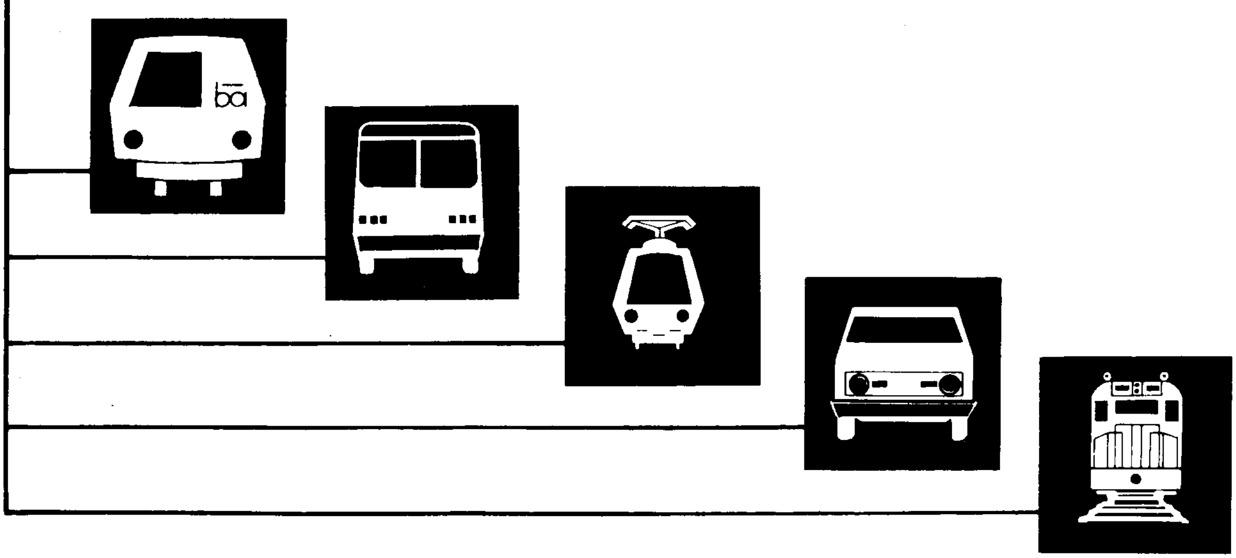
MTC
METROPOLITAN
TRANSPORTATION
COMMISSION

Peninsula Mass Transit Study



PENINSULA MASS TRANSIT STUDY

Prepared by a joint venture of

Kaiser Engineers (California Corporation)/Barton-Aschman Associates, Inc.

March 1985

(9628P)

STUDY ORGANIZATION

MTC Policy Committee: Peninsula Transit Alternatives Project (PENTAP) Committee

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*Member of PENTAP Committee for duration of SCR 74 Study only.

QUALIFICATIONS

This report summarizes basic information concerning each of the nine mass transit alternatives adopted by MTC's Peninsula Transit Alternatives Project (PENTAP) Committee for inclusion in the SCR 74 Peninsula Mass Transit Study. The evaluation and findings are those of the consultants. Peninsula transit operators have expressed differing views concerning such matters as the patronage forecasts, system capacity potential, the criteria for determination of new grade separations, and electrification costs for light rail and the electrified commuter rail modes. Appendix A contains comments from various transit operators on these and other issues under continuing discussion.

Also, in order to develop a comprehensive mass transit plan for the Peninsula, as requested by the State Legislature, other information needs to be developed along with the technical information in this report. This information includes an institutional plan for managing and operating an improved Peninsula mass transit system, an incremental staging program, and a financial plan. Various recommendations regarding these other study elements are contained in separate reports.

TABLE OF CONTENTS

I. INTRODUCTION

This Summary Report is intended to help elected officials and interested citizens understand the nine major mass transit alternatives being evaluated as part of the Peninsula Mass Transit Study requested by the State Legislature. The purpose of the study is to develop a long-range mass transit plan for the 50 mile rail corridor from San Jose to San Francisco that could include any one, or a combination of the following transit systems: upgraded commuter rail (CalTrain) system, light rail, BART, or express buses operating on dedicated lanes and transit guideways. The choice of the best transit system or combination of systems to meet future Peninsula travel demand will be determined largely by the cost effectiveness of the various options, the degree of local consensus, and the likelihood of developing necessary financial commitments to support improved transit service on the Peninsula. This Summary Report provides information concerning projected transit ridership, construction costs, operating costs, and revenues. Institutional and financial recommendations will be issued later in separate reports.

Background

Over the years, the Peninsula corridor has been the focus of numerous transit studies including two major BART extension studies; studies that helped create the local bus systems in San Mateo and Santa Clara Counties; the Peninsula Transit Alternatives Project (PENTAP) studies in the mid-1970's to preserve the commuter rail service, follow-up studies to PENTAP which outlined equipment, station, and terminal improvements for the commuter rail service; and finally the Guadalupe Corridor Studies which developed a plan for the new 22 mile light rail line in Santa Clara County now under construction. The future of mass transit on the Peninsula is, however, at a crossroads, and a plan is needed to guide future investments. This plan must answer a number of significant issues which are summarized below.

- Which mass transit system or combination of systems will result in the greatest transit ridership and will be most responsive to changing travel patterns in the corridor?

- Which types of equipment and terminal configurations are best suited to attracting additional ridership?

- Which systems have the capability to expand incrementally to meet short-term and longer-term corridor demand?

- Which system will be most cost effective over the long term?

- How should mass transit improvements be staged and which systems will best complement other existing and planned regional transportation investments?

- How should an improved Peninsula mass transit system be governed, managed, and financed?

- Which system or systems are most acceptable to corridor communities?

President Reagan's signature on the Surface Transportation Assistance Act of 1982 signaled a continuing federal transit program, including the prospect of some funding for new rail transit starts. To take advantage of this opportunity, MTC recently undertook an eight month effort aimed at developing a political and popular consensus on future rail development as well as a financial strategy to enable the San Francisco Bay Area to compete successfully for the necessary state and federal funds. These hearings concluded that a substantial portion of the rail modernization and new starts funds available to the Bay Area over the next 3 to 5 years will be needed for projects already in the pipeline -- the Guadalupe Corridor light rail project; the $110 million CalTrain modernization program; BART improvements, including the Daly City turnback and Storage Yard; and the Muni Metro Embarcadero Station turnaround.

