



Metropolitan Bakersfield Fixed Guideway Passenger System



Kern County Rail Advisory Committee

Phase I
Feasibility Study
October 14, 1991



Kern Council
of Governments



METROPOLITAN BAKERSFIELD FIXED GUIDEWAY PASSENGER SYSTEM

Project Steering Committee

L. Dale Mills, Chairman
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Don Turkal
Steve Ruggenburg
Connie Littlefield
Chester Moland
Ronald E. Brummett
Joseph Drew
Peter Thomas
Fred Kloeppe
Steve Walker
Marc Gauthier
Dave Rickles
Melvin Krause
Joel Heinrichs
Jeff Frapwell
Susan Weaver
Alan McCuen
Moses Pacheco
Gene Tackett

Kern County Public Works Department
Kern County Public Works Department
Kern County Public Works Department
Golden Empire Transit District
Golden Empire Transit District
Golden Empire Transit District
Kern Council of Governments
Kern County Administrative Office
Kern County Airport Department
City of Bakersfield, Department of Public Works
City of Bakersfield, Department of Public Works
City of Bakersfield, Department of Planning
Kern County Planning and Development Services
Kern County Planning and Development Services
Kern County Administrative Office
Kern County Administrative Office
Representing Supervisor Larwood
Caltrans, District 6
Caltrans, District 6
Project Clean Air

TECHNICAL ADVISORY COMMITTEE

Steve Ruggenburg,
Connie Littlefield
Ronald E. Brummett
Peter Thomas
Don Turkal
Dave Rickles
Melvin Krause
Fred Kloeppe
Steve Walker
Marc Gauthier
Alan McCuen
Moses Pacheco

Chairman Golden Empire Transit District
Golden Empire Transit District
Kern Council of Governments
Kern County Airport Department
Kern County Public Works Department
Kern County Planning and Development Services
Kern County Planning and Development Services
City of Bakersfield, Department of Public Works
City of Bakersfield, Department of Public Works
City of Bakersfield, Department of Planning
Caltrans, District 6
Caltrans, District 6

TABLE OF CONTENTS

	Page
PROJECT STEERING COMMITTEE	i
TECHNICAL ADVISORY COMMITTEE	i
TABLE OF CONTENTS	ii
GLOSSARY OF TERMS	v
LIST OF MAPS	v
EXECUTIVE SUMMARY	vi
INTRODUCTION	1
FIXED GUIDEWAY SYSTEM DEFINED	4
Rail Passenger Service Defined	
Rail Passenger Technology Defined	
LAND USE IMPACTS OF RAIL TRANSIT	6
Downtown Development	
Growth Focusing	
Land Use Policy	
IDENTIFICATION OF NEED	7
Traffic Congestion	
Transit Service	
Mobile Source Air Pollution Emissions	
Right-of-Way	
Demographic Characteristics	

SURVEY OF EXISTING AND ONGOING PLANS	13
<ul style="list-style-type: none"> 2010 General Plan for the Metropolitan Bakersfield Area City of Bakersfield Redevelopment Plan 1984 Transit Market and Operational Analysis 1985 Comprehensive Transit System Analysis 1990 Regional Transportation Plan AB 971 San Joaquin Valley High Speed Rail Study SB 1307 Integrated High Speed Ground Transportation System Study Assembly Concurrent Resolution No. 27 - High Speed Rail Link Bakersfield - Los Angeles 1991 Air Quality Plan Congestion Management Program High Speed Rail Terminal Study Amtrak Service 	
OPPORTUNITIES AND CONSTRAINTS	18
SYSTEM GOALS AND OBJECTIVES	20
PROJECT COST AND FUNDING	22
<ul style="list-style-type: none"> State Funding State Article XIX Transportation Development Impact Fee Urban Mass Transportation Administration Local Option Sales Tax Private and Joint Development Funding AB 2766 - Vehicle Registration 	
CONCLUSIONS	24
RECOMMENDATIONS	25
APPENDIX A - Light Rail Transit Defined	26
APPENDIX B - Fixed Guideway System Planning Study	27
APPENDIX C - Station Design Criteria	28
APPENDIX D - Recent Examples of Light Rail and Freeway Construction Cost	30

APPENDIX E - Experience of Other Urban Areas

31

Seattle, Washington
Portland, Oregon
Gresham, Oregon
Washington D.C.
Toronto, Canada
Calgary, Canada
Atlanta, Georgia
Dade County, Florida
Sacramento, California

BIBLIOGRAPHY

34

GLOSSARY OF TERMS

AB	Assembly Bill
AVR	Average Vehicle Ridership
APCD	Air Pollution Control District
AQMP	Air Quality Maintenance Plan
AT&SF	Atchinson Topeka and Santa Fe
Caltrans	California Department of Transportation
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
GET	Golden Empire Transit District
Headway	Time interval between transit vehicles.
Kern COG	Kern Council of Governments
LOS	Level of Service
LRT	Light Rail Transit
LRV	Light Rail Vehicle
MPH	Miles per Hour
NO _x	Oxides of Nitrogen
ROG	Reactive Organic Gases
RT	Sacramento Regional Transit
RTP	Regional Transportation Plan
SB	Senate Bill
SP	Southern Pacific
STIP	State Transportation Improvement Program
TAZ	Transportation Analysis Zone
TCM	Transportation Control Measures
UMTA	Urban Mass Transit Administration

LIST OF MAPS

EXISTING RAIL ROAD AND CANAL RIGHT-OF-WAYS	10
POPULATION DENSITIES	11
EMPLOYMENT DENSITIES	12
2010 GENERAL PLAN LAND USE CENTERS CONCEPT	15

EXECUTIVE SUMMARY

METROPOLITAN BAKERSFIELD FIXED GUIDEWAY PASSENGER SYSTEM

The need for a major transportation investment in the Metropolitan Bakersfield area can be clearly documented. Rapid growth is projected to result in the following:

- 46 percent increase in population in the Metropolitan Area by 2010;
- 47 percent increase in employment in the Metropolitan Area by 2010.

Growth of this magnitude can have a severe impacts on the transportation system.

- current levels of peak hour congestion on arterials in many areas of the community are increasing;
- projected demand greatly exceeds the combined capacity of the highway routes and existing transit system;
- rising cost of auto travel already threatens the mobility of some segments of the community;
- air pollution already exceeds desirable standards, with the area presently being a non-attainment area as defined by applicable state and federal statutes.

The objective of this study is to identify the feasibility of establishing a fixed guideway passenger rail system in the Metropolitan Bakersfield Area. The term "Guideway or Fixed Guideway" is defined as a passenger rail system including but not limited to commuter rail, intracity rail, intercity rail, monorail and maglev. A light rail system is generally used for commuter and intracity rail service. A commuter rail system is used for intercity rail service. Monorail is used in an urban setting similar to light rail. Maglev is used similar to intercity rail service.

Land use policies can be instrumental in determining the extent that development is complementary and supportive to a fixed guideway system. Fixed guideway improvements have influenced land use significantly in communities such as Toronto, Montreal and San Francisco.

Transit improvements can improve the access to the downtown and other areas designated for higher densities. Fixed guideway improvements will play a key role in intensifying land use in station areas. Improved access along with the existence of a strong demand for new office and retail space can be the primary factors in new development and redevelopment.

The "centers" concept in the 2010 Metropolitan Bakersfield General Plan calls for intensifying land uses in several areas of the community. The coordination of transit and a fixed guideway system can be complementary.

Population and employment growth and density patterns are of particular interest as they are reflective of the general relationship between fixed guideway investment and land use. Most heavy rail guideway systems require population densities of 6,000 to 12,000 persons per square mile. It has been shown in corridor studies prepared by the Urban Mass Transit Administration (UMTA) in San Diego, San Jose and Portland light rail system generally require population densities of 4,000 to 6,000 per square mile and employment densities of 6,000 to 8,000 per square mile.

At present in the Metropolitan Bakersfield Area, several areas meet the minimum density requirements or have planned densities that would support the start-up of a fixed guideway system.

Opportunities and Constraints

Planning for the installation of a fixed guideway system provides the following opportunities:

- Preserve Right-of-Way
- Improve Air Quality
- Reduce Traffic Congestion
- Coordinate with San Joaquin High Speed Rail Passenger Service
- Revitalize Downtown Bakersfield Area
- Educate of the Public about the Benefits of Public Transit
- Support the 2010 "Centers" and "Resource" Concept
- Improve the Multi-Modal System
- Conserve Natural Resources
- Improve Public Transit Service
- Numerous Transportation Corridors are Available for Consideration
- Portions of the Community have Population and Employment Densities to Support a Fixed Guideway System.

Constraints to implementing a system are as follows:

- Limited Public Funding
- Unprotected Rail Corridors
- Public Perception of the use of Public Transit
- Inflexibility of Fixed Guideway Systems to Change in the Land Use Pattern.

Project Cost and Funding

The capital cost of funding a typical fixed guideway system is estimated at \$10 to \$15 million dollars per mile. Funding from state and federal sources is limited. Possible funding sources include a transportation development impact fee, local option sales tax, vehicle registration fees (AB 2766) and private and joint development funding.

Conclusions

This Report has addressed the feasibility of developing a fixed guideway Transit system in the Metropolitan Bakersfield Area. The following conclusions are drawn from the findings of this study:

1. Metropolitan Bakersfield is a transportation "Hub" for the southern San Joaquin Valley with air passenger and freight service, common carrier and charter bus service, rail passenger and freight service and the planned high speed rail passenger service.
2. The population of the southern San Joaquin Valley during the next 20 years will continue to increase at a rate higher than the state and national averages.
3. The western portion of Kern County, including Bakersfield will continue to be designated a "clean air" non-attainment area.
4. The existing transportation infrastructure is inadequate to support the future transportation needs of the community.
5. A fixed guideway system would be a significant factor in re-vitalizing the downtown area and surrounding suburban living and employment areas, with incentives for heightened land use intensity and density.

6. There is the opportunity to plan and preserve the needed right-of-way for alternative transportation systems.
7. The development of a fixed guideway system, would provide an alternative fuel efficient mode for the transportation of people.
8. A fixed guideway system is an environmentally cleaner solution to meeting our futur transportation needs.
9. The present and planned land use, population and employment densities in several portions of the community will support a fixed guideway system.
10. A fixed guideway system would support both the "centers" and "resources" concepts identified in the 2010 General Plan.
11. A fixed guideway system is an affordable alternative when compared to the required mitigation measures associated with a comparable freeway facility (air quality, congestion management, etc.).
12. Financing for a fixed guideway system is limited., given the unfinished nature of the planned "Basic Transportation Infrastructure."

Recommendations

If a system is not designed and right-of-way is not reserved now, our options will be severely limited in the future. Therefore, the planning process should be continued. to keep this process moving, the following recommendations should be implemented

1. Authorize the Metropolitan Rail Committee to begin the Phase II, Systems Planning Study.
2. Authorize the Metropolitan Rail Committee to seek funding to support the planning, environmental and preliminary engineering required for the development of Phases II and III.
3. Support efforts to expand the local, state and federal funding sources for fixed guideways.
4. Consistent with the Systems Planning Study, develop a means to encourage private participation in the implementation of a fixed guideway system through the air quality, land use, and congestion management processes.
5. Consistent with the Systems Planning Study, revise the Land use and circulation elements of the 2010 General Plan to increase residential and employment densities within the "center" and connecting corridors as necessary to make a fixed guideway system feasible.
6. Consistent with the System Planning Study, careful coordination of state high speed rail plans and local land use and circulation plans should be accomplished.

