Guideway Transit and Intermodalism: Function and Effectiveness: Case Study, Sacramento

Ronald C. Sheck
Guideway
Transit
and
Intermodalism:
Function
and
Effectiveness

Case Study
Sacramento

Lehman Center for
Transportation Research
Florida International University

Center for Urban
Transportation Research
University of South Florida
This report is one of nine case studies prepared as part of the study, Guideway Transit and Intermodalism: Function and Effectiveness. This case study examines the introduction of light rail into Sacramento, the fourth U.S. city to make use of this “new” technology—essentially a modernized adaptation of the electric streetcar to meet the changing travel needs of late 20th century urban areas. Light rail transit, was inaugurated in 1987. The case study chronicles the development of this rail mode in Sacramento. The study emphasizes the four major themes of the Guideway project: technology, policy, planning and design. These themes are woven together into the narrative which characterizes the local setting, describes the rail transit technologies and networks, follows their evolution, discusses planning and building of the systems and their intermodal components, identifies policies supporting transit and describes rail impacts. A summary of main points and lessons learned concludes the case study.
Guideway Transit and Intermodalism: Function and Effectiveness

Case Study

Sacramento

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Project Manager
Ronald C. Sheck

Project Staff
Martin Catala
Forrest Cotton
Julee Green
Michele La Bruce
John Osborne
Cherie Reid
Fadhely Viloria
Ben Walker

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Preface

Over the past few decades more than a dozen U.S. cities have implemented new guideway public transit systems and virtually every major urban area has or is considering increasing public transportation infrastructure investments, frequently including the consideration of guideway transit investments. The country’s dramatic suburbanization and socio-economic changes have placed new challenges on public transportation. Various guideway investments are among the solutions that local communities have considered to meet the changing transportation needs of their communities. The result has been growing guideway transit ridership and an increase in the importance of guideway in the overall transportation system. Guideway transit investments are perceived as the public transit investment that provides an excellent opportunity to compete with auto travel, influence land use, motivate public and business financial support and address air quality and environmental goals. This report does not advocate guideway solutions or discourage careful consideration of non-guideway transportation investments, but provides a knowledge base to support those involved in guideway planning and implementation.

With the development of numerous systems over the past few years, a great deal of experience and knowledge has been gained about all aspects of using guideway investments to meet transportation and other local goals. Much of this knowledge resides with local planning agency staffs and is of great value to other urban areas if the most relevant information can be captured and communicated to the ever growing and changing group of professionals that are involved in guideway project planning and decision-making.

This report is one of several that are being produced as part of a study funded by the Federal Transit Administration on intermodalism and guideway effectiveness. This multi-year effort is being conducted by the Lehman Center for Transportation Research at Florida International University and the Center for Urban Transportation Research at the University of South Florida. The broadly-defined research project, a response to a U.S. congressional authorization, focuses on the examination of factors that influence the effectiveness and efficiency of guideway transit systems and passenger intermodal transportation. The work program is driven by eight primary research tasks, each of which is being addressed through a variety of research methodologies. The overall objective is to assemble existing and new information and interpret and communicate that information in a manner that supports the planning and decision-making efforts of public transportation planners. Knowledge gained in this project will provide useful information for the many communities and transportation professionals that are planning or considering guideway transit as a key component in their...
transportation system. In addition, many of the issues and much of the information will have application for all public transportation planning.

The products of this research effort in 1996 include technical reports, case studies, and data books.
# Table of Contents

List of Tables ................................................................. vii
List of Figures ................................................................. ix
Foreword ............................................................... xi
Introduction ................................................................. 1

## The Study Area
- Physical and Political Characteristics .................................. 3
- Demographic and Socio-Economic Characteristics ...................... 6
- Urban Patterns and History .................................................. 8
- Transportation and Travel Characteristics ............................... 11

## Guideway Transit Components in the Region
- Overview ................................................................. 15
- Evolution of Guideway Transit ............................................. 17
- Sacramento Regional Transit District (RT) .............................. 21
- New Technological Innovations ............................................ 37

## Intermodal Systems and Facilities
- The Sacramento Intermodal Transit System ................................ 41
- Sacramento Intermodal Facilities .......................................... 42
- Best Examples of Successful Intermodalism in the Sacramento Area 45

## Planning Guideway Systems and Intermodalism in the Sacramento Area
- Intermodalism in the Planning Process ..................................... 49

## Policies Supporting Transit
- Transportation Policies ....................................................... 51
- Downtown Development Policies ........................................... 55
- Land Use Policies and Transit Related Design and Development .... 57

## Guideway Transit Impacts
- Guideway Transit Mode Share ............................................. 61
- Land Use and Development Impacts ...................................... 62
- Area and Site Impacts ........................................................ 64

## Summary ................................................................. 67

## References ................................................................. 69
List of Tables

Table 1  California Urbanized Area Population and Transit Ridership .................. 5
Table 2  Demographic Changes in the Sacramento Urbanized Area: 1960-1990 ....... 7
Table 3  Sacramento City and County Population ............................................. 9
Table 4  Population Growth in the Sacramento Area: 1992-2015 ....................... 14
Table 5  Job Growth in the Sacramento Area: 1992-2015 ................................ 14
Table 6  Annual Unlinked Trips ................................................................. 16
Table 7  Annual Passenger Miles ............................................................... 16
Table 8  Sacramento Regional Transit District (RT) ......................................... 22
Table 9  Sacramento Area Intermodal Centers ............................................ 44
Table 10 Percent of Workers Using Transit for Work Trips ............................... 62
## List of Figures

| Figure 1 | Sacramento Urbanized Area Map | 4 |
| Figure 2 | Job and Population Growth Distribution: 1992-2015 | 13 |
| Figure 3 | Sacramento Light Rail | 23 |
| Figure 4 | Freeway Median Station | 25 |
| Figure 5 | In Street Track | 26 |
| Figure 6 | Sacramento Light Rail - Downtown | 27 |
| Figure 7 | Accessible Transit Mall Station | 26 |
| Figure 8 | Former Freight Right-of-Way | 29 |
| Figure 9 | Using Light Rail Ticket Machines | 35 |
| Figure 10 | Bus & Light Rail Central City Map | 36 |
| Figure 11 | Customer Information From Regional Transit's Bus & Light Rail Timetable Book | 40 |
| Figure 12 | Regional Transit Beltline Bus Connector | 43 |
| Figure 13 | Station Site on Private Right-of-Way | 58 |
| Figure 14 | Rail Station Neighborhood Design Integration | 59 |
| Figure 15 | Neighborhood Rail Station | 59 |
| Figure 16 | Annual Unlinked Trips | 63 |
| Figure 17 | Annual Passenger Miles | 63 |
This report is one in a series of case studies examining guideway transit and intermodalism. These case studies are one component in a broadly defined research project that examines factors that have resulted in implementing successful guideway transit systems and how intermodalism can enhance the role of public transportation. These two goals are interrelated through the consideration of guideway transit where it is present as a core transportation element in cities and metropolitan areas.

The use of case studies as a research tool was chosen because individual urbanized areas and transit systems have faced unique problems and sets of circumstances in the process of implementing fixed guideway service. Exogenous variables, including those such as the political environment that are difficult to quantify, have exerted significant influence on the development of public transportation services and intermodal connections. Therefore, case studies permit the careful identification of influential factors in particular situations. The information from multiple case studies can then be used to construct an overall paradigm regarding the implementation of guideway systems and intermodal connections. In addition, the case studies will support the development of refined hypotheses and the testing of other hypotheses that result from other research tasks undertaken as part of this research.

Each case study in this series focuses on an urbanized area. The criterion for selecting the case study areas has been the presence of one or more elements of guideway transit including commuter rail, heavy or rapid rail, light rail, cable cars, monorails, automated people movers, suspended cableway, and busways. Each study reviews intermodalism and emphasizes how those various modes fit together as a system, recognizing critical components that comprise of facilities where transfers from one mode to another take place.

To provide examples of lessons learned that may benefit others and provide the base data and preliminary analysis for the broader project; technology, policy, and planning are emphasized in the case studies. Each case study begins with an overview of the guideway transit components in the region, followed by a discussion of intermodalism. Planning history that has led to the present state of the transportation system is examined. Each case study concentrates on issues the author feels are most relevant to communicate to practitioners beyond the local region.
Introduction

Sacramento has been selected as a case study site because of the successful development of a new, low cost light rail system in a low population density city. This system, constructed and operated by the Sacramento Regional Transit District (RT) was the fourth new light rail system to be opened in the United States in the 1980s. The Sacramento light rail system was built at a cost of $176 million, or $9.6 million per mile, using abandoned freeway segments, railroad right of way and some on-street operation. It is the least expensive rail system (per mile) built in the U.S. with federal funds. The San Diego Trolley's original south line cost less per mile, but was built entirely with state and local funds.

Based on the new heavy rail systems (San Francisco, Washington, and Atlanta) that opened in the 1970s, transit experts forecasted a new boom period for rail transit growth. Urban rail transit has been introduced into nearly two dozen U.S. cities since the opening of BART in 1974. Heavy rail was the favored mode choice for larger cities in the first years of this resurgence of rail transit. By the 1980s the lower capital costs and greater flexibility of light rail gave it an edge over more expensive heavy rail projects that used exclusive rights-of-way, often on overhead structures or in underground tunnels. The inauguration of light rail service in San Diego in 1981 was followed by the 1984 opening in Buffalo, Portland in 1986 and Sacramento in 1987. Other new light rail systems have opened in San Jose (1988), Los Angeles (1990), Baltimore (1992), St. Louis (1993), Denver (1994) and Dallas (1996). Salt Lake City recently began construction in 1996 on a 15 mile light rail line that will be completed in 1999/2000. Hartford, Connecticut also announced in July 1995 plans for a light rail line to be completed by 2000. Sacramento offers an opportunity to review the development of one of the new systems in a low density urbanized area.

The research approach for this case study began with a literature review conducted through a computer search via the Transportation Research Information System (TRIS) and Transportation Library Subfile (TLIB). A search was made of trade publications to identify transit developments and activities occurring in the Sacramento metropolitan area since the concept of a urban rail transit was first broached in 1975. A field trip in June 1995 included visits to the light rail system and the metropolitan planning organization. This provided an opportunity to observe system operations, visit with key resource people, and collect reports and other data for the case study. Agencies contacted included Regional Transit, Sacramento Area Council of Governments (the local MPO), and the California Department of Transportation (Caltrans). Other information used in preparation of this case study has
come from Federal Transit Administration Section 15 reports, and other federal, state, regional and local publications.
The Study Area

Metropolitan Sacramento is typical of new growth urban areas of the Sunbelt region. The core city of Sacramento is surrounded by suburban satellite communities. New jobs were created as state government expanded to meet the needs of a California that tripled in population between 1950 and 1990. Defense employment swelled during the Korean and Vietnam wars. The aerospace and high technology industries of southern California and the Silicon Valley seeded new plants and subsidiary companies in the metropolitan complex. The U.S. Bureau of the Census has defined the Sacramento Urbanized Area (UA) to include the city of Sacramento and major portions of Sacramento County and the city of Roseville and portions of Placer and Yolo counties (Figure 1). In 1990, the Sacramento UA population reached 1,097,005. The central place population is 414,050 or 37.7 percent of the Sacramento UA. This includes 369,365 in the city of Sacramento and 44,685 in Roseville. A handful of incorporated, and numerous unincorporated, communities are home to the 62.3 percent of the UA population living in the "urban fringe." In 1994, 23.5 million unlinked trips were made on local light rail and bus transit.

Sacramento ranks sixth in population of the 36 urbanized areas in California with four percent of the state population. As the largest metropolitan area in the Central Valley area of California, it accounts for 12 percent of the state's transit ridership (excluding the Los Angeles and San Francisco-Oakland UAs) and ranks sixth of all the UAs (Table 1).

Physical and Political Characteristics

The heart of the metropolitan region is the city of Sacramento, located at the confluence of the American and Sacramento rivers in California's Central Valley. This great valley stretches nearly 500 miles north to south and is bounded on the west by the low mountains of the Coast Range and to the east by the high ridges and peaks of the Sierra Nevada. The entire valley drains westward via the Sacramento river and delta complex into the upper reaches of Suisun Bay, an outlier of the larger San Francisco Bay, which opens to the Pacific Ocean through the Golden Gate.