Fifteen other projects with an estimated cost of $2.1 billion were also included in MTC's New Starts Resolution. Each of these projects will require major further study before it can be recommended for funding. In the Peninsula Corridor, these projects include the proposed CalTrain terminal relocation project in San Francisco, a BART extension in the Daly City-San Francisco Airport Corridor, an extension of Muni Metro to the CalTrain terminal in San Francisco, an improved CalTrain terminal in San Jose, and possible additions to the new light rail line in Santa Clara County.

The SCR 74 Study

MTC's New Starts hearings were closely watched by local State Legislators who are also vitally interested in the Peninsula's transportation problems. To help resolve competing transit proposals for the Peninsula, Senator Foran called upon MTC to prepare a long range mass transit plan for the Peninsula corridor, including an incremental staging program, financial plan, and institutional plan (Senate Concurrent Resolution 74). The legislation further suggests that the mass transit plan identify the route, vehicle type, and operational characteristics of the improved corridor mass transit system. SCR 74 also sets out specific transit alternatives in the Corridor which MTC is to review.

In response to this request from the Legislature, MTC began work on the Peninsula Mass Transit Study on July 1, 1984 after hiring the Consultant team of Kaiser Engineers/Barton Aschman Associates to assist with the technical work. Later, another consulting team, sponsored by Chester McGuire, was selected to help MTC develop recommendations for governing, managing, and operating an improved transit system on the Peninsula.

Future Actions

Policy direction for the SCR 74 Study is the responsibility of MTC's Peninsula Transit Alternatives Project (PENTAP) Committee which will hold public hearings in early March. The PENTAP Committee will submit its recommendations for mass transit improvements to the full MTC Commission for action. The Commission will then report its conclusions to the State Legislature. Also starting shortly after this study, a second round of New Starts and Rail Extension hearings will be conducted by MTC to further update and refine its earlier recommendations. The SCR 74 Study recommendations will be reviewed together with recommendations from the other ongoing studies, such as the MTC-sponsored Fremont-South Bay Study and the Santa Clara County T2000 Study, to determine which Bay Area transit projects should be advanced for future study and possible federal funding.

Advancement to the next stage, means even more detailed planning must take place. Under the Urban Mass Transportation Administration's (UMTA's) guidelines, project sponsors seeking federal assistance must prove the cost effectiveness of proposed rail investments through a rigorous planning process. If an agreement can be reached on future rail improvements in the Peninsula Corridor, this study could lead to the preparation of an Alternatives Analysis/Draft Environmental Impact Statement (DEIS) for the locally preferred "rail extension" alternative or alternatives or a DEIS for projects classified as "rail modernization" projects. The Alternatives Analysis would be followed by preliminary engineering/ Final EIS, final design, and eventually construction. This process is illustrated in Figure 1. Progression from one step to the next must have UMTA concurrence. Currently, there are about 60 projects nationwide competing for a limited amount of federal funds, hence the degree of local commitment and financial support for transit projects is vitally important in the ultimate success of a project.

Organization of Report

This report includes the following information:

- Chapter II begins with a review of commuting trends in the Peninsula corridor and the key forecasting assumptions used to project future transit ridership.

- Chapter III discusses existing transit services and the relevant future plans of operators in the Corridor.

- Chapter IV summarizes information on each of the nine adopted alternatives relating to service, ridership, and costs.

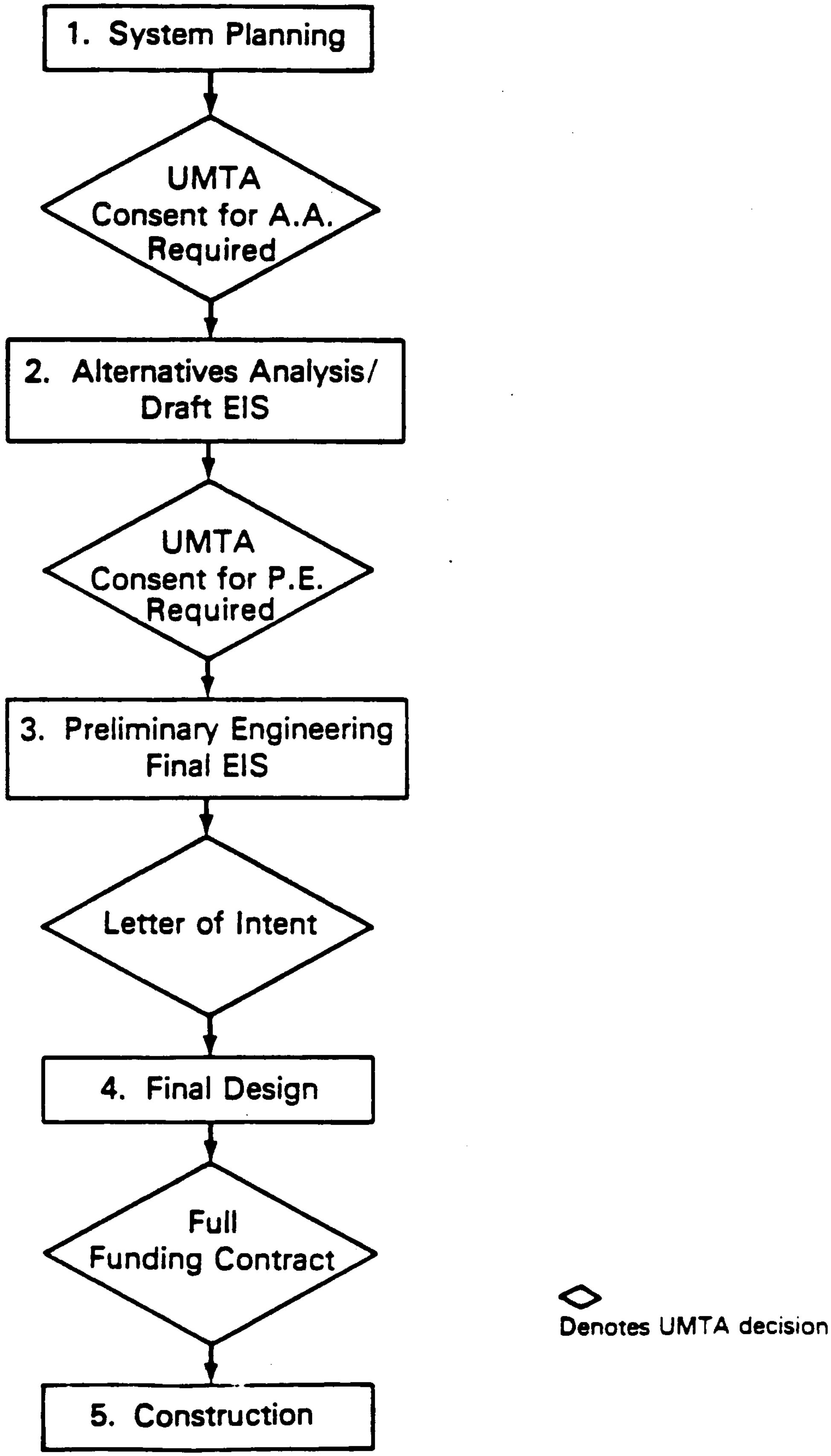
- Chapter V focuses on a review of the different mass transit technologies -- BART, CalTrain-diesel, Caltrans-electric, LRT and Bus/Busway -- incorporated in the corridor-wide alternatives.