In summary, implementation of a fixed guideway system appears to be a viable future transportation strategy. The planning process should continue so that barriers to implementation of such a system can be identified, mitigated and so that current land use and transportation actions can be coordinated with future plans for a fixed guideway system. At the conclusion of Phase II, further implementation actions will be identified.

The implementation of a fixed guideway system can provide a wide range of benefits, to those who use it, to those who remain in their automobiles and to the community as a whole. A fixed guideway system

can provide a quick and reliable trip, free from the ubiquitous congestion facing most urban areas today.

For those who must continue to drive, a fixed guideway system will remove cars from the roadway, providing less congested roadways. By taking cars off the road, a fixed guideway system precludes extremely expensive highway improvements.

Fixed guideway improvements in Portland, Montreal and Sacramento have significantly influenced land use and the degree to which complementary development occurs around transit stations. Transit improvements can be a significant force in intensifying high-rise commercial office development. The increase in access to an area will assist in its growth and development. In areas where inadequate access has been recognized as a constraint to growth, transit was seen as a necessity for intense development to occur.

**METROPOLITAN BAKERSFIELD FIXED
GUIDEWAY PASSENGER SYSTEM**

METROPOLITAN BAKERSFIELD FIXED GUIDEWAY PASSENGER SYSTEM

Introduction -

The Metropolitan Bakersfield Rail Committee was formed by local transportation officials in order to respond to a growing need to provide capacity to the metropolitan transportation system. The rapid growth of the Metropolitan Bakersfield area has caused increased traffic congestion and an increase in air quality problems.

During the 1989 and 1990 Kern County Transportation Symposiums, light rail and high speed rail systems were discussed. Representatives of the City of Bakersfield, County of Kern, Golden Empire Transit District and Kern Council of Governments joined together to outline a program to investigate light rail passenger transit systems. The committee adopted the following goals:

1. Develop a concept for integrating all modes of transportation.
2. Develop land use policies that are supportive of rail transportation.
3. Identify the high speed north/south rail corridor.
4. Identify the high speed rail terminal location.
5. Identify the light rail corridors.
6. Identify the light rail terminal locations.
7. Estimate the capital and operating financial issues associated with the integrated plan.
8. Estimate the local issues associated with the integrated plan.
9. Ensure maximum public input in plan development.
10. Achieve consensus on the integrated rail system plan.
11. Develop a legislative strategy that supports the attainment of plan goals.

The committee identified a six phase rail development program. The phases are as follows:

- Phase I: Feasibility Study (six months).
- Phase II: System Planning Study (eighteen months).
- Phase III: Alternatives Analysis/Environmental Analysis (EIR/EIS) (eighteen months).
- Phase IV: Preliminary Engineering (2 years from authorization).
- Phase V: Final Design (2 years from authorization).
- Phase VI: Construction and Deployment (4 years from authorization).

The need for some type of transportation investment is clearly indicated by:

- o **Current levels of peak hour congestion on arterials in many areas of the community are increasing;**
- o **Rapid growth projected to result in a 46 percent increase in population in the Metropolitan area by 2010;**
- o **A projected 47 percent increase in employment in the Metropolitan area by 2010;**
- o **Projected demand greatly exceeds the combined capacity of highway routes and existing transit services;**
- o **Rising cost of auto travel which already threaten the mobility of some segments of the urban community;**
- o **The general need to conserve energy in transportation;**
- o **Air pollution which already exceeds desirable standards;**
- o **The need to preserve right-of-way presently reserved for transportation purposes; and**
- o **A continuing need to revitalize downtown.**

Bakersfield Public Transit History

In 1888 The first public transportation system in Bakersfield began operation. The trolley system consisted of a horse drawn street car on railroad tracks. The two mile trolley system ran from 19th and Chester east to the Southern Pacific Railroad station in Sumner (East Bakersfield). The line operated under a franchise to the Bakersfield and Sumner Street Railroad Company. In 1901, under the Bakersfield and Kern Electric Railway Company, electric street car service began operation.

The street-car system prospered during the next thirty years. New service was added and new cars were purchased. In 1915, the company began operating modified autos to complement the trolley line. This was one of the earliest such operations in the United States. During the 1930's and 1940's, inefficient routes were eliminated and the system made the transition to buses. By the 1950's the private auto was increasing in use which resulted in a decline in ridership. After approval of the voters in Greater Bakersfield, the Golden Empire Transit District was formed in 1973.

During the 1970's, the Golden Empire Transit District revised and extended the fixed route system, reversed the decline in ridership, and added a dial-a-ride service for the disabled. In the early 1980's, GET improved service levels by decreasing headways, initiating wheelchair-accessible service on all routes, extending District boundaries to include service to high growth areas, and eliminating unproductive route segments.

By the mid-1980's, the impact of regional growth patterns on the provision of efficient and effective public transit service became an issue. The radial orientation of the route system was insufficient to accommodate the region's primary public transit needs. Therefore, a Comprehensive Transit Analysis was conducted. Findings from the study showed that the on-going pattern of development in Bakersfield, and the subsequent changes in travel patterns, strongly indicated that the District's routes and schedules could be improved to better address these changes.

As a result of this study, a crosstown system was initiated in 1986. The system was designed to serve the area's diverse trip destinations in a more direct manner, while continuing to provide a high level of service to the Central Business District. Peak hour service was also provided for the first time. The success of the crosstown system has been reflected in a steady ridership growth and record productivity levels.

In the 1990's the District is a major participant, encouraging improved air quality and congestion management. The consideration of public transit in local development plans, parking management, and land use is a key issue. In response to the rapid growth affecting the area, the District is initiating long-range development plans. Specific areas of analysis include future service expansion, long-range financial needs, capital projections, and impact of federal regulation, including alternate fuels, service for the disabled, and funding levels.

FIXED GUIDEWAY SYSTEM DEFINED

The term "Guideway or Fixed Guideway" is defined as a passenger rail system including but not limited to commuter rail and intracity rail (light rail and heavy rail), intercity rail, monorail, maglev. It should be noted that both the light rail and heavy rail technologies will accommodate the movement of goods.

Rail Passenger Service Defined

Commuter Rail - Commuter rail refers to that form of passenger transportation that is characterized by medium distance home-to-work passenger travel, multiple ride ticketing, recurring peak-hour travel and use of chair cars with high-density seating. Commuter rail is characterized by diesel electric or overhead electrically powered locomotives, and only they are powered. Passenger cars are not generally powered. Examples are the Caltrans operated by Caltrains from San Jose to San Francisco, and GO Transit in Toronto.

Intercity Rail - Intercity rail is the form of rail transportation that is operated by common carriers and utilizes fixed guideways. The service is characterized by inter-regional passenger travel provision for personal carry-on baggage, and possible use of specialized cars for food service, sleeping accommodations, checked baggage, and package express.

Intracity Rail - Intracity rail is high capacity, high speed transit which can consist of either light rail or heavy rail vehicles. These vehicles all are powered by electricity from overhead or third rail powered lines. The distinction between light rail and heavy rail is capacity and operating configuration.

Rail Passenger Technology Defined

Light Rail - Light rail vehicles can operate as single vehicles or can be trained and frequently do operate on surface streets as well as on exclusive rights-of-way and draw electric power from an overhead catenary system. Light rail systems can have passenger boarding at surface as in San Diego and Sacramento or from elevated platforms as does Los Angeles. The Santa Clara County rail system has both surface boarding and elevated platforms. The maximum capacity of a light rail system is generally regarded as 10,000 passengers in each direction.

Heavy Rail - Heavy rail vehicles cannot operate on surface streets but must have exclusive grade protected guideways, either subway, at surface or aerial configuration. Heavy rail vehicles can operate in pairs or trained up to ten cars and powered by third rail or overhead catenary. Heavy rail systems must have platforms for boarding passengers. A heavy rail system can carry up to 40,000 passengers per hour in each direction.

Monorail - This is a technology which differs from light rail in that it rides on rubber tires on a single horizontal beam of concrete or steel. The vehicle may either be bottom supported or suspended from the beams. Horizontal stability also is provided by rubber tires. The capacity of monorail systems is somewhat greater than light rail system. The operation of monorail system above ground creates relatively little disturbance to existing transportation modes. Much of monorail's appeal has been due to such technological features as the use of modern structural design techniques and lightweight rolling stock with rubber tire wheels, features which are not readily applicable to conventional rail systems.

Maglev - The term maglev (magnetic levitation) is a particular type of technology. The function of carrying passengers is similar to that of intercity rail (Amtrak). Maglev prototypes in Germany and Japan have logged thousands of miles at speeds of up to 250 miles per hour. Maglev technology has several possible benefits:

- o **Environmentally acceptable**
- o **Fuel efficient (electric power)**
- o **Possibility of relieving highway and airport congestion**
- o **Ability to cover short distance in roughly the same amount of time as airplane travel**
- o **Considered safer than other kinds of trains, because the train wraps around the rail, and is very difficult to derail.**
- o **Non-contact levitation system (no friction and less wear and tear)**
- o **Offers high sustained maximum speeds, capable of speeds over 300 mph**
- o **Elevated guideway uses less space.**

LAND USE IMPACTS OF RAIL TRANSIT

Land use policies have often been instrumental in determining whether and to what degree complementary development would occur around transit stations. Light rail transit improvements have influenced land use significantly in Portland, San Diego and San Francisco.

Downtown Development - Transit improvements can be significant forces in the extent and nature of the intensive high-rise commercial office development in the central business district. The increase in access to the downtown area will assist its growth. Improved access along with the existence of a strong demand for new office and retail space can be the primary factors in new downtown development. In areas where inadequate access has been recognized as a constraint to growth, transit was seen as a necessity for intense development to occur.

Growth Focusing - Major rail transit improvements can play a key role in intensifying land use in station areas outside the central business district. High-rise apartment, large office and commercial centers will be attracted to suburban stations. Intense developments are significantly more productive when located within walking distance of the station.

Several factors may influence the development potential provided by transit improvements. These include; neighborhood opposition, social and physical characteristics of the area, ease of access to the station site, availability of land and public policy toward development.

Land Use Policy - The coordination of transit and land use should not be restricted to a one-time light rail transit development planning effort. If rail transit is to be an effective policy instrument for shaping the city, its application should be based on urban development objectives which are accepted policy and which are compatible with rapid transit. Such objectives tend to involve a focusing of development and intensifying of density near transit stations or in corridors served by transit rather than a more suburban, lower density pattern.

The key policy implications are as follows:

- Rail transit improvements can influence land use significantly when supported by other essential factors including land use controls, availability of land, attractiveness of surroundings, and regional demand.
- Local land use and development related policies should be identified and transit related land use objectives should be supportive.
- The factors that influence land use change should be approved as policy and coordinated in general urban development as well as in transit planning.
- Impact assessments for proposed transit improvements on land use should include site specific evaluations.
- Site specific evaluations should include knowledgeable real estate development perspectives in conjunction with planning principals.
- Commitment to land use policies supporting desired land use strategies should be demonstrated prior to the installation of transit improvements.