Sacramento occupies river plains along the banks of the Sacramento and its tributary, the American River. The low lying site of the city has been protected by constructed levees for generations, the levees marking the boundaries of urban settlement that were broached by suburban spillover after World War II. The fertile nature of the soils in the Central Valley have supported a rich agricultural base. The snow-fed streams flowing into the valley have
Figure 1
SACRAMENTO URBANIZED AREA MAP
Table 1

CALIFORNIA URBANIZED AREA POPULATION AND TRANSIT RIDERSHIP
(Includes guideway and motorbus)

<table>
<thead>
<tr>
<th>Urbanized Area</th>
<th>1990 Population</th>
<th>Annual Unlinked Trips</th>
<th>Transit Ridership per Capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bakersfield</td>
<td>302,605</td>
<td>5,824,439</td>
<td>19.25</td>
</tr>
<tr>
<td>Fresno</td>
<td>453,388</td>
<td>8,283,499</td>
<td>18.27</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>11,402,946</td>
<td>509,538,457</td>
<td>44.68</td>
</tr>
<tr>
<td>Modesto</td>
<td>230,609</td>
<td>2,594,852</td>
<td>11.25</td>
</tr>
<tr>
<td>Oxnard-Ventura</td>
<td>480,482</td>
<td>2,927,574</td>
<td>6.09</td>
</tr>
<tr>
<td>Riverside-San Bernadino</td>
<td>1,170,196</td>
<td>30,103,393</td>
<td>25.73</td>
</tr>
<tr>
<td>Sacramento</td>
<td>1,097,005</td>
<td>21,661,411</td>
<td>19.75</td>
</tr>
<tr>
<td>San Diego</td>
<td>2,348,417</td>
<td>72,107,847</td>
<td>30.70</td>
</tr>
<tr>
<td>San Francisco-Oakland</td>
<td>6,929,516</td>
<td>415,069,998</td>
<td>114.36</td>
</tr>
<tr>
<td>San Jose</td>
<td>1,435,019</td>
<td>51,917,357</td>
<td>36.18</td>
</tr>
<tr>
<td>Stockton</td>
<td>262,046</td>
<td>3,298,446</td>
<td>12.59</td>
</tr>
</tbody>
</table>

Source: 1993 FTA Section 15 Reports

been tapped to irrigate a variety of crops. The construction of the Central Valley Project in the 1960s provided a stable source of water that has also fostered urban growth. Today, Sacramento is not only the capital of the nation's most populous state, but the largest inland urban area in northern California, and has a diversified economic base. State government, military, high technology, light industry, education, medical services, agribusiness and regional financial institutions make up the employment mix of this metropolitan area of over one million.

The political map of the Sacramento region is somewhat complex. Eight incorporated cities and towns and portions of three counties comprise the local government pieces of this political map. Sacramento city is the largest incorporated area (1990 population: 369,365) and is contained within the county of the same name. Of the county's 1,041,219 residents, 35 percent live in the City of Sacramento. Folsom (population: 29,802) is the only other incorporated Sacramento County community in the UA. Two adjacent counties, Yolo and Placer, are part of the metropolitan area. Yolo County lies across the Sacramento River to the west and includes the immediately adjacent area of West Sacramento and two
incorporated towns, Davis (population: 46,209) and Woodland (population: 39,802), that are urban outliers. Placer County is located to the northeast of Sacramento and Roseville (population: 44,685), Rocklin (population: 19,033) and Lincoln (population: 7,248), all incorporated communities, are part of the Sacramento metropolitan area.

Transportation planning at the metropolitan level is the responsibility of the Sacramento Area Council of Governments (SACOG). The SACOG region includes all of Sacramento, Yolo, and Sutter counties, the western half of Yuba County and Roseville, Rocklin and Lincoln in the western part of Placer County.

The Sacramento Regional Transit District (RT) is the major provider of public transportation in the metropolitan area. The RT service area includes the City of Sacramento and adjacent suburban areas within the county. Yolobus is a public bus system funded by local communities and Yolo County. Yolobus serves West Sacramento, Davis, Woodland and downtown Sacramento. Folsom Stage Line and Roseville Urban Shuttle operate local bus service in their respective cities. Bus service is also provided between commuter hours in Placer, El Dorado, Sutter and Yuba County points and the city of Sacramento.

**Demographic and Socio-Economic Characteristics**

Thirty-eight percent of the 1.1 million people in the Sacramento Urbanized Area (UA) live in the City of Sacramento. The population of the Sacramento UA has increased 118 percent since 1960 from 502,778 inhabitants to a total of 1,097,005 in 1990 (Table 2). Population growth has been consistently high, averaging between 3.4 and 3.9 percent annually for each intercensal period between 1960 and 1990. In comparison with the 32 other urbanized areas with guideway transit, Sacramento ranks 23rd in size.

Sacramento has a low population density. At 3,286 persons per square mile, it ranks 15th among the guideway transit cities. The proportion of the urbanized area population living in the central city (37.7 percent) is considerably less than the U.S. urbanized area average of 49.8 percent. Over 60 percent of the population lives outside of the central city.

The central city population density (3,282 persons per square mile) is less than that of Portland, Oregon and somewhat higher than that of Atlanta, Georgia, both cities with new guideway transit systems. Per capita transit ridership in Sacramento is only 21.4 trips per year compared with 55 in Portland and 65 in Atlanta.
Table 2

DEMOGRAPHIC CHANGES IN THE SACRAMENTO URBANIZED AREA: 1960-1990

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population</td>
<td>502,778</td>
<td>633,732</td>
<td>796,266</td>
<td>1,097,005</td>
</tr>
<tr>
<td>Total Households</td>
<td>164,576</td>
<td>256,621</td>
<td>307,634</td>
<td>416,780</td>
</tr>
<tr>
<td>Household Population</td>
<td>489,076</td>
<td>630,734</td>
<td>781</td>
<td>1,076,223</td>
</tr>
<tr>
<td>Persons per Household</td>
<td>2.97</td>
<td>2.46</td>
<td>2.54</td>
<td>2.58</td>
</tr>
<tr>
<td>Employed Residents</td>
<td>184,009</td>
<td>231,146</td>
<td>343,961</td>
<td>511,243</td>
</tr>
<tr>
<td>Workers per Household</td>
<td>1.12</td>
<td>0.90</td>
<td>1.12</td>
<td>1.23</td>
</tr>
<tr>
<td>Total Household Vehicles</td>
<td>189,875</td>
<td>209,879</td>
<td>303,524</td>
<td>456,788</td>
</tr>
<tr>
<td>Vehicles per Household</td>
<td>1.15</td>
<td>0.82</td>
<td>0.99</td>
<td>1.10</td>
</tr>
</tbody>
</table>

Source: U.S. Bureau of the Census

The age distribution of the Sacramento UA population is slightly younger than the United States. Twenty-four percent of the UA population is under 16 years of age, just a bit higher than the U.S. average of 22.7 percent. Sacramento has a smaller percentage (10.6 percent) of persons age 65 and over than the national average of 12.5 percent.

Minorities comprise 30 percent of the population of Sacramento. Persons of Hispanic origin are the largest minority group, accounting for 12 percent of the total. African American and Asian minorities make up nine percent each. The African Americans are under represented in the Sacramento population compared with the national average of 14 percent. The population of Asian origin is three times greater than the U.S. average of three percent.

The median household income of the Sacramento UA is $32,306, nearly eight percent higher than the U.S. median of $30,056. The poverty level for a family of four was $12,674 in 1989 and 13.1 percent of the U.S. population falls below that level. The poverty rate for Sacramento (12.4 percent) is slightly below the national rate.

Sacramento is almost identical with the United States in the share of households with wage income and in participation in the labor force. Sacramento is lower than the national average in households that receive social security income. In the Sacramento UA, 78 percent of households had wage income compared with 77 percent nationally. However, only 22
percent of Sacramento households reported social security income, compared with 26 percent for the United States. For Sacramento, the overall labor force participation is 66 percent. Seventy-four percent of Sacramento adult males and 59 percent of adult females participate in the labor force. Comparable figures for the U.S. are 74 percent for males and 57 percent for females.

Income levels, poverty status and labor force participation indicate that the Sacramento population is quite similar to national patterns and other urbanized areas with guideway transit.

Eight percent of the households in Sacramento have no vehicle available. This is only two-thirds the national average of 12 percent. Sacramento has slightly more two-car households (39 percent) than the United States (37 percent). Workers who use public transit as their means of transportation to work represent three percent of the population in the Sacramento UA. This is less than half of the national average of 6.72 percent. It is also substantially less than other cities that have developed light rail since 1981. The share of people driving alone to work is slightly higher (76 percent) than for the United States (73 percent).

**Urban Patterns and History**

The urbanized area is dominated by the city of Sacramento which accounts for 38 percent of the population. Sacramento is typical of many California cities which were established as towns in the mid-nineteenth century, grew at a moderate rate around an expanded commercial downtown, and burgeoned to accommodate a large influx of new residents after World War II. The urban morphology of present-day Sacramento is of an older central city with a grid-pattern layout of streets parallel and perpendicular to the waterfront of the Sacramento River. The state capitol building and surrounding state offices are set amidst a 40 acre site a few blocks east of the waterfront. The city's historic central business district lies to the northwest of the capitol complex and south of the Southern Pacific railway yards which occupy the American River bank just south of its confluence with the Sacramento. The two rivers bracket the city on the west and north. To the south and east, the city edge is less easily defined and blends into the surrounding plains of the great Sacramento-San Joaquin valley.

The dominant patterns of urban settlement today are suburban growth that extends outward from the pre-World War II city. Older settlement is visible in the area between the two rivers and south for a few miles downstream along the Sacramento. Except for this well-
established city area and a handful of small clustered settlements sited along the rivers or rail lines today's settlement is largely post-1950. The suburban growth nature of Sacramento can be seen in the comparisons of city and county populations from 1920 to 1990 (Table 3).

Sacramento was founded as the center of an agricultural settlement in 1848 by John Sutter, a Swiss immigrant who received a 50,000 acre land grant from the Mexican government. In the same year John Marshall discovered gold near the south fork of the American River, launching the great California gold rush. Sacramento rapidly grew into a major supply center for the northern part of the Mother Lode gold mining area in the foothills of the Sierra Nevada. In spite of being nearly destroyed by two fires and two floods between 1849 and 1853 the new town was selected as the state capital in 1854.

In 1856, California's first railroad connected Sacramento with Folsom and the new capital city became the western terminus of the Pony Express mail line from St. Joseph, Missouri. The Central Pacific Railroad began construction eastward from Sacramento in 1865 and its completion in 1869 made Sacramento the western end point of the first transcontinental rail line. River boats connected the rail lines to San Francisco and other ports emerging around the great bay 90 miles downstream. Mining expanded in the Sierra Nevada, and agriculture flourished in the valley lands surrounding the city.

<table>
<thead>
<tr>
<th>Year</th>
<th>City Population</th>
<th>County Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920</td>
<td>65,908</td>
<td>N/A</td>
</tr>
<tr>
<td>1930</td>
<td>93,750</td>
<td>N/A</td>
</tr>
<tr>
<td>1940</td>
<td>105,958</td>
<td>N/A</td>
</tr>
<tr>
<td>1950</td>
<td>137,572</td>
<td>277,140</td>
</tr>
<tr>
<td>1960</td>
<td>191,667</td>
<td>502,778</td>
</tr>
<tr>
<td>1970</td>
<td>254,413</td>
<td>631,498</td>
</tr>
<tr>
<td>1980</td>
<td>275,741</td>
<td>783,381</td>
</tr>
<tr>
<td>1990</td>
<td>369,365</td>
<td>1,041,219</td>
</tr>
</tbody>
</table>

Source: U.S. Bureau of the Census.
Today Sacramento is an important highway, rail and river hub. It is the capital city of the nation's largest state and a trade, marketing and processing center for a rich agricultural region. Military installations, aerospace and other industries, and regional commerce also contribute to Sacramento's economy. A deep water channel to San Francisco Bay was completed in 1963, making the city a major inland port.

Transportation has always been important in the growth of Sacramento. The city's location at the interchange between river and rail lines in the late 19th Century has matured into a role as a major hub on rail and highway networks and as an important port for the export of agricultural commodities. Interstate Highway 40 a modern day successor to older transcontinental roadways and north-south Interstate 5, intersect here. The original transcontinental railroad was extended westward to Oakland in 1872 and complimented by lines constructed to link Sacramento south to Fresno, Bakersfield and Los Angeles and north to Portland and Seattle. The Western Pacific Railroad reached Sacramento from Salt Lake City in 1911 to give the capital city a second transcontinental rail link.

Rail transit was also a factor in the growth of Sacramento. The first electric streetcars appeared in 1893. As in many other cities, streetcar lines were built by the electric utility company. In Sacramento, Pacific Gas and Electric (PG&E) remained owner and operator of the lines until 1946. Real estate and street railway development were closely tied together. New lines were constructed into the rural fringe of the city. Housing developments emerged along these lines. Sacramento streetcar lines radiated from a terminal area in front of the Southern Pacific Railroad Station at 4th and Eye Streets. Lines extended throughout the city. At the height of service, the PG&E fleet consisted of 132 cars operating over 10 routes.