- Chapter VI then contains summary information and observations to facilitate the review and comparison of Corridor alternatives.

Figure 1

UMTA Project Development Process

Major Investments



II. DEVELOPMENT TRENDS AND COMMUTING PATTERNS

The study corridor extends from downtown San Francisco, through San Mateo County, into Silicon Valley in Santa Clara County to downtown San Jose. The study is focussing on the existing Southern Pacific-owned transportation right-of-way which is 50 miles in length and which is heavily urbanized and economically diverse. Employment in the Corridor is projected by ABAG to increase by 27% -- or 335,000 new jobs -- between 1980 and 2000. A further indication of the potential for new jobs and expanded local and regional travel demand is the amount of planned or proposed office and commercial development. Almost 22 million square feet of new office/commercial floor space are planned for downtown San Francisco, 23 million square feet are proposed along Route 101 between Candlestick Park and Mountain View, and 44 million square feet are expected in the Golden Triangle area of northern Santa Clara County. Both San Francisco International Airport and San Jose Airports will handle significantly larger volumes of air travelers by the year 2000 and are themselves major generators of surface travel in the Corridor.

Between 1970 and 1980, Census figures show that workers commuting from San Mateo County into San Francisco increased 16% (11,000 workers). Also during this period, the rapidly expanding electronics industry created many new jobs in Santa Clara County which resulted in an increase of 13,000 commuters (62% increase) from San Mateo County into Santa Clara County and an 18% decline in workers traveling the length of the Corridor from Santa Clara County to San Francisco. During this 10 year period, the Silicon Valley area replaced San Francisco as the largest employment center in the Corridor.

Rapid job growth on both ends of the Corridor has had its effect on the transportation system. Delays and congestion have grown significantly on the I-280 and Route 101 freeways into and through San Francisco, Silicon Valley, and San Jose. Overall, 6.6% of the Corridor's workers use transit to their jobs, with the largest transit market consisting of workers traveling from the Peninsula into downtown San Francisco on BART, CalTrain, and Samtrans. By contrast, local bus services (Samtrans and SCCTD) serve about 2% of the workers whose trips start and end in the Corridor.

Corridor work trip patterns in the year 2000 were projected by MTC by expanding the 1980 census data to the year 2000 in proportion to residential and employment growth forecast by ABAG for different geographic zones within the Corridor (See Appendix B). The number of projected riders for each transit alternative therefore is derived from the changes in land use within the Corridor. No attempt has been made to assess the effect of the transportation improvements themselves on future commuting patterns. Figure 2 illustrates the number of workers commuting between different locations in the Corridor in the year 2000. Overall, the growth rate for workers traveling from the Peninsula to San Francisco is expected to be lower than in the past while the growth rate for shorter, intra-Peninsula trips and trips in the "reverse" commute direction (south and eastbound along the spine of the Corridor) is projected to be higher. Development of additional freeway lanes on portions of Route 101, I-280, Route 237, and Route 85 is expected to ease, but not solve future traffic problems.

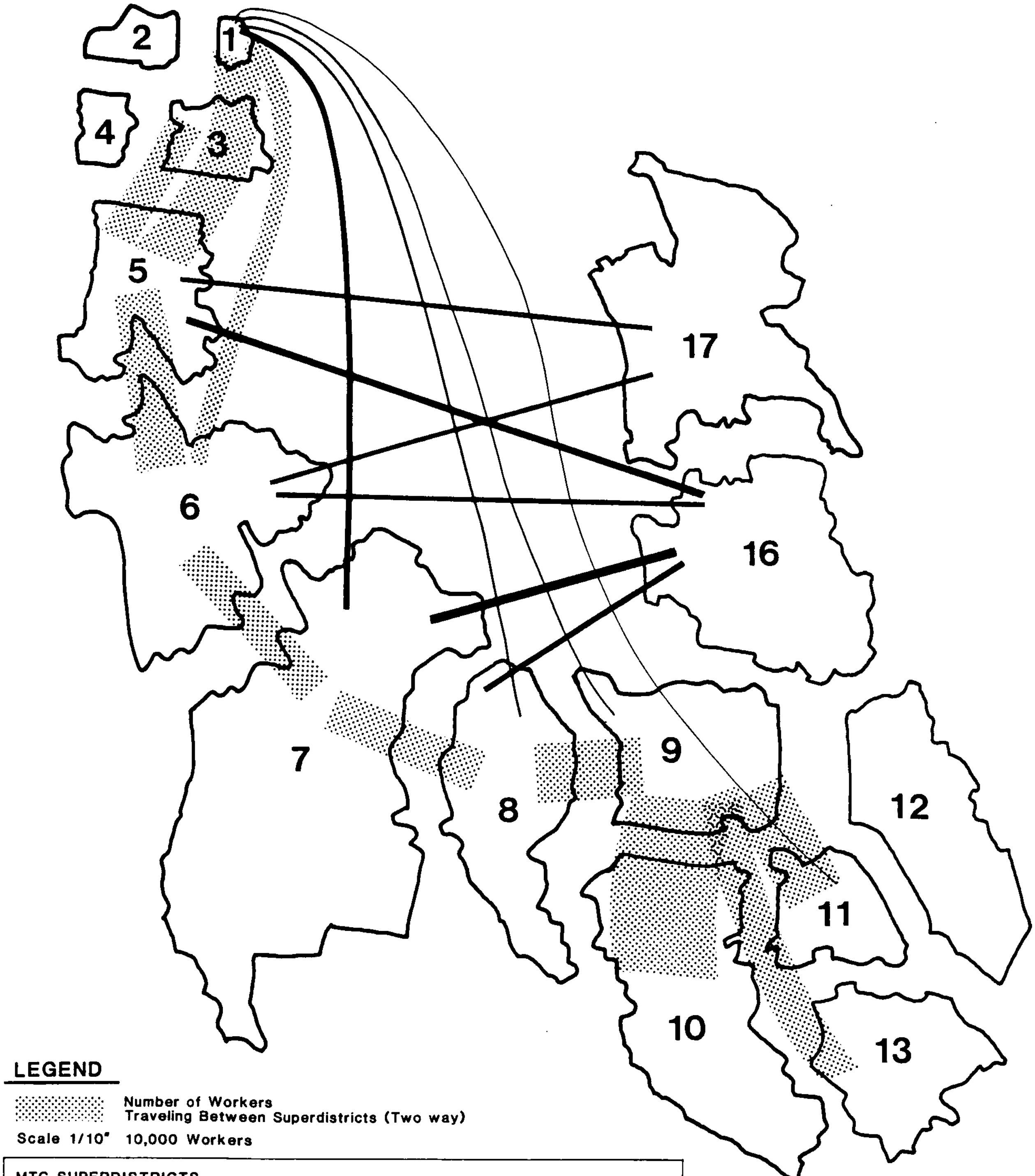
Finally, two additional markets will be of significance in determining the long-term demand for mass transit. These are the non-work trips to shopping, school, and recreation centers along the Corridor which occur primarily in the off-peak, and air travelers using San Francisco and San Jose Airports. Significant growth rates are forecast for air passengers using San Francisco and San Jose Airports due to airline deregulation and the general economic vitality of the Bay Area.