Once local urban development policies are defined, supporting policies and programs can be developed. These should focus on influencing the land development investment decisions. Light rail transit can be used as one factor to help shape land use patterns. Transit cannot create the desired land use patterns by itself if other policies are in place which run counter, or have the opposite effect.

Effort to direct growth may include, packaging development proposals and combining resources to create a greater impact. These efforts may impact the degree to which a new development is physically integrated within the transit system, thus enhancing the use of each.

IDENTIFICATION OF NEED

Traffic Congestion - The Metropolitan Bakersfield 2010 General Plan provides the following overview of traffic congestion:

"In general, the existing street system operates smoothly. Points of congestion are beginning to appear, however, as a result of two phenomena. The city is increasing in population and geographical area, thereby placing greater demands on the street system. Secondly, physical barriers have disrupted the grid of arterial streets and the freeway system, leading to discontinuities. Physical barriers include the Kern River, canals, railroad tracks, and (in the case of freeways) established residential neighborhoods" (page III-2).

"Congestion occurs on numerous streets where they cross Highway 99, including Olive Drive, Rosedale Highway, California Avenue, Stockdale Highway Ming Avenue, Planz Road, and White Lane. Freeway interchanges with congestion or other problems include Golden State/99/Airport Drive, 178/Mt. Vernon, 178/Oswell, 99/Rosedale, 99/California, 99/White and 58/Union Avenue" (page III-5). There are also several other portions of the circulation system where volume is approaching capacity.

The "...land use plan, when built out, will add significantly to the area's population and employment base. Existing areas of the city will increase in land use intensity, and to a larger extent, geographic expansion of the city will occur. Major expansion areas include the southwest, northwest (Riverlakes Ranch), and northeast (Rio Bravo). This will lead to an accompanying increase of travel. Specifically, the plan calls for an increase of 154,000 households and 244,000 jobs (by 2010). These increases will cause traffic volumes to more than double. Daily vehicle trips will increase by 1.6 million to a total of 2.6 million" (page III-7).

"Congestion would occur in the new growth areas where the street network is presently incomplete. These areas include the southwest, the northwest (Riverlakes Ranch) and the northeast (Rio Bravo). Although the street network is more mature, the airport area would also experience congestion due to growth. Two of the existing freeways in the area (Freeway 99 and Highway 58) would experience congestion due to increased regional travel demand. Increased regional demand would also overload the Taft-Bakersfield Highway/Panama Road and Enos Lane. Rosedale Highway, Truxtun Avenue, California Avenue, and Stockdale Highway would be overloaded due to increased demand for travel between downtown Bakersfield and the areas west of Highway 99. Growth in the downtown would also contribute congestion on Route 178 and the Golden State Highway (SR 204). The general intensification of land use throughout the planning area would contribute to congestion on other existing arterials, including Morning Drive, Fairfax Road, Oswell Street, Mt. Vernon Avenue, Haley Street, Union Avenue, Ming Avenue, White Lane, Panama Lane, and Pacheco Road" (page III-7).

Transit Service - In 1986, the Golden Empire Transit District redirected service away from a radial system serving primarily downtown into a crosstown system. This new alignment allows passengers to choose a trip through the downtown area or a trip directly from one side of the town to the other through a transfer site at the Valley Plaza Mall.

After an initial loss of passengers from 10,000 boardings per day to below 8,000 boardings per day, the crosstown system began to gain ridership approximating 20% to 25% each month compared to the same month of the prior year. These increases add to a nearly 8% increase in total operating revenue per year overall, from a low of approximately 14% operating revenue to today's 22% revenue cost ratio. State law mandates that Bakersfield's transit district recover a minimum 20% of its revenue from passenger fares. Today's system boardings reaches highs of more than 17,000 daily.

However, the transit system is beginning to feel the stretching of its routes. As more than four routes begin carrying standing loads each day during the school year, waiting passengers are being passed up due to full buses. This is the first of several indicators that the system is beginning to experience the need for

growth and expansion to accommodate an expanding passenger base. As the City of Bakersfield annexes new areas, the GET district also is expanded. With more than 145 square miles of service area and more than 305,000 population within the service area, the need for more transit service is becoming critical. Without the addition of more convenient service the customer base built up during the past five years will begin to erode, leaving a deteriorating transportation network that will be unable to meet the needs of the coming, alternative intercity systems being considered.

Mobile Source Air Pollution Emissions - Mobile sources (passenger vehicles, light trucks, heavy duty trucks, and buses) whether powered by gasoline or diesel engines, emit chemical compounds that are undesirable air pollutants or that form other air pollutants via chemical reactions in the atmosphere. In Kern County the major mobile source pollutants are oxides of nitrogen (NOx) and reactive organic gases (ROG) that combine chemically in the atmosphere when exposed to sunlight to form ozone.

The California Clean Air Act requires The San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) to implement Transportation Control Measures (TCMs) sufficient to achieve an average vehicle ridership (AVR) of 1.5 during week day commute hours and no net increase in vehicle emissions after 1997. The current AVR is 1.1 persons per vehicle.

The SJVUAPCD is reviewing recommended transportation control measures prepared by Jacobs Engineering Group, Inc. for the Kern Council of Governments. Most frequently TCMs are thought of as air pollution control measures. However, many also reduce traffic congestion. While reduced congestion has air quality benefits, these benefits may not be the primary reason for implementing the program.

The following is a brief list of the recommended TCMs:

- Street and Highway Improvements
- Transit Improvements
- Employer Based Trip Reduction
- Indirect Source Review
- Vehicle Inspection and Maintenance
- Alternative Fuels
- Park and Ride, Remote and Fringe Parking
- Traffic Flow Improvements
- Bicycle Facility Improvements
- Parking Management
- Transportation Management Associations
- Telecommunications
- Public Education Program.

Right-of-Way - The need to preserve transportation right-of-ways is important. They are irreplaceable resources. When they are abandoned or sold, they may be lost for transportation purposes. Moreover, the ability to operate urban and commuter rail service in a given corridor may require a shift in ownership under federal law. State and local agencies have no guarantee that limited public funds will be available for land acquisition.

Criteria should be established to prioritize the acquisition of competing rail corridors given the limited funding available. Evaluation should be made of each rail corridor potential for serving existing or future commute patterns and does it benefit the overall regional or statewide rail system.

Existing freeway right-of-ways, arterials, utility right-of-ways, canal right-of-ways and other types of easements exist and are already in the public ownership. The use of publicly owned rights-of-way would reduce expenditure of public funds for land. The potential for joint use of freeway, utility and other types of right-of-way should be considered. Where commute patterns are established such as freeway corridors, rail service as a joint use could help alleviate the existing congestion, since it would follow the commute pattern and provide an alternative travel mode.

The Rail Right-Way Inventory adopted by the California Transportation Commission identifies the following rights-of-way within the Metropolitan Bakersfield Area for preservation.

The Atchison Topeka & Santa Fe (AT&SF) yard just north of California Avenue and east of Route 99; the spur of the AT&SF mainline between L Street and Union Avenue; the Southern Pacific (SP) spur north of Route 178 turning northward to parallel Union Avenue on the west; the Sunset Branch of the SP; and the SP yard in East Bakersfield;

Demographic Characteristics - Of key interest in this study are the trends in population growth, population density and housing density. The intensity magnitude and density of employment to be served by the line are also important factor to be considered.

Population growth in Kern County has been significant and sustained. From a 1980 population of just over 400,000, the county as a whole has grown to nearly 559,800 at the beginning of 1991. Current projections call for a year 2010 population of 991,000.

The population projections for the Metropolitan Bakersfield Area indicate that between 1987 and 2010 the population will grow from 285,950 to 567,500. This population increase will result in a demand for 112,620 new dwelling units, an additional 20,812,800 square feet of commercial floor area and 18,654,500 square feet of industrial building floor area.

In 1985 the Metropolitan Bakersfield Area had a density of 5250 persons per square mile. The Metropolitan General Plan projects a density of 5460 dwelling units per square mile in 2010.

Commercial employment density in 1985 was 4500 employees per square mile. In 2010, commercial employment density is projected to increase to 8600 employees per square mile. Industrial employment density in 1985 was 2800 employees per square mile. The 2010, industrial employment density is projected to increase to 6100 employees per square mile.

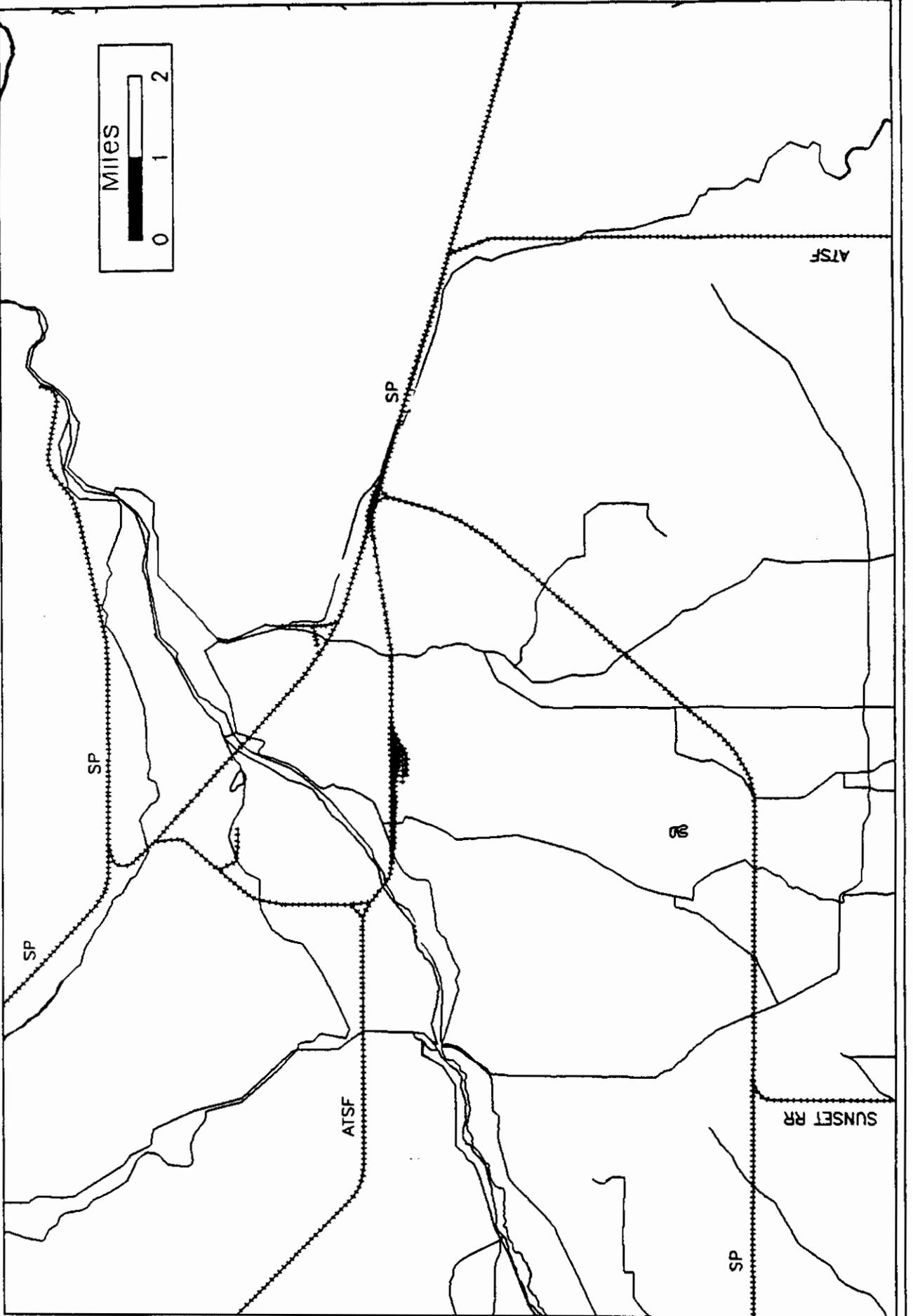
Population and employment growth and density patterns are of particular interest as they are reflective of the following general relationships between fixed guideway transit investment and land use.