Intercity electric transit lines, known as interurban railways, served dozens of U.S. cities including Sacramento. The Sacramento Northern Railway, created in 1923 from the merger of three smaller companies, operated trains to Marysville, Yuba City, Colusa and Chico in the northern Valley, west to Woodland in Yolo County, and southwest to Antioch, Oakland, and San Francisco. Interurban electric trains were operated by Central California Traction (CCT) between Sacramento, Stockton, and Modesto. The trains of both of these companies entered Sacramento on tracks laid in city streets. Both also operated local streetcars on these lines. Central California Traction discontinued its passenger service in 1933 followed by Sacramento Northern in 1941.
PG&E, like many streetcar operators, began to replace streetcars with motor buses in the 1930s. The utility company sold its Sacramento transit system to National City Lines in 1946 which operated the service as Sacramento City Lines. Streetcars were entirely replaced by diesel buses in 1948. Sacramento City Lines remained the transit provider until 1955 when declining revenues imposed a financial burden and the private company sold its operation to the City of Sacramento. From 1955 to 1973 the city-owned Sacramento Transit Authority operated the local urban transit system. In 1973, the municipal authority was replaced by the newly created Sacramento Regional Transit District enlarging the service area to include most urbanized areas of the city and county.

**Transportation and Travel Characteristics**

Sacramento, like most urbanized areas of the country, has experienced an increase in travel that outpaces the growth in population. This is reflected in the growth in number of vehicles and in the decrease in the share of households without automobiles. Between 1960 and 1990 the number of household vehicles increased by 141 percent, from 189,875 to 456,788. Population increased 118 percent in the same period. The number of households without vehicles dropped from 24 percent in 1960 to nine percent in 1990. Growth of population, increased labor force participation and dispersion of jobs to the suburbs have contributed to growth in total travel. Much of the employment growth has been in suburban areas to the east, west and southeast of Sacramento. However, downtown employment has also increased, and total travel and work travel to the CBD are also growing.

Transit ridership has experienced substantial growth in the Sacramento UA. Between 1983 and 1990 the number of unlinked trips on Regional Transit (bus before 1987, bus and light rail subsequently) rose from 14.9 million to 20.3 million, an increase of 36.3 percent. This growth trend has continued and in 1994 RT generated 22.9 million trips.

The work trip is a critical component of total travel in urban areas. Sacramento is no exception to this axiom. Concentration of work travel in the weekday morning and late afternoon hours puts great pressure on the transportation network. Capacity is stretched and congestion problems are more likely to occur at this time than any other. Transit offers the potential of providing some relief for peak hour roadway congestion.

Future travel is very much a function of job and population growth. Where people are going to live and where new jobs will be located will drive increases in travel demand. SACOG has
projected job and population growth to 2015 within its multicounty planning area (Figure 2). The existing and planned light rail lines coincide with these growth areas.

Projections indicate that although considerable growth is expected in population and jobs to 2015, for the Sacramento metropolitan region, the greatest share of that growth will take place in suburban counties. Sacramento County will grow less rapidly than the peripheral counties and the metropolitan region. (Table 4 and Table 5).
Guideway Transit and Intermodalism: Function and Effectiveness

Figure 2


Center for Urban Transportation Research
### Table 4

**POPULATION GROWTH IN THE SACRAMENTO AREA: 1992-2015**

<table>
<thead>
<tr>
<th></th>
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<td>1,099,100</td>
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<td>1,791,843</td>
<td>69.8%</td>
<td>63.0%</td>
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<td>149,200</td>
<td>10.2%</td>
<td>263,719</td>
<td>10.3%</td>
<td>76.8%</td>
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<td>86,886</td>
<td>5.9%</td>
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<td>69,000</td>
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<td>177,087</td>
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<td>117.6%</td>
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<td>75.2%</td>
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* The cities of Lincoln, Rocklin, Roseville, and surrounding areas.

Source: Sacramento Area Council of Governments, Metropolitan Transportation Plan (September 1993).

### Table 5

**JOB GROWTH IN THE SACRAMENTO AREA: 1992-2015**

<table>
<thead>
<tr>
<th>County</th>
<th>1992 Jobs</th>
<th>Percent Share</th>
<th>2015 Jobs</th>
<th>Percent Share</th>
<th>Percent Growth</th>
<th>Actual Growth</th>
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<tr>
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<td>486,789</td>
<td>75.9%</td>
<td>921,182</td>
<td>70.7%</td>
<td>89.2%</td>
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<td>63,921</td>
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<td>11.3%</td>
<td>130.6%</td>
<td>83,456</td>
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<td>45,780</td>
<td>7.1%</td>
<td>124,223</td>
<td>9.5%</td>
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<td>22,178</td>
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<td>22,837</td>
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<td>103.1%</td>
<td>661,618</td>
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* The cities of Lincoln, Rocklin, Roseville, and surrounding areas.

Source: Sacramento Area Council of Governments, Metropolitan Transportation Plan (September 1993).
Guideway Transit and Intermodalism: Function and Effectiveness

Guideway Transit Components in the Region

Overview

Rail transit has become a highly visible presence in the Sacramento urbanized area since the opening of the starter light rail line in 1987. Light rail is marketed as part of the Regional Transit (RT) system. It is not given a special designation as "The Trolley," "Muni Metro," or "MAX" as has happened with light rail respectively in San Diego, San Francisco and Portland. RT operates the Sacramento area's first rail transit service since Sacramento City Lines substituted buses for the last streetcars in 1948. In 1994, the seventh full year of service, RT light rail accounted for 6.96 million trips or 30 percent of the total transit trips in the Sacramento urbanized area (Table 6). Light rail passengers traveled longer distances than bus riders and generated 33.3 percent of all passenger miles (Table 7). The rail mode share of total transit ridership, which includes RT and Yolobus service, has grown steadily since 1987. The opening of two rail extensions, the first along the Northeast/I-80 corridor to Watt Avenue on March 12, 1987, and the second on the Folsom/Highway 50 corridor to Butterfield on September 15, 1987 contributed to the increase in rail transit ridership. A 430,000 annual increase in rail ridership is expected to take place when a 2.3 mile extension from Butterfield to Mather Field Road opens in June 1998.

RT is moving ahead with four light rail extensions. Construction began in October 1996 on a 2.3 mile extension from Butterfield to Mather Field Road. The $34.8 million extension, planned for opening in summer 1998, includes a new station at Mather Field Road and Folsom Boulevard, and expansion of the existing Butterfield Station. The historic Mills Station, built in 1911, and used recently as a commercial center and post office for Rancho Cordova, is being relocated to the Mather Field Road site. The building is expected to house a transit information center, retail space, a local history museum, offices, meeting space for community activities, and a cafe. This extension is being funded with federal CMAQ and TSM funds, state Proposition 116 and TCI funds, a local sales tax, and county development fees. Once construction of the Mather Field extension is complete, RT expects to begin construction of a 3.0 mile extension further east to Sunrise Boulevard. These two extensions were made possible by the recent purchase of 53 miles of railroad right-of-way from the Southern Pacific Transportation Company at a cost of $14 million by the Sacramento-Placerville Transportation Corridor Authority Joint Powers Agency.

The highest priority project for Regional Transit is the new South Light Rail Line, a 6.3 mile extension from downtown Sacramento to Meadowview Road. The $200 million project
### Table 6

**ANNUAL UNLINKED TRIPS (000,000)**

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Source: FTA Section 15 Reports

### Table 7

**ANNUAL PASSENGER MILES (000,000)**

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<tr>
<td>YOLOBUS</td>
<td>MB</td>
<td>5.8</td>
<td>6.8</td>
<td>6.1</td>
<td>6.2</td>
<td>6.3</td>
<td>5.9</td>
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<tr>
<td>Total</td>
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<td>98.3</td>
<td>100.0</td>
<td>105.9</td>
<td>100.0</td>
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</table>

Source: FTA Section 15 Reports
Includes the construction of six stations and the purchase of 24 light rail vehicles. Bus transfers will be provided at three stations, with 3,361 parking spaces to be provided at the six stations. The line projected to carry 15,000 daily riders, an increase of 58 percent over the present system. Final design work will be completed in 1997, followed by the beginning of construction in 1999 and opening of the line for service in 2003. Federal funding has been committed for a share of the project.

RT is also proceeding with the development of the first phase of the Downtown/Natomas/Airport Line. First phase construction will provide a half-mile connection between the K Street Transit Mall with the current Amtrak intermodal center. This phase is fully funded using state Flexible Congestion Relief Funds and local Measure A sales tax revenues.

An additional component of rail transit is being planned as a regional service. Caltrans has been the lead agency for the long range development of commuter rail services between Colfax, Auburn, Loomis, Rocklin and Roseville in Placer County, through Sacramento to Davis in Yolo County. The commuter rail service would be overlaid on the Caltrans/Amtrak intercity "Capital Corridor" service that presently operates Roseville-Sacramento-Davis-Oakland-San Jose. No specific implementation schedule for commuter train service has been developed.

Evolution of Guideway Transit

Although RT light rail operations date only from 1987, rail transit played a role in the development of Sacramento. Electric streetcars operated in the city from 1889 to 1948. The initial battery operated cars of 1889 were replaced by ones drawing current from an overhead wire a year later. At the peak period of streetcar service during World War I, 16 million passengers were carried on 10 routes. Ridership declined during the Depression years, only to bounce back during World War II when gas rationing limited automobile travel. Substitution of buses for streetcars began in 1932. By the end of World War II, Sacramento had five streetcar routes and a dozen bus lines.

Electric interurban lines connected Woodland, West Sacramento, Rio Linda, and North Sacramento to the city. These satellite towns and villages were served largely by interurban trains scheduled for longer trips. However, streetcars operated by Sacramento Northern used the same tracks to service the closer communities of West and North Sacramento. Sacramento Northern discontinued its intercity and streetcar operations in 1941.
National City Lines, a transportation holding company, owned by Firestone, Goodyear, Standard Oil, Phillips Petroleum, General Motors and Mack Truck purchased the PG&E transit system in 1945. The system was renamed Sacramento City Lines and looked for means of economizing as ridership plummeted. Buses were cheaper to operate, did not require expenditures in track and overhead wire maintenance, and offered flexibility in routing. The last streetcar made its final run in Sacramento in January 1947. However, transit was hard pressed to compete in an environment where automobiles were once again available and affordable, where highway and freeway construction allowed greater travel flexibility, and where growing suburbanization was difficult to serve with fixed route transit.

Ownership of the transit system was transferred to the City of Sacramento in 1955 with the formation of the Sacramento Transit Authority (STA). Other private transit operators, notably Gibson Lines suburban bus services, were acquired by STA and, under private ownership, the bus system experienced moderate growth in both fleet size and ridership. During the late 1960s and early 1970s the Sacramento metropolitan area experienced rapid population growth, particularly in the unincorporated areas to the north and east of the city. Responding to this growing transportation need, the Sacramento Regional Transit District (RT) was created by legislative action to provide public transit service in the greater Sacramento metropolitan area. Regional Transit took over STA bus service on April 1, 1973. The bus fleet and network were expanded, new employees hired and trained and annual ridership reached 12.8 million in 1978, a 66 percent increase over the 1970 figure of 7.7 million.

Rapid population growth in California in the 1970s produced undesirable side effects that included runaway real estate prices, air pollution and severe traffic congestion. Although growth was primarily centered in the Los Angeles basin and the San Francisco Bay Area, the effects were also felt in Sacramento. A loosely formed citizens advocacy group was put together in Sacramento in that same period. They call themselves the Modern Transit Society (MTS). The group enlisted aid from organizations like the Sierra Club and the American Lung Association in proposing an alternative form of transportation for Sacramento.

In the 1970s, concerned with deterioration of a ten block area between the Sacramento River and downtown, local community leaders proposed an effort to clean up and redevelop this area of historic buildings, many dating from the Gold Rush era. Efforts to restore this "Old Sacramento" district and to build a California State Railroad Museum also involved a study of a historic streetcar operation to connect the railroad museum, Old Sacramento, and the downtown area. Carried out by the consulting firm of Wilbur Smith Associates, the 1975
study became the basis for MTS to look at light rail as a "problem solving transportation mode" for the entire metropolitan area. MTS began meeting with city and county political and business leaders as well as legislative and congressional representatives to present their ideas on light rail transit as part of Sacramento's transportation future.

MTS focused on available, underutilized railroad rights-of-way and a 4.5 mile section of freeway right-of-way purchased as a bypass route for Interstate 80 into downtown Sacramento. MTS argued that light rail could be a low cost alternative to additional freeway construction in Sacramento. The light rail advocates stressed that light rail could be built as a simple "no frills" system using proven off-the-shelf vehicle technology and a combination of single and double track to minimize capital costs.