Forecasting Procedure

The objective of the patronage analysis is to develop travel demand forecasts that are reliable and are sensitive to the range of alignments, transit modes, and service levels among the adopted mass transit alternatives.

To accomplish this objective, it was necessary to develop a detailed structure for patronage forecasting, involving state-of-the-art forecasting techniques and computer modeling software. This detailed approach incorporated the calibration of a home-to-work trip mode choice model and the validation of these models using Peninsula and Bay Area travel data available from the census, MTC surveys, and transit operator files.

Figure 2
Year 2000 Workers Traveling Between Superdistricts



MTC SUPERDISTRICTS

1. Greater Downtown San Francisco
2. Southeast San Francisco
5. Daly City - South S.F. - Millbrae
6. Burlingame - San Mateo - Belmont
7. San Carlos - Menlo Park
8. Palo Alto - Mountain View
9. Sunnyvale - Santa Clara - San Jose'
10. Cupertino - Saratoga - Campbell
11. San Jose'
13. South San Jose'
16. Fremont - Union City
17. San Leandro - Hayward

Source: MTC Year 2000 Projections by Growth Factor Method (FRATAR)

The extensive and complex interrelationships of bus, BART, CalTrain, and light rail systems operating in the Peninsula Corridor also required the development of a "submode choice" model to reliably estimate the proportion of transit users attracted to these potentially competing transit modes. A final component of the passenger forecasting system was the inclusion of an "air passenger" mode split model developed for MTC by others.

In short, the approach followed by this study was to thoroughly structure a comprehensive methodology, to incrementally expand upon current Bay Area modeling efforts using proven techniques, and to carefully undertake an objective and consistent application of the models.

The process began with the definition of operational system components in the Task 3 Report - Operational System Definition. This specification included the frequency of service parameters for the guideway alternatives, the station locations for each line-haul mode, the design of the background and feeder support bus system, and the definition of policy variables such as fare levels, parking costs, and operating costs.

Each of the alternatives was next coded to allow for a computer simulation of the transportation network. This represented a major task of updating available 1980 networks, prepared by MTC, to represent future highway, bus, and rail transit conditions. Networks were checked and travel paths simulated through the network to ascertain their logic. Simulated system statistics were then checked with existing system observations, and these steps were repeated when necessary to obtain accurate transportation networks for future-year forecasting.

The travel demand forecasting process itself began with projections of year 2000 regional commutation travel patterns prepared by MTC. These were based on 1980 census data, supplemented by surveys of Bay Area residents, and expanded to future-year projections in proportion to residential and employment growth forecasts prepared by ABAG. Commuter travel thus described was converted to person trips (home-to-work trips) and the calibrated mode split and submode choice models applied to produce forecasts of daily transit use, drive alone, and shared ride travel.

Finally the trips estimated for each mode and submode were loaded onto the simulated transportation networks to obtain volume estimates for individual transit services and highway elements. The computer modeling framework for the entire process was provided by the Urban Mass Transportation Administration UTPS program set.

In the case of the non-work and non-home-based trip purposes, person trips were estimated using a ratio of work to non-work trips based on current ratios observed for existing rail and bus modes. Estimates of air passenger trips on transit were derived from an air passenger mode choice model developed by MTC and others in conjunction with MTC estimates of Year 2000 air passenger origins and destinations by "550" zone.

Key Forecasting Assumptions

- Use of MTC's Year 2000 forecasts of commuter travel which reflect no change in regional accessiblity resulting from new, improved, or degraded transportation facilities.

- Use of the MTC work trip mode choice model, a high proportion of whose predictive powers are dependent on socio-economic variables as opposed to transportation system characteristics.

- Validation of the above mode choice model to correct for overprediction of transit use in counties outside San Francisco. This was accomplished through the introduction of "bias" coefficients for each county, calibrated against 1980 observed transit use.

- Use of highway and transit speeds observed in 1980 except for guideway rail or bus modes, which were not constrained by systems (signaling, power, etc.) limitations.

- Use of 1984 transit fare levels with all guideway modes using BART's fare structure.

- Use of automobile operating cost projections which essentially retain the status quo with respect to transit user costs.

- Use of an improved level of feeder bus services and an unconstrained supply of parking at most guideway stations.

These assumptions together with the patronage forecasting process were applied to all alternatives consistently; therefore, while absolute changes would be expected from different assumptions, relative changes among alternatives would not be expected.

III. TRANSIT SERVICES AND ISSUES

The Corridor is presently served by multiple transit operators providing local and regional bus and rail service: CalTrain, BART, SamTrans, SCCTD, and Muni. The current services and relevant future plans of these operators are briefly summarized below.

