Ventura Avenue/Kings Canyon Road corridor, the implementation of BRT along the corridor would be an increase in the level of service that is much needed for the communities between Fancher Creek and downtown.

5.1 Corridor Characteristics

The Ventura Avenue/Kings Canyon Road corridor was formerly a California Department of Transportation facility (former State Route 180). It begins on the southern edge of downtown Fresno and extends easterly to the newly developing suburban communities in the southeast quadrant of the metro area. After leaving the downtown area by passing beneath the SR 41 freeway, the route extends for just over two miles through an area of primarily older commercial development. This area is characterized by street-fronting businesses with many driveways and extensive dependence on on-street parking. Residential areas in this segment consist mostly of single-family neighborhoods located a block or more off the main corridor. Major traffic generators along this segment include the University Medical Center, County social services offices and the Fairgrounds.

East of Chestnut Avenue, the corridor enters an area of newer development characterized by large shopping centers on both sides of the street, centered on South Winery Avenue. Medium-density apartment developments surround the shopping centers. This segment is approximately 0.6 miles long.

Beginning at South Adler Avenue, the alignment enters an area consisting of medium-density residential complexes interspersed with large tracts of undeveloped land. This segment extends 1.4 miles to a commercial node at Clovis Avenue. A dominant feature of this segment is the mature palm trees that line both sides of the right-of-way, which are considered aesthetically and historically important to the community and may reduce the feasibility of road widening. Major traffic generators along this segment include the Sunnyside High School located at Peach Avenue and the IRS complex, located about a half-mile to the south. The extensive undeveloped parcels along this segment present good opportunities for higher-density, transit-oriented development.

The area east of Clovis Avenue comprises a mixture of land uses including large-scale commercial development and newly-developing land, including the Fancher Creek planned community. Since this area is near the outer limit of Fresno's existing urban footprint, it is proposed to be the terminus of the planned BRT route.

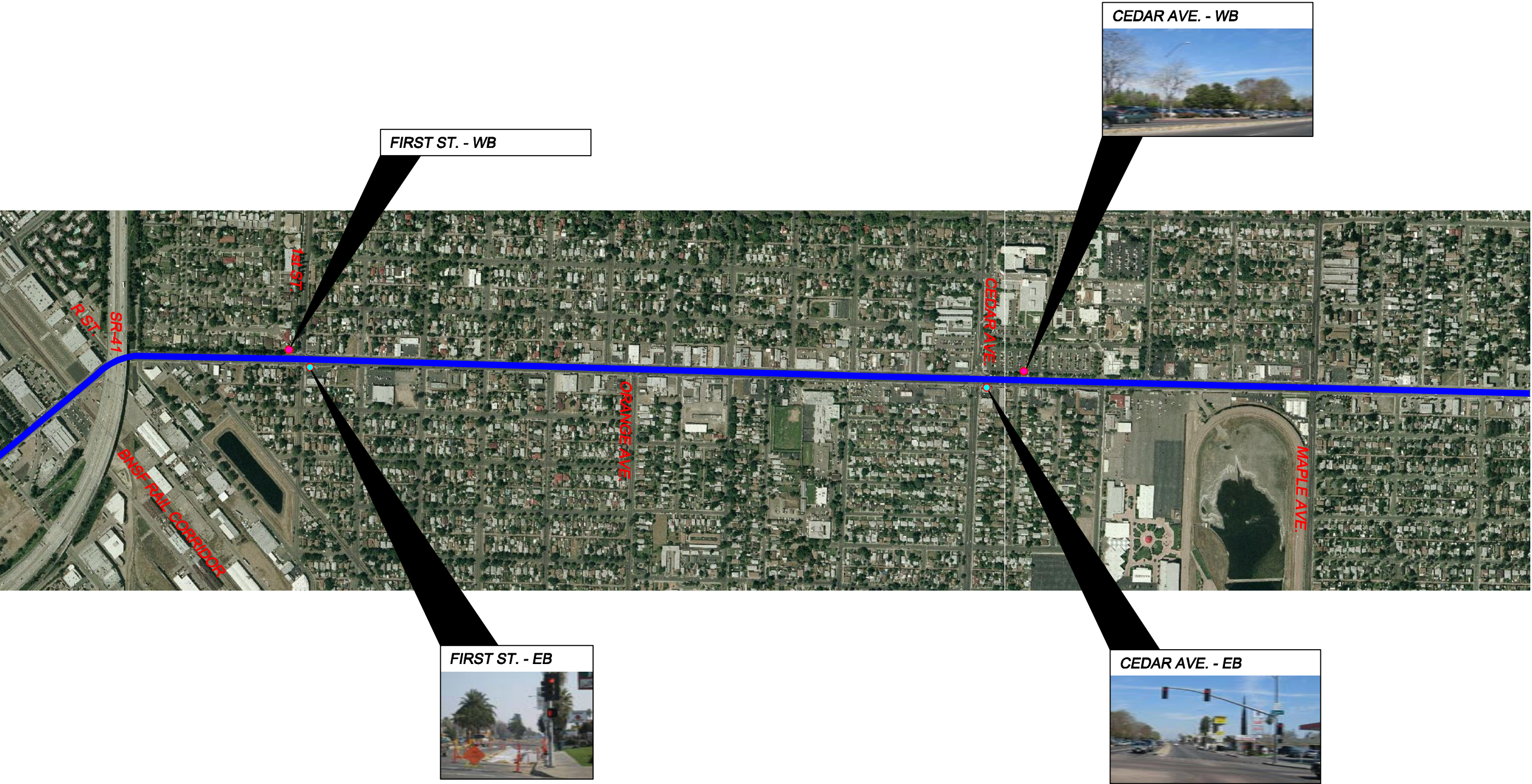
5.2 *Proposed Alignment and Station Locations*

As mentioned in the previous chapter, Ventura Avenue/Kings Canyon Road was one of four major arterials proposed for high frequency service or rapid transit service. It is also a corridor that currently experiences high transit ridership on FAX Route 28. The proposed Ventura Avenue/Kings Canyon BRT follows much of the same alignment as Route 28 from the intersection of Van Ness Avenue and Ventura Avenue in downtown Fresno to Peach Avenue, and continues east to either Clovis Avenue or Fowler Avenue as described below—**Figures 5.1a-c** Ventura Avenue/Kings Canyon Road Corridor Alignment and Stations.

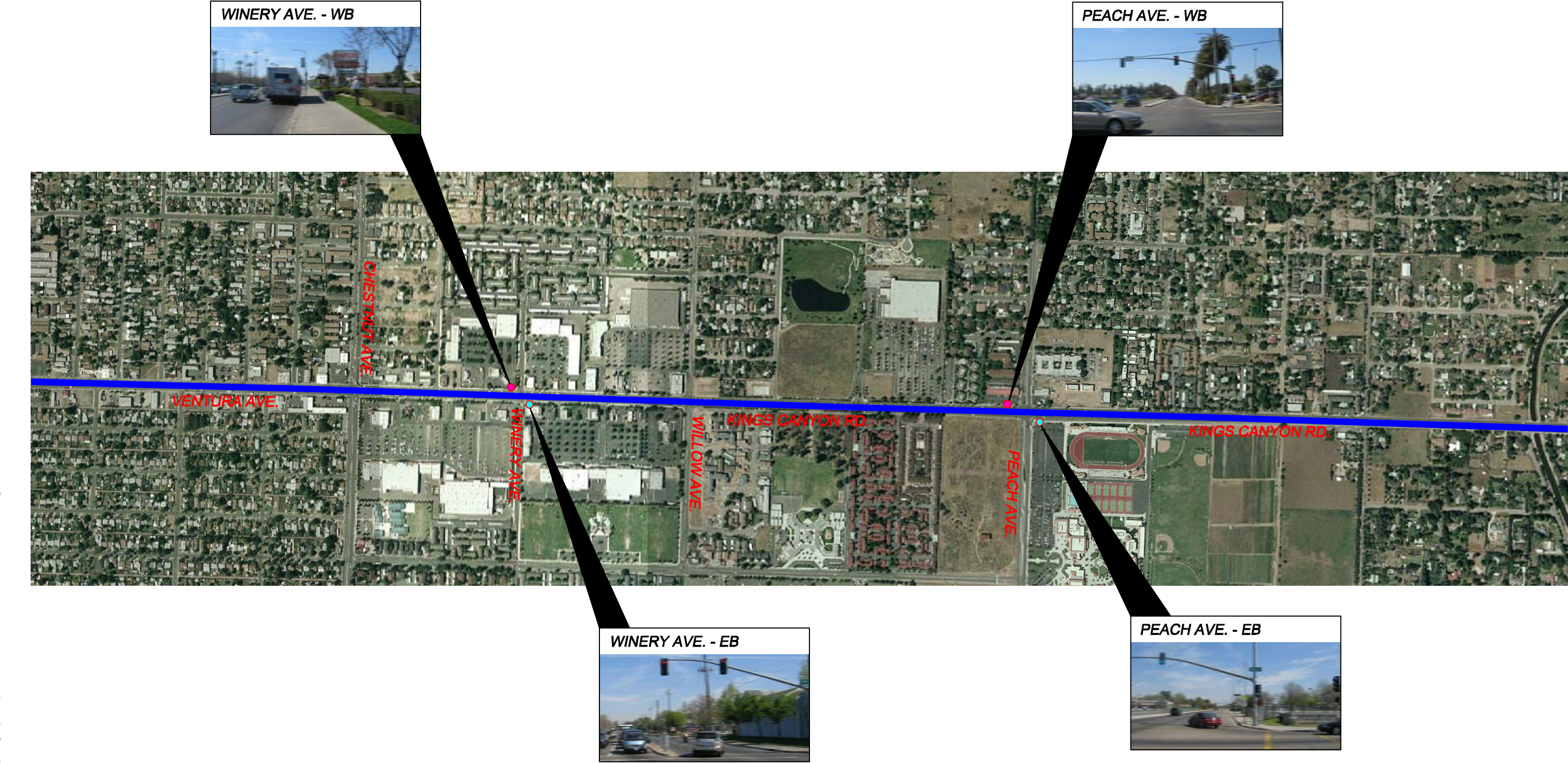
Downtown Fresno

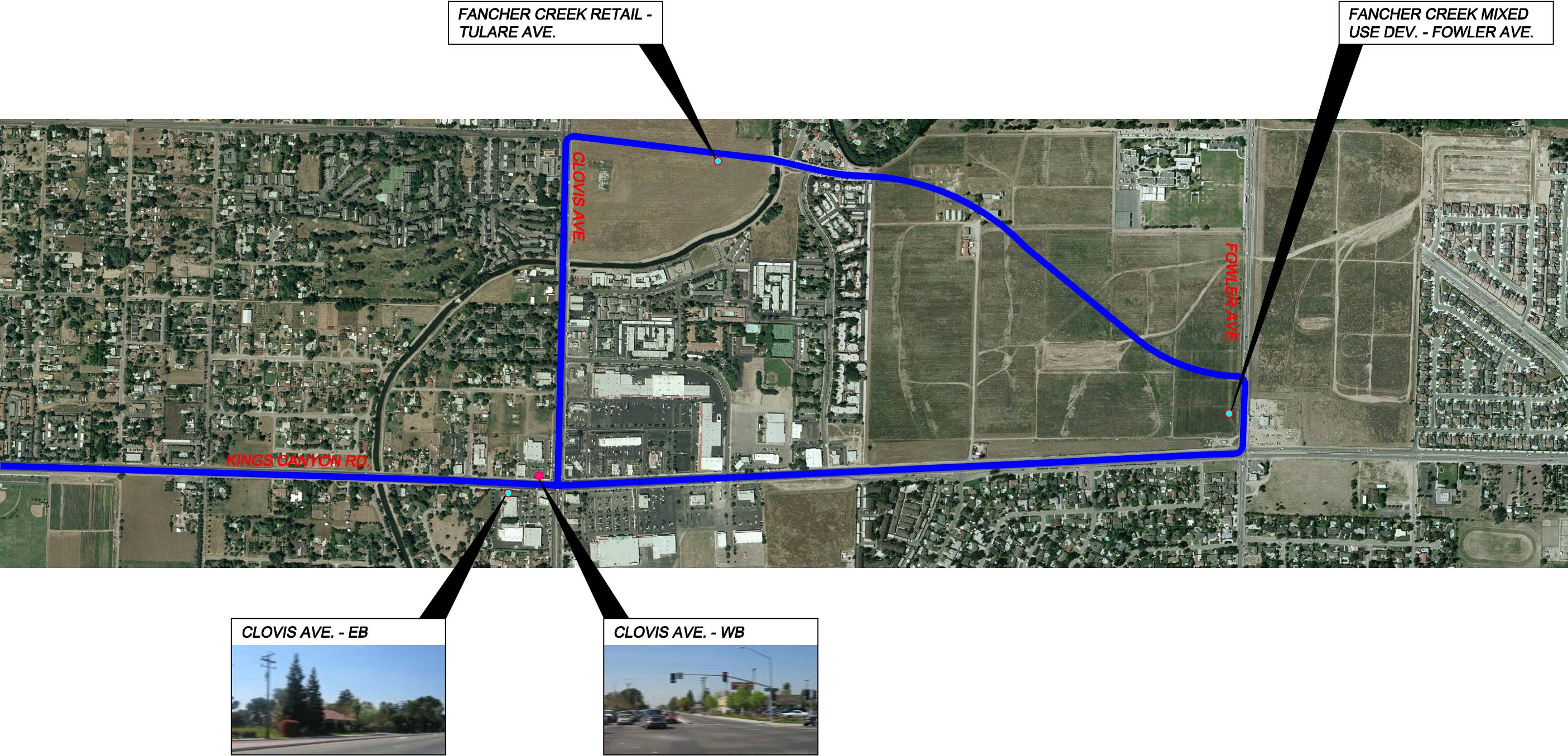
The alignment of the Ventura Avenue/Kings Canyon Road BRT through downtown Fresno should be coordinated with other planned BRT routes and ideally connect with the Blackstone Avenue alignment. Final resolution of the BRT alignment through the downtown area is beyond the scope of this study; however the Downtown Transportation Infrastructure Study proposed Van Ness Avenue as the transit corridor for downtown Fresno for its centralized location within downtown. One possibility is to operate the Blackstone BRT on the one-way couplet of Stanislaus Street/Tuolumne Street to reach Van Ness Avenue, and stop at a station or stations in the downtown core. The route would then become the Ventura Avenue/Kings Canyon Road BRT and proceed southeasterly to Ventura Avenue. Turning left on Ventura Avenue, the BRT would depart from the downtown area by passing under the SR-41 freeway overpass.