The Sacramento City Council took action in 1976, which stopped construction on the bypass freeway and requested that federal funds allocated for the project be reprogrammed to build a light rail transit line. Work began on an alternative analysis process as federal and state funds were sought to construct a 18.2 mile starter line. The proposed line was to take advantage of several opportunities including:

- The former I-80 bypass freeway right-of-way.
- An abandoned Sacramento Northern interurban right-of-way.
- A seldom used Western Pacific corridor.
- Sharing of a portion of the Southern Pacific Railroad's Placerville Branch right-of-way.
- Use of downtown streets for running, especially K Street, which would be redeveloped as a transit mall.

Construction was to be delegated to a new joint powers agency called the Sacramento Transit Development Agency (STDA). The City of Sacramento, the County of Sacramento, the California Department of Transportation (Caltrans) and the Sacramento Regional Transit District (RT) made up the joint powers agency. While the approach appeared to be a good one involving several levels of local and state government, the STDA lacked accountability to any one agency. The STDA was further complicated by the fact that RT was the designated federal grantee and responsible for cost overruns that the project might incur.
Concerned about its potential liability, RT hired its own consultant to review the project and the consultant determined that the original $131 million budget was inadequate to complete the project. The ensuing controversy and political action led to a decision that Regional Transit would take over the project in its entirety. The City of Sacramento agreed to make up the $45 million difference in the original budget and the new, and more realistic, project budget of $176 million.

Regional Transit took over the project in August 1985. At that time 26 light rail vehicles were on order from Siemens/DuWag and in various stages of construction. Utility relocations were underway, material was stockpiled at the North Sacramento storage yard and three miles of track had been laid. Construction continued in spite of problems that included the concern of the Urban Mass Transportation Administration (UMTA) with the American content of the light rail vehicles, the bankruptcy of two contractors, and continuing surprises associated with the utility relocation in the 125 year old downtown area.

Nevertheless, work proceeded. The first light rail vehicle was delivered in November 1985. Extensive negotiations with labor unions were carried out to reach agreements on wages, promotions, transfers and training programs. Vehicle testing began in the spring of 1986. The north or I-80/Watt Avenue segment of the line was completed for the beginning of service, in time for an opening on March 12, 1987. The east segment to Butterfield in the U.S.50/Folsom corridor was opened on September 5, 1987 and marked the completion of the entire 18.2 mile system.

This starter line was designed as 60 percent single track with double track and passing sidings at strategic points to allow for 15 minute headways. Subsequent double tracking has taken place since 1987 so that by mid-1995 less than three miles of the system remained single track. The first segment of double tracking, with one mile of private right-of-way, was completed in late 1988. Although opening as a single track system kept capital costs lower, there are significant problems with double tracking once service has commenced. Most work was done at night or on weekends. Occasional disruptions of rail service had to be supplemented with motor buses. This was usually not as fast or efficient as the trains being replaced. Passenger travel are disrupted, which resulted in unhappy customers for the short run.
Sacramento Regional Transit District (RT)

Regional Transit operates in the City of Sacramento and in unincorporated areas of Sacramento County. The RT service area population is 931,146. This represents 85 percent of the population of the Sacramento UA. Regional Transit provides fixed-route motor bus and light rail service seven days a week (Table 8).

Portions of the urbanized area are outside of the Regional Transit District in western Placer county and eastern Yolo County. Roseville, Placer County, is served by a local transit operator that connects with RT buses just inside Sacramento County. Yolo County Transit Authority, operating as Yolobus, provides bus service into Sacramento on 12 routes from Davis, Woodland and West Sacramento. Connections are made in downtown Sacramento with RT light rail and bus lines.

Regional Transit is supported by a sales tax passed in 1988 as "Measure A." Voter approval of this measure provides a one-half cent sales tax within Sacramento County. Two thirds of these funds are allocated for road construction and maintenance, the remaining one third is allocated to RT for capital and operating expenses.

The 1995, RT light rail network consists of one basic route, an 18.2 mile U-shaped line (Figure 3). The line begins in the northeast suburbs at the intersection of I-80 and Watt, runs southwestward toward downtown Sacramento, makes a loop around the state capital area, continues eastward through older residential areas and into the eastern suburbs along U.S. 50 where it currently terminates at Butterfield Road. A 2.3 mile extension is under construction which moves the eastern terminus to Mather Field Road.

RT light rail trains serve 29 stations. From the northeastern terminal at I-80/Watt Avenue (Figure 4) the rail line continues southward in the Interstate freeway median for just over one mile, then leaves the freeway and crosses over the Southern Pacific Railroad south of the Roseville Road station. Three stations are located in the freeway median, all are served by special ramps and provide parking. The light rail alignment then continues along the western side of the Southern Pacific right-of-way for nearly 2.7 miles. At this point the line jogs sharply to the west in a circuitous detour around a lumber yard that successfully resisted condemnation proceedings in a court battle with Regional Transit over rail line alignment. From the Royal Oaks station on Arden Way, the light rail alignment parallels roads and streets to reach a single-track bridge over the American River.
Table 8
SACRAMENTO REGIONAL TRANSIT DISTRICT (RT)

Service Area Size: (sq. miles): 295  
Service Area Population: 931,146  

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<th>Light Rail</th>
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</tr>
<tr>
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</tr>
<tr>
<td>In subway or tunnel</td>
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</tr>
<tr>
<td>Elevated</td>
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<tr>
<td>Number of Stations (total)</td>
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<td>With parking</td>
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<td>With transit</td>
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<td>Federal: 6%</td>
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<td>Other: 2%</td>
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Source: Sacramento Regional Transit District, FTA Section 15 Reports.
Figure 3
Sacramento Light Rail

- Train Station
- LRT in Service
- LRT Under Construction
- LRT Funded
- Central City
- Roads

- Mather Field Road
- Butterfield
- Starfire
- Watt / Manlove
- University 65th Street
- Power Inn
- College Greens
- US Highway 50
- East Sacramento Freeway
- Oak Park
- South Sacramento Freeway
- Alkali Flat / La Valentina
- Royal Oaks
- Swanston
- Marconi / Arcade
- Watt / I-80 West
- Watt / I-80
- I-5
- I-80 (Blue Route)
- I-60
- Roseville Road
- Sierra Heights
- Del Paso Heights
- South Sacramento
- Land Park
- Meadowview Road
- 23rd Street
- 29th Street
- 39th Street
- 49th Street
- 59th Street
- North Sacramento
- Arden / Del Paso
- Globe
- Central City Roads
Figure 4. Freeway Median Station. The northern terminal at Watt Avenue is constructed in the I-80 freeway. Special ramps provide access from I-80 for buses and to parking and auto-drop off locations at the LRT track level. Stairs and elevators access bus stops on Watt Avenue. (Photo: Ronald Sheck)

After crossing the river, trains run in reserved lanes on 12th Street (Figure 5) to reach downtown Sacramento. The 12th Street alignment was constructed as a single track with trains running in both directions on a one-way street. When this section was double-tracked in 1989 two lanes were reserved for trains. Southbound tracks provide a buffer between southbound automobile lanes and the counterflowing northbound trains. At K Street, the light rail line turns westward for five blocks (Figure 6). This former major thoroughfare has been closed west of 15th and rebuilt as a transit mall between 12th and 7th Streets. Road traffic is restricted to emergency service and delivery vehicles. Two major downtown stations, Cathedral Square and St. Rose of Lima Park (Figure 7) are located on the K Street light rail mall.
Figure 5. **In Street Track.** An outbound Watt/I-80 train proceeds north along 12th Street. Originally single track, the addition of a second track provides parallel adjacent southbound vehicle and light rail traffic, the latter buffering automobiles from the counter-flow of northbound LRVs. (Photo: Ronald Sheck)

Figure 7. **Accessible Transit Mall Station.** A Butterfield bound train is turning from the K Street Transit Mall onto 7th Street at St. Rose de Lima station. The entrance to Downtown Plaza Mall is visible behind the raised circular platform that provides handicapped access. (Photo: Ronald Sheck)
Figure 6
Sacramento Light Rail - Downtown

- Train Station
- LRT in Service
- LRT Funded
- Central City
- Roads
Parallel single track lines on 7th and 8th Streets take the light rail alignment through the capital mall area to O Street. The rail route turns eastward here for a few blocks to 12th Street where it jogs south to begin an eastward alignment on the former Southern Pacific right-of-way between Q and R Streets. This alignment is followed east beyond 65th Street to a crossing of the Southern Pacific Railroad on a curved single track bridge. Portions of the freight railroad branch parallel to the RT tracks have been retained to provide access to warehouses, industrial spurs and the Sacramento Bee printing plant. This section is a mixture of double and single track. Single track is used on bridge spans crossing the two major railroads. Other segments have been double tracked. Two new stations serving residential neighborhoods at 39th and 48th Streets were opened in 1994 in connection with a double tracking project. East of the University/65th Station the RT light rail trains run on track laid parallel to the Southern Pacific's Placerville freight branch (Figure 8). Trains terminate at a stub-end double track station at Butterfield Road, 18.2 route miles from the I-80/Watt Avenue station.

Figure 8. Former Freight Right-of-Way. A four car peak hour outbound Butterfield train nears 48th Street on double-track line that replaced former single-track Southern Pacific freight branch. (Photo: Ronald Sheck)
RT began light rail operations in two phases in 1987. Service from I-80/Watt Avenue to downtown began on March 9, 1987 and was extended to Butterfield on September 5, 1987, completing the initial 18.2 mile system. Most RT trains operate over the entire line between I-80/Watt Avenue and Butterfield. A few early morning inbound trains on the Northeast segment begin their runs at the Arden/Del Paso station after pulling out of the maintenance facility. Although double-tracking has been on-going since the 1987, several short stretches of single-track remain, totaling less than 3 miles. Except for the street running sections in downtown Sacramento (about 2.5 miles) the system is protected by automatic block signals of the railroad type. Rolling stock, track, signal and electric system maintenance are based at the 6 acre facility located on Arden Way in North Sacramento.

System Physical Characteristics

- The Sacramento light rail system is electrically powered. Power is purchased from electric utilities and is supplied at 750 volts through 14 substations to an overhead system that consists of simple trolley wire or catenary. Current is picked up by roof-mounted pantographs at the outer ends of each articulated light rail car.

- The 18.2 mile system includes 15.5 miles of double track and 2.7 miles of single track. In downtown Sacramento the line is double track except where there are parallel one-way lines on 7th Street (southbound) and 8th Street (northbound). Single track sections include the American River Bridge on the northeast alignment, and elevated structures taking RT light rail over the Union Pacific and Southern Pacific mainlines on the eastern alignment. Short stretches near the outer ends of the system are also single track. These surface alignments will eventually be converted to double track. However, the expense of constructing structures for a second track will keep bridges as single track for the foreseeable future.

- Track on exclusive right-of-way is constructed of 115 lb. welded rail laid on wood or concrete ties. This includes track east of 29th Street on the eastern alignment and most track north of the American River Bridge on the northeast section. In downtown Sacramento, and at a few other short segments of street running track is constructed of girder rail laid in city streets.

- Twenty-nine stations are located on the Regional Transit light rail line. Minimum low-level platform length is 350 feet to accommodate four car trains. In the street running sections of the line, curbs, and sidewalks have been extended to railside in the
Guideway Transit and Intermodalism: Function and Effectiveness

transit mall; on other streets trains run along side the curb, or passengers board from the roadway surface. Stations on exclusive double track, right-of-way segments have platforms on the outside of the tracks with access from one side to the other by track level walkways equipped with warning signals. With the exception of some streetside stops, all stations have roofed passenger shelters with benches. One or more fare machines are located at each station. Signage provides train information and directs passengers to connecting bus transit and/or parking lots. A wayside lift is located on each platform at the front of each train to enable wheelchair passengers to board.

- Station spacing varies from three to four blocks in downtown Sacramento to over one mile on segments of the northeast alignment in less densely populated areas.

- Free parking is provided at nine RT light rail stations. A total of 2,352 spaces are provided at six stations on the northeast alignment and at three on the east line.

- Regional Transit rolling stock is cleaned, serviced and repaired at the maintenance facility located adjacent to the Marconi/Arcade station on the northeast alignment. The office-shop complex is a three story structure surrounded by yard tracks used for storage of the light rail vehicles (LRVs) when they are not in service. Maintenance of the LRV's takes place inside the five track shop building. Inspection pits, car jacks, drop tables and overhead cranes facilitate vehicle inspection, repair and overhaul. A car washer is located on an outside pull-through track. Six yard tracks and a turn-around loop complete the facility.