- CalTrain - On July 1, 1980, Caltrans entered into a 10 year purchase-of-service agreement with the Southern Pacific (SP) Transportation Company and thereby assumed financial and management responsibility for the Peninsula commute service -- now called CalTrain. SP continues to operate the service, as it has since 1870, but under the direction of Caltrans and under the terms of the contract. Caltrans currently schedules 46 weekday trains between San Francisco and San Jose and carries about 15,500 riders. The service is primarily oriented to San Francisco, bringing workers to the downtown in the morning and back to the Peninsula in the evening. Under a cooperative agreement with SamTrans, Muni, and the Santa Clara County Transit District, Caltrans funds 50% of the net operating deficit, while SamTrans, Muni, and SCCTD provide the remaining 50%.

  Caltrans has proposed a number of substantial improvements to this service, including the extension of tracks to a new terminal in San Francisco located behind the Transbay Terminal, improvement of the San Jose terminal, an increase in service to 60 trains a day within the next ten years, and the possibility of further service increases and electrification of the line beyond ten years.

- BART - The BART system currently terminates at Daly City, just inside San Mateo County, where 18,000 boardings and deboardings are made each weekday. This station receives heavy use by commuters from northern San Mateo County into San Francisco, and there is a severe shortage of parking space, even with extensive SamTrans feeder bus service. SamTrans is considering the acquisition of an 8 acre site south of the Daly City station at Serramonte/Colma for a satellite park-and-ride lot to alleviate a portion of the Daly City overcrowding problem. BART plans to construct a turnback and storage yard about 1-1/2 miles south of the Daly City station to be operational in 1988. This project together with other improvements will enable the time between trains to be shortened to 2-1/2 minutes in the peak hours and will provide storage and maintenance facilities for 150 cars on the West Bay, substantially reducing costs to deadhead transbay trains back to the East Bay. Extension of BART to the San Francisco Airport and beyond to Menlo Park was studied in the early 1970's and is being examined again as part of the SCR 74 Study.

- SamTrans - SamTrans began providing bus service in San Mateo County in 1977 and currently carries 71,000 weekday riders with its fleet of 267 buses. SamTrans contracts with Greyhound to provide mainline service on El Camino and Route 101 into San Francisco on its 7F, 7B, 7R, and 7Z lines. Most of these lines terminate in San Francisco at the Transbay Terminal. In addition, SamTrans operates over 30 routes which connect to CalTrain Stations in San Mateo County. SamTrans also provides extensive feeder service to the Daly City BART Station from San Mateo County, carrying 55% of the riders who use the station on the average weekday. Several SamTrans routes extend to the Stanford Industrial Park in Santa Clara County where connections can be made to the SCCTD buses. Air passengers can use SamTrans buses from the Transbay Terminal to San Francisco Airport but are restricted from carrying baggage as a result of an earlier court agreement between the privately operated Airporter service and SamTrans.

- SCCTD - SCCTD began providing fixed route bus service in 1973 and carries 123,000 average weekday riders with its fleet of 614 buses. SCCTD also provides extensive feeder service to CalTrain stations with 20 different routes connecting to these stations. SCCTD does not operate any service outside of the County on the Peninsula but does connect with BART at Fremont. SCCTD local and express buses serve between 2-5% of the workers commuting within the portion of Santa Clara County contained in the SCR 74 Study Corridor. The broad expanse of Silicon Valley and the large number of employment centers and residential areas makes it difficult to schedule frequent service between all areas and creates a need for coordinated transfers between bus lines.

  Most of the planned bus system expansion has now been completed and the major focus of the District is directed towards more efficient operation of the bus system and construction of the 22 mile Guadalupe Corridor Light Rail Transit (LRT) line. This line will connect residential areas south of San Jose with the San Jose downtown and growing job center in the

"Golden Triangle" area north of San Jose. The Urban Mass Transportation Administration (UMTA) has agreed to provide the necessary funds for this system by signing a full funding agreement in September, 1984. The system will be operational in 1988.

- Muni - Muni currently is the largest transit operator in the Bay Area, carrying 700,000 riders on an average weekday with a mixed fleet of cable cars, diesel buses, electric trolleys, and light rail vehicles. Muni is considering extension of its light rail metro system from the end of Market, beyond the planned Embarcadero turnaround facility, to the San Francisco CalTrain terminal. Such an extension could provide a dual service of distributing commuters on CalTrain and connecting the growing south of Market/Mission Bay Area with the rest of San Francisco.

- Airport Transit - Transit access to San Francisco Airport is currently provided by SamTrans and a number of private airport limousine services, the largest of which is the San Francisco Airporter service from downtown San Francisco. SamTrans serves the San Francisco Airport from its mainline routes and connects the Airport to the Millbrae CalTrain Station, Daly City BART Station, and Transbay Terminal. Airporter buses run on frequent headways from the hotel area and the Financial District and convenient transfers are possible for East Bay air passengers to Airporter buses at the Embarcadero BART Station. When the Guadalupe LRT system is completed, shuttle buses will connect the light rail line to the San Jose Airport.

Summary of Key Issues

Key transit issues for this study are:

- Which future travel markets can best be served by CalTrain, BART, or a new transit technology in the Peninsula Corridor?
- How can Peninsula mass transit systems capture a greater share of the existing travel market, including shorter trips and trips destined for Silicon Valley?
- How can Peninsula mass transit systems serve new development that in many cases is locating further away from the existing Southern Pacific railroad right-of-way?

- What quantity and quality of mass transit service is needed and desirable to serve off-peak riders to commercial, shopping, and employment centers along the corridor?
- How much express bus service will be needed in the corridor to complement upgraded Peninsula rail service?

IV. DESCRIPTION OF ALTERNATIVES

The first task of the Peninsula Mass Transit Study was to develop a set of potentially feasible transit alternatives in the corridor. This task was carried out in close cooperation with Caltrans, other Peninsula transit operators, and local governments. In mid-August MTC conducted a series of public information meetings to review with the public alternatives being considered. Comments from all sources were considered by PENTAP in selecting the alternatives listed below for further evaluation. Each major alternative generally consists of a number of subalternatives requested by study participants. Although the potential combination of alternatives and subalternatives is large, an effort has been made to anticipate the need for "mixing and matching" alternatives in order to develop a locally preferred option.