- o High population growth between 1988 and 2010 (above 1000 persons per transportation analysis zone or TAZ). Fewer than 100 persons per TAZ of growth is not a significant level of growth. Very high growth (1000 to 5000 persons per TAZ).
- o Start-up of fixed guideway system requires 4000 to 6,000 persons per square mile and are the minimums for light rail system. Levels of 6000 to 12,000 persons per square mile are required for start-up of a heavy rail system.
- o Heavy rail requires employment levels of 12,800 to 19,200 employees per square mile. For light rail, employment levels of 9600 to 12,000 employees per square mile within one-half mile of the transit corridor are used.

METRO BAKERSFIELD RAILROADS AND WATER WAYS

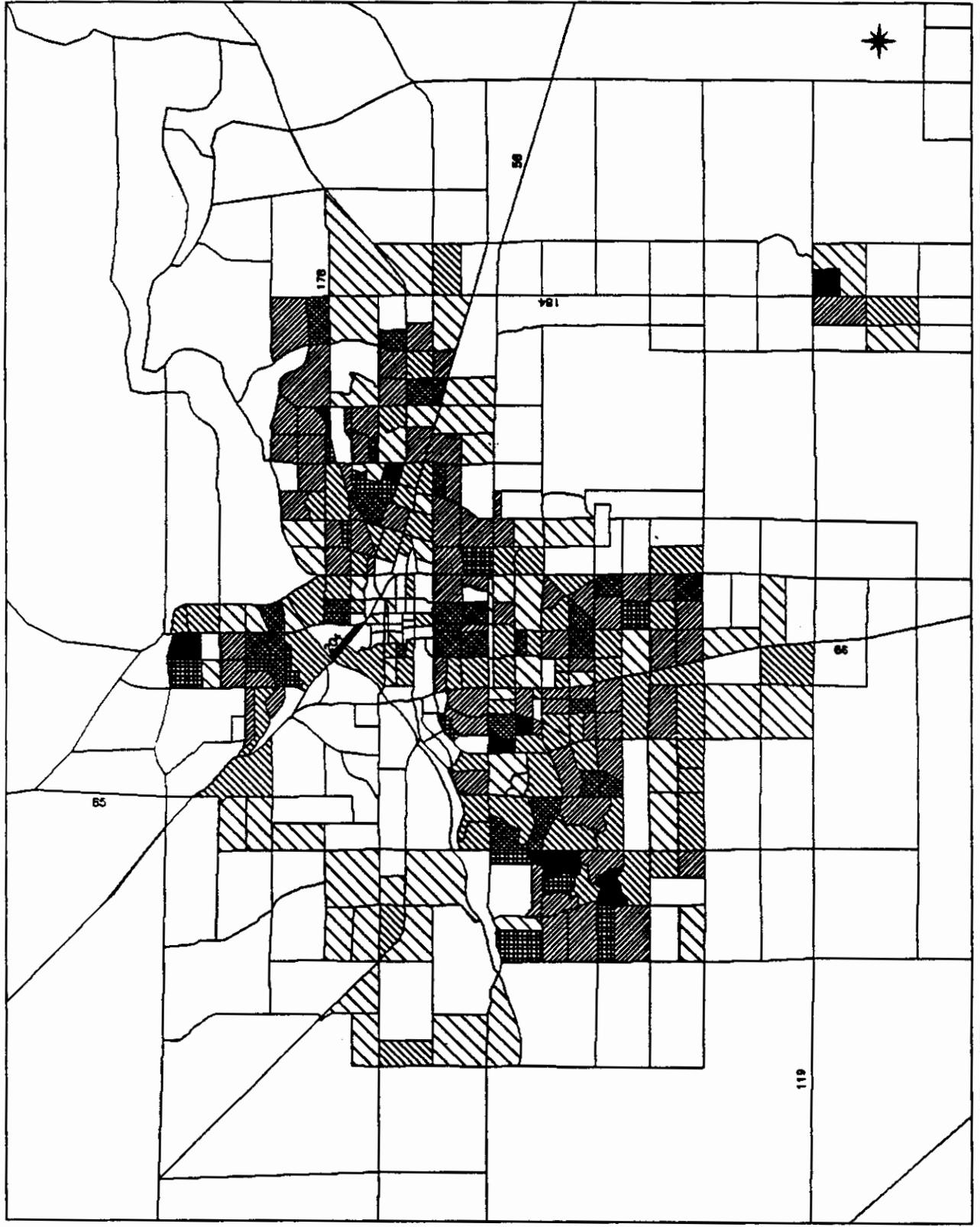
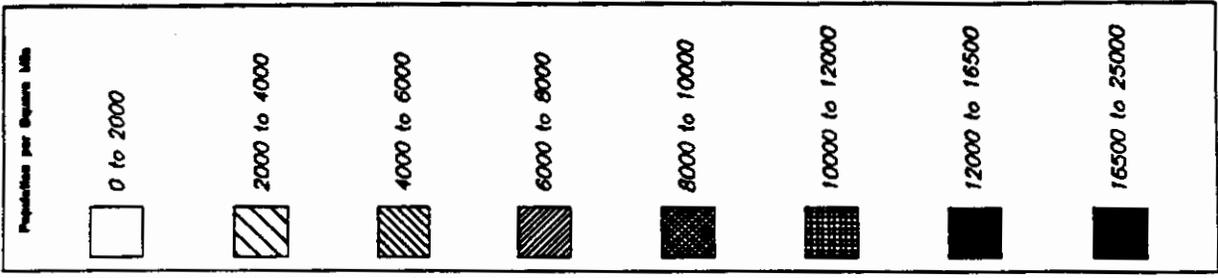
LEGEND

- Hydrography
- Railroads

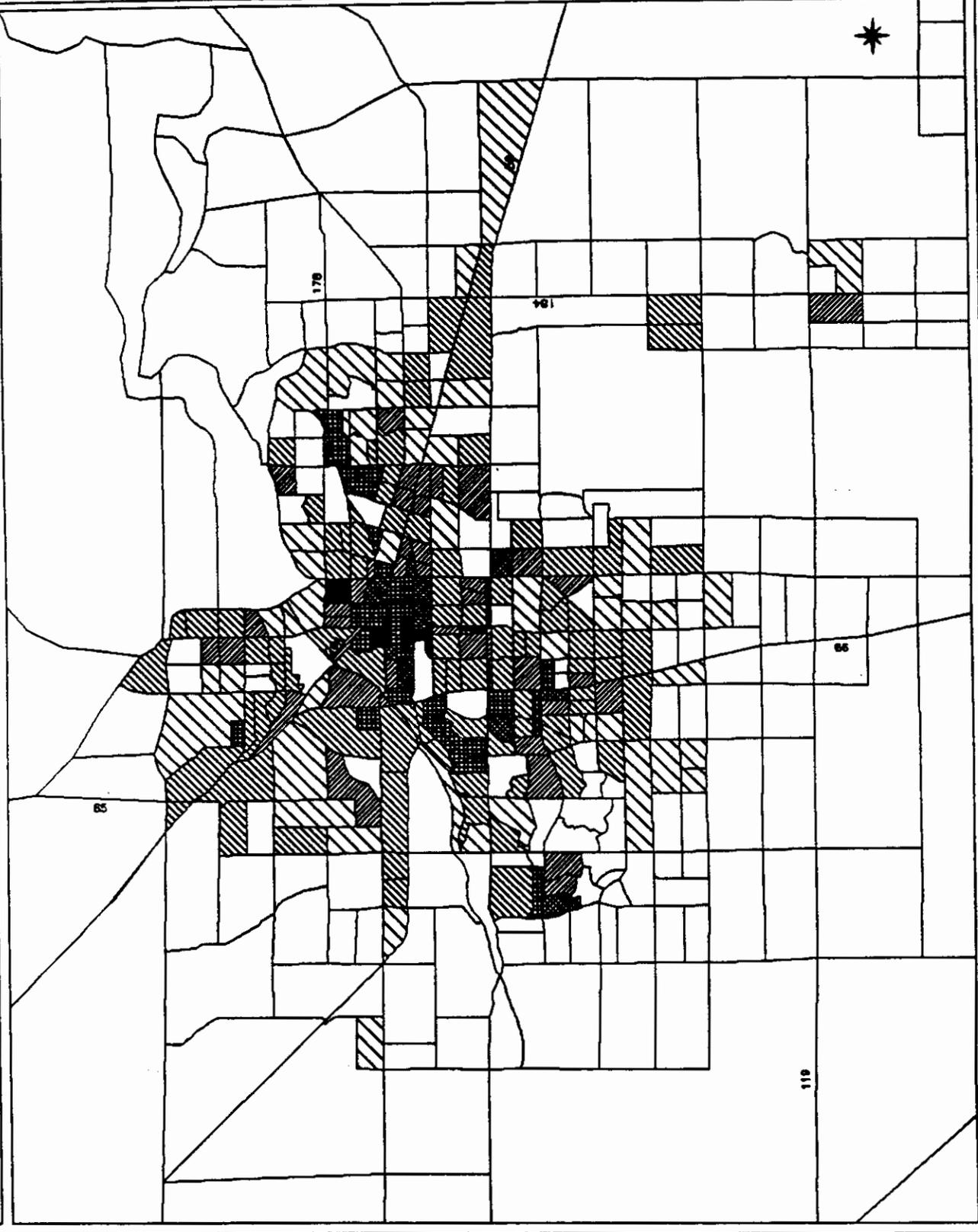
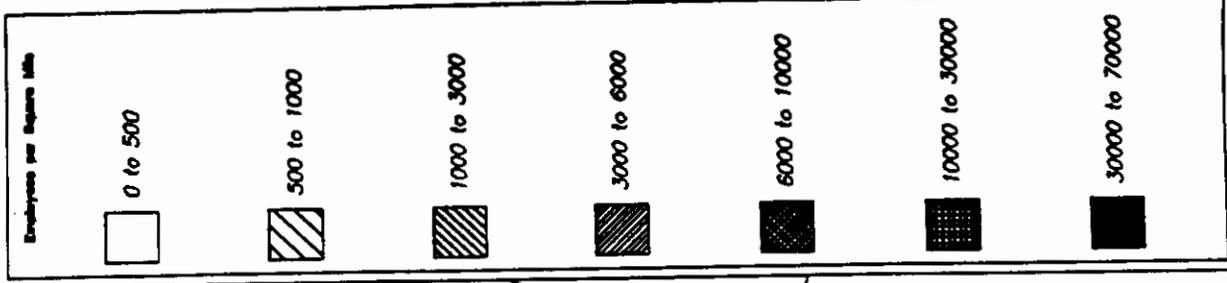


METRO BAKERSFIELD POPULATION DENSITY, 2010

Map Compiled by Kern COG
Using Traffic Analysis Zone Population
Population based on Dept. of Finance
estimates.