Perhaps the most significant design issue facing this segment of the BRT is the crossing of the BNSF railway near the freeway overpass. Delays related to train movements can be lengthy and are inconsistent with the service goals of a BRT system especially those dealing with service reliability. A grade-separated crossing would be a costly element of a BRT project but at a minimum this should be considered and evaluated as part of the conceptual design process, especially for the medium and high-investment concepts.



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Council of Fresno County Governments (COFCG)

Ventura Avenue/Kings Canyon Road Corridor

East of SR-41, the BRT would proceed along Ventura Avenue. BRT stations are proposed to be spaced at intervals of one-half mile to one mile, with the approximate locations being adjusted to gain maximum proximity to major traffic generators. In addition, stations typically should be located near the major cross streets on which transit lines are located, to facilitate transfers. In Fresno, the major streets are located on roughly a one-mile grid, and the major FAX bus lines follow these streets, so in most cases the logical station locations are adjacent to these one-mile arterial cross-streets.

1st Street and Ventura Ave

This intersection provides a connection to Route 34 on 1st Street. The station is located near neighborhoods on the north and south. This is also the last station before entering downtown Fresno—see **Figures 5.2, 5.3, and 5.4**.

Cedar Ave and Ventura Ave

Cedar Ave is currently a major bus stop on Route 28 and is likely to be a major destination within the proposed BRT system. The station is adjacent to the University Medical Center campus operated by the County of Fresno—see **Figures 5.5, 5.6, and 5.7**. The county is currently in the process of developing a master plan for the campus with an interest to integrate public transportation. This station would provide convenient access to a new campus that integrates effective pedestrian access toward and from the BRT station. Also, the surrounding neighborhoods are transit dependent and would greatly benefit from additional service along the corridor.

It should be noted that the distance between the first three stations along the corridor is approximately a mile. This mile spacing means only half of this portion of the corridor would have access to a BRT station within a quarter mile. While not recommended for initial implementation mid-point stations at half-mile intervals—that do not provide transfer opportunities within the existing FAX network—can be considered for future implementation when the demand warrants. The implementation of the “mid-point” stations would provide ¼ mile access to any station along this portion of the corridor which currently contains the majority of the residential and commercial development.

Winery Ave and Kings Canyon Rd

This intersection is a compromise between providing connecting service to Route 41 and providing service to a commercial center surrounded by higher density residential apartment and condos. This site would serve a large FAX market of shopping based trips while taking advantage of potential redevelopment opportunity of the area (parking lots) surrounding the proposed station—see **Figure 5.8**.

Peach Ave and Kings Canyon Rd

This location shows substantial promise for a successful BRT station. The station is located near a high school (serving one of FAX’s top markets – student customers) and adjacent to an empty which provides a great opportunity for transit oriented development to further support the BRT. An additional characteristic of the location that is favorable for BRT is the width of right-of-way where transit-only lanes can be effective and inexpensive to implement—see **Figure 5.9**.

Clovis Ave and Kings Canyon Rd

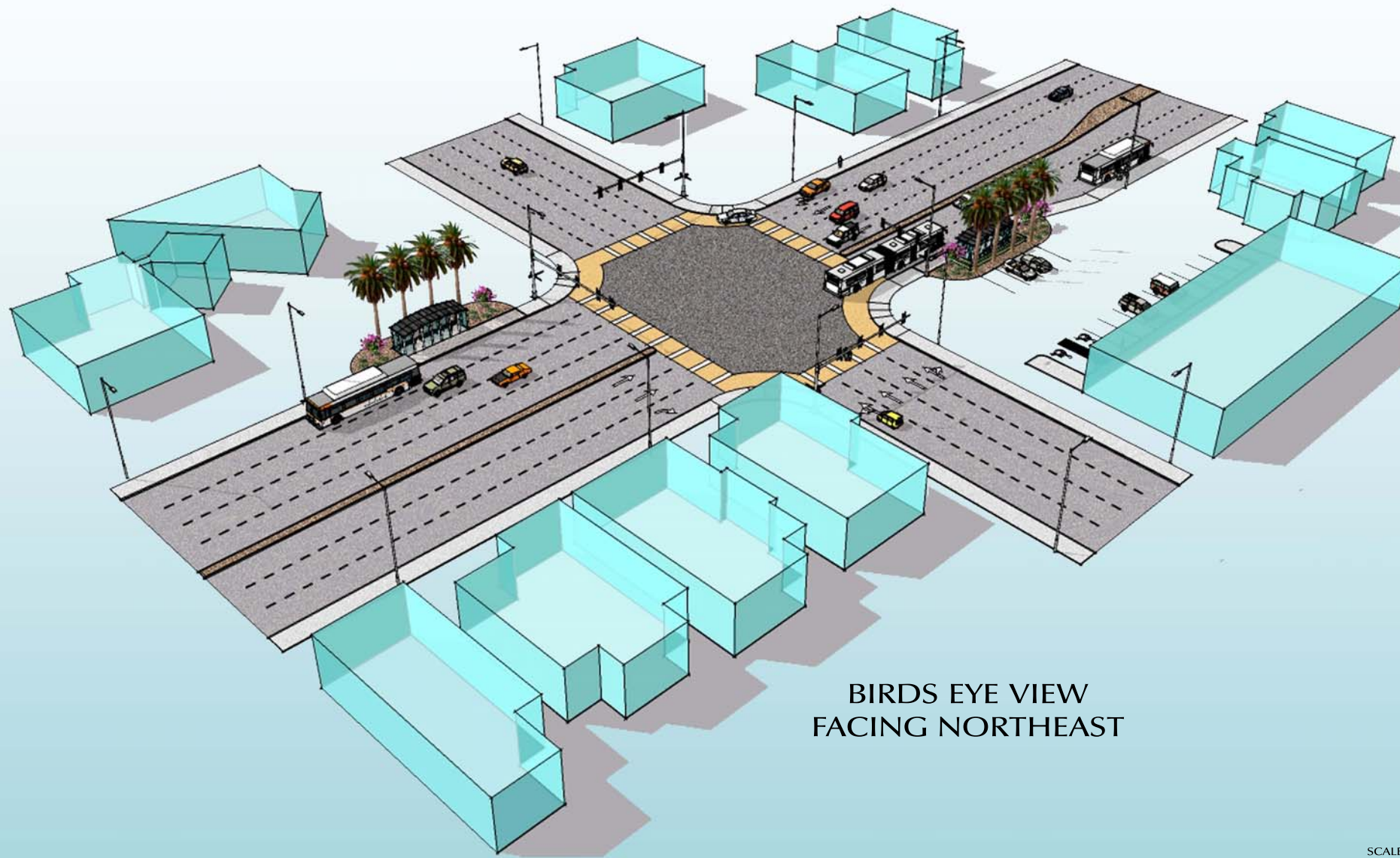
Clovis Avenue is a station proposed to serve an area with little to no service currently. The station has some high density residential to the south on Clovis Ave that may provide some potential ridership; however, the main premise for a station is to provide connecting service to the possible future north/south bus service on Clovis Ave—see **Figure 5.10**.