Alternative 0** - Transit Status-Quo
Alternative 1** - Transportation System Management (TSM) Actions
Alternative 2 - Minimum Rail Service Extensions
Alternative 3* - BART to San Jose
Alternative 4* - Light Rail Transit (LRT) to San Jose
Alternative 5* - Electrified Commuter Rail
Alternative 6** - Bus/High Occupancy Vehicle (HOV) Lanes
Alternative 7* - BART/LRT Combination
Alternative 8 - BART/CalTrain Combination

Definition of Rail Transit Modes

The following definitions describe the general characteristics of the principal rail transit modes involved in the study. These definitions establish a common nomenclature in order to avoid misconceptions due to the use of diverse terms to identify the various systems being considered.

- <u>Commuter Rail (CalTrain)</u> - The term "commuter rail" refers to a portion of a regional, interstate, or national railroad that forms part of an intercity passenger service and carries passengers within suburban and urban areas. This operation has traditionally been provided by a railroad company as part of its mainline service. It differs from rail rapid transit in that the commuter rail passenger

* Required by SCR 74

** Necessary to conduct UMTA-required evaluations cars are heavier; seating arrangements do not maximize standee space; the layout, access, and doors do not accommodate fast massive movements of people; and the trips are usually longer. Commuter rail trains are composed of electric or diesel vehicles that normally operate in multiple units (MU) or push-pull arrangements and may use third-rail or overhead electrification; also stations may have low or high platforms.

- Heavy Rail - "Heavy rail" is a relatively new term in the USA that came to replace the term "rail rapid transit," or what is known internationally as "Metro" (short for metropolitan railway). The term Metro is used for a service restricted to urban and suburban areas, unlike the commuter rail which is part of an interurban or intercity network. The Metros were traditionally underground facilities. In the United States, these systems were called either subways or "els" (short for elevated railways), both of which were grouped under the term rail rapid transit.

  Recent developments have required a closer definition of what is encompassed by this term, based on the perceived difference between what was traditionally called "rail rapid transit" with third-rail electrification (trains of cars adapted only to operation on an exclusive right-of-way characterized by extensive underground and elevated structures), and the long disparaged but suddenly resurgent technology of street and interurban railways. The resurrected streetcar-based system was called "light rail," and the Metros, subways, and els, which do not use trolley-like vehicles and are fully grade-separated, became known as "heavy rail." BART is a typical example of the heavy rail mode.

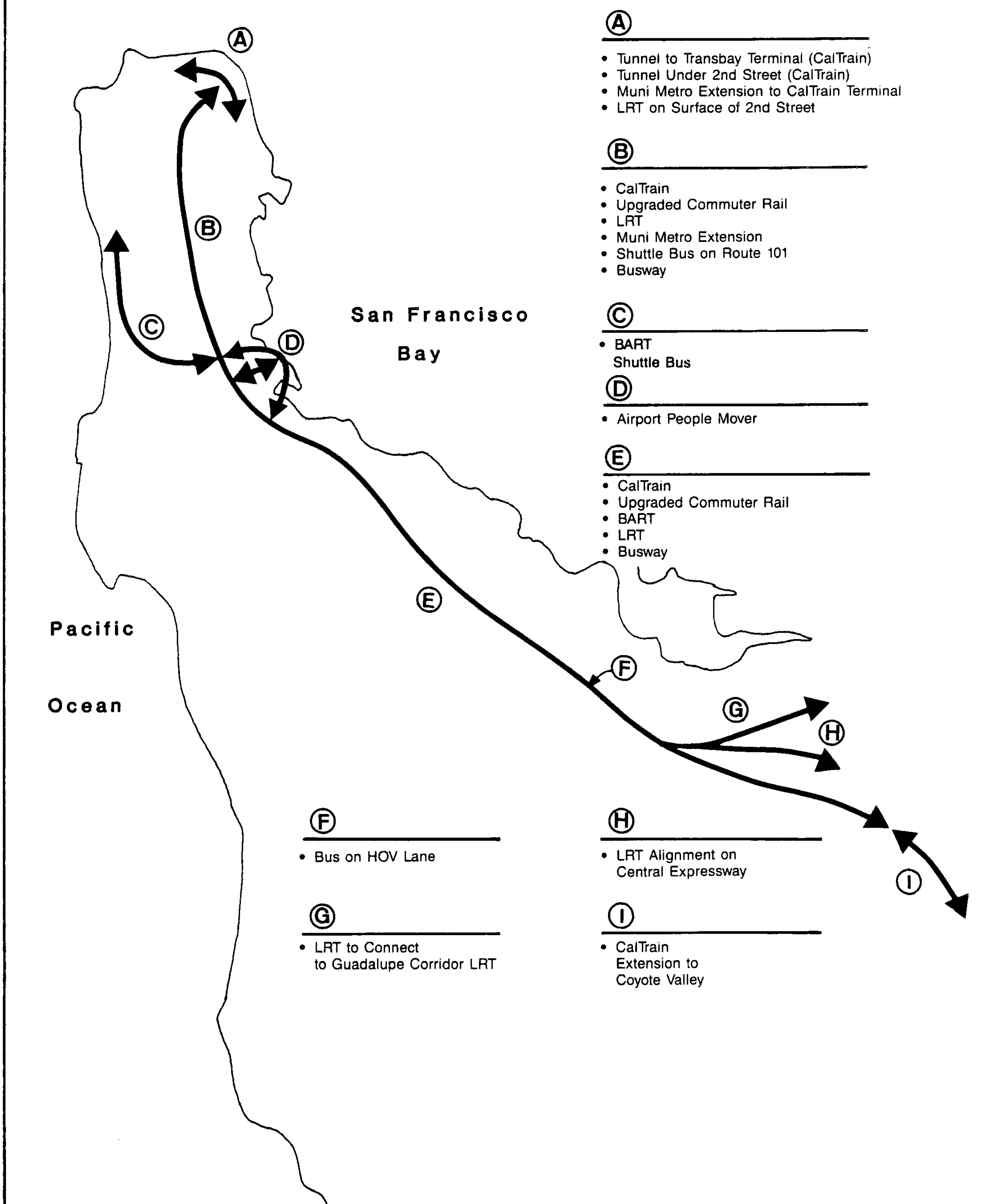
- Light Rail Transit - Most light rail systems use cars that are narrower than heavy rail cars and, although modern, are entirely comparable to the old streetcars, except that the vehicles may now be longer and may be articulated. Light rail systems usually use overhead electrification, short trains (usually of one to three cars), high or low platforms, and self-service fare collection. They can either be grade-separated or operate on city streets with the regular traffic. Muni's Metro service is a typical example of this sytem.