METRO BAKERSFIELD EMPLOYMENT DENSITY, 2010



SURVEY OF EXISTING AND ONGOING PLANS

Nine indicators were selected for this general and community plan review as follows:

- o Mapping of the preferred corridors
- o Medium to high density development
- o Clustered, multi-use development pattern
- o Transit infrastructure requirements
- o Improved pedestrian/bicycle circulation
- o Planning overlay zones/special development zones
- o Exactions, developer agreements, financing mechanism
- o Parking management/control
- o High speed rail terminal location
- o Bus shuttle/Jitney service to stations

2010 General Plan for the Metro Bakersfield Area - The general plan is a policy document designed to address the long-range physical development as well as its economic, social and environmental goals for the Metropolitan Bakersfield planning area. The 2010 General Plan was jointly developed and adopted by the City of Bakersfield and the County of Kern.

Two basic principals govern the plan: the focusing of new development into distinctive centers which are separated by low land use densities and the siting of development to take advantages of the environmental setting. These principals are defined as the "centers" and "resource" concepts respectively.

The "centers" concept provides for a land use pattern consisting of several concentrated mixed use commercial and high density residential centers surrounded by medium density residential uses. Single-family residential uses are located between these mixed-use commercial/residential centers primarily. This concept encourages people to live and work in the same area and, thus, serves to minimize sprawl and reduce traffic, travel time, infrastructure cost, and air pollution.

The "resources" concept emphasizes the siting of development to reflect the planning area's natural and visual resources; its rivers, canals, and foothills.

Several land use and transportation goals and policies in the 2010 General Plan address the installation of a light rail transportation system. They are as following:

Land Use

Goal (4) - Accommodate new development which channels land use in a phased, orderly manner and is coordinated with the provision of infrastructure and public improvements.

Policy (37) - Enhance existing and established new centers as the principal focus of development and activity in the planning area, around which other land uses are grouped. Centers should be linked by adequate transportation facilities..

Circulation/Transit

Goal (3) - Provide cost effective public transportation services.

Goal (4) - Reduce traffic congestion and parking requirements and improve air quality through improved transportation services.

Goal (5) - Enhance rail service capacities and usage in the planning area.

Policy (1) - Consider transit service issues in the design of the arterial and collector street system

Policy (3) - Consider transit service issues in the site plan review process.

Policy (7) - Encourage the development of a multi-modal public transportation terminal.

Policy (10) - Work with Amtrak to maintain and improve rail passenger service and facilities in Bakersfield.

Policy (13) - Support efforts to develop high-speed rail facilities to service the Plan area.

City of Bakersfield Redevelopment Plan - The Central District Development Agency adopted a Redevelopment element of the General Plan in 1984. Land use and transportation goals address the need for consideration of a light rail transportation system. They are as follows:

Goal (6) - The redevelopment must work to maintain and strengthen the role of the Central City as the prime cultural, administrative, economic and governmental center of the region.

Goal (9) - The redevelopment element should strive to improve the viability of public and private transportation systems within the context of a regional transportation system.

Objective - The plan should strive to de-emphasize the private auto by encouraging the development of public transit facilities.

Objective - The plan should develop pedestrian oriented features to improve both the function and the aesthetics of the pedestrian system.

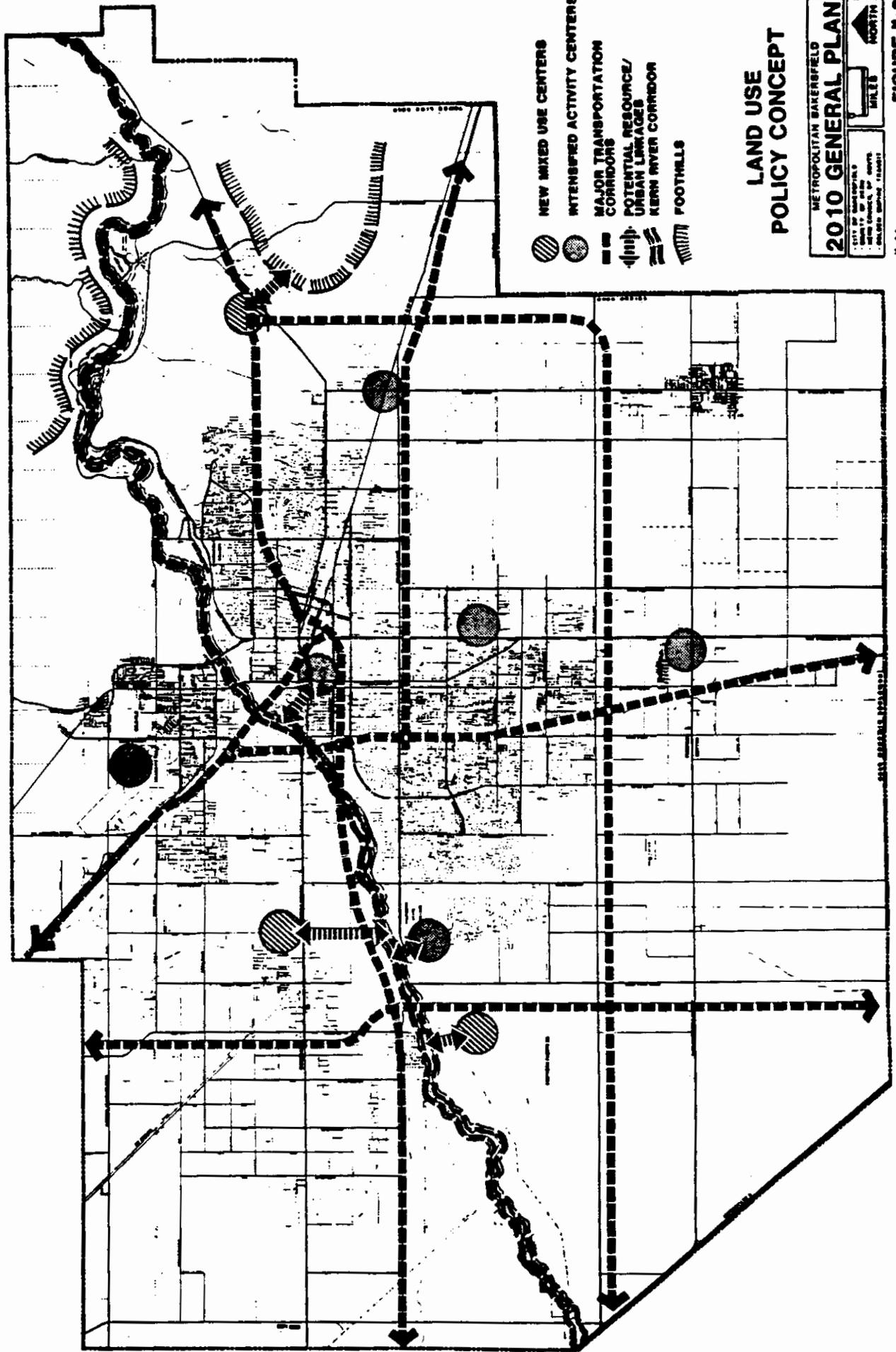
1984 Transit Market and Operational Analysis - The analysis, prepared by the Golden Empire Transit District, presents the findings of an analysis of the local transit market in the metropolitan Bakersfield area, and an operational analysis of the existing transit service on a route-by-route, area-by-area basis. As part of the analysis, system goals were developed. The analysis identified service goal as follows:

- To plan and develop a public transit system designed to provide a safe, convenient and efficient level of transit service at a reasonable cost.
- Promote and encourage the use of public transit as an alternative mode of mass transportation.

1985 Comprehensive Transit System Analysis - The analysis, prepared for the Golden Empire Transit District, identified two alternative routing systems designed to improve the transit system. Both alternatives represented significant departures from the radial routing system that was in operation. After a public review process, the cross-town routing system with peak hour service was implemented.

1990 Regional Transportation Plan - The Regional Transportation Plan (RTP), prepared by Kern COG, provides a long-range examination of transportation issues, opportunities and needs for the Kern Region. The RTP identifies goals, objectives and policies for future transportation improvements, addresses implementation actions, and funding options.

The overall goal of the transit system is to provide a transportation alternative to the general public and mobility for those dependent upon public transportation, with access to essential locations. Objectives identified in the RTP are as follows:



- NEW MIXED USE CENTERS
- INTENSIFIED ACTIVITY CENTERS
- MAJOR TRANSPORTATION CORRIDORS
- POTENTIAL RESOURCE/URBAN LINKAGES
- KERN RIVER CORRIDOR
- FOOTHILLS

**LAND USE
POLICY CONCEPT**

METROPOLITAN BAKERSFIELD
2010 GENERAL PLAN
 CITY OF BAKERSFIELD
 COUNTY OF KERN
 1 MILE
 NORTH
 M-11

Provide an intermodal transit facility in Bakersfield by 2000.

Coordinate with the City of Bakersfield, County of Kern and Golden Empire Transit District to establish future light rail guideway corridors.

Improve coordination of transit system policies and land use policies that support and influence transit.

The overall goal of the Non-motorized Transportation section is to promote the safe, convenient and efficient use of bicycles as and integral part of the total transportation network.

The policies in the Aviation section discuss the integration of air transportation with ground transportation. The Highways and Roads section identifies objective to coordinate roadways with a multi-modal transportation system.

AB 971 San Joaquin Valley High Speed Rail Study - Assembly Bill 971 formed a study group to develop a long-range plan for a high speed rail corridor connecting the San Joaquin Valley with the Bay Area/ Sacramento and Los Angeles area. This project is a phased improvement program that would commence with the improvement of existing rail facilities and would ultimately construct high speed (185 to 300 mph) rail passenger facilities. Seven objectives were adopted by the Project Study Group for the evaluation of improvement project. The objectives are as follows:

- 1. Reduce travel time and enhance speed for trips within the corridor.**
- 2. Provide additional passenger rail service and passenger-carrying capacity within the corridor.**
- 3. Extend direct rail service to Los Angeles, Sacramento and the Bay Area.**
- 4. Increase patronage potential and accessibility of rail service within the corridor.**
- 5. Improve the quality of passenger rail service in the corridor.**
- 6. Maintain capacity for freight operations.**
- 7. Provide cost-effective improvements that maximize benefits within the corridor relative to costs.**

A program of improvements identified four levels of improvement for the San Joaquin High Speed Rail Corridor:

LEVEL 1 - This is the existing level of rail passenger service with three trains daily between Oakland and Bakersfield and bus connections to Los Angeles and northern California. Travel time between Oakland and Bakersfield is six hours.