Fresno Transit Master Plan - Ventura / Kings Canyon Corridor

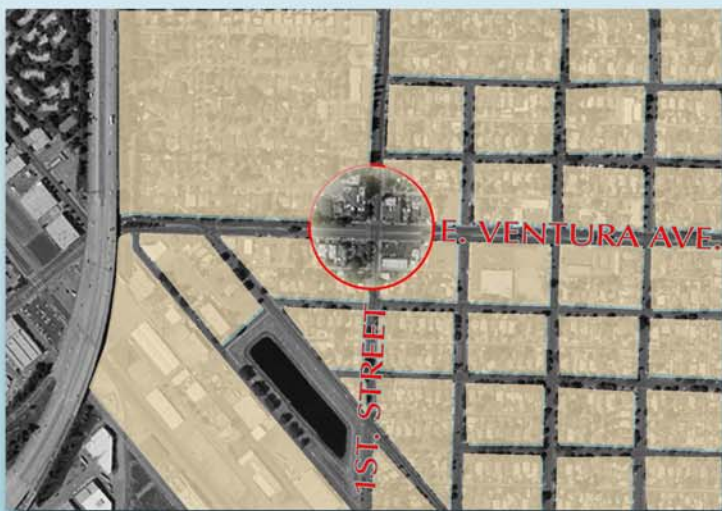




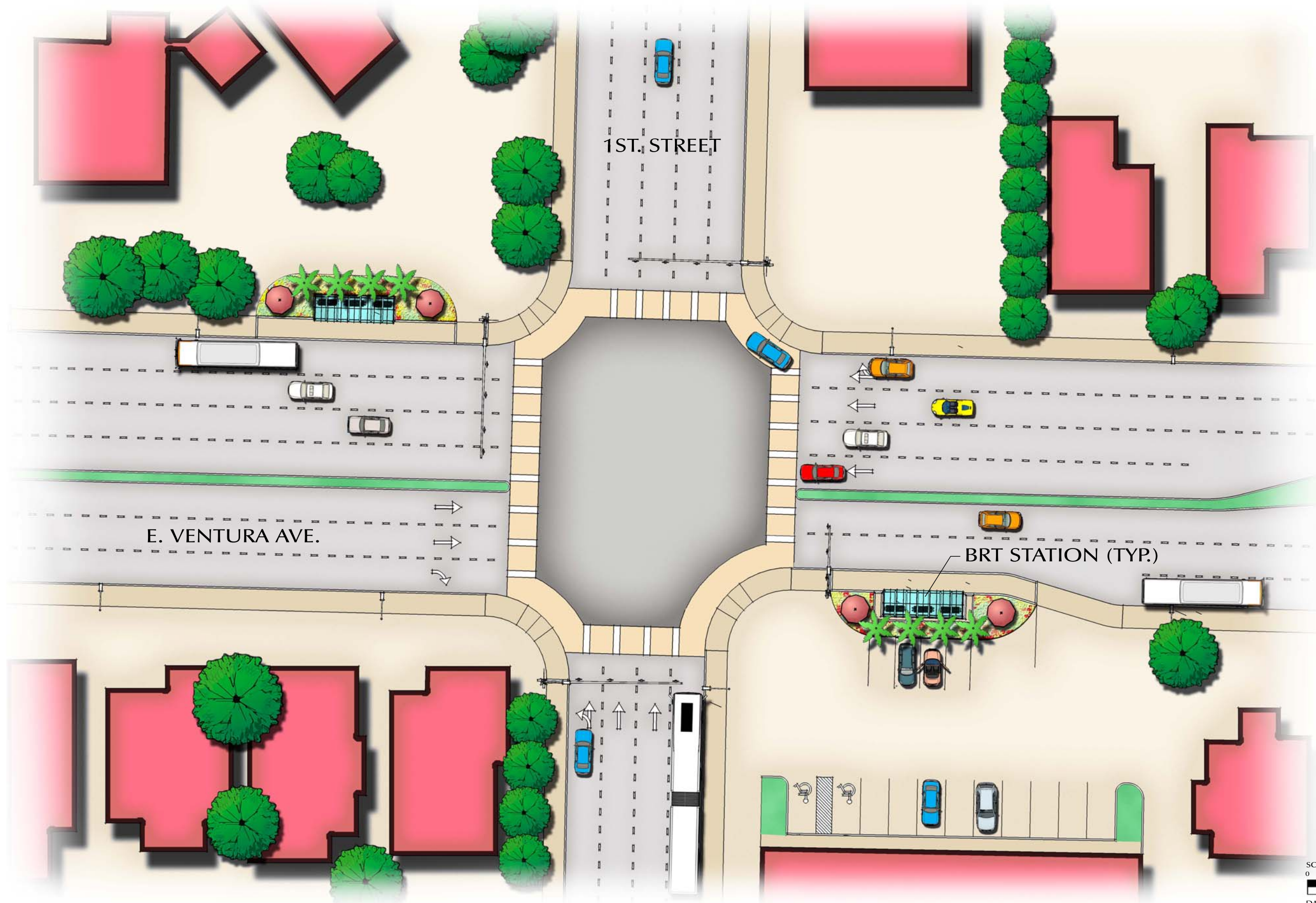
CHARACTER PERSPECTIVES



BIRDS EYE VIEW
FACING NORTHEAST



SCALE: NTS
DATE: SEPTEMBER, 2007



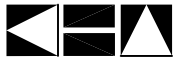
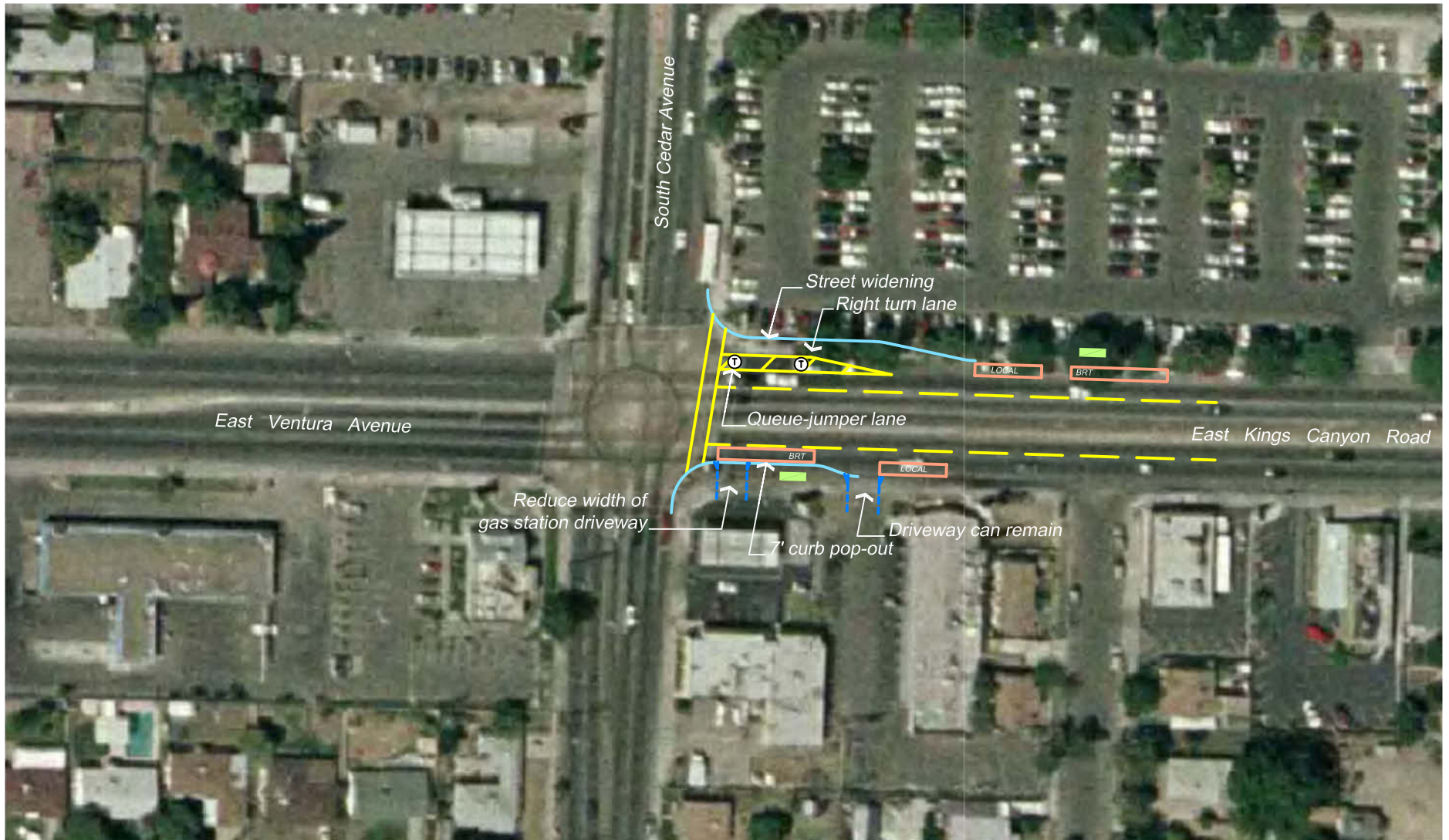
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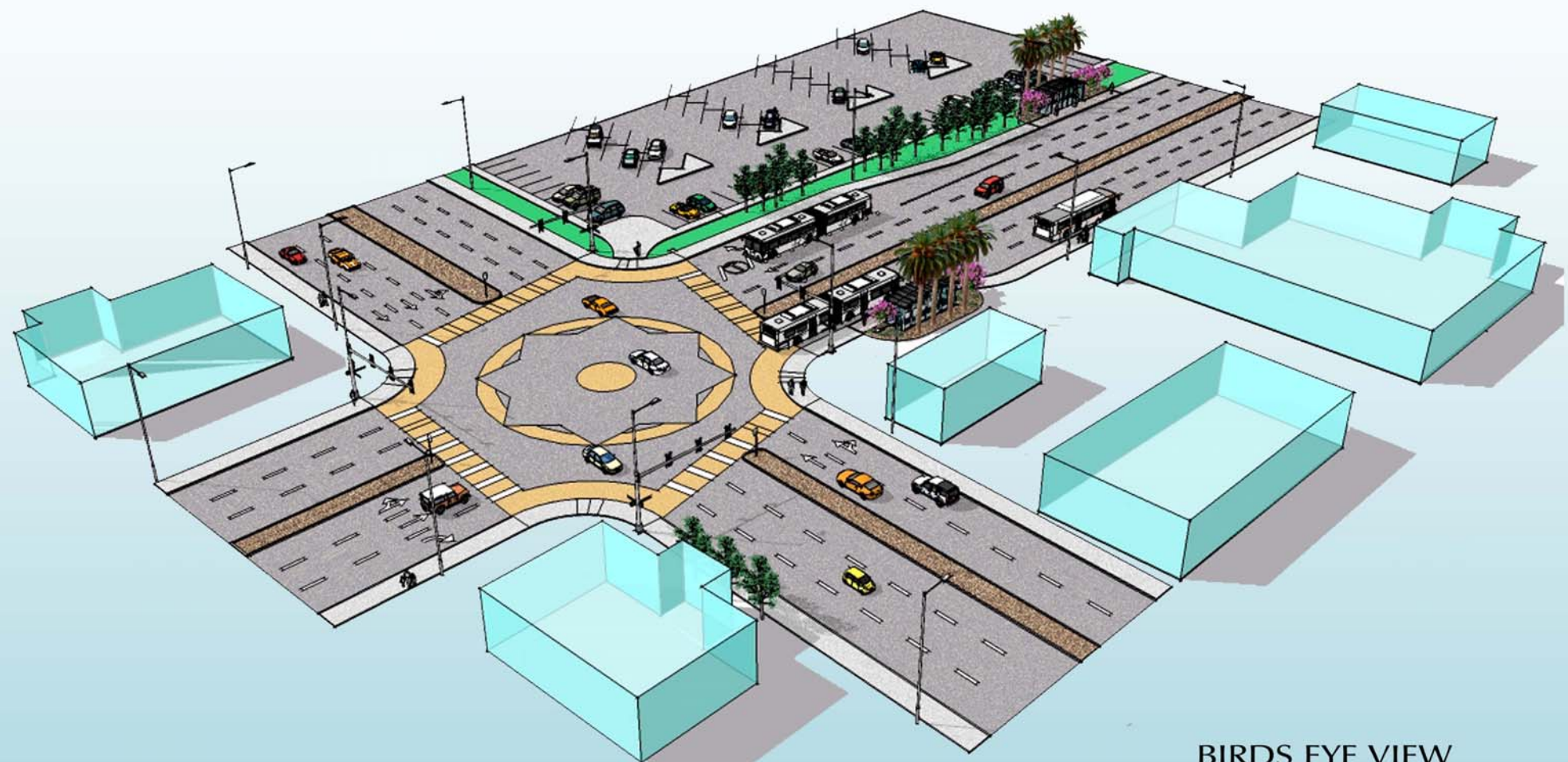


Fresno Transit Master Plan - Ventura / Kings Canyon Corridor





CHARACTER PERSPECTIVES



BIRDS EYE VIEW
FACING NORTHEAST



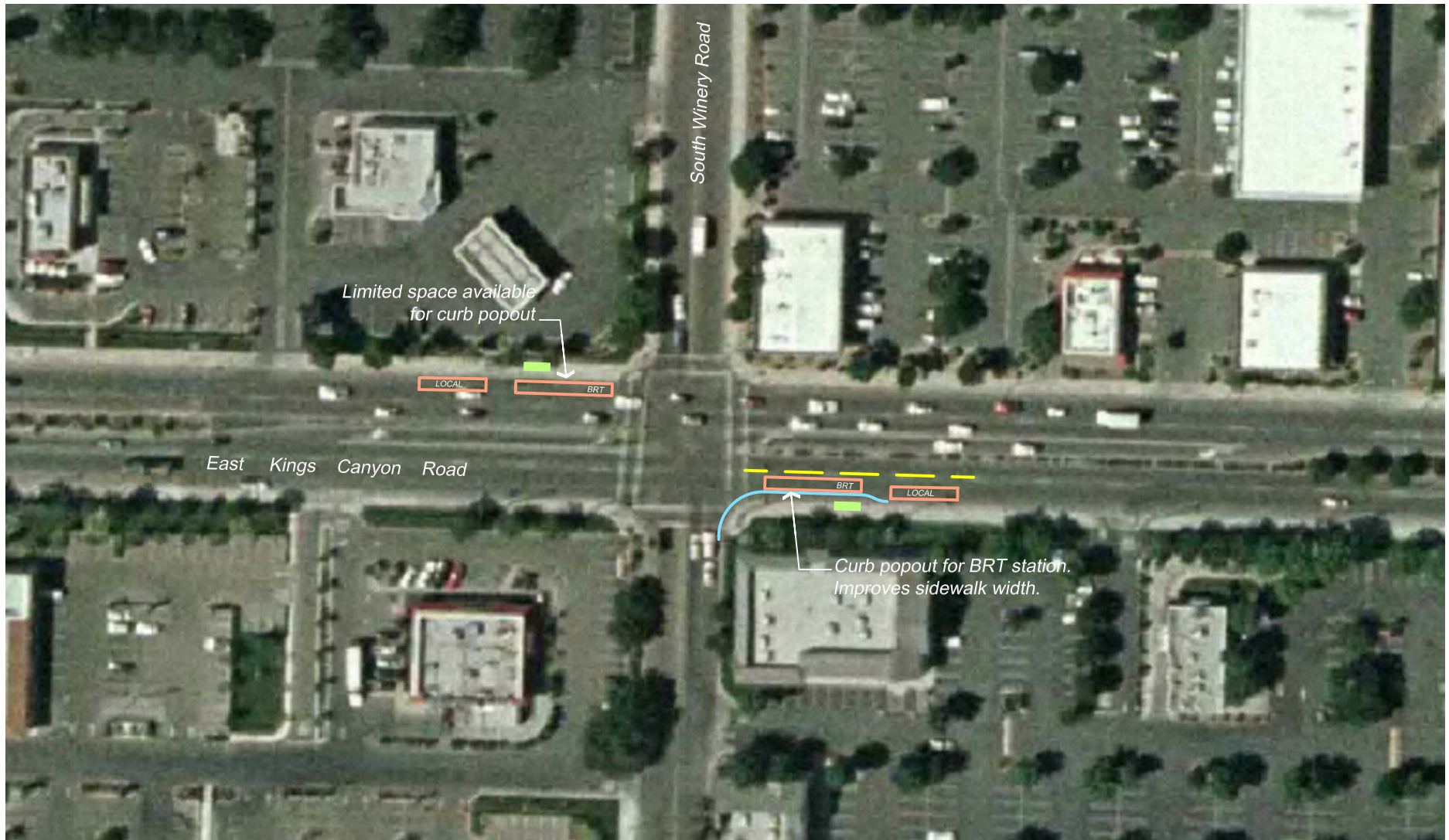
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Fresno Transit Master Plan - Ventura / Kings Canyon Corridor



Fresno Transit Master Plan - Ventura / Kings Canyon Corridor





BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

Fancher Creek – East of Clovis Ave

The master planned community of Fancher Creek occupies a large tract of land between Clovis Avenue and Fowler Avenue, and is expected to be a major generator of ridership for the Ventura Avenue/Kings Canyon Road BRT when fully developed. Two options have been identified for providing service to Fancher Creek. The first is to follow a direct alignment along Kings Canyon Road, with a terminal station near Fowler Avenue. A turn-around would need to be provided near the intersection of Fowler Avenue. While this alignment is the most direct and provides the shortest running time, it would provide only limited service to Fancher Creek. The majority of the Fancher Creek residential units and all of its major shopping centers would be outside the quarter-mile convenient walking radius from any station site along Kings Canyon Road.

An advantage of the Kings Canyon Road alignment would be the possibility of future extension to Highland Avenue (four miles east of Clovis Avenue and three miles east of Fowler Avenue), which would allow this BRT alignment to bisect the Southeast Growth Area. The Southeast Growth Area is a planned new growth community for the City of Fresno that is part of the 2025 Fresno General Plan. The growth area encompasses 14 square miles and is anticipated to have 55,000 residents. It is bisected north-south by Wolf Ave and east-west by Kings Canyon Road. The proposed alignment on Kings Canyon Road would allow for future (2020) extensions of the BRT and branching into the Southeast Growth Area.