System Rolling Stock

- RT light rail service is currently provided by a fleet of 36 articulated light rail cars. Car bodies are made of low-alloy steel, and come equipped with four sets of double, bi-fold doors on both sides of the car. Doors open at low platform levels and access to car floors is by steps inside the car. Wheelchair access is via a platform mounted lift which opens into the right hand door immediately behind the driver's cab of these double-ended cars. Cars are air-conditioned and equipped with standee window panels that open. Each articulated car seats 64, and has space for an additional 100 standees and 2 wheelchairs.

Center for Urban Transportation Research

31
The 36 LRVs manufactured by Siemens/Duewag are a modification of their U2 body style delivered to Calgary, Edmonton and San Diego. The Sacramento cars are 79 feet, 6 inches in length over their automatic Dellner couplers, and 8 feet, 10 inches wide. They weigh 78,000 pounds and have Siemens cam control and two Siemens type 1KB2021 traction motors mounted on the outer trucks. The center truck, under the articulation joint, is unpowered. The cars have dynamic and magnetic track brakes and spring-applied, electrically released, disk friction brakes. The Sacramento cars can accelerate and decelerate at 3 mph/sec. and have a top speed of 50mph. All but the first car, built in Germany, were assembled at the manufacturer’s new Sacramento plant.

System Operations

Sacramento Regional Transit District provides transit service on a 20 hour basis. Rail service operates 20 hours a day, generally between 4:00 a.m. and midnight. Bus service hours vary with route but follow a general pattern of service from 5:00 a.m. to 11 p.m. RT operates 60 bus routes, although 20 of these are weekday commute hours and peak direction only services.

RT light rail operates trains of up to four cars. Four car trains are the norm during weekday peak travel hours, 6:00 a.m. to 9:00 a.m. and 3:30 p.m. to 6:00 p.m. Weekday off-peak and Saturday trains are composed of two or three cars. Single car trains operate in the evenings and on Sundays and holidays.

Unlike most light rail operators, RT does not make significant changes in service frequency from weekdays to weekends. The basic schedule provides for 15 minute headways from first morning departures through 6:00 p.m.. After 6:00 p.m. the headways increase to 30 minutes. On Saturday mornings, the service headways are 30 minutes until 7:00 a.m.

RT trains have a single operator on board. System dispatch of trains is carried out from the central control facility at the RT headquarters building at 29th and N Streets. Operators control all the cab doors through either opening and closing them directly or releasing locks which allow passengers to use individual door opening buttons on the inside and outside of the cars. Contact is maintained between operators and the control center by radio-phone. Operators also have public address access to all cars in the train.
• Trains are run on a visual basis with operators controlling acceleration, braking, doors and on-board bridges to wayside car-floor level platforms for handicapped access. Wayside signals govern train operations outside of the street-running areas in Sacramento and North Sacramento. The areas of signal coverage extend from Royal Oaks station on Arden Way to I-80/Watt Avenue station on the northeast alignment, and from 29th Street to Butterfield on the east alignment. Train movements in downtown streets are governed by vehicle traffic signals. Speeds are restricted to 50mph on exclusive rights-of-way, and to 15 to 30mph on downtown streets.

• Scheduled travel time is 51 minutes for the 18.2 mile end-to-end run, an average overall speed of just over 21 mph including 28 intermediate stops between I-80/Watt Avenue and Butterfield.

• Fare payment on RT light rail is by purchase of tickets or passes. Passengers are required to carry proof-of-payment while riding trains. Fare inspectors may randomly ask passengers for their tickets. Single tickets and a one-day pass may be purchased from fare machines. These are located on platforms at all rail stations. The machines accept coins only, in $.05 to $1.00 denominations, and do not make change (Figure 9). Instructions are provided in English and Spanish. Monthly passes, good for unlimited rides on RT light rail and buses, are sold at the RT downtown transit center and over 60 outlets throughout the metropolitan area. Tickets are also sold in books of 11 for regular fares and 10 for discounted fares at these outlets. All tickets must be validated in the station ticket machines before boarding trains.

• Regional Transit uses a flat fare system. The basic regular fare for light rail and bus trips is $1.25. Single tickets are valid for 90 minutes from the time of purchase or validation. Daily passes, sold for $3.00, are valid for unlimited rides on RT buses and light rail until 1:00 a.m. the day after purchase or validation. Single discount fares for seniors (aged 62 and over), youth (ages 5-13) and disabled are $.50 for the single ticket and $1.25 for the day ticket. Regular monthly passes are $45.00 for senior/disabled and $20.00 for youth passes. A lifetime pass is available to persons age 80 and older, and entitles them to unlimited free travel on RT buses and trains. All discounted passes require a photo ID at time of purchase. Regular passes and ticket books may be purchased by phone with a valid credit card.
• Unlimited travel for 90 minutes is allowed in a Central City zone for $.25. Central City tickets are valid from 9:00 a.m. to 3:30 p.m. and after 6:00 p.m. on weekdays and anytime on weekends or national holidays. The Central City zone is an area of about three square miles bounded by C Street (north), Broadway (south), Alhambra Boulevard (east) and the Sacramento River (west) (Figure 10).

• Monthly pass holders may purchase a $10.00 monthly sticker which allows them free transfer to Yolobus express buses to Davis, Winters and Woodland.

• With a valid RT permit, bicycles are allowed on light rail and RT buses all day on weekends and national holidays and on weekdays except during the 6:00 a.m. to 9:00 a.m. and 3:30 p.m. to 6:00 p.m. peak hours. Up to two bicycles may be placed in the rear of each light rail vehicle and one bike is allowed at the back of each bus. A three-year bicycle permit is available for $5.00. Bicycle lockers are available for rent at several suburban light rail stations.

• RT has given separate color designations to indicate the direction of travel at light rail stations. Red signs on the station platform indicate that this is the boarding area for trains going toward Butterfield. Green signs indicate the appropriate side to board for I-80/Watt Avenue.

System Performance

• The Sacramento light rail system operates 1.78 million annual vehicle revenue miles and 98,515 annual vehicle revenue hours according to FTA Section 15 data from Fiscal Year (FY) 1994. In the same year the Regional Transit bus system operated 6.76 million vehicle miles and 495,656 vehicle revenue hours. The Yolobus system operated 477,789 vehicle revenue miles and 26,244 vehicle revenue hours.

• In FY 1994, RT light rail generated 6.9 million unlinked trips and produced 33.3 million passenger miles. The Regional Transit bus system generated 15.9 million unlinked trips and produced 61.5 million passenger miles in the same year. The Yolobus network generated 609,963 unlinked trips and 6.1 million passenger miles. The number of rail passenger miles and unlinked trips increased by 53.4 and 73.9 percent respectively from 1989 to 1994 (Tables 6 and 7). Regional Transit bus ridership increased 22.9 percent and Yolobus ridership grew by 1.6 percent.
Using Light Rail Ticket Machines

Proof of fare payment is required before boarding light rail. Violators are subject to citation under California Penal Code Section 640. Tickets are not required with a valid RT monthly pass or transfer.

MACHINE DOES NOT GIVE CHANGE

INSERT COINS
$1.00/.50/25/10/5

COIN CANCEL

OVERPAY

Select Fare.
Push the button for the correct type of fare. The amount will show in the top left corner.

Deposit Exact Change in Coin Slot.
The machine does not give change.

Take Ticket.
This is your proof of payment. Keep it handy to show a RT Fare Inspector.

Prepaid Tickets — If you are using a prepaid ticket, you must validate it in the slot provided in the lower right corner of the ticket machine or in the validator located near the ticket machine.

Overpay Button — If you do not have exact change and are willing to deposit more than the amount displayed, make your fare selection and before the last coin is inserted push the “Overpay” button. You will get your ticket but no change.

More than One Ticket Button — Push this button before selecting your first fare. Then push the fare button once for each ticket that you want, and the combined total for each additional fare will be displayed.


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Center for Urban Transportation Research

35
Transit ridership has grown moderately in the Sacramento UA since the inauguration of light rail service in 1987. Light rail service accounts for much of that growth. Bus ridership has also grown on both Regional Transit and Yolobus.

Total annual operating expenses for light rail increased from $5.6 million in 1989 to $15.4 million in 1994, a 175 percent rise. For the Regional Transit bus system operating expenses increased 78 percent from $21.0 million in 1989 to $37.4 million in 1994.

Of the total transit ridership in the Sacramento urbanized area in 1994, light rail accounts for 29.6 percent of the unlinked trips and 33.0 percent of the passenger miles. Motor bus service provided by Regional Transit and Yolobus accounts for the remainder.

Operating expenses were $8.69 per vehicle mile in 1994 for Sacramento light rail and $5.53 per mile for RT buses. Operating expenses per passenger trip were $2.22 for light rail and $2.34 for buses. The expenses per passenger mile were $0.46 for light rail and $0.61 for bus.

Passenger fare revenues for Sacramento Regional Transit for combined rail and bus service were $15.9 million in 1994 and covered 29 percent of operating costs.

Administrative Structure

The Sacramento Regional Transit District (RT) was created by legislative action in 1973 to meet transportation needs in a region of rapid suburban growth that extended beyond the service limits of the municipally owned Sacramento Transit Authority. The District is governed by a seven-member board of directors. All board members are elected officials that serve as county supervisors or city council members. Three members are selected by the Sacramento County Board of Supervisors and four members are chosen by the Sacramento City Council. The board hires a general manager who serves as the chief executive officer of the District. The agency has 730 employees, 110 in light rail operations and maintenance.

New Technological Innovations

Sacramento has not been as much of an adopter of new technology innovation. Regional Transit has borrowed ideas from other new light rail systems in Edmonton, San Diego and
Portland. The proof-of-payment fare collection system was adopted early in the planning of Sacramento’s light rail system. In order to implement this system, fare machines with time validators have been installed at all light rail stations. Policies have been developed to allow acceptance of transfers from RT buses as payment proof along with tickets and passes. Local ordinances and regulations have been put in place to provide authority for random inspections, issuing citations to those who evade payment of fares and to allow for follow-up fines and court action if necessary. The system apparently works well and the evasion rate is estimated at less than two percent.

Sacramento has pioneered in some areas that are not necessarily technological, but are innovative in terms of policy and programs. One of these is in the approach of providing light rail service using large segments of single track line in order to reduce initial capital costs. At just over $9 million per route mile the Sacramento system is the lowest cost of all new federally funded light rail projects. At the opening in 1987, the starter line was over 60 percent single track. Sufficient sections of double track and long passing sidings, mostly controlled by spring switches or turnouts, were adequate to provide for reliable operation at 15 minute headways. Several double tracking projects completed from 1988 onward have reduced the amount of single track and plans are to double track the entire line except for three bridges by 1999. This approach has allowed capital costs for the initial 18.2 mile segment to be spread out over a longer period than if the entire alignment had been constructed initially as double track.

Sacramento, following the San Diego and Portland examples, has made considerable use of freight railway rights-of-way. This has involved parallel construction of separate track for light rail rather than time separated joint use in San Diego. In the R Street corridor, a Southern Pacific industrial branch could be abandoned because shippers had switched to trucks. In this case, light rail track was laid on an improved alignment on the former track bed. One industrial customer, the Sacramento Bee, needed to maintain rail access for delivery of newsprint to their printing plant. A short freight spur was built alongside the new RT alignment to connect with the Union Pacific mainline west of 20th street.

Development of a sound marketing strategy with good supporting materials is a significant accomplishment of Regional Transit. Fare policy has kept public transit costs low. Good discounts exist for frequent users of the bus and light rail system. RT has developed and maintained a high profile in the community. Information on transit service and use is readily available. The *Sacramento Bus & Light Rail Timetable Book* is published annually and sold for $1.00. This 3 ½ by 7 inch, 200 page book contains individual schedules and maps for
all RT bus and light rail routes, Yolobus routes and contact information for other local transit, paratransit and intercity public transportation services. How to use the system and fare information is provided in English and Spanish. The schedule book is well organized and extremely readable. Fold-out system and Center City maps are included. Advertising panels emphasize non-commute destinations, employee transit assistant possibilities and intermodal connections (Figure 11).
Figure 11
CUSTOMER INFORMATION FROM REGIONAL TRANSIT'S
BUS & LIGHT RAIL TIMETABLE BOOK

American River College
- RT is the easy way to American River College.
- Take bus routes 1 or 81. Timed connections between Light Rail and route 1 at the Watt/I-80 Station.

Amtrak Connection
- Connecting Bus Routes 30, 31, & 32 serve the Amtrak Depot. Trackside connections to all trains including the "Capitol Corridor" Bay Area service.
- For a complete California Amtrak Timetable, call Caltrans at (916) 327-3032 or call Amtrak at 1-800-USA-RAIL.