LEVEL 1a - This phase would provide new service between Bakersfield and Los Angeles on existing rail through the Tehachapi Pass. Train service would also be extended from Stockton to Sacramento/Bay Area through Altamont Pass. The maximum speeds with this improvement would be 79 mph.

LEVEL 2 - The major capital investment in level 2 is the construction of a new direct rail line connecting Los Angeles with Bakersfield via the Grapevine, roughly parallel to Interstate 5. This new line would be designed and built for high speed rail (level 3) performance defined as 185 mph, and would be electrified double track. Level 2 speeds would be 110 mph. A new terminal would be necessary in Bakersfield during the phase.

Travel time between Los Angeles and Sacramento would be four hours and forty-two minutes. Between Bakersfield and Los Angeles, travel would be one hour and thirty-six minutes.

LEVEL 2a - This level involves the electrification of the two track railroad between Bakersfield and Sacramento, along with additional program elements to allow top speeds of 125 mph. To accommodate these speeds at-grade crossings would need to be eliminated.

**Between Los Angeles and Sacramento the travel time would be three hours and fifty-six minutes.
Travel between Bakersfield and Los Angeles would be one hour and thirteen minutes.**

LEVEL 3 - This phase would involve a second high speed rail track within the level 2 corridor between Bakersfield and Sacramento. With the completion of this work, a complete two track, fully grade separated, high speed electrified route, would exist.

Travel between Los Angeles and Sacramento would be reduced to three hours and fourteen minutes. Between Bakersfield and Los Angeles, travel time would be fifty-nine minutes.

LEVEL 4 - This level of improvement involves maglev (magnetic levitation) technology. This emerging technology should not be ignored. Intercity rail planning should accommodate the possibility of implementing this type of "very high speed" system in the future. At this early stage, the primary emphasis is placed on identifying right-of-way requirements.

SB 1307 Integrated High Speed Ground Transportation System Study - The renewed interest in rail in general and high speed rail technology in particular is a result of concern not only about congestion and air pollution but the increasing need to provide a balanced, integrated and unified transportation system. Transportation is a critical part of our socioeconomic system and development of an integrated high-speed rail within that structure is determined and conditioned by many complex, interdisciplinary forces that affect the rest of the system. Implementing a quality high-speed rail service is further viewed economically viable, energy efficient, and environmentally desirable.

SB 1307 calls for the investigation of elements in several areas. These elements include surveys of technology and corridor viability and prioritization, environmental and economic impacts of a high-speed system, and institutional and financial considerations.

Assembly Concurrent Resolution No. 27 High-Speed Rail Link: Bakersfield-Los Angeles -ACR 27 (Costa) requests the Department of Transportation to consider several specific factors while conducting the feasibility studies and preliminary engineering for the high-speed passenger rail link between Bakersfield and Los Angeles. The Clean Air and Transportation Improvement Act of 1990 (Prop. 108 and 111) includes \$5 million for the feasibility studies.

The purpose of the rail link is to provide a modern rail line connecting with existing rail lines at Bakersfield and Saugus. The specific factors identified in this measure are as follows:

- 1. An alignment which incorporates grades up to the attainable maximum for high-speed rail passenger service while minimizing tunneling should be selected, unless it is cost-effective to construct.**
- 2. The rail link should be designed to accommodate high-speed passenger trains, with freight carriage limited to parcels and other lightweight freight.**
- 3. The line should be engineered to be double-track and electrified, able to accommodate trains with a speed of up to 200 miles per hour, where not otherwise restricted by grades or curves.**
- 4. The engineering and study work authorized should be completed in 12 months.**

1991 Air Quality Management Plan - The San Joaquin Valley Unified Air Pollution Control District

will be preparing the AQMP for the San Joaquin Valley in response to requirements of the California Clean Air Act of 1988. The draft AQMP and environmental impact report are scheduled for release in the Spring of 1991. The AQMP will include air pollution control measures to reduce emissions of ozone precursor to attain state air quality standards by the earliest practicable date. In general, proposed control measures can be categorized according to those that reduce emissions from stationary sources and mobile sources.

Congestion Management Program - A congestion management program (CMP) must be developed, adopted and annually updated for every county that includes and urbanized area. The CMP shall be developed in consultation and cooperation with the cities, county, transportation providers, Caltrans and the air pollution control district.

The intent of the program is to reduce or avoid congestion, based on current year traffic conditions on existing roadways and commuter rail systems. The goal of the program is to increase vehicle and/or person capacity of either the congested facility or adjacent facilities. This may include constructing new roadways and rail systems, modifying or expanding existing roadways and rail systems, or implementing traffic flow improvements.

High Speed Rail Terminal Study - The need for a new rail terminal has been discussed since 1987. The City of Bakersfield and Kern COG retained the services of Parsons Brinkerhoff Quade and Douglas, Inc. to prepare an Intermodal Transit Facility Plan. The study, released June 1988, identified an intermodal site at Truxtun and "S" Street. This site meets all of the criteria identified by the City of Bakersfield, Amtrak, Santa Fe Railroad and the requirements of the AB 971 High Speed Rail Study.

To address the High Speed Rail terminal issue a committee consisting of County of Kern, City of Bakersfield, Golden Empire Transit District, Kern COG and Caltrans met to discuss the issue of locating a terminal. The committee initially identified twelve sites. After a preliminary analysis, the number of sites was reduced to five. The committee is continuing to develop the information required for the final analysis.

AB 971 identifies the need for a new rail terminal during Level II of the improvement program. Level II includes the construction of a new direct electrified double track rail line connecting Bakersfield and Los Angeles. Train speed would be 110 miles per hour.

Amtrak Service - Amtrak's San Joaquin rail line has its southern terminus in Bakersfield. Funding for the San Joaquin was first included in Amtrak's 1973/74 appropriation. Amtrak selected a joint Southern Pacific and Santa Fe route. Service began on March 6, 1974.

In 1979, a 43 percent reduction in Amtrak's nationwide route structure was proposed. The San Joaquin was identified for elimination. At this time, the State of California reached agreement with Amtrak to continue the train, with support from the state under the provisions of Section 403 (b) of the Amtrak Act. Service improvements have included the addition of a second and third train, station improvements, the addition of stop and connecting buses. It should be noted that the Bakersfield stop has the third highest average daily ridership on the San Joaquin route.

Proposed service improvements include train service to Sacramento, the re-routing onto the Southern Pacific north of Fresno, a fourth train, and checked baggage service. Many of these improvements will be accomplished in conjunction with the improvements in the AB 971 High Speed Rail Study.

OPPORTUNITIES AND CONSTRAINTS

Opportunities

Preserve Right-of-Way
Improve Air Quality
Reduce Traffic Congestion
Coordinate with San Joaquin High Speed Rail Passenger Service
Revitalize Downtown Bakersfield Area
Educate the Public about the Benefits of Public Transit
Support the 2010 "Centers" and "Resources" concepts
Improve the Multi-Modal System
Conserve Natural Resources
Improve Public Transit Service
Numerous Transportation Corridors are Available for Consideration
Portions of the Community have Population and Employment Densities to Support a Fixed Guideway System.

Constraints

Limited Public Funding
Unprotected Rail Corridors
Public Perception of the Use of Public Transit
Inflexibility Fixed Guideway Systems to Changes in the Land Use Pattern.

SYSTEM GOALS AND OBJECTIVES

The following presents the goals and objectives for the development of a fixed guideway in the Metropolitan Bakersfield area. These goals and objectives set the framework for the comparative evaluation of alternatives that will occur during Phase II.

Goal 1. Improve Transportation Service.

Objectives:

- A. Reduce Traffic Congestion**
- B. Reduce Travel Times**
- C. Increase Travel Safety**
- D. Improve Transit Reliability**
- E. Improve Transit Productivity**
- F. Improve Transit Comfort and Convenience**
- G. Improve Intercity-city Transportation System Interface**
- H. Facilitate Bicycle Travel**
- I. Coordinate Multi-modal Travel**
- J. Facilitate Pedestrian Circulation**
- K. Minimize User Costs**
- L. Provide Adequate Parking Consistent with Community Objectives**

Goal 2. Protect and Enhance the Environment.

Objectives:

- A. Improve Air Quality**
- B. Reduce Noise Levels**
- C. Protect Wetlands, Threatened and Endangered Species**
- D. Minimize Flood Hazard**
- E. Protect Water Quality**
- F. Preserve Cultural Resources**
- G. Preserve Open Space and Parks**
- H. Minimize Housing and Business Displacement**
- I. Avoid Neighborhood Disruption**
- J. Enhance Public Safety/Emergency Preparedness**

Goal 3. Conserve Energy.

Objectives:

- A. Minimize Transportation Energy Consumption**
- B. Minimize Related Non-Transportation Energy Consumption**

Goal 4. Maximize Social Welfare and Equity.

Objectives:

- A. Maximize Accessibility to Jobs**
- B. Maximize Accessibility to Community Facilities and Services**
- C. Avoid of Displacement of Disruption of Community Facilities**
- D. Improve Mobility for Elderly, Handicapped, Minority and Lower Income Groups**
- E. Provide Suitable Housing Accommodations and Opportunities**

Goal 5. Encourage Infill Development and Redevelopment.

Objectives:

- A. Stimulate Development of Downtown Bakersfield**
- B. Improve Job Formation (Number and Location)**
- C. Enhance Economic Base and Income**
- D. Maintain and Enhance Local Property Values**

Goal 6. Maximize Financial Feasibility.

Objectives:

- A. Optimize Public Cost - Total and Incremental**
- B. Maximize Public Revenues - Total and Incremental**
- C. Balance Costs and Funding Available**

Goal 7. Maximize Community and Institutional Acceptance.

Objectives:

- A. Conform with National/State/Regional/Local Goals and Objectives and Policies**
- B. Minimize Financial Impacts**
- C. Minimize Vulnerability to Labor Disputes**
- D. Maximize Governmental and Administrative Feasibility**
- E. Minimize Vulnerability to Delays**
- F. Minimize Risks and Uncertainties Relative to Procurement**
- G. Facilitate Disaster Preparedness and Evacuation Capabilities**
- H. Maximize Private Sector involvement**
- I. Promote Consolidation and Cooperation of Transit Service**

Goal 8. Maximize Economic Efficiency.

Objectives:

- A. Minimize Net Public Costs - Cumulative**
- B. Minimize User Costs - Total and Incremental**
- C. Minimize Non-User Costs**
- D. Maximize User Benefits**
- E. Maximize Non-User Benefits**

PROJECT COST AND FUNDING

The capital cost of implementing a light rail system is estimated at \$10 million to \$15 million per mile in 1990 dollars. According to the San Diego Association of Government report "Long Range Transit Element" (1984), the average LRT capital cost per mile for the LRT systems within the rail corridor was \$8.05 million/mile, and \$9.44 million/mile within a freeway corridor. These figures include the cost of track bed, signals, electrification, stations, right-of-way and vehicles.

State Funding - Public funding for rail services and improvements is limited. All revenues from Proposition 108 and from two subsequent bond measures in 1992 and 1994 have already been programmed in the 1990 STIP; and of that amount \$2 billion remains contingent on future voter approval.