The second major option for the BRT service at Fancher Creek would be to provide direct service by making a one-way loop through the center of the development. In this scenario, the BRT would turn left (north) onto Clovis Avenue and proceed north to Tulare Avenue, where it would turn east into the Fancher Creek site. The BRT would then proceed along Tulare Avenue to Fowler Avenue, where it would turn south to Kings Canyon Road, and finally turn west to complete the loop and begin the return trip to downtown Fresno. This scenario would provide two stations, one near the commercial center and one along Fowler Avenue within the Town Center area. This alternative would provide much more convenient service to Fancher Creek and higher near-term ridership. However, the alternative would be less conducive to future direct extension into the Southeast Growth Area but would not preclude branching service to the growth area to the east.

Regardless of the routing of the BRT to and from Fancher Creek, all transit customers will use the pedestrian access links within Fancher Creek to and from the BRT Station. Pedestrian friendly design within Fancher Creek is imperative for the BRT's success in attracting riders within the development. The best way for a development to promote pedestrian mobility and access is by providing clearly defined pedestrian paths and uses. This includes main entrances to buildings along the sidewalk as opposed to having a parking lot between the street and the building. In Fresno, shade trees along sidewalks can be inviting for a more comfortable walk along the street. Other potential measures include shortening pedestrian crossings with curb popouts along anticipated high traffic pedestrian paths, providing a land use plan that encourages people to use walking as a mode of transportation for short trips as opposed to their cars, and providing an environment that promotes comfort and safety for pedestrians such as high visibility from the surrounding area.

5.3 Conceptual Station Improvements

One of the required features for FTA-funded Small Starts and Very Small Starts projects is “substantial stations”. There is some flexibility in the interpretation of this term, although BRT stations nearly always include shelters that are larger and more attractive than standard bus shelters. The shelters and other station amenities contribute to the “branding” of the project image and the public perception of the BRT as a high-quality form of transit. By being highly visible, the stations also contribute to public awareness of the BRT alignment.

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Council of Fresno County Governments (COFCG)

Features of BRT Stations/Stops

A variety of features can be incorporated into BRT stations. The following list could be considered as a “menu” from which some items, but usually not all, can be selected depending on the project’s budget or quality goals:

- “Substantial” station structure (mandatory project element, usually architecturally designed) typically having seats and space for wheelchair users
- Ticket vending machines – this feature has several benefits for the BRT system: pre-paid fares result in significantly faster boarding and reduced running times, customer convenience is enhanced by the ability to accept credit/debit cards or make change, and the presence of fare vending machines adds to the overall impression of a rail-like customer experience
- “Next Bus” announcement displays, based on data from an Automated Vehicle Location (AVL) system, advising passengers of the waiting time until the next bus will arrive
- Passenger information displays or kiosks, including transit information or maps of the surrounding community
- Ticket validation devices, if required by the fare collection system
- Landscaping and/or trees may be included, especially where shade is needed
- Increased curb height to allow for level boarding (floor of bus is approximately level with the platform area).
- Curb popouts the width of the parking lane, to move the curb line out to the edge of the right-hand driving lane or transit-only lane. This allows the bus to stop at the station without pulling over, and to move forward after boarding without having to merge into traffic. The construction of curb popouts also affords an opportunity to transition to a higher curb face if level boarding is being used. Curb popouts also provide extra space for the station facilities.
- Station signage, with lettering large enough to be legible from inside the vehicle
- ADA-compliant boarding area
- A separate boarding area for local buses. Local buses should not stop at the BRT platform if possible because they usually lack provisions for expedited boarding and could delay the BRT vehicle.
- Pedestrian access enhancements in the surrounding area, such as improved crosswalks, enhanced sidewalks, or additional curb popouts beyond those used for the station

Where BRT vehicles stop at larger transit centers, they should still have a special boarding area with enhanced signage to reinforce the branding of the project.

Issues to be addressed in the design of BRT stations include:

- Drainage issues associated with the curb popouts, since these typically block the gutter
- Utility relocations, especially where underground utility lines may be in conflict with proposed shelter locations
- Visibility of businesses and their signage may be an issue where stations are located in front of existing businesses
- Pavement elevations and grading require careful attention especially where increased curb heights are being used adjacent to existing zero-setback storefronts sometimes found in business districts

Types of BRT Stations and Proposed Application within BRT Corridor

Even along a BRT corridor each station or stop has unique characteristics, from the type of passenger to the number of passengers using the facility. Again, building on the theme of flexibility with BRT components, stations can be defined as basic, moderate, and high level station improvements—the key is to build in the flexibility with the initial design to ensure that a basic station can eventually be upgraded to a high level station as demand dictates. Also, station design

should provide both continuity along the BRT corridor and distinguishable features reflecting the character of the surrounding community. The consistent recognizable style of the stations is a key element of system branding and public awareness of the alignment. However, many systems choose to also include some form of public art or other unique element at each stop to tie in to neighborhood themes.

The following basic, moderate, and high investment descriptions are point of reference in a wide range of investment possible at stations. It should be noted that some elements once included at one station should be implemented across all station such as “next bus” display technology. Mostly, the level of investment at stations should be consistent along a corridor with variations for higher demand stations where additional investment to accommodate that demand may be necessary—for example, downtown Fresno or Cedar Ave near the University Medical Center campus.

Basic stations—provide a minimum range of amenities that includes a substantial BRT shelter and BRT signage, plus essential station elements such as new paving, trash and recycling receptacles, way-finding signage, landscaping, and ticket vending machines (assuming off-board fare collection). Basic stations are recommended for stations integrated into existing sidewalks without a popout.

Moderate stations—provide a broad range of amenities and station elements, including a substantial BRT shelter and BRT signage, upgraded paving, trash and recycling receptacles, real-time traveler information system, way-finding signage, landscaping, additional seating and lighting outside of the shelter, and ticket vending machines. Moderate stations may include an additional shelter unit for larger passenger volumes. Moderate stations are recommended at locations where popouts are used and for stations located along segments of BRT dedicated lanes or where passenger volumes exceed the capacity of basic stations.

High investment stations—provide the highest level of amenities and station elements specifically targeted to locations with the highest ridership and are highly visible (such as Downtown Fresno). Amenities and elements include BRT shelter (possibly two units), BRT signage, and a full range of elements in addition to those provided at moderate stations, including additional landscaping, special paving, an information kiosk, and decorative features. High investment stations are recommended for the Downtown Fresno station and for stations along median running BRT segment. High investment stations should be able to accommodate over 15 people per vehicle arrival

5.4 Corridor Improvement Concepts

The Ventura Avenue/Kings Canyon Road BRT corridor improvement concepts encompass convenient and passenger friendly transit services by improving transit facilities such as BRT stations and providing preferential treatment to transit along the corridor. Travel time is the key to a successful BRT service attracting patronage as well as helping FAX utilize their resources more efficiently. To achieve a reduction in travel time for BRT patrons along the corridor, several strategies can be employed, including:

- Traffic signal coordination
- Queue jumper lanes
- Transit signal priority or preemption
- Far-side bus stop locations (preferred) or near-side locations with countdown clocks
- Dedicated transit-only lanes

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

- Off-vehicle fare collection
- Level boarding and/or low floor BRT vehicles

The first five improvement categories listed above help to reduce or even eliminate delays to transit movement associated with traffic congestion. In addition to improving the overall speed of the BRT vehicle, these measures also help eliminate variability in the travel time, resulting in more reliable service. The last two items reduce the required dwell time within stations. Savings of up to 30 seconds per station stop can be realized, resulting in an overall travel time reduction of several minutes along an entire BRT alignment.

An additional benefit of these corridor improvements results from the overall “branding” effect achieved by the combination of several measures. One obstacle to increasing “choice” ridership beyond the transit-dependent population is the fact that many potential riders are unfamiliar with the system, and unaware of what services may exist that could meet their needs. Highly visible BRT facilities create a higher degree of public awareness as to where the bus routes are located and what destinations they serve. The branding of the system also contributes to a perception of higher-quality service that can be attractive to customers who currently assume the existing bus service is too slow or unreliable to meet their needs.

Traffic Signal Coordination

Traffic signal coordination is an important measure for reduction of transit travel times and improvement of travel time reliability. It also improves the overall flow of general traffic, resulting in high community acceptance and environmental benefits including air quality, noise, safety and traffic congestion. This measure has an excellent cost-benefit ratio and virtually no negative impacts on the community.

A system of traffic signal coordination typically consists of a physical connection between traffic signal controllers (conduits with wires or fiber optic cables) along the entire coordinated segment. Traffic signal timing is then designed such that vehicles moving in the peak direction at near the speed limit receive a nearly-continuous sequence of green lights. Ideally, the timing sequence is planned so as to also minimize delays in the off-peak direction to the extent possible.

Often one of the chief obstacles to creating coordinated signal corridors is the need to obtain cooperation from multiple jurisdictions. Where BRT lines cross city limits, a regional agreement or operating authority may be needed to take control of the signal timing and maintenance of the system. For corridors that intersect Caltrans facilities, additional coordination is required if the Caltrans signals are to be integrated into the regional system.

Queue Jumper Signals and Lanes

Queue jumper lanes are a corridor improvement element with potential to reduce running times along the corridor and improve schedule adherence. This improvement measure allows for BRT vehicles to bypass the traffic queue at the intersection and move up to the stop line. An advance signal lasting a few seconds allows buses in these lanes to move through the intersection ahead of the adjacent traffic lanes.

There are two common forms of queue jumper lanes: 1) a transit only lane between the through lanes and the right turn only lane; and 2) a shared right turn only lane with BRT vehicles exempted. The former provides BRT vehicles with an exclusive lane leading up to the stop line at the intersection. The presence of a BRT vehicle within the lane activates a transit only signal to proceed through the intersection ahead of other traffic. This type of queue jumper may require increasing the right-of-way at the intersection to accommodate the additional lane for the BRT

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

vehicle. Since a separate lane is provided for the BRT vehicle, the system can use conventional detector loops to alert the signal to the presence of a bus. The second form, or the shared queue jumper lane, provides a right turn signal phase to clear the queue in the lane when a BRT vehicle is detected, and allows BRT vehicles to use the right turn lane to avoid the traffic queue and obtain a transit only signal to pass through the intersection. This alternative requires some form of signaling device such as an optical transmitter to alert the signal to the presence of a bus (see further discussion below under Transit Signal Priority). This second type of queue jumper is often less costly (due to reduced right-of-way requirements) but also somewhat less effective since the BRT vehicle still must wait behind vehicles making a right turn.

Queue jumper lanes are also a very effective marketing and branding tool due to their physical presence at the intersection—more so when BRT vehicles are seen using the lane to bypass the traffic congestion. This serves to reinforce public awareness of the BRT route location as well as enhancing public perception of the BRT system as a rapid form of transportation.

Transit Signal Priority or Pre-emption

Transit Signal Priority (TSP) is technique that reduces travel delays for transit vehicles due to red signals. The most common form of TSP, known as “green time extension,” consists of traffic signal modifications which allow the signal controller to recognize the presence of an approaching bus. If the signal is currently green but about to turn red, the controller adds a few seconds of extra green time to allow the bus just enough time to move through the intersection. There are a number of variations of this concept, including shortening the red time when a bus is already stopped at a signal. In headway based systems, another variation involves controllers capable of determining whether the approaching bus is running on time or late, and giving the TSP advantage only to late-running buses.

The highest level of transit priority would be full pre-emption, in which the signal would automatically turn green for all approaching buses. In practice this is seldom used due to the severe impact on other traffic, as well as issues with pedestrians who may be in the middle of a crossing.

Several forms of technology can be utilized in TSP systems to allow the controllers to detect approaching buses, but the most common type is optical strobe systems such as the Opticom system. Traffic signal systems along the corridor must have appropriate detector hardware and controller firmware to be able to recognize and respond to the approaching transit vehicle, and for older systems this usually requires an upgrade of the existing equipment. In addition, if similar optical systems are already in use in the area for emergency vehicle pre-emption, then all signals within line-of-sight of the transit line must be upgraded to allow them to distinguish transit vehicles. This system also requires all BRT vehicles to be outfitted with emitters.

Far-side Bus Stop Locations or Near-side Locations with Countdown Clocks

To maximize travel speeds, the preferred location for BRT stations is on the “far side” of intersections; in other words, allowing the bus to stop after passing through the intersection rather than before. This allows the BRT vehicle to take advantage of coordinated green signals and TSP as described above before making a stop. By comparison, at near-side stations a bus may stop to load passengers while the signal is green, only to have the signal turn red just as the bus would have been ready to move. An additional disadvantage of near-side stations is potential conflicts with right-turning vehicles which must turn directly in front of the stopped bus.

In spite of the preference for far-side stations, there are some locations at which local conditions dictate a near-side stop. Examples include locations where there is a major traffic generator on the

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Council of Fresno County Governments (COFCG)

near-side corner (such as the University Medical Center at Cedar Avenue and Ventura Avenue), or where right-of-way conditions or obstructions make it impractical to locate the station on the far side. In these cases, the use of a countdown clock is recommended. This is a digital display showing the number of seconds remaining in the red signal. This allows the driver to prepare for immediate departure and to move forward to the stop line. In many locations, this function can be served by countdown-style pedestrian walk signals.