Downtown Plaza
- Shop and Relax - Ride RT!
- Downtown Plaza is located right across the street from the St. Rose of Lima Park Station Light Rail Station (7th & K Streets).
- Most downtown buses serve the Downtown Plaza and K Street Mall.

Take in a Show...
- Take in a show at the Sacramento Convention Center...
- Ride Light Rail to the Cathedral Square Station (11th & K Streets) and walk two blocks to 13th & K Streets.

TAXI/TRANSIT SERVICE
- Now serving your trip continuation needs
- Taxi stands at the following Light Rail stations:
  - Butterfield
  - Watt/Manlove
  - Marconi
- For more information call: 321-BUSS TDD 483-HEAR

Source: Regional Transit, Sacramento Bus & Light Rail Timetable Book, April 1995
Guideway Transit and Intermodalism: Function and Effectiveness

Intermodal Systems and Facilities

The Sacramento Intermodal Transit System

This section discusses how the transit components in the Sacramento urbanized area function as a system. Emphasis is placed on how the guideway component, the RT light rail line, links to non-guideway transit (RT and Yolobus), to other local transportation and to intercity transportation carriers. The ease of transfer from one mode to another is examined as to the number, location and size of intermodal facilities, coordination of transit schedules, and the payment of fares between modes.

- Integrated, easy-to-use public transportation has been the approach taken by the Regional Transit District in developing transit for the Sacramento metropolitan area. Coordinated efforts have been undertaken by RT, Yolobus and other transit providers working with SAGOG, the designated MPO for greater Sacramento. Regional Transit, as the largest transit provider, has taken the lead through integration of its own bus and light rail system and initiated efforts with the other transit operators to move towards development of a region-wide network. The RT service area covers 295 square miles and contains a population of 931,146. Yolobus covers a somewhat larger service area, 1,014 square miles, yet with a population of only 141,092. The service areas of the two major transit providers take in about 95 percent of the urbanized area 1990 population of 1.1 million. However, the thin nature of the transit network in moderate and low density suburban networks brings a much lower share of population within one-half mile of transit routes.

- The existing, under construction and planned elements of light rail and planned commuter rail services will become the backbone of public transportation in the Sacramento UA by 2005. In 1994, Regional Transit light rail produced 29.6 percent of the unlinked trips and 33.0 percent of the passenger miles. Light rail ridership and transit mode share are expected to grow slowly as additional segments of the system are phased in during 1997. No substantial increase in guideway mode share is anticipated, however before the proposed South corridor line is implemented early in the 21st Century.

- The Regional Transit District has developed a strategy for the efficient integration of light rail and bus transit. A key part of this strategy has been to create a series of transit centers where various transit elements connect to enhance functional
Guideway Transit and Intermodalism: Function and Effectiveness

integration as a single, user-friendly network. Four bus only transit centers, eleven suburban rail transit stations, plus downtown light rail stops have been designated as key transfer locations. Examination of these centers where connections are made between the various components of the transit system indicate the importance of the light rail line to the total network. A further integration is expected to take place when planned commuter rail service is implemented.

- A key element in the RT strategy is to use the bus a feeder/distributor at light rail stations. Some bus routes have been truncated to serve suburban light rail stations. New routes have been added. An interesting strategy has been the creation of a loop bus route tying together the two end points of the light rail line. Route I (Beltline) connects the I-80/Watt and Butterfield light rail stations to each other and to the Sunrise Mall bus transfer center (Figure 12). Most bus feeder services have had frequencies and schedules modified to dovetail with light rail trains.

Sacramento Intermodal Facilities

The role and character of intermodal facilities that are part of the Sacramento Urbanized Area guideway transit system are the focus of this section. Since the RT light rail line is the only guideway component, there are no rail to rail stations.

Rail/Non Rail Transit

Connections between Regional Transit light rail and components of the bus network are important at several key points. The largest possible number of connections exist in downtown Sacramento in the low fare zone designated as Central City (Figure 6). The 26 RT bus routes that serve downtown Sacramento operate largely in two major corridors on parallel one-way streets. Fifteen bus routes pass northbound along 8th Street and southbound along 7th Street between F Street and P Street. Light rail trains use the same one-way streets between K Street and O Street. On the several blocks shared by buses and trains, transfers are made easy by use of common or adjacent stations and stops. The second bus corridor parallels the K Street light rail transit mall. Seven bus routes operate westbound on L Street and eastbound on J Street. Here, transfer between bus and light rail requires a short walk between parallel streets.
Figure 12
REGIONAL TRANSIT BELTLINE BUS CONNECTOR

Legend
- Regular Bus Service
- Peak Only
- Light Rail
- State & Interstate Highways
- Connecting bus routes 12
- Timetable Timpoints
- Transfer Center
- Light Rail Stations
- Park & Ride Lot

Several suburban light rail stations are also important intermodal link points with bus transit. Seventeen bus routes connect with RT light rail trains at the Watt/I-80 station, the largest number of bus routes connecting at any single rail station. This station consists of a lower level rail platform and access road from I-80 to a parking lot, drop-off lanes, and bays for six bus routes. An upper level bus area opens off of Watt Avenue and provides space for 11 bus routes.

Several other suburban light rail stations are also important intermodal link points with bus transit. Arden/Del Paso and Arden Fair on the northeast alignment and University/65th Street and Butterfield on the east alignment are all served by five or more RT bus routes (Table 9).

Intermodal linkages with the automobile are made easier at the nine stations with parking. No parking exists at rail stations in downtown and residential areas within the City of Sacramento except on streets and in nearby public lots. The rail stations in the I-80 corridor of the northeast alignment, and along U.S. 50 on the east alignment, are located at highway access points. Highway signage stresses location and access to these rail stations.

<table>
<thead>
<tr>
<th>Light Rail Station</th>
<th>Number of Connecting Bus Routes</th>
<th>Number of Free Parking Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arden/El Paso</td>
<td>8</td>
<td>47</td>
</tr>
<tr>
<td>Butterfield</td>
<td>4</td>
<td>749</td>
</tr>
<tr>
<td>College Greens</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Marconi/Arcade</td>
<td>3</td>
<td>416</td>
</tr>
<tr>
<td>Power Inn</td>
<td>1</td>
<td>286</td>
</tr>
<tr>
<td>University/65th Street</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Watt/I-80</td>
<td>15</td>
<td>243</td>
</tr>
<tr>
<td>Watt/Manlove</td>
<td>4</td>
<td>496</td>
</tr>
</tbody>
</table>

Location and information enhance the potential feeder/distributor automobile connections to form with urban light rail.

Urban Rail and Intercity Transportation

At the present time there are no direct intermodal connections between RT light rail line and intercity rail, bus or airport facilities. Both Amtrak and Greyhound terminals are a few blocks from the closest light rail stations on the K Street Mall. Plans exist to extend light rail to the present Amtrak station site at 4th and Eye Streets and redevelop the site as Sacramento's major downtown intermodal transportation center. These plans also include relocating Greyhound to the center. At the present time several Amtrak Connection intercity bus feeder services from throughout northern California and western Nevada link with Amtrak trains at this station. Three RT bus routes provide local transit service.

Sacramento International Airport is not accessible by rail or bus transit, but Sacramento Metro Shuttle offers door-to-door van service. Long range transportation plans include a future light rail route to the airport from downtown Sacramento.

Best Examples of Successful Intermodalism in Sacramento

Several examples of successful intermodalism occur in the Sacramento Urbanized Area. At the system level, these include:

- The commitment of Regional Transit to link rail and bus modes effectively into a seamless transit system. These include physical connections, schedule coordination, and a fare policy that makes for an easy transfer between bus and rail. The use of a single proof-of-payment ticket on RT trains that is also accepted on buses, and the reciprocal acceptance of bus transfers on trains is part of a traveler-friendly strategy. Included in this strategy is a variety of daily and monthly passes each attractive to a different group of users.

- Long range plans for further expansion of an integrated transit system that relies on rail service in major travel corridors. The next large scale element of this plan is the southern extension of rail service into a corridor to serve the rapidly growing areas of Fruitridge and Elk Grove areas. Extensions of the northeast and east alignments of the existing 18.2 mile light rail line are also high priorities. As new rail lines come into service they will replace parallel bus services into downtown Sacramento.
Additional bus routes will be reconfigured to provide feeder/connector services at rail stations.

- A well-defined marketing strategy aimed at increasing ridership on both bus and rail transit is another example of intermodalism. Regional Transit publishes a well thought-out, and attractive, system guidebook with detailed schedules, maps and instructions and an easy-to-follow section on using transit. This is a key piece in a marketing effort that incorporates fare policies designed to encourage repeat riders, enhanced public information and sale of tickets and passes by retail outlets throughout the community.

At the facilities level, there are several examples of successful intermodalism including the following:

- The K Street light rail transit mall with parallel and intersecting bus routes, facilitate transfers from one transit mode to another. The transit mall is relatively short, just five blocks long, and contains only two stations, both with attractively designed ADA accessible platforms. Sidewalks have been widened, shelters constructed and motor vehicle traffic restricted to emergency and delivery use only. Twenty-six bus routes can be reached within a one or two block walk from the Cathedral Square and St. Rose of Lima light rail stations on the mall. Signage at light rail stations includes downtown area maps showing the locations of nearby bus stops and pinpointing important traveler destinations: state office buildings, Plaza Mall, Old Sacramento, municipal, county buildings, etc. The widening of sidewalks has been accompanied a by major tree-planting effort which has transformed K Street into a shaded, pleasant outdoor environment.

- The north alignment stations (Roseville Road, Watt/I-80 West, and Watt/I-80) constructed in the median of I-80 present a unique location for intermodal stations and reflect the importance of the auto/rail link to the Sacramento transit system. They have incorporated unique design elements by having dedicated lanes for access and egress from the freeway, special lanes from major arterials that cross the rail line via overpasses and parking lots in the widened medians. Bus bays are provided at two different levels (one for freeway access, the other for Watt Avenue access) at the Watt/I-80 Station. Bus, rail and auto interface at the Watt/I-80 Station, light rail and auto only at the other two.
Planning Guideway Transit and Intermodalism in the Sacramento Urbanized Area

Sacramento has built the first new light rail guideway transit system in northern California in over a decade. With just over one million people in the urbanized area, Sacramento is the smallest metropolitan area on the west coast to build urban rail. Like many other cities, Sacramento became a center for growth in the post-World War II decades. An influx of population and a diversification of the economic base occurred because of several reasons, some of which included: expanding role for state government in a rapidly growing state, the growth of the aerospace industry and military base build-up during the cold war, the start-up of new industry based on electronics and computer technology, the expansion of agribusiness as farming shifted to more intensive production, and construction of a deepwater port for ocean-going vessels. Between 1950 and 1990, the population of the Sacramento urbanized area increased by 118 percent, from 502,778 to 1,097,005. This new growth of the metropolitan area occurred at a time of rapidly rising automobile ownership, entry of a second wage earner per household into the work force, and the shifting location of jobs from the central city to the suburbs.

The 1975 decision by the Sacramento City Council to build light rail was the culmination of citizen efforts to find alternatives to an ever-expanding road and freeway network that had not adequately met the mobility needs of this rapidly growing urban region. Thirty years of highway building and road widening had disrupted older neighborhoods, accelerated urban sprawl, contributed to strip development, increased noise and air pollution levels and contributed to an overall deteriorating urban quality of life. Citizen frustration became translated into action by a variety of groups concerned with these issues. A search for alternative transportation possibilities that began in the late 1960s coalesced around the proposals of the Modern Transit Society (MTS) for a balanced approach to meeting transportation needs. The project proponents borrowed concepts and ideas from the other new systems developed in the western United States and Canada in the previous decade: Edmonton, San Diego and Portland.

The MTS approach emphasized light rail as the cornerstone of a revived, and revised, mass transit system that could alleviate the need for unlimited roadway expansion. The argument was presented that mass transit deserved a test, and that only when an adequate supply of transit was made available, would it be possible to determine if Sacramentans would get out of their cars and onto the bus or train. MTS proposed that light rail transit could be
implemented at relatively low cost and advocated a no-frills starter line be constructed in key travel corridors.

The Modern Transit Society found support from many individual citizens, other advocacy groups concerned with environmental issues, business community proponents of a revived downtown, and the Sacramento Bee, the city's largest newspaper. Convincing arguments in favor of light rail earned the support of several key city and county elected officials. Further support came from a sympathetic state administration. Governor Jerry Brown and his Caltrans Director, Adriana Gianturco, recognizing the limitations of an automobile-only solution to California's transportation problems had pushed state policy towards the development of a diversified transportation program that incorporated various modes working in a collaborative fashion to enhance mobility and relieve congestion. Caltrans then became a strong supporter of the Sacramento light rail project.