State funding may be available for rail right-of-way from the Transportation Planning and Development account, through deposits from Proposition 116. This is subject to the annual budget process of the California Transportation Commission and the legislature. These funds are not available for long-range planning and financing plans. Over the next ten years, \$3 billion will be spent in the Flexible Congestion Relief Program. Local agency rail projects are eligible for funding, not already programmed.

State Article XIX - This is a third state source which is also known as Proposition 5 Fixed Guideway Funds, are available to selected counties who have voted through a general election to authorize the use of State Highway Account funds to build guideway projects. Kern County passed the measure in 1988.

Transportation Development Impact Fee - Impact fees are a form of development exaction which are regulatory devices used by local governments to impose charges on new development. The purpose of the fees is to generate revenues for capital funding for off-site facility expansion necessitated by that new development. An impact fee is a land use regulatory device distinguished from a revenue raising device. Part of its purpose is to provide local governments the ability to encourage the orderly development of land by ensuring the availability of adequate capital facilities to service new growth and development, and to coordinate the provision of those capital facilities. Impact fees have been adopted and judicially accepted by many states, including California for a number of types of capital facilities including highway congestion relief projects and purchase or donation of rail right-of-way and bus facilities such as terminals.

There are several essential elements that distinguish impact fees as a land use regulatory mechanism instead of a general revenue raising device such as a tax of special assessment. First, the fee can be imposed only upon new growth and development and only for capital facilities. Second, impact fees are fees imposed for the purpose of constructing off-site capital facilities expansion. They can be used to implement a jurisdiction-wide capital facility program if a "nexus" between the development and needed facilities can be established.

Third, the impact fee exacted upon development can be no more than the cost incurred by the local government to accommodate new growth and development. This is recognized as the "fair share" or "proportionate share" approach. Fourth, to ensure that new development receives a sufficient benefit from the fee, it must be programmed to the intended use within a reasonable period of time after it is paid.

Urban Mass Transportation Administration (UMTA) - UMTA provides funding for public transportation purposes. Section 9 grants fund 80 percent of operations, planning and capital projects. Section 3 discretionary funds are primarily for capital improvement, and are available for new fixed guideway such as light rail and heavy rail transit systems.

To obtain UMTA funding it must be demonstrated that the light rail transit system will be cost-effective compared to alternative transportation modes solutions.

Local Option Sales Tax - Section 180000 through 180264 of the Public Utilities Code enables each county in California to propose a sales tax increase for transportation improvements. The counties of Orange, Santa Clara, Sacramento, San Diego and Los Angeles have passed measures to implement transit and rail systems.

Private and Joint Development Funding - Joint development includes physical integration of a station. An active joint development program may include the lease and sale of development rights, construction cost sharing for joint use areas and a "connections policy" under which a property development pays a fee for the benefit of having direct access to a transit station.

Variations of a connection policy are as follows:

Cash-in-lieu programs allow developers to contribute money for the development of peripheral municipal parking garages instead of building parking downtown.

A touch-down rights program would allow an office tower built over a station for a fee.

A "kiss and ride" facility built by a developer, with connection to a station by a concourse or pedestrian bridge would require an access fee.

Transit stations have been constructed by developers to serve their new developments if a stop is approved.

A shuttle or jitney service from a neighboring development would require an access fee.

Coordination may also lead to other developer investments in the system such as; development of parking spaces, people-mover system, station and guideway construction. Other investments may include pedestrian overpasses, bike lanes, land dedications, and park and ride lots.

AB 2766 Vehicle Registration Fee - AB 2766 authorizes the collection of registration vehicle fees by air quality districts for reducing air pollution from motor vehicles. The first priority of funding are the development of transportation control measures, participation in integrating air quality and transportation system plans, congestion management programs, indirect source control programs, improvement of data quality and analysis methods and the expansion of public education and involvement.

The second priority uses of the funding include development of programs that accelerate the introduction of low emission vehicles into fleets, feasibility studies and start-up cost to encourage new transportation services, and financing the ongoing operation of TCM programs. The third priority identifies support of capital expenditures for transportation facilities of equipment and support of current activities.

CONCLUSIONS

This Report has addressed the feasibility of developing a fixed guideway Transit system in the Metropolitan Bakersfield Area. The following conclusions are drawn from the findings of this study:

- 1. Metropolitan Bakersfield is a transportation "Hub" for the southern San Joaquin Valley with air passenger and freight service, common carrier and charter bus service, rail passenger and freight service and the planned high speed rail passenger service.**
- 2. The population of the southern San Joaquin Valley during the next 20 years will continue to increase at a rate higher than the state and national averages.**
- 3. The western portion of Kern County, including Bakersfield will continue to be designated a "clean air" non-attainment area.**
- 4. The existing transportation infrastructure is inadequate to support the future transportation needs of the community.**
- 5. A fixed guideway system would be a significant factor in re-vitalizing the downtown area and surrounding suburban living and employment areas, with incentives for heightened land use intensity and density.**
- 6. There is the opportunity to plan and preserve the needed right-of-way for alternative transportation systems.**
- 7. The development of a fixed guideway system, would provide an alternative fuel efficient mode for transportation of people.**
- 8. A fixed guideway system is an environmentally cleaner solution to meeting our future transportation needs.**
- 9. The present and planned land use, population and employment densities in several portions of the community will support a fixed guideway system.**
- 10. A fixed guideway system would support both the "centers" and "resources" concepts identified in the 2010 General Plan.**
- 11. A fixed guideway system is an affordable alternative when compared to the required mitigation measures associated with a comparable freeway facility (air quality, congestion management, etc.).**
- 12. Public financing for a fixed guideway system is limited, given the unfinished nature of the planned "basic transportation infrastructure".**

RECOMMENDATIONS

If a system is not designed and right-of-way is not reserved now, our options will be severely limited in the future. Therefore, the planning process should be continued. to keep this process moving, the following recommendations should be implemented

1. Authorize the Metropolitan Rail Committee to begin the Phase II, Systems Planning Study.
2. Authorize the Metropolitan Rail Committee to seek funding to support the planning, environmental and preliminary engineering required for the development of Phases II and III.
3. Support efforts to expand the local, state and federal funding sources for fixed guideways.
4. Consistent with the Systems Planning Study, develop a means to encourage private participation in the implementation of a fixed guideway system through the air quality, land use, and congestion management processes.
5. Consistent with the Systems Planning Study, revise the Land Use and Circulation elements of the 2010 General Plan to increase residential and employment densities within the "center" and connecting corridors as necessary to make a fixed guideway system feasible.
6. Consistent with the System Planning Study, careful coordination of state high speed rail plans and local land use and circulation plans should be accomplished.

In summary, implementation of a fixed guideway system appears to be a viable future transportation strategy. The planning process should continue so that barriers to implementation of such a system can be identified, mitigated and so that current land use and transportation actions can be coordinated with future plans for a fixed guideway system. At the conclusion of Phase II, further implementation actions will be identified.

APPENDIX A LIGHT RAIL SYSTEM DEFINED

Light Rail Transit - The common theme in the definition of Light Rail Transit (LRT) is the flexibility and adaptability to different ridership demands. The International Light Rail Commission defines light rail as:

"A form of rail transport that can be developed by stages... Each development stage may be completed in itself, but should make it possible for development to continue to the next higher stage."

The "Guide to Public Transportation Terms and Definitions" defines light rail transit as:

"Steel wheel/steel rail transit construction on city streets, semi-private right-of-way, or exclusive private right-of-way... LRT vehicles can be coupled into trains which require only one operator and often are used to provide express service."

Examples of existing systems that illustrate this flexibility are: Boston, Buffalo, Calgary, Cleveland, Fort Worth, Newark, New Orleans, Philadelphia, Pittsburgh, San Diego, San Francisco, Seattle, Toronto, Sacramento Los Angeles and San Jose.

The popularity of light rail systems and their longevity (Boston began operating in 1897, Philadelphia in 1892) have resulted in sustaining industry that provides reproducible vehicles and equipment with considerable competition. Vehicle variations range from single "trolleys" to two and three section articulated combinations (with capacities of 50 to 100 passengers for each section). The vehicles are universally powered by electric motors, with traction power taken either from an overhead catenary system or a track-side third rail/shoe combination. In few applications, vehicles are equipped with both pick-up systems.

Vehicles can be coupled in combinations of two or more, and frequently can be controlled from either end. This reversibility is helpful in shuttle situations. Maximum speeds vary by application, but are commonly stated as 50 to 55 mph.

Many LRT applications are not in dedicated guideways and require coordination with street traffic. The vehicle operator is frequently assisted in these applications by track circuits of sensors that activate traffic lights and/or barriers. Control of the vehicle locomotion and brakes, as well as operation of the doors, is generally by a single operator on the lead vehicle of the train.

The simplicity of light rail technology makes the basic system a relatively modest investment compared to other guideway options. The same simplicity applies for the extension and expansion reasonable additional cost packages, which can be planned and coordinated to preclude lost value as system parameters of characteristics are changed. The passenger capacity of LRT systems is variable. Simply by changing the configuration of the train or by modifying the run schedule to adjust the headway (time between trains) to accommodate demand. Cars can be run alone, or in trains of two to four cars as the demand varies, all with a single operator. These changes can be accomplished as the system matures and ridership increases, and can also provide the flexibility to respond to daily peaks and valleys in demand.

The adaptability of light rail technology to a wide range of situations ranging from shared right-of-way streets to exclusive, dedicated guideways lends itself to easy planning and apparent ready acceptance by many communities that have systems. The building block concept of the system development assists many municipalities in acquiring rail transit they might not otherwise be able to afford.

APPENDIX B

FIXED GUIDEWAY SYSTEM PLANNING STUDY

Transit Demand Estimates - The first steps in developing demand estimates is the identification of the major travel corridors. When identifying corridors, land use and travel desires must take into consideration. To a great extent, existing transportation facilities control the selection of transportation corridors. The connection of activities within the community will guide the final selection of corridors.

The following factors should be considered in choosing and defining travel corridors:

- Barriers such as rivers, airports, rail and freight yards.
- Existing transportation facilities (rail lines and highways).
- Land use (residential, commercial, industrial and recreation).
- Population densities.
- Employment densities.

In order to estimate travel demand the area must be divided into transportation analysis zone (TAZ). The TAZ when organized into the corridors become the basis to generate, distribute and assign transit trips. For each TAZ the main input variables are:

- The number of Dwelling units and the number of persons employed.
- Transit information: line-haul distance, fare, and mode of access to a line-haul facility.
- Highway information: airline distance, parking cost, running cost per mile and average speed.

Trip Generation - Within each TAZ the number of trips produced by each land use type are estimated. Trip generation characteristics are similar for comparable types of land use. By using standard trip generation rates, light rail transit alternatives can be effectively evaluated.

Trip Distribution - Once the number of trips produced have been identified, the next step is to distribute the trips. This involves allocating trips to each mode of travel (auto, LRT, bus, walk, bicycle, etc.). Making a trip on any mode of travel has a certain inconvenience or impedance. During the trip distribution, this impedance is taken into account.

Assignment to Transit - The number of trips assigned to transit is an estimate of the daily ridership on the transit system in that corridor. At this point the identification of the total ridership and trips at the maximum load points.

Physical and Cost Analysis - Along with estimating the transit demand, analysis of the supply side of transit is necessary. From a social and community point of view, transit costs may not be the most significant factors in accepting or rejecting a transit system.