Dedicated Transit-only Lanes

Dedicated transit-only lanes provide the highest degree of priority to BRT vehicles, with a correspondingly higher cost. There are three major categories of transit-only lanes:

- Median-running transit lanes, see **Figure 5.11**
- Side-running transit lanes (along the right side of arterial streets), see **Figure 5.12**
- Grade-separated transit lanes

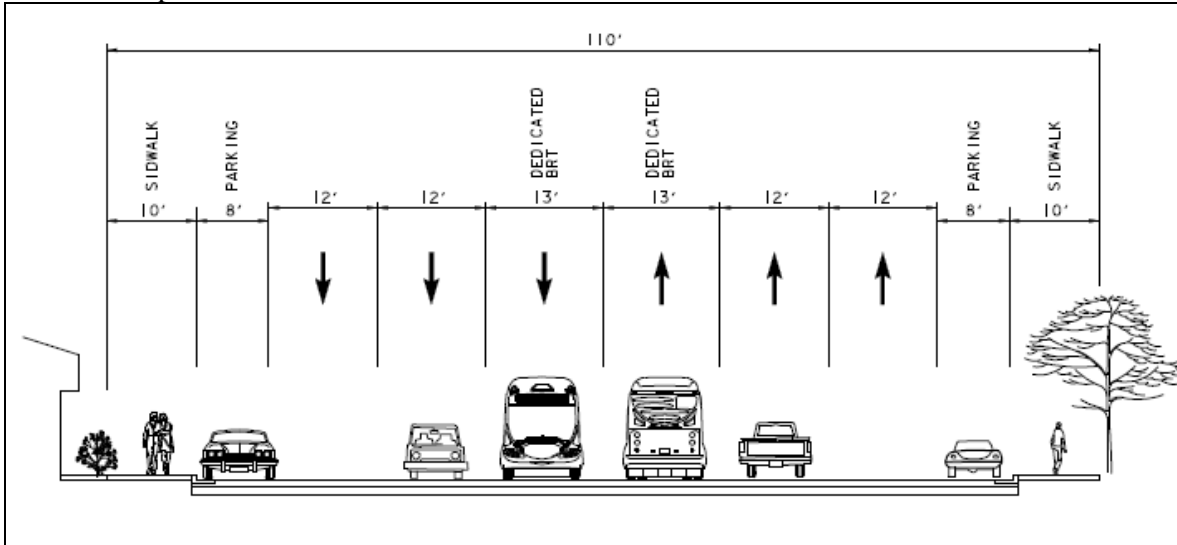


Figure 5.11 –Median Running Transit Lanes Typical Section

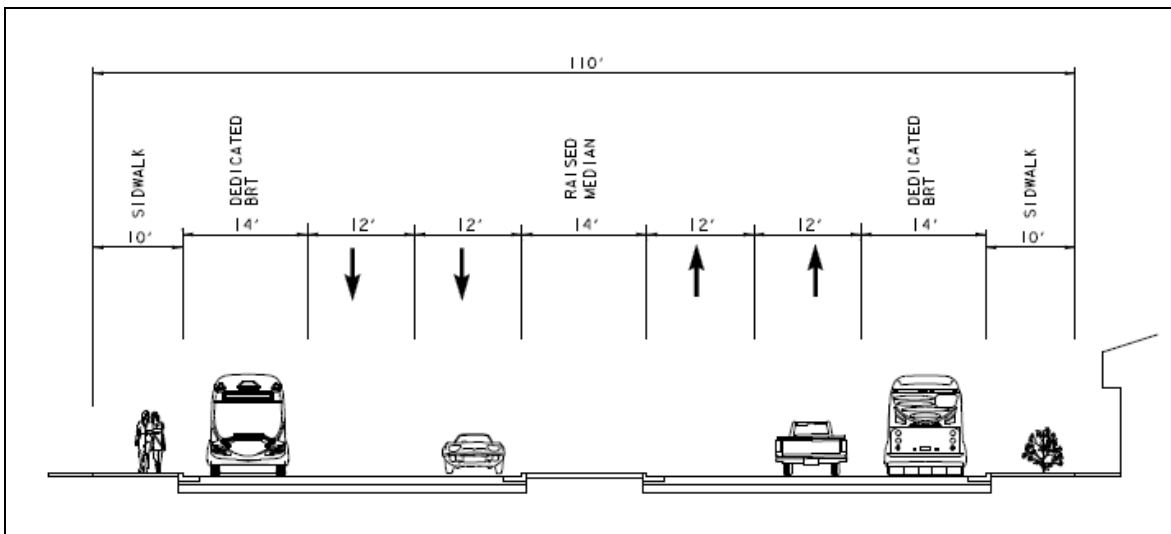


Figure 5.12 – Side Running Transit Lanes Typical Section

Each of these concepts has advantages and disadvantages, and each segment must be assessed individually to select the most advantageous option. The advantages and disadvantages of the median and side-running lanes are summarized in Table 5.1.

Table 5.1: Transit Only Lane Advantages and Disadvantages

Advantages

Disadvantages

Side Running Transit Lanes

- | | |
|--|--|
| <ul style="list-style-type: none">▪ Easier to co-locate BRT stations with local bus stops, since local buses already use the right lane. Transfers are facilitated.▪ Allows use of standard vehicles with right-side boarding.▪ Stations are located outside the traveled way; patrons may feel safer waiting at the side of the road near pedestrians and businesses, rather than in the center of the road.▪ Lane is shared with local bus services | <ul style="list-style-type: none">▪ On-street parking, if it remains, will partially conflict with bus movements.▪ BRT lane is interrupted by right-turning vehicles at intersections.▪ Requires two separate stations at each stop (one for each direction) and therefore greater infrastructure cost than median stations. |
|--|--|

Median Transit Lanes

- | | |
|---|---|
| <ul style="list-style-type: none">▪ More efficient use of space at stations, since buses can board from both sides of a single center platform.▪ Eliminates conflicts with right turns, parking maneuvers, and bicycles. Easier to implement completely dedicated transit lanes, as opposed to shared lanes with general traffic.▪ Because a single station serves both directions of travel, station costs are lower for both initial construction and ongoing maintenance.▪ May be more acceptable to the business community, since stations are not located in front of businesses. | <ul style="list-style-type: none">▪ Requires contra-flow configuration with buses traveling on the left side of the centerline, unless specialized left-boarding vehicles are used.▪ Depending on available space, may require reduction or elimination of landscaped medians.▪ Requires all patrons to make a street crossing to reach the station or to connect from local buses▪ Typically, the existing median width is already being used for left-turn pockets. The median transit lane would either remove the left-turn lane or relocate it. Removal of the left-turn lane would cause backups and safety concerns in the through lane. Relocation of left-turn lanes may require elimination of an additional through lane. Left turns across a transit lane can cause line-of-sight difficulties and safety issues. Some left-turn lanes may need to be closed, which would concentrate access at fewer intersections. |
|---|---|

Grade separated transit guideways are by far the most costly type of transit-only lane, and are normally only employed in isolated locations where a significant travel time savings can be gained. Additional considerations, where stations are to be elevated or below grade, include pedestrian

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

access, emergency egress, and security, since the stations lack the direct access and visibility associated with street-side stations.

Off-vehicle fare collection

In addition to physical improvements along the corridor, running time can also be improved through incorporation of systems to reduce vehicle dwell time at stations. An example of this is off-vehicle fare collection, in which the on-vehicle farebox is eliminated and replaced with one or more measures for collecting pre-paid fares. The travel time savings result from the faster boarding that occurs by eliminating on-board fare payment at the entry door. The exact time savings vary depending on passenger volumes and the specific methods used, but savings on the order of 15 to 30 seconds per stop could be anticipated.

Several methods can be used to accomplish off-vehicle fare collection:

- Standard monthly passes are a form of off-vehicle fare collection. They require no new investment since the distribution network already exists.
- Ticket vending machines (TVMs) at the BRT stations allow patrons to purchase a ticket before boarding. An advantage of this system is that it allows the use of credit or debit cards, eliminating the barrier to ridership that results from the requirement for customers to have exact change. This can be highly attractive to “choice” riders. The cost of installing TVMs is significant (on the order of \$50,000 per machine). In addition, a communications system is required, including a central processing center and either a fiber-optic or wireless link to each station, to transmit payment data. This system also requires additional operating costs due to the need to service the machines and collect cash. These costs can be partially offset by increased ridership and ticket sales. The availability of TVMs also adds to the image of the BRT system as a “rail-like” form of transit.
- Another method is the use of “smart cards”, which are proximity cards containing embedded computer chips for processing fare information. These cards can be sold at retail distribution locations, through mail order, or via TVMs. In a BRT application, the vehicle typically would have a validation device near the entry (or entries), allowing passengers to simply tap their card on the reader without stopping as they walk onto the vehicle. The decision to implement a smart card system is a significant investment with benefits and costs affecting the entire transit network; it would not be implemented solely for a single BRT line.

All of the above off-vehicle fare collection methods involve a decision by the agency regarding whether or not multiple door entry is desired. Using all available doors for entry provides the fastest boarding time by allowing passengers to disperse themselves to multiple entry points rather than forming a single queue at the front door. However, this usually requires roving inspectors to check for fare compliance, which adds to operating costs. The alternative is to require all passengers to enter through the front door, which allows the driver to check for fare compliance but with a penalty of somewhat longer boarding times.

Level Boarding and/or Low Floor Buses

The use of level boarding and/or low-floor buses can also reduce station boarding time by about 20% compared to standard high-floor vehicles, and in addition is a required project feature for any system wishing to utilize FTA Small Starts or Very Small Starts funding. Level boarding usually involves constructing new curbs at the station site that are somewhat higher than standard curbs (from 8 to 14 inches is typical) so that the elevation of the boarding platform is nearly level with the floor of the entry door on the vehicle. This facilitates entry by able bodied passengers but wheelchair users may still require a ramp to be extended to the platform. Use of a lift is usually not

necessary in a level-boarding configuration since the elevation difference is small. Most contemporary buses that do not have stairs at their entries could be classified as “low floor” buses.

Other features can be incorporated in vehicles or stations to further improve the walking surface at entry doors. These include magnetic, optical or mechanical guidance systems to maneuver the vehicle as close as possible to the curb. These measures add additional cost to the system, but the most sophisticated installations may achieve ADA-compatible entries without the use of ramps.

5.5 BRT Vehicles

BRT vehicles can be a very important element in increasing ridership, system performance, and mitigating environmental impacts. Propulsion systems impact revenue, service times, emissions, and operating and maintenance costs. Seating arrangements, floor height, and door configuration impact dwell time at stations, BRT travel time, and passenger comfort. Physical vehicle size; aisle width; and number, width, and arrangement of doors influence BRT system capacity. Also, as mentioned in Chapter 3, BRT vehicles can be the primary marketing device in attracting the “choice” rider in Fresno.

Because BRT vehicles are “rubber-tire” technology, the BRT system has some flexibility as to the type of vehicles that are used throughout the system. For example, peak hour conditions may require articulated buses similar to the NABI 60' BRT Vehicle (see **Figure 5.13** – NABI 60' BRT Vehicle with FAX branding) which can carry more passengers than the standard 40' bus. However, the off-peak service may be better served with a 40' bus when the demand is not as great.



Figure 5.13: NABI 60' BRT Vehicle with FAX Branding (Provided by NABI USA)

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

The Ventura Avenue/Kings Canyon Road Corridor can be a prime example as to how incremental increases in service frequency and vehicles can better serve a community. For example, the corridor is currently contributing to Route 28's 8,000 daily passengers with 15 minutes headways and 40' standard buses. Potentially, upon implementation of the BRT corridor, the demand can be served with 40' BRT vehicles. As the demand continues to increase, the BRT corridor can be increased to every 10 minutes with 40' BRT vehicles or at 15 minutes 60' articulated vehicles. The first provides marginal increase in capital and operating costs since more vehicles—and drivers—would be necessary to serve the higher frequency. However, the later involves substantial capital costs with limited increases in operating costs since the number of drivers is constant.

For the Ventura Avenue/Kings Canyon Road Corridor implementation, it is recommended that Fresno design as much operating flexibility as possible upon initial implementation of a BRT system. The 60' articulated BRT vehicle at the frequency for Route 28—at the time of implementation—is suggested. The 60' articulated BRT vehicles have shown their appeal to many Fresno residents. They are an icon on the road that would not be overlooked, and would provide FAX operating flexibility from the beginning of BRT operations.

5.6 Probable Operating and Capital Costs

Based on the above recommendations on corridor and station improvements, estimates of probable costs were developed for the Ventura Avenue/Kings Canyon Road Corridor.

5.6.1 Operating Cost Estimates

For weekday service it assumed that the BRT service will follow the FTA funding guidelines of 10 minutes headways in the peak hours and 15 minutes in the off-peak. Weekend service is assumed will be every 15 minutes all day. This level of operating service is assumed to be a high level of service that may not be necessary at the commencement of BRT service but can be considered an operating goal in the short term (i.e. within 3-5 years). Frequencies and time periods are assumed as follows:

Weekdays

- Every 10 minutes from 6:30 AM to 9:30 AM and 4:00 PM to 8:30 PM
- Every 15 minutes from 9:30 AM to 4:00 PM and 8:30 PM to 10:30 PM

Weekends

- Every 15 minutes from 6:00 AM to 10:00 PM

Assuming an overall cycle time for a Fancher Creek to Downtown Fresno BRT line of 50 minutes³, the BRT corridor would require approximately 75 trips on weekdays and 50 trips on weekends. This level of operating service translates to approximately 21, 100 annual operating hours. Assuming a high estimate for fully allocated operating cost of \$90 per hour, the annual operating cost for the 7-mile, 7-station BRT corridor is expected to be approximately \$1,900,000.

5.6.2 Capital Costs Estimates

Capital costs have been broken into three levels of investment that are similar to the running way and station descriptions given in earlier sections of Chapter 5—with vehicles procurement as a

³ Using a conservative estimate of 20 minutes of one-way travel for a 7-mile trip (average speed of approx. 20 mph over the corridor) with an addition of 10 minute recovery time at the end of the cycle.