- People Mover - The people mover is a form of transportation that provides a short-haul collection and distribution service, usually within an urban complex or major center of activity. These systems usually consist of small electric traction or cable-operated vehicles with peripheral seats and ample standee space. Because they often operate on demand on an exclusive guideway and are totally automatic, they are sometimes referred to as "horizontal elevators." For this study a people mover is included as part of the San Francisco International Airport connection to a potential mainline station outside of the Airport proper.

The SCR 74 Mass Transit Alternatives

Figure 3 illustrates the travel corridors and transit technologies included in the SCR 74 study. These corridors and technologies have been combined into nine basic mass transit alternatives which are described in detail in the following text. This section includes a discussion of the service concept, ridership, and capital costs, provides maps of the alternatives, and summarizes key information in a section called "Alternative at a Glance".

Figure 3
Corridors and Transit Technologies



Alternative 0

Transit Status Quo

Service Concept

This alternative assumes there would be no further expenditures for mass transit on the Peninsula corridor beyond the projects which have already obtained funding commitments from state and federal agencies (i.e., the transit "no build" or "null" alternative). These funded projects include:

- Guadalupe Corridor LRT in Santa Clara County
- BART Daly City Turnback/Storage Yard and new "C" cars
- CalTrain modernization program (station acquisition and boarding improvements)
- New park-and-ride lot for Daly City BART Station (SamTrans)
- Muni Metro Embarcadero Turnaround

CalTrain service would remain at 46 trains per day; however, 18 new locomotives and 63 new cars have already been purchased (delivery will start in 1985) and stations are being acquired and improved. BART's new Daly City Turnback and Storage Yard would be completed. This turnback facility, together with systemwide train control improvements and the purchase of new "C" cars, would enable headways to be reduced from 4 minutes to 2.5 minutes between trains at Daly City. A new park-and-ride lot constructed by SamTrans at Serramonte/Colma would help relieve the shortage of parking now experienced at the Daly City Station. At the southern end of the corridor, the 22 mile Guadalupe Corridor Light Rail Transit system would be completed and begin operation by 1988.

This alternative also assumes there would be additional expansion of highway facilities on Route 101, I-280, Route 237, and Route 85 consisting of new lanes, upgrading of freeways to expressways in some cases, and designation of HOV lanes on county expressways.

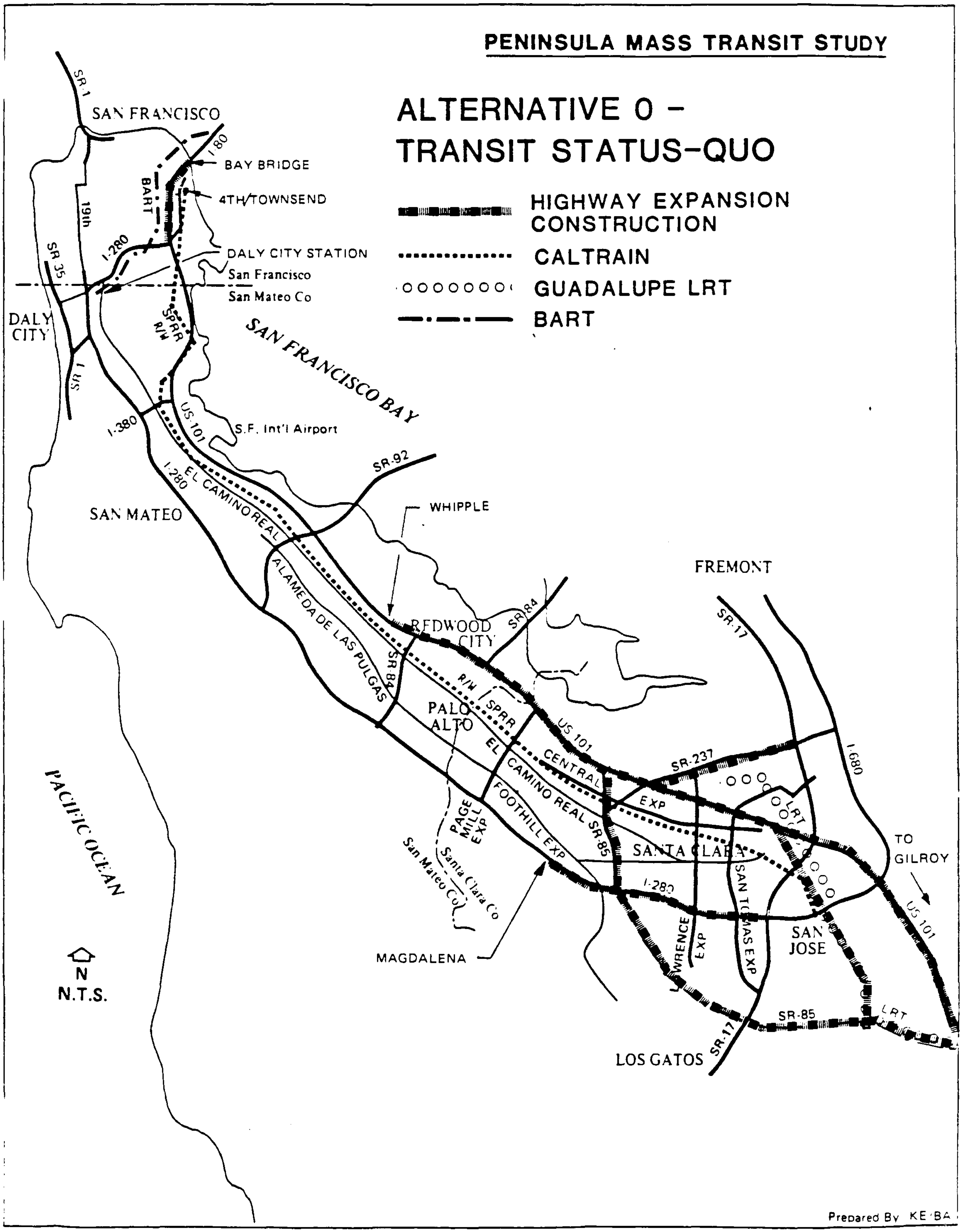
Ridership

In the null alternative, CalTrain attracts approximately 19,000 daily riders while SamTran's mainline express and local services attract about 33,000 passengers. SamTrans' routes 7A, 7B, 7F, 7R, 7Z constitute this mainline service and attract this large number of trips in part due to the local service they provide in San Mateo County and the one seat ride to the Financial District. The BART lines to Daly City would be expected to serve approximately 19,000 daily transit trips with an origin or destination in the Peninsula Corridor. An additional 2,100 daily air passengers were forecasted to use BART and CalTrain to San Francisco Airport.