The realistic analysis of cost is required in both comparison of alternative transportation proposals and in investigation of trade-offs with other, non-monetary benefits. The information required for this task are: operating cost, fare revenue, capital cost and subsidies.

Impact Evaluation - Transportation systems affect the communities infrastructure in many ways. These effects should be carefully weighted during the selection process. Air pollution, energy consumption and accidents are only examples of what may need to be considered.

APPENDIX C

STATION DESIGN CRITERIA

Station design and scheduling of transfers is often the greatest importance for both transit system efficiency, user convenience and attraction. Passenger transfers between transit routes or modes of travel represent an important component of transit travel. No network can serve all trips by direct routes without transferring. By combining modes of transportation, you hope to accomplish six goals:

- link modes of travel
- to offer better service
- to attract new riders
- to increase the efficiency and effectiveness of the existing systems
- to bolster community development plans.
- provide a total transportation system

After the transit system plan has been established, a number of alternative sites for each station must be evaluated. Station planning must take into consideration ridership potential, land availability, topography, right-of-way, and adjacent land uses.

Station design should provide adequate capacity for each modes of travel and should separate the modes (especially pedestrian). Direct access paths should be provided to the greatest extent possible. The station design should minimize access travel distances.

The most significant factors in locating a station will be the access network (including facilities for pedestrian, bicycle, surface bus and automobile), number of passengers, ticket counter/baggage areas, quality of passenger flow and control of passenger flow. Station design principles will require that access priority be given in the following order:

1. pedestrian
2. bicycle
3. buses
4. taxis
5. kiss-ride
6. park-ride

When market factors are favorable, major commercial development can be expected at stations served by major arterials with large tributary areas. Apartments often develop with in sight of stations. Strong commercial gains can also be expected at the rapid transit terminal if economics provide a basic impetus.

Downtown Station - Rapid transit improvement can help to induce increased downtown development. The presence of other supportive factors is essential.

- most important-effective demand.
- availability of land feasibility for development.

The length of time from commitment, construction, or initial operation of a major transit improvement to the generation of significant related land use change is completely unpredictable. A minimum of 5 years.

Not only must conditions at the site be opportune, the general areas level of demand for development and capital to meet it must also be healthy.

Outlying Stations - Transit improvements can help in intensification of land uses around outlying stations. Locations in low density residential surroundings may completely block land use impacts when low density zoning is supported by residents.

Transit Station Design and Decision Process

STEP 1 Policy Development - Development and adoption of a set of goals.

STEP 2 Site Selection - The selection of a site is based on a number of consideration including:

- ridership potential.
- accessibility to major corridors.
- accessibility to local walk, auto and bus travel.
- compatibility with surrounding land use.
- current use of site.
- size of site.
- potential for site expansion.
- cost of construction.

STEP 3 Preliminary system demand evaluation - Forecast of transit ridership for station service areas.

STEP 4 Translation of policy and demand into initial design requirements - One of the most important decisions involves joint development (concessions, office and shopping).

STEP 5 Re-evaluation of demand estimates - Once the initial design requirements have been formulated, the original demand estimates must be reviewed (total volume, special users, joint development generation and access/egress mode split).

STEP 6 Design requirements:

- parking
- fare collection activities (ticket and baggage area)
- waiting areas
- platform areas
- operational functions (mechanical, etc.)
- transit areas
- personal care facilities
- future expansion
- landscaping
- linkage to other modes
- other mixed uses (i.e. commercial office, etc.)

STEP 7 Station financing:

- public financing
- private financing
- public-private financing

STEP 8 Hearing and Approval

STEP 9 Construction

APPENDIX D RECENT EXAMPLES OF LIGHT RAIL & FREEWAY CONSTRUCTION COSTS

The advantages of building a double-track light rail system instead of a six lane freeway are clear in terms of carrying capacity, cost and potential for maintaining air quality standards. The comparison of constructing one mile of a light rail system to building one mile of a six lane freeway

is almost equal in terms of full person carrying capacity but significantly different in cost. The per-person passenger transporting capacity of the light rail system to a six lane freeway would be 1:1.06 in effect. Yet, the cost of building one mile of light rail system at \$15 million per mile is 60% of the cost of building one mile of a six lane freeway at \$25 million per mile; the cost is \$1339.00 per passenger for light rail compared to \$2100.00 per passenger for the freeway. The

advantages of constructing a light rail system is carrying capacity almost equal to a six lane freeway, the tremendous savings of providing effective transportation facilities and the fact that light rail would remove almost 10,800 vehicles per-hour from their potential use and effect on air quality.

Construction Cost Per Mile Comparison

Sacramento		Visalia	
Light Rail System (Urban Area) Double Track		Freeway System (Urban Area) 6Lanes	
- Construction	\$7 million	- Construction	\$14 million
- Equipment (Coaches/Locomotives)	\$6 million		
- Stations	\$1 million		
Capital Sub-Total	\$14 million		\$14 million
- Right-of-Way (40' & Mitigation)	\$ 1 million	- Right-of-Way	\$11 million
		(204' & Mitigation)	
	\$15 million		\$25 million

Passenger Carrying Capacity Comparison

- Trains per Hour (2 way)	16	- Vehicles per Lane	1,800
- Cars per Train	4	- Vehicle Capacity	1.1
- Passengers per Car	175	- Total Passenger per hour	11,900
- Passengers per Train	700		
- Total Passengers per Hour	11,200		

APPENIX E

EXPERIENCES OF OTHER URBAN AREAS

Seattle, Washington

Parking mitigation requirements were written into city's zoning code so developers know in advance what will be expected.

Portland, Oregon

Cap on downtown parking, shifting transportation cost of growth to transit. Light rail may be credited with spurring development and investment on a large scale and in strengthening existing business.

Gresham, Oregon

Special land use designations such as: central urban core area and transit development districts (central urban core mixed use development). Transit development district - 24 to 45 units per acre, up to 75 units per acre if developer provides direct pedestrian connection from development to LRT station.

Washington D.C.

"Wedges and corridor" programs - Planning and zoning are modified to encourage high density development along rail corridors and strengthen residential development in the wedges between the corridors.

The area transit agency has an active joint development program including the lease and sale of development rights, construction cost sharing for joint use areas and a "Connections policy" under which a property owner/developer pays a fee for the benefit of having direct access to a transit station. The transit agency has also received proposals from developers offering to build stations to serve their new developments if a stop is approved.

In many developments, actions have been taken to ensure that new development will be designed for easy transit and pedestrian access, with auto access a secondary consideration. This type of design approach will result in the higher densities which are required to make bus service feasible and which eventually might support rail service.

Toronto, Canada

"Lock-step development" - a policy that allows developers to only build 1/3 of the entire project until the final heavy rail line is approved. Upon construction of the transit line, the balance of construction may proceed.

Calgary, Canada

The LRTs are designed to pre-empt auto use by operating at high speed in the median of highways and arterials at 5 minute headways during rush hours.

The first step in LRT planning is a coordination of land use and transit planning (fully integrated). Second, long-term transportation planning. Third, functional planning study, preliminary engineering study with environmental document, including the development of station area (land use) plans which link transit development with supporting land uses.

Circulation of development applications process - A consolidated review process by planning, transit, and other affected department/agencies where development proposals are evaluated, exactions including pedestrians overpasses, bike lanes to land dedications for stations and park and ride lots.

Cash-in-lieu program - Downtown developments contributed money for the development of peripheral municipal parking garages instead of building parking downtown.

Atlanta, Georgia

Joint development includes physical integration of a station within a state office building, lease of air rights. "Touch-down rights" - for a fee an office tower built over a station. "Kiss and ride" - built by a developer, and access fees paid for stations connected by a concourse of pedestrian bridges.

Dade County, Florida

Long-range land use/transportation planning-Transit is to be used to implement the master plan elements. Station area design and development programs - to plan for development and to identify value capture opportunity. Rapid Transit zones along the corridor. Rapid transit development zone within 1000 feet radius of stations. Station area planning process includes extensive public participation.

Three reports for station locations:

- Background report describing the area.
- Alternatives report identifying development options.
- Recommendation Action Report.

A great deal of effort was invested in directing growth, packaging development proposals and combining resources to create a greater impact. These efforts clearly affected the degree to which new development is physically integrated within the transit system, thus enhancing the use of each. The coordination also contributed to developer investments in the system. (2000 parking spaces, people-mover system, station and guideway construction).

Sacramento, California

The Regional Transit (RT) serves most of urbanized Sacramento County, an area of 340 square miles with a population of about 1 million. Service is provided by using an integrated transit system consisting of a 18.3 mile starter light rail line, 35 local bus routes, 19 peak period bus routes and a downtown shopper shuttle. The RT system was built for \$176 million, or \$9.6 million per mile, using abandoned freeway segments, railroad right-of-way and some on-street operations. The very nature of RTs design philosophy produced an economical "starter line" which minimized cost while preserving the flexibility to accommodate increased future demands. The basic design criteria adopted by RT and enforced throughout planning and design phases are highlighted by four principles:

- maximum utilization of existing right-of-way;
- use of off-the-shelf, proven technology in all vehicle, equipment and system design;
- low cost, functional and accessible stations with minimum frills; and
- integration of RT with the existing bus fleet to optimize service and minimize operation costs.

Currently, RTs 26 air-conditioned light rail vehicles (LRVs) are at capacity during peak hours. Ten new cars are now on order. The new cars will enable RT to operate four-car trains on all peak period trips that require them.

The April 1989 service changes emphasized bus-train coordination. Ridership now exceeds the weekday projections of 23,500 riders per day. The RT fleet of 203 buses now carries 58,300 passengers per weekday. A factor in RT's ridership increase has been an active corporate outreach program. RT encourages employers to offer transit pass subsidies to their employees and assistance to companies to become pass sales outlets. The outreach program also includes RT participation in Employee Transportation Fairs held by employers to encourage their workers to use transportation alternatives. The transportation fairs, along with pass outlets and subsidy programs, are ways that employers can meet trip reduction goals mandated by the city and county.

The introduction of RT into the downtown area is encouraging development. Since RT's opening in 1987, a 32-story high rise office building and a new hotel have been built near stations. New buildings and business are springing up along other parts of the line as well. Major new office buildings have been built at several stations and there has been a noticeable amount of improvement in small businesses located along the line. Buildings close to an RT station gives developers a feeling of permanence that the stop will be there for 30 to 40 years, providing good regional access and constant flow of pedestrians.

"Transit Oriented Development" or "Pedestrian Pocket" concept is proposed for new subdivisions in various areas of the county. This new form of urban development replicates traditional town planning with a "Main Street" commercial core oriented toward the transit station. The core would be surrounded first by higher density housing (apartments and town houses) and then an outer ring of single-family homes. All streets, pedestrian and bicycle paths would focus on the town center and transit station, making it possible for residents to run errands by foot or bicycle and commute to job centers by transit.

Sacramento County is about to include pedestrian pockets in the county General Plan. Developers may be rewarded with incentives such as density bonuses and reduced parking requirements for building these "transit oriented developments" as infill of new sites along major transit corridors. RT owns several large surface parking lots adjacent to stations that could be used for such development as the system is extended outward.

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