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

separate capital cost since it remains constant across the three levels of investment. Using general cost estimates for BRT elements from the Federal Transit Administration and other Kimley-Horn BRT projects across California, the following are station and corridor improvement cost estimates for the three levels of investment and the anticipated capital cost for procuring BRT vehicles.

Corridor Improvement Estimates

Transit Signal Priority (Cost per signalized intersection) – Implementation of TSP can cost approximately \$25,000 per intersection which includes the detection equipment and modifications to the traffic controllers.

Side Running Dedicated Lanes (Cost per corridor-mile) – Implementation of side running dedicated lanes has varying costs on different portions of the Ventura Avenue/Kings Canyon Road Corridor. In the segment of the corridor where the right-of-way is wider and includes on-street parking, side running dedicated lanes can be created by removing the parking and re-striping the road—i.e. no right-of-way increases for the BRT. This cost for dedicated lanes for striping a dedicated lane without colored asphalt is approximately \$300,000 per mile. The addition of a colored asphalt overlay would increase the total per mile cost of dedicated lanes to approximately \$500,000 per mile. The typical section for side running dedicated lanes is shown in **Figure 5.11**.

Median Running Dedicated Lanes (Cost per corridor-mile) – Implementation of median running dedicated lanes results in substantial increases in costs mostly due to reconstructing the road and the addition of stations within the roadway. The cost range for median running lanes—including the footprint for stations—can range between \$3 million per mile to \$10 million per mile not including increases in right-of-way. For Ventura Avenue east of Winery Ave where the right-of-way is wider than portions to the east, assuming that median running dedicated lanes are the appropriate running ways, the right-of-way increase would be approximately 12' feet between stations and 22' feet at stations. This could cost between \$15 million and \$20 million per mile because the increase may require acquisition of the street fronting properties. The typical section for median running dedicated lanes is shown in **Figure 5.12**.

BRT Station Cost Estimates

Based on the station descriptions above, Tables 5.2 summarizes the approximate cost for a BRT station with typical elements of a BRT system (a station is defined to cover the BRT station facilities in both directions of operation). Other items were included in the cost estimate as follows:

- **Demolition** – This line item includes removing pavement/sidewalk, curb-and-gutter, existing striping or street markings, signage at station location, and landscaping in order to provide physical improvements to accommodate the BRT stations and their amenities. For example, the existing curb may be only 6" in height while a BRT station would need elevated curb in order to provide level boarding.
- **Utilities & Drainage Modifications** – This line item is intended to quantify the modifications to storm drain systems, utility pipes or structures, and electrical services. These costs are site specific and can vary greatly depending on the design of the BRT facilities and the existing conditions.
- **Street Improvements** – These improvements encompass curb and gutter, pavement, and landscaping (two trees per station, one on each side).
- **Sidewalk / Pedestrian Improvements** – BRT stations will likely require improvements to pedestrian facilities such as sidewalks, curb ramps, and cross-walks to provide a higher quality pedestrian environment to BRT patrons and the community surrounding the station.
- **Traffic Control** – Cost estimation item to account for impacts to traffic during construction.

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

- Communications and Electrical Service – Accounts for the provision of communication and electrical service to the station shelters for ticket vending machines, lighting, and the next bus signage.

Elements can be reduced—and consequently the cost—or removed based on the goals of the BRT system.

Table 5.2: BRT Station Cost Elements

BRT Station Cost Elements	Qty		Approx. Unit Cost	Element Cost
BRT shelters	2	EA	\$120,000	\$240,000
PCC pavement at BRT stop	1,200	SF	\$12	\$14,400
Station lighting (lump sum per station)	2	EA	\$8,000	\$16,000
Station paving	2,000	SF	\$13	\$26,000
Detectable Warning Strip	320	SF	\$30	\$9,600
Concrete pad for local bus stop (inc. AC removal)	2	EA	\$10,000	\$20,000
Smart card readers	2	EA	\$5,000	\$10,000
Ticket vending machines	2	EA	\$65,000	\$130,000
Bike Rack	2	EA	\$500	\$1,000
Trash Receptacles	2	EA	\$400	\$800
Next-bus signage and electronic equipment	2	EA	\$3,000	\$6,000
Photovoltaic system	2	LS	\$10,000	\$20,000
Communications cabinet	1	EA	\$10,000	\$10,000
Kiosk - Community Information	2	EA	\$35,000	\$70,000
Variable message signs	4	EA	\$4,500	\$18,000
Demolition	1	LS	\$40,000	\$40,000
Utilities & Drainage Modifications	1	LS	\$30,000 - \$100,000	\$30,000 - \$100,000
Street Improvements	1	LS	\$30,000	\$30,000
Traffic Signal Modifications	1	LS	\$100,000	\$100,000
Sidewalk / Pedestrian Improvements	1	LS	\$10,000- \$25,000	\$10,000- \$25,000
Traffic Control	1	LS	\$50,000	\$50,000
Communications and Electrical Service	1	LS	\$60,000	\$60,000
Subtotal				~\$900,000- \$1,000,000

Corridor improvements are elements proposed across the entire corridor such as a traffic signal interconnect, installation of opticom hardware and software, or restriping/construction of transit only lanes along portions of the corridor—not proposed as part of Ventura Avenue/Kings Canyon Road Corridor.

Table 5.3: BRT Corridor Improvement Cost Elements

Corridor Improvement Cost Elements	Qty		Approx. Unit Cost	Element Cost
Traffic Signal Coordination	1	LS	\$120,000	\$240,000
Opticom Sensors and Controllers	23	EA	\$25,000	\$600,000
Subtotal				~\$900,000

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

BRT Vehicle Costs

Assuming the operating service levels will be as described in the previous sections, the peak hour vehicle requirement would be five BRT vehicles. Adding two buses for spares brings the total anticipated BRT fleet requirement to seven BRT vehicles. The following table shows the cost of acquiring either 40' or articulated 60' BRT vehicles.

Table 5.4: BRT Vehicle Costs

BRT Vehicle	Qty		Approx. Cost	Total Vehicle Cost
60' Articulated BRT Vehicles	7	EA	\$1,000,000	~\$7,000,000
40' BRT Vehicles	7	EA	\$500,000	~\$3,500,000

5.6.3 Probable Cost for Proposed Ventura Avenue /Kings Canyon Road Corridor

Based on the recommendations above for both station and corridor improvements, the following estimates are aggregated to determine the “order of magnitude” costs for initial implementation of BRT on Ventura Avenue/Kings Canyon Road corridor.

Table 5.5: Preliminary Costs for Proposed Stations

STATION	Probable Cost
Fancher Creek Commercial Center Station	\$ 900,000
Fancher Creek Town Center Station	\$ 900,000
Clovis Ave Station	\$ 900,000
Peach Ave Station	\$1,000,000
Winery Ave Station	\$ 900,000
Cedar Ave Station	\$1,000,000
1 st Street Station	\$ 900,000
Downtown Fresno Station	\$1,000,000
Probable Station Cost Estimate	~\$7,500,000

Table 5.6: Preliminary Corridor Improvement Costs

CORRIDOR	Recommended Investment – Long Term 5+ years	Distance /Intersections	Probable Cost
Fancher Creek Interior	Dedicated Lane (One-way)	1 mile	\$1,000,000
Kings Canyon Rd between Fowler Ave and Winery Ave	4 Queue Jumper Lanes @ Approx. \$100,000	4 intersections	\$ 400,000
Traffic Signal Upgrade for TSP	23 Intersections		\$ 600,000
Probable Corridor Cost Estimate			~\$2,000,000

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

Table 5.7: Preliminary

VENTURA / KINGS CANYON BRT PROJECT with Dedicated Lanes on Ventura Ave between 1st St & SR-41	Probable Cost
Stations	\$7,500,000
Corridor Improvements	\$2,000,000
Central Control (AVL, Fare Collection and Next Bus)	\$2,000,000
<i>Subtotal Construction plus 25% Contingency</i>	<i>\$14,375,000</i>
Environmental Documentation and Design	\$2,875,000
Right of way acquisition inc. prof. fees (assumed value)	\$2,000,000
Final Design @ 12% of Construction inc. contingency	\$1,725,000
Plan Check Fees @ 2% of Construction inc. contingency	\$287,500
Construction Management @ 12% of Construction inc. contingency	\$1,725,000
Administration @ 10% of Construction, Contingency, Engr. & CM	\$2,070,000
Probable BRT Implementation Cost Estimate w/o Vehicles	~\$25,000,000
Probable BRT Implementation Cost Estimate w/ Vehicles	~\$32,000,000

5.8 Next Steps for BRT Implementation

The Kimley-Horn team has been working with the Technical Advisory Committee (TAC) to receive input on the project issues and to develop guidelines for the BRT Master Plan and the initial implementation plan for Ventura Avenue/Kings Canyon Road Corridor. In addition, the team organized a community open house which was held on June 27, 2007.

The following are next steps recommended to implement a BRT corridor within the next three to five years:

1. *Update Regional Transportation Plan:* Begin process to update the Regional Transportation Plan (RTP) for COFCG to include the Ventura Avenue/Kings Canyon Road Corridor, Blackstone Ave Corridor, Cedar Ave, and Shaw Ave Corridor for BRT implementation over the next 3-10 years. These corridors have demonstrated substantial ridership and are the corridors with the largest potential for success in both the short- and long-term. Additional corridors defined in Chapter 4 can be added by COFCG and FAX to the RTP after the implementation and evaluation of the first corridor implementation.
2. *Initial Contact with FTA:* Section 6.3 below describes the federal funding programs that may be available to provide capital development funds for one or more BRT lines. In order to retain eligibility and improve the region's prospects for such funding, it is desirable to begin discussions with FTA staff early in the project development process. FTA staff members can often provide helpful guidance on the most recent FTA policies and guidelines which can help local agencies avoid delays or unnecessary issues in the subsequent grant application process.
3. *Perform Alternatives Analysis and Initial Environmental Assessment:* Assuming that FTA funding is desired, it is essential that the early phases of implementation be carried out in accordance with FTA policy. Several volumes of guidance have been issued and recently updated by FTA providing complete current information about these policies. Because these documents are revised frequently, it is advisable to maintain regular communications with FTA staff members to ensure the most current approach is being followed. In general, however, it is important to note that the Alternatives Assessment process must be carried out in strict conformance with FTA guidelines, which are coordinated with NEPA

requirements. A key point is that the development of project alternatives must not proceed prematurely to such a level of completion that it could be seen as prejudicing the comparison of project alternatives under NEPA. However, initial environmental assessments should be performed early in the process since the initial application for FTA funding must contain information about the project's impacts and an assessment of the appropriate environmental approval document. Also, the ridership estimation as part of the alternatives analysis may require significant repairs and updating to the COFCG transportation demand model.

4. *Public Outreach:* A project that can demonstrate a strong level of public support will have a higher probability of achieving FTA funding. Therefore, some level of public involvement in the planning process can be helpful. A public workshop to introduce the completed BRT Master Plan would be an example of an appropriate step. Another necessary step is to obtain evidence of official approval of the decision to move forward with the selected BRT line as the first stage of system implementation. This could be in the form of an ordinance enacted by the Board of COFCG approving the Master Plan and identifying a specific corridor for initial implementation.
5. *Develop Funding Plan:* At the conceptual development stage, an initial operating plan should be prepared. The plan should identify capital and operating costs, service levels, and any system adjustments or cost saving opportunities that would arise from project development. The application for FTA funding will need to include complete cost breakdowns using FTA's Standard Cost Categories as well as sufficient evidence that the agency has adequately accounted for project costs and has sufficient resources to construct and operate the system. Three years of audited financial statements will be required to accompany the application.
6. *Prepare Application for Small Starts or Very Small Starts Funding:* The application consists of a set of documents providing required information to FTA to begin the process of seeking grant funding. The application process also allows the project to be "rated" (i.e., given a priority ranking by FTA) and entered into the "pipeline" of projects awaiting FTA approval to enter Project Development (PD). FTA considers "preliminary engineering" to be a component of Project Development, and therefore it is important to limit design activities to the very conceptual level prior to obtaining permission to enter PD. After receiving this permission, subsequent PD and design activities may be partially cost-reimbursable.
7. *Environmental Documents and Design:* The appropriate environmental process varies depending on the extent of impacts. Transit projects in California would in most cases require both NEPA and CEQA documentation, assuming that federal funding is used. Some BRT projects have been allowed to use the less-rigorous forms of environmental documentation under NEPA/CEQA, such as EA/MND. Some projects have been granted Categorical Exclusion status. Preliminary engineering and final design should proceed only after approval has been granted by FTA.
8. *Branding and Marketing:* In general, these efforts occur later in the development process. During the Project Development process, public relations activities and public involvement can be used to build public support, enthusiasm, and overall awareness of the system.

Chapter 6 – Funding Mechanisms for Implementing BRT

Identifying funding mechanisms to support the proposed capital and operating costs associated with the BRT system is a critical component needed prior to implementation. Capital expenses associated with the project will be the near-term focus and operating costs will then need to be identified to help support the service once it is operating. Generally speaking, more opportunities exist for funding the capital projects and improvements while operating costs are more difficult to secure and maintain.