The MTS proposal focused on several arguments in favor of light rail and particular opportunities that made it a viable option in Sacramento:

- The availability of underutilized railroad rights-of-way for much of the proposed system.

- The idea that light rail could be a low cost alternative to additional freeway construction.

- Diversion of construction funds for building a publicly unpopular 4 one-half mile section of freeway right-of-way purchased and cleared in the early 1970s as a bypass route for Interstate 80 into downtown Sacramento.

- The availability of federal and state funds to assist in the project.

- The concept that light rail transit could be built on a "no frills" basis, using proven "off-the-shelf" technology and a combination of single and double track to minimize capital expenses.

In 1976, the Sacramento City Council took action to stop construction on the Interstate 80 bypass freeway and requested that federal funds programmed for additional freeway construction be reallocated to help build the light rail project. A system plan was developed that followed many of the concepts and ideas proposed by MTS. Work began on the
alternative analysis process in the late 1970s. In mid-1981, a draft Environmental Impact Report (EIR) was approved that identified an 18.2 mile system.

Construction began in late 1982 under the auspices of the Sacramento Transit Development Agency (STDA), a joint powers organization created to implement the light rail system. Development was placed in the hands of Regional Transit in 1985 after STDA proved too cumbersome to move the project towards its expected 1987 opening. Many of the low-cost ideas and operational concepts contained in the MTS proposals, were further modified and polished during numerous public meetings. These discussions continued as the project advanced to a detailed planning stage, which became part of the basic design criteria adopted for the project. The criteria, used throughout the planning and design phases were highlighted by four principles:

- Maximum utilization of existing rights-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.
- Integration of light rail with the existing bus fleet to optimize service and minimize operating costs.

**Intermodalism in the Planning Process**

Consistent with the principles adopted for planning and design is the concept of intermodalism. An integrated bus-rail transit system was an early goal of STDA and RT from the earliest days of planning for light rail. Local transit officials and planners recognized the importance of connectivity to the bus network even before light rail was to be part of the expanding system. However, the introduction of the light rail system led to rethinking and restructuring of the service network.

The traditional concept of radial routes extending outward from the downtown area was revised. In 1987, when light rail became operational, RT began to realign the bus system. New lines were introduced to act in a feeder/distributor role to the rail system. Several radial bus routes were cut back to play a similar role. The first large scale restructuring took place in 1989. A new route #1, Beltline, bus was put in service replacing two 30-minute routes and one 60-minute route with 15 minute all-day service connecting with LRVs at the I-80/Watt
and Butterfield stations. Eleven routes were scheduled to provide timed connections with RT trains at suburban stations. Five routes were restructured to provide coordinated 15 minute service between the Arden/Del Paso and 29th Street light rail stations and the Arden Fair Shopping Mall. Before restructuring, all of the trips on these routes were operated to and from downtown. This strategy reduces the number of bus route and service miles, and provides faster travel times to downtown locations for many outlying residents.

Several rail stations were selected as key transfer points where bus lines fan out to serve nearby neighborhoods, or even extensive suburban areas. Four bus transfer centers were also developed at locations not reached by the rail line. These transfer centers and the bus/rail intermodal stations provide attractive waiting areas with shelters, lighting, signage and other transit information, bicycle racks and sometimes lockers. Fare policies and fare collection are supportive of making intermodal transfers as smooth and convenient as possible. System planning, facilities planning and operations planning at Regional Transit have all proceeded with the customer in mind.

The various agencies (RT, STDA, SACOG and Caltrans) responsible for planning and development of Sacramento's light rail transit system emphasized intermodalism before it became a national policy with the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991. This six-year reauthorization of federal highway and transit funding emphasizes the importance of various transportation modes integrated together into a seamless system.
Policies Supporting Transit

This section discusses the role of policies in the Sacramento urbanized area that have worked in support of, or against, transit in comparison with other travel modes. Although the main emphasis is on policies other than transportation, a brief discussion of transportation policy is included to provide some context.

Transportation Policies

Transportation policy in the Sacramento urbanized area mirrors a change in public attitude and perception that has evolved in some California cities and in the neighboring states of Oregon and Washington over the past three decades. Suburban sprawl, strip malls, cookie-cutter subdivisions, urban neighborhoods split apart by freeway construction, roadway congestion, and air and noise pollution are negatives that urban residents want to overcome. A multimodal approach to transportation with an emphasis on greater use of mass transit, tied into land use planning, is one strategy for improving urban areas. By the 1980s new directions were starting to emerge at local, state and national levels. The impetus for this change came from a growing frustration shared by citizens, business and government. It culminated in a reexamination of transportation policy at the federal level that became embodied in ISTEA.

Federal, State and Urbanized Area Policies

ISTEA provided important new directions for the nation's transportation future. A shift in emphasis from moving vehicles to moving people and goods lies at the heart of this policy. To accomplish this, the preamble to the legislation suggests that each mode has a particular role to play and that integration of modes into a single system providing for seamless travel is an important national goal. Transit is clearly identified as part of this system and the authorization levels contained in the Act provide for a greater share of surface transportation funding for transit.

Since the early 1970s California has moved away from a highway exclusive approach to meeting transportation needs to one emphasizing the use of various modes working together. State transportation policy in California now states that transit should play a greater role in solving state mobility issues, particularly in urban areas. The state has provided funding for transit assistance and allowed local communities wider latitude in the use of local tax dollars for transit purposes. Perhaps the biggest single boost for transit
occurred in 1990 when California voters approved three major statewide bond issues (Propositions 108, 111 and 116) for transportation purposes.

These three bond issues provided $22 billion, of which $3.2 billion was available for local transit and intercity rail projects. A companion ballot measure raised the state gasoline tax by 10 cents per gallon, phased in over a five year period. The state bond issues have provided money for constructing new urban rail systems and for expanding and upgrading existing ones. Sacramento has made use of these funds for double-tracking, additional stations and construction of the Mather Field Road extension of the east alignment of the light rail system. Some $250 million in state bond funds were made available in these bond issues to the Sacramento region for urban rail projects.

The Sacramento Area Council of Governments (SACOG) adopted a series of transportation goals and policies in 1992 as part of the Regional Transportation Plan. These goals were updated in 1993. Included in these goals are the following:

- Work with transit operators and planning agencies, human resource agencies, and the general public to determine the need for improvements through the "unmet transit needs process" as required by the Transportation Development Act.

- Advance in the funding process, proposed transportation projects which facilitate higher-density or mixed-use development as a means of affecting travel behavior.

- Advance proposals for multiple-occupant vehicle systems in the project-funding process as a means of expanding the capacity of the transportation system, with emphasis on public transit service and carpool facilities and services.

- Assist local agencies and the State in their efforts to market alternative modes of travel, with information provided in all appropriate languages.

- Try to obtain funding for improvements to the inter-regional passenger-rail system.

- Work with transit providers and congestion management agencies to develop programs and policies aimed at the development of adequate transit systems for the region, acceptable minimum levels of service within given areas, ridership objectives and other planning standards as deemed appropriate.
Guideway Transit and Intermodalism: Function and Effectiveness

- Use the long- and short-range transit plans of all transit providers as input to the Metropolitan Transportation Plan, provided they are consistent with the plan.

- Assist local air quality districts in developing plans for meeting the standards of the California Clean Air Act, and encourage the air quality districts to coordinate their efforts with ridesharing agencies and transit operators (standards include 1.4 persons per vehicle during peak periods by 1999, a five percent annual reduction in district wide emissions, and no net increase in mobile source emissions after 1997).

- Obtain all possible revenues brought about by Propositions 108, 111 and 116.

While these goals and policies do not necessarily identify rail transit projects, they are, or potentially are, supportive of a greater role for transit.

Transit Agency Policies

Sacramento Regional Transit District has developed a set of strategy roles for the agency that are related to issues facing Sacramento. RT identifies these roles to include:

- Traffic congestion relief - A more fully developed transit system would provide an effective alternative to an overcrowded roadway system. One full bus or light rail vehicle can remove 40 to 125 cars from crowded local roadways.

- Air pollution mitigation - No-emission, electrically powered light rail trains and trolley buses, and low-emission compressed natural gas (CNG) buses will help improve future air quality in the Sacramento region.

- Regional mobility enhancement - Sacramento's regional and local mobility will be improved with a mass transit system which includes commuter rail, light rail and buses, coordinated with taxis, private shuttles and paratransit services.

- Accessibility for people with disabilities - By providing transit vehicles, services and information that are accessible and convenient, people with disabilities will have more transportation options.
Land use and trip generation - By providing guidance to cities and counties on designing and directing development, transit ridership can increase and auto dependency decrease.

Preserving urban quality of life - Greater reliance on transit means that less land needs to be paved for roads and parking, making it available for other important uses that make Sacramento a good place to live.

These role strategies have been the basis for the development of policies and plans. Actions emerging from this combination include:

- The definition of light rail as the desired transit mode in key corridors.
- The expansion of the bus fleet and network, improvements in service, restructuring bus routes to feed light rail lines.
- The development of a multimodal system with convenient transfer points and coordinated schedules, fares and ease of payment.
- The consideration, and subsequent rejection, of trolley buses for heavily traveled bus routes. Purchase of 95 CNG-fueled buses, the largest fleet of any U.S. transit system.
- The development of a nearly totally accessible transit vehicle fleet. All weekend services are fully accessible. The new CNG bus fleet "kneels." Complimentary paratransit service is available.
- The encouragement of transit friendly land uses and development policies at rail stations and transit centers, as well as, throughout the metropolitan area.

Other transportation and transit policies are also important. Fare policies and service policies have been discussed earlier and are clearly relevant to transit use and affect the ability of RT to attain its goals and objectives.
Downtown Development Policies

Sacramento, like many other cities, experienced a decline in economic activity and deterioration of downtown in the 1960s and 1970s. Retail stores moved to suburban shopping centers and malls. The flight of private sector office employment to more attractive and accessible locations outside of downtown was partially offset by public sector employment growth resulting from the expansion of state and local government. Vacant buildings, graffiti, increased crime and a general malaise were symptomatic of a drop in business income and tax revenues. Particularly troublesome was a feeling of a deserted and abandoned community in the evenings and on weekends. Week day office jobs were the mainstay of economic life. A growing transient and homeless population was associated, justly or unjustly, with an increase in the crime rate.

Community leaders, concerned with a near crisis situation began a multipronged approach to restoring security and vitality to downtown Sacramento. Thus, the Sacramento Housing and Redevelopment Agency (SHRA) was created in 1973 to provide a mechanism, and funding, to start the revitalization effort.

Among the elements supporting redevelopment were public investments in new government buildings. The State of California was actively involved in construction of new office buildings. Most of these were concentrated in a district to the south and west of the capitol building and Capitol Mall, which extends from the statehouse west to the Sacramento River centered on M Street. Along N, O, and P Streets the state office district extended east to 16th Street. A concentration of new city and county buildings emerged between G and I Streets. The central business district, largely between these two concentrations of new public sector office employment continued to suffer decline.

Two other events began to shape the redevelopment of downtown Sacramento. One of these was the decision in 1979 to construct a California State Railway Museum along the Sacramento River just south of the Southern Pacific Railroad (now Amtrak) passenger station. The museum was planned for the site of California's first railroad. Built with a combination of public and private funds, the museum stimulated redevelopment of an area of old houses and shops, some dating to the 1870s, immediately to the south. This area, now designated Old Sacramento, in combination with the railroad museum has become a tourist district with shops, restaurants and museums in buildings rebuilt to preserve the area's historic character.
A second event was the decision to construct the light rail line, and to use that action as stimulus to redevelop the area along K Street. East of 12th Street the new Sacramento Convention Center was constructed along with a theater. K Street became closed to automobile traffic and was rebuilt as the light rail transit mall. On the other front, SHRA has attempted to stimulate development along the Mall. Unfortunately, this has not worked out as well as originally anticipated. Some new construction and some rehabilitation efforts have taken place. Generally, however, there has not been a major impact of new economic activity. Ground floor land use is predominantly in small retail shops and food service facilities. About 15 percent of the space is vacant. The Light Rail Transit Mall appears to be in transition, in spite of the fact that it is surrounded by successful new construction and redevelopment only a block or two away.

Several other downtown projects are also noteworthy. The most successful private sector downtown redevelopment effort has been in the creation of the Downtown Plaza Mall. Six city blocks, bounded by L and J and 4th and 6th Streets have been turned into a retail, hotel, and an office complex. This is situated where the light rail line turns from K Street onto 7th Street, southbound, at the St. Rose of Lima Park. Macy’s and Weinstocks are major anchor department stores and 118 other retail outlets and food facilities are present in the two-level landscaped, courtyard-facing complex. A new 16 story, 368 room Holiday Inn hotel dominates the northwest corner of the property and overlooks Old Sacramento and the Railroad Museum. Sacramento’s other new downtown hotel is on L Street, across from the state capitol building. This is the 15 story, 500 room Hyatt Regency.

New residential activity has not materialized on a large scale in downtown Sacramento. There has been some development on the edge, and a considerable amount of rehabilitation of existing housing. Sacramento lacks the residential vibrance that has characterized redevelopment in San Diego, Portland and Seattle over the past two decades.

There is little question about change in downtown Sacramento. Projects launched since creation of the development agency have brought in more than $1.2 billion in public and private investment into downtown Sacramento. Downtown development has created new jobs and shopping opportunities. Hotel capacity has doubled, but lags far behind other cities of similar size. Downtown Sacramento has become an expanding destination possibility for potential transit riders. It also has a growing tourist element that may use transit to reach other destinations. Regional Transit has accommodated the new developments in downtown Sacramento not only by investment in the light rail project, but by a complete rerouting of bus lines to serve state, county and city office employment centers.
A planned redevelopment of the former Southern Pacific Railyard property, some 240 acres (about the size of present-day downtown Sacramento) may dramatically alter the shape and character of the city center. Located just north of the present CBD, plans for the property include the multimodal transportation center, 2,100 housing units, 28 acres of parks and open space, four new office towers, retail and entertainment locations and a major extension of city streets north to the Richards Boulevard Redevelopment Area that borders on the American River. Alternative proposals exist for the development of major professional sports facilities in this area.

**Land Use Policies and Transit Related Design and Development**

Sacramento has not moved as aggressively as San Diego or Portland in encouraging the development of land around transit stations. City and county planning efforts, and those of SACOG, however, are beginning to address this type of coordination. Nevertheless, there are few visible signs of action. One problem may be the lack of development opportunities. Within the City of Sacramento light rail station sites, except for those on the K Street Mall, are in locations already built up. Patterns are well-established and any change to zoning that would increase residential densities or allow for commercial use would probably meet with neighborhood resistance.

Two areas do offer some potential for coordinated development. The first of these is around stations on the eastern alignment. Vacant and developable land exist to the east of several station sites. The second lies in the planning of the rail line for the South Corridor. It is in this new effort that there appears to be the greatest opportunity for creation of a transit oriented development (TOD).

Sacramento Regional Transit has expressed considerable interest in the concept of mixed-use transit-oriented development where housing is clustered around other activities that both serve the needs of the new local residents and offer possible shopping or entertainment for persons arriving by transit or making an intermodal connection between auto and transit, or between transit modes. RT has hired architect/urban designer Peter Calthorpe to present conceptual plans and guidelines for TODs in the Sacramento area. City and county zoning ordinances have been modified to accommodate this type of development. Ironically, the single proposed TOD for which a developer has been secured, is planned around a bus transit center rather than on a light rail line.
Rather than promote station area development in established urban areas on the RT light rail line, the agency has adopted a position of designing stations to fit into neighborhood situations. This is particularly evident in the new 39th and 48th Street stations of which opened in 1994 to serve established residential neighborhoods on the Butterfield route (Figures 13, 14, 15). Nearby residents and community associations worked closely with the station architect and RT staff to provide input during the design process. The 39th Street shelters resemble turn-of-the-century railroad sheds. The 48th Street shelters integrate plans with a garden gazebo architectural style. Both are pedestrian access stations without public parking.

Figure 13 Station Site on Private Right-of-Way. The 39th Street station on the east line includes paved surfaces at rail-level which allow pedestrian flows between platforms on both sides of this double-track section. Pedestrian access is provided to an adjacent residential neighborhood. (Photo: Ronald Sheck)
Figure 14. Rail Station Neighborhood Design Integration. The 39th Street station, opened in 1995, brought rail service to a well-established east Sacramento neighborhood. Kiosk and platform elements were designed to reflect neighborhood character as seen in this LRV riders view. (Photo: Ronald Sheck)

Figure 15. Neighborhood Rail Station. A residential street ends at the 39th Street station, sidewalk extensions provide easy pedestrian access to light rail from the adjacent neighborhood. (Photo: Ronald Sheck)
Guideway Transit Impacts

This section examines several ways of measuring guideway transit impacts. Impacts can have considerable policy implications. For instance, the planning and decision making processes are affected by perceptions of how transit currently impacts the community.

Guideway Transit Mode Share

There are two ways of measuring the impact of guideway transit mode share in the Sacramento metropolitan region. The first considers how transit is performing as part of the total transportation system. This is followed by a comparison of the use of light rail and bus transit modes.

Transit accounts for only 2.8 percent of the 1990 journey-to-work trips in the Sacramento UA according to the U.S. Census. This is smaller than the U.S. average (6.72 percent), but markedly lower than that of older rail transit cities and the lowest of new light rail cities (Table 10). Transit ridership grew nearly three percent in Sacramento between 1980 and 1990. However, population in the Sacramento urbanized area increased 38 percent in the same period.

The rail share of transit ridership has grown dramatically. Between 1987, the first year of RT train operation and 1994, light rail has captured 29.6 percent of the total transit ridership in the urbanized area as measured by unlinked trips. The light rail share of passenger miles has risen to 33.0 percent. The trend from 1981 throughout 1994 can be seen in Figures 16 and 17.

Overall transit growth has slowed since 1990 which may reflect a general downturn in the economy and an increase in unemployment. Growth in the rail mode share may result from its advantage in serving strong travel corridors and from the truncation of bus lines to avoid duplication of service by bus and rail. There are no bus lines that parallel light rail lines. The rate of light rail transit growth to total transit growth also slowed between 1990 and 1994. Moreover, no new expansion of rail transit service will take place until the Mather Field Road extension of the east alignment opens in 1997.

The slowed growth of light rail transit may be related to another factor. Market saturation may have taken place, particularly on the outer segments of the two alignments. The distance of light rail penetration into the suburbs is only about eight miles. The travel time
advantage of rail is offset by access time to the stations on congested streets during commute hours. Most population and employment growth in eastern and southern Sacramento County over the past decade has taken place beyond the two ends of the light rail line and extensions are expected to tap into these already large suburban locations. Some intensification of densities will continue as in-fill occurs in areas that experienced growth earlier.

**Land Use and Development Impacts**

While it is evident that there are significant changes in land use and a large amount of new investment made near light rail lines in Sacramento, it is extremely difficult to infer a causal relationship. It is possible to document, as SHRA has done, over $1.2 billion in new development in the downtown area and to account for $172 million in light rail investment. However, explaining a connection beyond the complimentarily of the two lacks hard evidence. Would the investment in new development have occurred without light rail? It is
Figure 16
Annual Unlinked Trips (000,000)

Figure 17
Annual Passenger Miles (000,000)

Source: Federal Transit Administration Section 15 Data
hard to imagine that much of it would not have occurred regardless. Nevertheless, light rail may well have been a factor in the choice of location and site.

Examination of development adjacent to or, within close proximity of, the RT light rail line does not heavily strengthen the case for the transit-development relationship. Some of the examples of this have been noted in earlier discussions in this case study. It is probably useful to review some of the more important of those, and also to note the general growth of office, retail and entertainment activities that have taken place in the downtown area near the rail line and stations. Regional Transit, Sacramento City, and Sacramento County have developed transit design guidelines that incorporate land use and neighborhood site planning efforts with rail transit planning to accomplish community economic development and quality of life goals. This is evidence of new thinking about the transportation-land use relationship.

Area and Site Impacts

Several area or site locations on the Regional Transit light rail network are identified where development has taken place between 1980 and 1995. Some of this development proceeded the construction of rail. Even where development has taken place, whether it has been simultaneous or subsequent to implementing light rail, it is difficult to establish a cause and effect relationship.

• **Downtown Sacramento Transit Mall Area.** This 45 block area in the heart of Sacramento has experienced a large amount of public and private sector development. Coordinated efforts of private investors, the State of California, the city and the county, the housing and redevelopment agency and Regional Transit have resulted in major infrastructure improvements and a revitalization of much of the area. Reconstruction of buildings along K Street was leveraged by infrastructure improvements and by government investment. The former Weistock Department Store between 11th and 12th Streets was remodeled as a state office building. New construction included the Sacramento Convention Center which anchors the east end of the transit mall and the Downtown Plaza Mall at the west end. Light rail provides access to jobs, shopping and entertainment from the Cathedral Plaza and St. Rose of Lima Park stations. Employment is estimated at 37,000 in this portion of downtown Sacramento.

• **South Capitol: 8th & O Street and Archives Plaza Station Area.** The State of California has constructed several new office buildings in the five blocks along O...
Street between 7th and 12th and the surrounding area. Routing of the light rail line through this part of the City Center was designed to serve work trips to these state offices. Three buildings erected after the RT line have completed the concentration of California offices in the area south and west of the capitol building and grounds. Related retail activities and nearby private office employment bring the total number of jobs in this area of downtown to nearly 12,000.

- 29th Street Station Area. Sacramento Regional Transit District headquarters, Caltrans and other state agencies, and the Sacramento Area Council of Governments are all clustered adjacent to, or within a few blocks of the 29th Street RT light rail station. Employment within a four block radius of this station totals over 1,800. The rail station occupies a unique site under I-80 freeway which offers weather protection from sun and rain. The station area is undergoing redevelopment as an office/limited commercial and multi-family residential zone.

Where other commercial development has occurred near RT light rail stations and along rail corridors, it has generally preceded rail construction. This is true of Del Paso Road and Arden Way in North Sacramento on the northeast alignment, and along Folsom Boulevard in the Rosemont and Rancho Cordova areas on the east alignment.
Summary

This Sacramento case study examines guideway transit and intermodalism in the context of a relatively low cost light rail system built in an urbanized area composed of a moderate density older city and low density, sprawling suburbs. Sacramento has borrowed concepts and ideas from Edmonton, San Diego and Portland, its immediate predecessors in light rail development, and added some new ideas and twists of its own. There are a number of points and lessons learned that can be useful for other communities considering investment in rail transit.

- Light rail can be built at relatively low cost if already existing right-of-way can be used. Sacramento benefited from opportunities to recycle an abandoned rail freight line and to share right-of-way with active line railroads. The width of these rights-of-way was adequate to allow for laying of separate track for LRVs alongside existing Southern Pacific main and branch lines.

- Maximizing the use of single-track in combination with segments of double track or passing sidings can substantially reduce initial capital investment in a light rail project. Keeping headways to no less than 15 minutes allows this to be a reliable operating strategy. RT opened the Sacramento light rail line with 60 percent of it single-track.

- Increasing the double-track system share to 80 percent of the route mileage has reduced bottlenecks, allowed flexibility in maintaining schedules, and improved on-time performance. Bridges over the American River and two railroad lines will be retained as single-track structures for the foreseeable future. This is a cost-saving measure that will not impact negatively of system operations.

- Expanding system capacity to meet peak hour travel demands has been accomplished by lengthening trains to four cars rather than reduce headways. Station platforms are 320 feet long to accommodate these trains. Double-track street running stops are located at opposite ends of city blocks so trains will not block cross-streets.

- The Sacramento light rail system has a very positive image among users and non-users. The white, yellow and blue trains have become a symbol of community pride.
The single 18.2 mile line carries 29.6 percent of the metropolitan area's transit ridership.

- A grass-roots citizen effort has been instrumental in the development of light rail in Sacramento. The Modern Transit Society advocated a low-cost, no-frills system which had considerable appeal for local political leaders. Development of light rail in Sacramento was added by citizen frustration with congestion by highway dominated solutions to transportation problems combined with a shift in the state transportation agency policy.

- The availability of funds designated for a highway project that the local community considered no longer necessary facilitated the construction of Sacramento's light rail project.

- Planning light rail service into suburban areas requires careful consideration of the trade-offs between available funding and extending lines as close as possible to concentrated areas of potential riders. A serious question can be asked, whether Regional Transit light rail lines reach far enough into eastern Sacramento County to adequately tap the metropolitan travel market.

- Downtown redevelopment efforts contributed to a favorable situation for light rail. Public and private sector investments created new jobs in the city center and enhanced the potential for transit ridership. The retention of downtown shopping and the creation of tourism and other recreational opportunities has also benefited transit.

- Integration of bus and rail transit is important in maintaining the competitiveness of transit for the discretionary urban transit market. Regional Transit has completely restructured its bus network and added new routes to feed into rail trains at timed-transfer locations where bus and rail services operate at the same headway. Establishing these actions as system goals before implementing the rail element has contributed to customer satisfaction.

- Successful marketing of an integrated transit system involves providing clear, concise and thorough information in an attractive format to show how to use rail and bus to meet a variety of travel needs. Marketing, service provision and fare policy must work together to maximize ridership.
References


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