Capital costs for FAX and other transit agencies typically include cost of obtaining and maintain the fleet and passenger facilities. FAX's capital improvement program for FY06 through FY10 is estimated to cost \$22.5 million and focuses on the following projects:

- Replacement, expansion, and retrofit of fleet (40' buses)
- Replacement of Handy Ride and non-revenue vehicles
- New multimodal facility
- Passenger amenities and facility upgrades
- Various planning projects

Based on the 2005-2010 SRTP estimates for operating costs, FAX's primary costs in FY07 will be generated by employee services (62%) and operations, maintenance, and training (16%) associated with its fixed route operations. In 2004, Handy Ride operations accounted for 11.5% of the District's operating costs, a percentage that has been on the rise since it became part of the Transit Division's farebox calculation in 1980. As opposed to the FAX system, nearly 90% of the operating costs associated with the Handy Ride system come from operations, maintenance, and training and only 5% are attributed to employee services.

In FY07, revenues to fund these operating costs are anticipated to be generated primarily through passenger fares, federal funding, and state funding sources. **Figure 6.1** shows an anticipated breakdown of these sources for FY07.

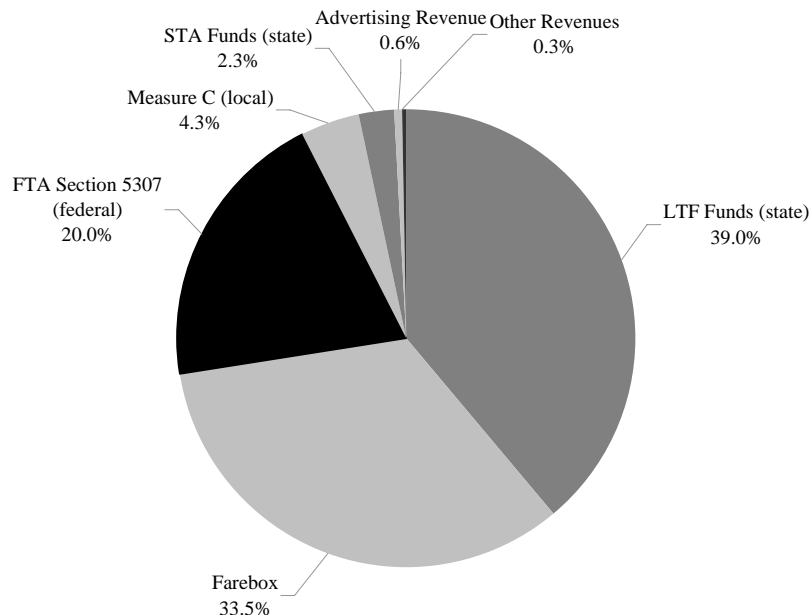


Figure 6.1: FAX's Operating Revenue Breakdown (FAX 2005-10 SRTP - Estimated FY07)

It is likely that FAX will need to look beyond the traditional sources of federal and state grants and fare revenues to support additional services proposed as part of the BRT project. The following is a summary of potential funding sources that have been used by various agencies to generate new revenue streams to fund both capital and operational costs for increasing or improving transit service. Examples of each funding source are provided where applicable.

6.1 Local Funding Options

A number of local funding options exist to generate revenues for transit. For a number of these funding sources there is competition with other forms of transportation for the dollars, so the total funding levels available to transit are dependent on political support from policy makers. Six different local financing sources are listed below and summarized in Table 6.1.

Sales Tax Measures

Taxes are one of the most common financing mechanisms used by municipalities to build and maintain public infrastructure. This is typically done through a municipal, regional, or county sales tax measure. Many counties across the country including Fresno, San Francisco, San Diego, and Santa Clara in California use a portion of their sales tax revenues to fund local transit capital costs. Measure A in Marin County is an example of sales tax dollars also being used for funding the planning, operating, marketing, and maintenance of the local fixed route bus services.

Measure C is a half cent sales tax increase that is used to fund transportation improvements in Fresno County, including capital and operating expenditures for transit. Nearly 14% of the total \$1.7 billion generated over the next 20 years will be allocated to FAX to improve bus service. In FY07, revenues from Measure C are anticipated to account for 4.3% of FAX's total operating budget.

Tax Increment Financing

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

Tax increment financing (TIF) is a tool that uses future gains in taxes to finance the necessary improvements needed to create those tax gains. This is often achieved when public projects (schools, roads) are built which subsequently increase the value of surrounding real estate. This increase in property value generates increased tax revenues.

In California, TIF must be done within a redevelopment district. Fresno current has 19 redevelopment project areas where this funding strategy could be used. These areas include a significant portion of the Blackstone corridor running north from Highway 99, the Highway 99/UPRR corridor, the Central Business District in Downtown, and along Kings Canyon Road (east of Downtown).

Although TIF is more commonly used for public works projects such as roads, sidewalks, and sewers, it has also been used for transit. Major capital improvement projects including significant portions of the Dearborn Subway and Randolph/Washington Station in Chicago and elements of the Central City Streetcar in Portland have used this mechanism for generating financing.

Benefit Districts

Benefit Districts have been established throughout the state of California as a tool to generate revenues for improving downtowns or specific business districts. Benefit Districts differ from Business Improvement Districts in that Benefit Districts do not tax the property owners; rather they increase use fees to generate revenues. The best examples of Benefit Districts are Parking Benefit Districts that place additional charges on parking to generate revenues to be used to fund improvements in the District. Many cities in California have Parking Benefit Districts including Pasadena, San Luis Obispo, and Redwood City. The City of Ventura has recently adopted a Commercial Parking Benefit District that will use dedicated parking revenues from its downtown district to fund improvements in the District including transit infrastructure.

Transit Impact Fees

A transit impact fee program is designed based on the same principles as a traffic impact fee. Both are developed to provide funding for incremental costs of providing transportation to new development.

San Francisco has a transit impact fee program that was established in May of 1981. This fee applies only to new development located in the greater downtown area. The transit impact fee was intended to recover the capital and operating costs of increased peak-period transit service associated with new office construction in downtown San Francisco. The law says:

The demand for public transit service from downtown area office uses imposes a unique burden on the Municipal Railway, qualitatively different than the burden imposed by other uses of property in San Francisco. The need for that level of service provided by the Municipal Railway during peak-periods can be attributed in substantial part to office uses of property in the downtown area.

The Transit Impact Development Fee attempts to recover the cost of carrying additional employees into downtown via public transit, capturing fees on office development on a square foot basis at the time the development is occupied. The fee is intended to capture “all costs incurred by the Municipal Railway in meeting peak-period public transit service demands created by office uses in each new development subject to the fee, including the expansion of service capacity through the purchase of new rolling stock, the installation of new lines, the addition of existing lines and the long term operation, maintenance, repair and replacement of those expanded facilities.”

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

Impact fees, sales tax measures, and TIF are good funding sources for transit-related capital projects but often the operating cost of new service is the true challenge for the agency. Two types of taxing measures including County Service Areas and a Transit Concurrency System have been used by jurisdictions and transit agencies to provide a continuous stream of funds that can be used to cover the incremental operational costs of funding new service.

County Service Area

A County Service Area is typically established to provide funding for basic services (water, sewer, police, fire protection, etc.) to an unincorporated area. Often, adequate levels of basic services are difficult to provide to areas that are geographically diverse. Through the establishment of a County Service Area, residents who live in these rural areas and want a higher level of these services can choose to pay (through taxation) to get these services.

County Service Areas are established through an initial petition of registered voters or by adoption of a resolution at the county level. They have also been established as a condition of approval for new developments in unincorporated areas. The majority of residents or land owners in these areas must then vote in favor of the taxation for its approval.

A County Service Area for transit funding was recently established in Contra Costa County as a condition of approval on the Intervening/Alamo Creek residential development project. The project is expected to add over 1,000 single family and 220 multi-family units to 609 acres just east of Danville and San Ramon. As a condition of approval, the County required the establishment of "County Service Area T-1 (Public Transit)" requiring each homeowner to pay a fee that will enable the County to finance extended public transit services to the new development.

The fee is structured as an annual homeowner fee that is adjusted based on the inflation index. These funds will be used to implement a transit service plan that is laid out in a phased approach. The first phase will include either vanpool or maxi-taxi service, the second phase will provide a shuttle bus service operated by a private contractor, and the third and final phase will integrate the development into the County Connection service network.

Establishment of these County Services Areas requires support from land owners and residents who must vote to tax themselves for these additional transit services. As observed in the Alamo Creek case, requiring these as a condition of approval on a new development, prior to the establishment of a large homeowner population, can be a good strategy toward a successful implementation.

Transit Oriented Concurrency System (Broward County, FL)

A transit oriented concurrency fee system was recently established in Broward County, Florida to create a revenue stream for increased transit operations in the County. Since the County is nearing a build-out condition, the Board of Supervisors made a policy decision to require new development to contribute to a fund used to support transit rather than toward the development of new roadway infrastructure.

The Transit Oriented Concurrency System assesses a fee to each new development project in the County based on the project's location within the County and the peak hour trip generation of the project. Each of the ten Concurrency Districts each has their own fixed cost (per peak hour trip) that is based on the current transit level of service for that area. In general, the more transit service already provided to an area, the lower the cost for new development in that area, and vice versa. The system was developed following a Countywide five-year Transit Development Plan. **Figures**

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

6.2 and 6.3 below show the various concurrency fees by land use and district and their corresponding locations on the map.

The program is also designed to give concessions or credits to those projects that are designed to encourage transit use. The credits can translate into 10% to 50% discounts depending upon the specific site characteristics. Affordable housing and government uses that promote the health and safety needs of the general public are given waivers from these fees.

To date the system has been deemed a success by the County in terms of generating revenue for transit. However, since the program was designed to only cover the initial five-year capital costs and three-year operating costs of the project, costs beyond this initial start-up period are shifting to the responsibility of the County, which must look to other sources of revenue to continue the expanded services. The program is currently being evaluated to determine if fees need to be adjusted to address long term transit needs.

The City of Fresno's new traffic impact fee is established in a similar manner to the Transit Concurrency System. The traffic fee system is based on vehicle miles traveled rather than acres and distinguishes between development in infill and new growth areas as shown in **Figure 6.4**. Like the Transit Concurrency System, the new traffic impact fee recognizes that development in areas where infrastructure is already in place should be charged less than areas where new infrastructure is needed. This is reflected in the Concurrency System's levels of constant charges it placed on each district based on its location within the County. Since the boundaries of the traffic impact fee's Infill Zone closely align with FAX's service area, a parallel developer impact fee program used to finance transit could be explored by the City.

EXAMPLES OF CONCURRENCY FEES BY LAND USE AND DISTRICT

Column #	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Land Use	# of Trips	Trip Length Factor	NORTH EAST DISTRICT	NORTH CENTRAL DISTRICT	SOUTH CENTRAL DISTRICT	CENTRAL DISTRICT	EASTERN CORE DISTRICT	SOUTH EAST DISTRICT	SAW GRASS DISTRICT	PORT AIRPORT DISTRICT
Cost per trip --->			\$975	\$986	\$1,334	\$1,430	\$1,641	\$1,535	\$1,579	\$1,219
50 Single Family Units	50.5	0.88	\$43,329 (See example below)	\$43,818	\$59,283	\$63,549	\$72,926	\$68,215	\$70,171	\$54,172
50 Garden Apts.	30.5	0.88	\$26,169	\$26,464	\$35,805	\$38,381	\$44,044	\$41,199	\$42,380	\$32,718
50,000 sq ft industrial	38.5	1.00	\$37,538	\$37,961	\$51,359	\$55,055	\$63,179	\$59,098	\$60,792	\$46,932
50,000 sq ft Office	111.52	0.77	\$83,723	\$84,668	\$114,551	\$122,794	\$140,913	\$131,810	\$135,589	\$104,676
50,000 sq ft Retail	397.4	0.65	\$251,852	\$254,694	\$344,586	\$369,383	\$423,887	\$396,506	\$407,871	\$314,880

Please note: Staff will be recommending substantial credits be made available for projects designed to encourage transit usage.

Notes: (1) All trips are p.m. peak hour trips.

(2) Trip generation rates used are those adopted by Broward County Commission for TRIPS model ([see web link](#)).

Example: Calculate the transit concurrency fee for a 50 Single Family unit project located in the North East District.

50 Single Family units multiplied by trip generation rate for single family (1.01 T/PH) = **50.5 Trips/Peak Hour** (column #1)

50.5 Trips/Peak Hour multiplied by .88 (trip length factor - column #2) = **44.44 Trips/Peak Hour**

44.44 Trips/Peak Hour multiplied by the cost per trip per District (North East District - column #3) **\$975 = \$43,329**

Figure 6.2: Fee Calculation Matrix by Land Use and District

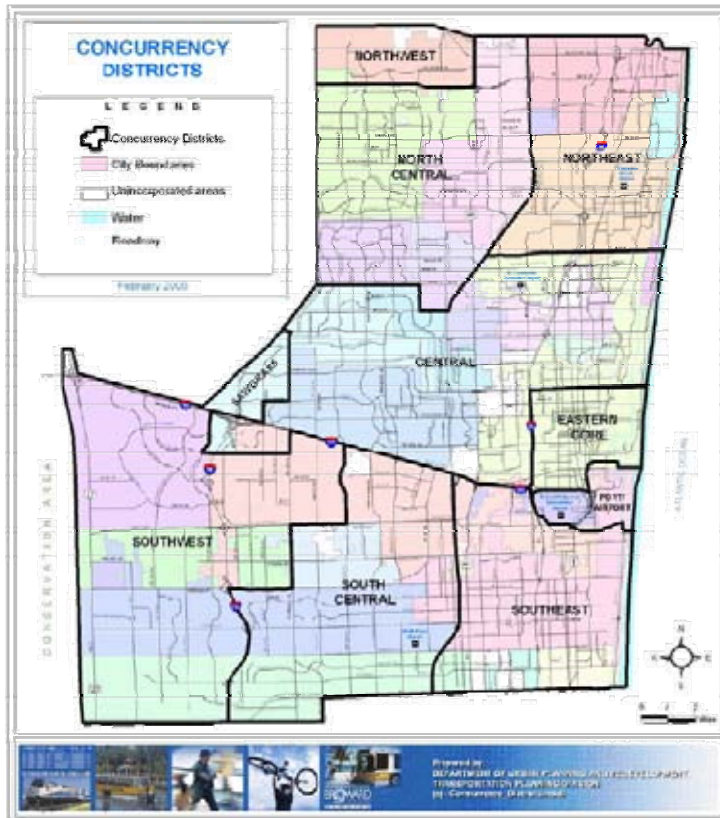


Figure 6.3: Concurrency District Boundaries

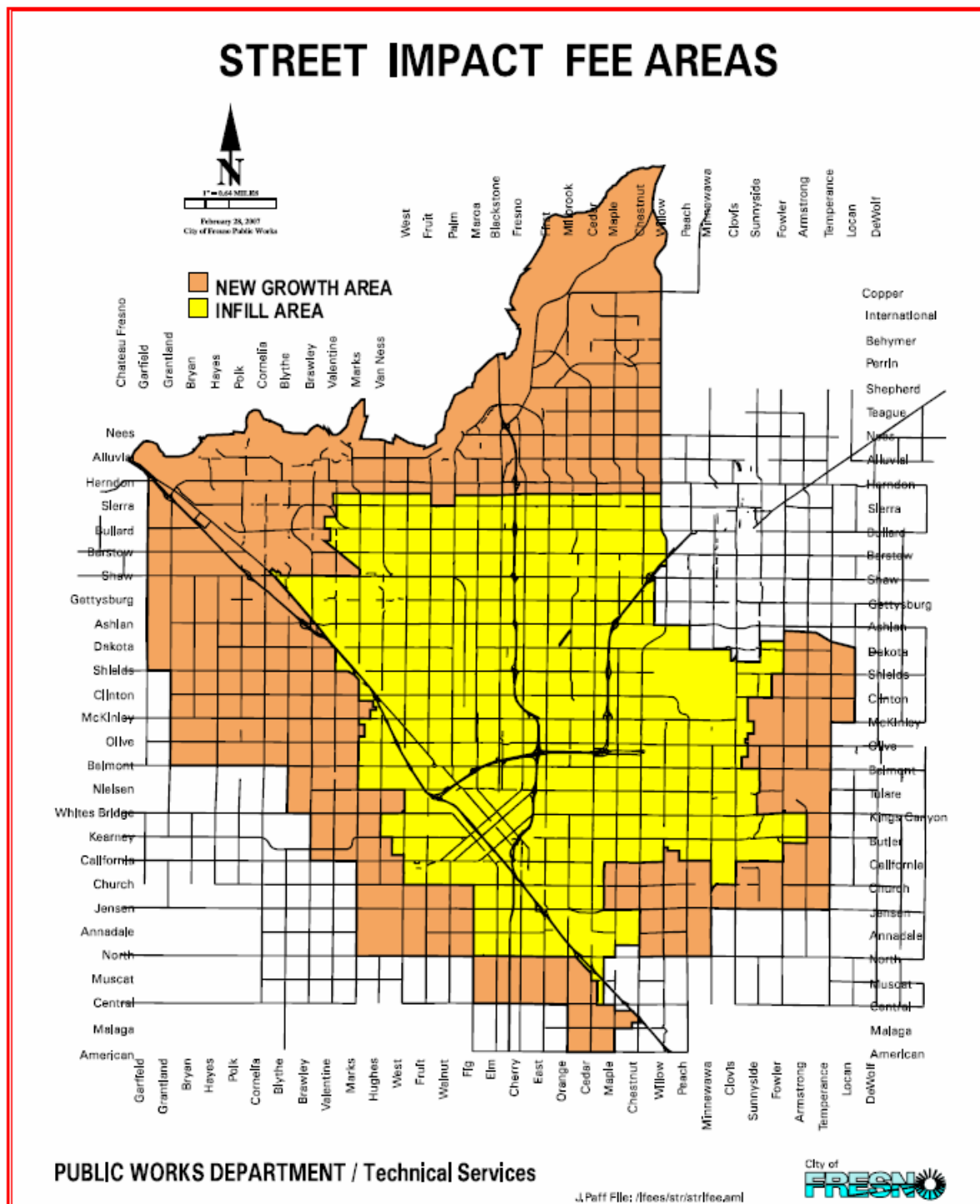


Figure 6.4: Street Impact Fee Area

Source: Fresno Major Street Impact Fee Program Nexus Study, 2007

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

Table 6.1: Comparison of Various Local Funding Sources

Name	Type of Charge	Assessment	Determination of Charge	Who Is Charged	Areas Funded	Applicable Setting	Example
Sales Tax Measures	Ongoing charge	Sales tax	Percentage of total fund (total amount depends on the economy)	Consumers	Capital and Operations	Counties with traffic congestion issues	Fresno's Measure C
Tax Increment Financing	Ongoing charge	Property tax	Property value	Local Governments/ Property Owner	Capital	Redevelopment areas	Portions of Portland's Central City Streetcar
Transit Impact Fee	One-time charge	Size (Various measures including per sq.ft., per dwelling unit, etc)	Extended life of providing transit to a new development	Developers	Capital and Operations	High transit use areas	San Francisco's Transit Impact Fee
Transit Concurrency Fee	One-time charge	Trips & location (trips generated times fixed dollar amount based on location)	Cost to introduce and/or provide service to new areas	Developers	Capital and Operations	All land uses. Urban settings, well established roadway network	Broward County, FL's transit oriented concurrency system
County Service Area	Annual charge	Size of the new development	Annual cost to provide transit to a new area	Homeowners	Capital and Operations	Residential rural setting, limited transit services	Contra Costa County's T-1 (Public Transit)
Benefit Assessment District	Ongoing charge	Use (per hour)	Fixed Amount	Users	Capital and operations	Commercial Urban setting, attractive areas	Parking Benefits District – City of Ventura

6.2 State Funding Programs

FAX currently receives funds from the Local Transportation Fund (LTF) and the State Transit Assistance Fund (STA), both are generated from the State's Transportation Development Act (TDA). In FY06, 1.4 billion dollars was collected from the LTF which is generated from a statewide quarter-cent sales tax. This money is apportioned to each County in California based on population. In Fresno County, the Council of Fresno County Governments (COFCG) distributes these funds to each jurisdictions and also determines the quantity of distribution on population. Revenues from the LTF will vary based on the economy and to continue receiptment of these funds, FAX must maintain a 20% recovery from its farebox. The five year operating budget outlined in the 2005-2010 FAX Short Range Transit Plan estimates the LTF to contribute nearly \$12.8 million or 39% of the District's total operating budget in FY07.

STA funds for transit come from the Transportation Planning and Development portion of the account which is generated from the statewide sales tax on motor vehicle fuel (gasoline) and use fuel (diesel). Statewide allocation to the Fresno COG is 50% based on its proportion of population compared to the rest of the state and 50% based on the proportion of FAX's previous year's revenues compared to the statewide total of transit operator revenues. Statewide STA expenditures were nearly 200 million in 2005-06 or 29% of all state transit expenditures for that year. This fluctuating and uncertain source of funds requires operators to meet an efficiency standard in order to qualify for these funds. This efficiency standard is based on operating costs per hour beginning in FY92. Since the inception of this funding source, FAX has received anywhere from \$16,000 to \$1.4 million per year from STA funds. In FY07, FAX is estimated to receive \$946,000 toward its operating budget, accounting for only 2.8% of its total estimated operating budget.

6.3 Federal Funding Programs

Funding sources available at the federal level are disbursed through the Federal Transit Administration's (FTA) capital investment program. The Section 5309 Capital Investment Grant program provides capital funding for transit related projects. To date, these funding sources have been divided into three classifications; New Starts, Small Starts, and Very Small Starts. These classification levels are based primarily on the size of the project and the amount of funds available for request from the FTA.

The BRT project recommended for Fresno will likely qualify for funding under either the Small Starts or Very Small Smarts program. The cost of the project will determine which of these two funding sources should be explored. Small Starts is limited to projects with a total cost of \$250 million and Very Small Starts is limited to projects with a total cost of \$50 million and a per mile cost less than \$3 million (excluding vehicles). Both programs also require that the total cost of the project accounts for no more than 5% of the agency's operating budget.

The portion of the total project cost that is available from federal funds varies but will not exceed 80%. During the application process the FTA assigns a rating to each project to determine if the project should ultimately be recommended for funding. If the local match of funds is 20%, the project will receive a medium rating. If the local match is boosted to half the total project cost, the project will receive a high rating and have increased chances of being recommended for funding.

The FTA also requires agencies applying for federal funds to be able to demonstrate a local financial commitment including:

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

- A reasonable plan to secure funding for the local share of the capital costs or sufficient available funds for the local share (all non-New Starts funding must be committed before receiving a Project Construction Agreement)
- The additional operating and maintenance cost of the project are less than 5% of the agency's operating budget
- The agency is in reasonably good financial condition

FTA has recently made an attempt to streamline the financial evaluation process. Under this new process, FTA requires the project sponsor to submit the following pieces of information to prove the above mentioned requirements:

- The Small Starts Project Finance Worksheet, available for download from their website
- A detailed plan to secure funding for the local share of project costs which includes the sources, amount, and steps needed to secure funding commitments
- A detailed operating and maintenance cost estimate
- The current agency budget documenting that the project's operating and maintenance costs would constitute no greater than 5% of the system wide operating and maintenance costs; and
- Three years of audited financial statements documenting the financial health of the transit agency

Sponsoring agencies who are unable to provide the relevant information mentioned above are required to complete and submit a financial plan consistent with FTA's June 2000 Guidance for Transit Financial Plans, but only covering the period up to and including the opening year.

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

APPENDIX A – Ridership Gains Associated With Specific Amenities – Kings Canyon Road-Ventura Avenue-Blackstone Corridor

The TCRP report does not explicitly assume ridership increases due to increased corridor service levels. As described in Chapter 4, the Kings Canyon Road-Ventura Avenue-Blackstone Corridor was projected to have an 18% increase in ridership due to increased service levels and faster bus speeds. Of this increase, 10% was attributed to increased service levels, and the other 8% to service pattern improvements. The TCRP study found that additional increases of ridership can be gained based on specific amenities selected as part of the BRT program description. These incremental gains are additive, that is, systems that incorporate a combination of amenities can anticipate ridership increases equal to the sum of the gains for each individual amenity. In addition, a “bonus” of extra ridership was found to occur in systems that achieve very high levels of perceived quality by incorporating most of the major features. Ridership gains are itemized for each specific amenity category, and are summarized at the bottom of the table.

	Max.	Fast Bus	Basic BRT	Moderate BRT	High BRT
Increased Service <i>(from model - not BRT handbook)</i>		10%	10%	10%	10%
Running Ways (not additive)	20%				
Grade Sep. busways (special ROW)	20%				
At-grade busways (special)	15%				15%
Median arterial busways	10%			10%	
All-day bus lanes (specially delineated)	5%				
Rush-hour bus lanes	0%				
Mixed traffic	0%				
Stations (additive)	15%				
Generic shelter	0%				
Unique/ attractively designed shelter	2%				2%
Illumination	2%			2%	2%
Telephones/security phones	3%			3%	3%
Climate controlled waiting area	3%				
Passenger amenities[what is this? Aren't all these items "amenities"]	3%			3%	3%
Passenger services	2%				2%
Vehicles (additive)	15%				
Conventional vehicles	0%				
Uniquely designed vehicles (external)	5%		5%	5%	5%
Air conditioning	0%				
Wide multi-door configuration	5%		5%	5%	5%
Level boarding (low-floor or high platform)	5%		5%	5%	5%
Service patterns (additive)	15%				
All-day service	4%	4%	4%	4%	4%
High-frequency (10 minutes or less)	4%				
Clear, simple service pattern	4%	4%	4%	4%	4%
Off-vehicle fare collection	3%		3%	3%	3%
ITS applications (selective additive)	10%				

BUS RAPID TRANSIT MASTER PLAN

Council of Fresno County Governments (COFCG)

	Max.	Fast Bus	Basic BRT	Moderate BRT	High BRT
Passenger information at stops	7%		7%	7%	7%
Passenger information on vehicles	3%		3%	3%	3%
BRT Branding (additive)	10				
Vehicles & Stations	7%		4%	7%	7%
Brochures/schedules	3%		3%	3%	3%
Summary					
Running Ways	20%	0%	0%	10%	15%
Service Patterns	15%	8%	11%	11%	11%
Stations	15%	0%	0%	8%	12%
Vehicles	15%	0%	15%	15%	15%
ITS applications	10%	0%	10%	10%	10%
Branding	10%	0%	6.5%	10%	10%
Sub-total	85%	8%	43%	64%	73%
BRT component synergy (when subtotal is 60 or more)	15%	0%	0%	15%	15%
Increased Frequencies (not in BRT handbook)	--	10%	10%	10%	10%
Total	100%	18%	53%	89%	98%
Change from Lesser Alternative			35%	37%	9%

Source: TCRP Report 118, FCOCG Travel Model, Cambridge Systematics