Capital Costs

Capital costs shown below for the various committed projects are the costs for Fiscal Years 84/85 and beyond to complete each project.

o	BART	-	"C" Cars	$73,269,000
		-	Daly City Turnback	94,869,000
o	CalTrain	-	Station Acquisition	8,000,000
		-	Station Boarding Improvements	4,760,000
o	SamTrans	-	Satellite Park & Ride Lot at Serramonte/Colma	7,500,000
o	Muni	-	Embarcadero Turnaround	43,600,000


PENINSULA MASS TRANSIT STUDY
ALTERNATIVE 0 -
TRANSIT STATUS-QUO
HIGHWAY EXPANSION CONSTRUCTION
CALTRAIN
GUADALUPE LRT
BART
SAN FRANCISCO
BAY BRIDGE
4TH/TOWNSEND
DALY CITY STATION
San Francisco
San Mateo Co
DALY CITY
SAN FRANCISCO BAY
S.F. Int'l Airport
SAN MATEO
WHIPPLE
REDWOOD CITY
FREMONT
PALO ALTO
SANTA CLARA
SAN JOSE
LOS GATOS
MAGDALENA
TO GILROY
PACIFIC OCEAN
N
N.T.S.
SR-1
I-80
BART
19th
I-280
SR 35
SPRR R/W
US 1
I-380
US 101
EL CAMINO REAL
SR-92
ALAMEDA DE LAS PULGAS
SR 84
CENTRAL EXP
SR-237
I-680
LRT
SR-85
FOOTHILL EXP
PAGE MILL EXP
Santa Clara Co
San Mateo Co
SAN TOMAS EXP
LAWRENCE EXP
SR-17
Prepared By KE/BA

ALTERNATIVE AT A GLANCE

Alternative 0

- Transit Status Quo -

SYSTEM OPTIONS

- Highway Improvements

  Route 101 expanded from 6 to 8 lanes, from Redwood City (Whipple Ave.) to south San Jose (Bernal), and six lanes to Gilroy (36 miles); I-280 expanded from 6 to 8 lanes, east of Magdelena (Santa Clara County) (12 miles); West Valley Transportation Corridor/Route 85 built as 6 lane freeway (26 miles); Guadalupe Corridor Expressway built as 4 lanes; Route 237 expanded to 6 lane freeway with HOV lanes (10 miles); Route 17, north of Route 101, expanded from 6 to 8 lanes.

- Transit Improvements

CalTrain	-	46 trains/day; 18 new locomotives, 63 gallery cars; station improvements
BART	-	Daly City turnback and Serramonte/Colma Yard; peak headways reduced from 3.75 to 2.5 minutes
Guadalupe LRT	-	New 22 mile LRT system
Muni Metro	-	Embarcadero Turnaround

SERVICE

o Schedule

BART	-	2.5 minute service at Daly City Station
CalTrain	-	10 minute dispatch with trains serving alternative (skip stop) stations, with some common (all stop) stations for transfers; non-peak direction trains every 30 minutes, serving all stops

o Year 2000 Demand at Maximum Load Point (passengers per hour in peak direction)

CalTrain - 2,640

o Travel Time (peak period, minutes)

	San Jose to S.F.	Redwood City to S.F.	S.F. Airport to S.F.
CalTrain	84.4	52.5	34.0

ALIGNMENT

Transit service alignments remain as is, except Guadalupe LRT built from Edenvale through downtown San Jose to Marriott's Great America

CAPITAL COST (Millions of Dollars)

All capital expenditures are expected to occur regardless of results of this study; therefore, capital cost for this study is $0

OPERATING AND MAINTENANCE COSTS (Millions of Dollars)

All costs are expected to occur regardless of the results of this study; therefore, operating and maintenance cost for this study is $0

SYSTEM RIDERSHIP (Average Weekday)

- % of Corridor work trips by Transit: 13.0%

- Fixed Guideway Transit Trips:
  - Work: 25,000
  - Non-Work: 13,000
  - Air Passenger: 2,100

- Transit Ridership by Mode

	Work & Non-Work	Air Passenger	Total
BART	19,000	1,400	20,400
CalTrain	19,000	700	14,700
Express Bus	33,000	-	33,000

Alternative 1
Transportation System Management Actions

Service Concept

The TSM (Transportation Systems Management) concept incorporates relatively low cost capital improvements to the overall transportation system, but does not contain any new rail extensions. CalTrain service improvements would be on a scale that would not require long-term control of the right-of-way or addition of a third track to accommodate separate freight operations. This alternative includes the following improvements:

- Installation of high occupancy vehicle (HOV) lanes on all new highway lanes added in Alternative 0, by designating these lanes for use by express buses and shared-ride vehicles.
- CalTrain service increased from 46 to 68 trains per day. This schedule was based on input from the Southern Pacific Transportation Company and increases service in the reverse commute direction and service during the mid-day, but preserves existing freight "windows".
- San Jose Terminal improvements at Cahill and Alma, reflecting the results of recent deliberations by the City of San Jose, Caltrans, and the SCCTD.
- Express bus service by SamTrans and SCCTD on Route 101 and I-280, and construction of additional park-and-ride facilities adjacent to these highways.
- New CalTrain Airport Station west of Highway 101 near San Francisco Airport, linked to airport passenger terminals by shuttle buses.
- Shuttle bus from BART's Daly City Station to San Francisco Airport.

Ridership

Patronage on the CalTrain commuter rail service increases by almost 5,000 daily trips over the null alternative due in part to more reverse commute trains, longer hours of peak directional service, and enhanced feeder bus services. SamTrans mainline express patronage declines by 6,000 daily trips compared to the null alternative. Many of these patrons shift to the commuter rail service and the remainder use local bus services.

BART patronage in the West Bay remains relatively constant compared to the null alternative as the service to Daly City is identical. Ridership on the local transit services in San Mateo and Santa Clara Counties increases substantially, however, as headways are significantly reduced in both instances. Daily ridership on SamTrans increases by 28,000 trips and SCCTD gains 55,000 passenger trips. These figures include transfer passengers.

In San Francisco, Muni patronage increases by 10,000 daily passenger trips due in part to the growth in CalTrain ridership and the need to distribute more passengers from the 4th and Townsend station.

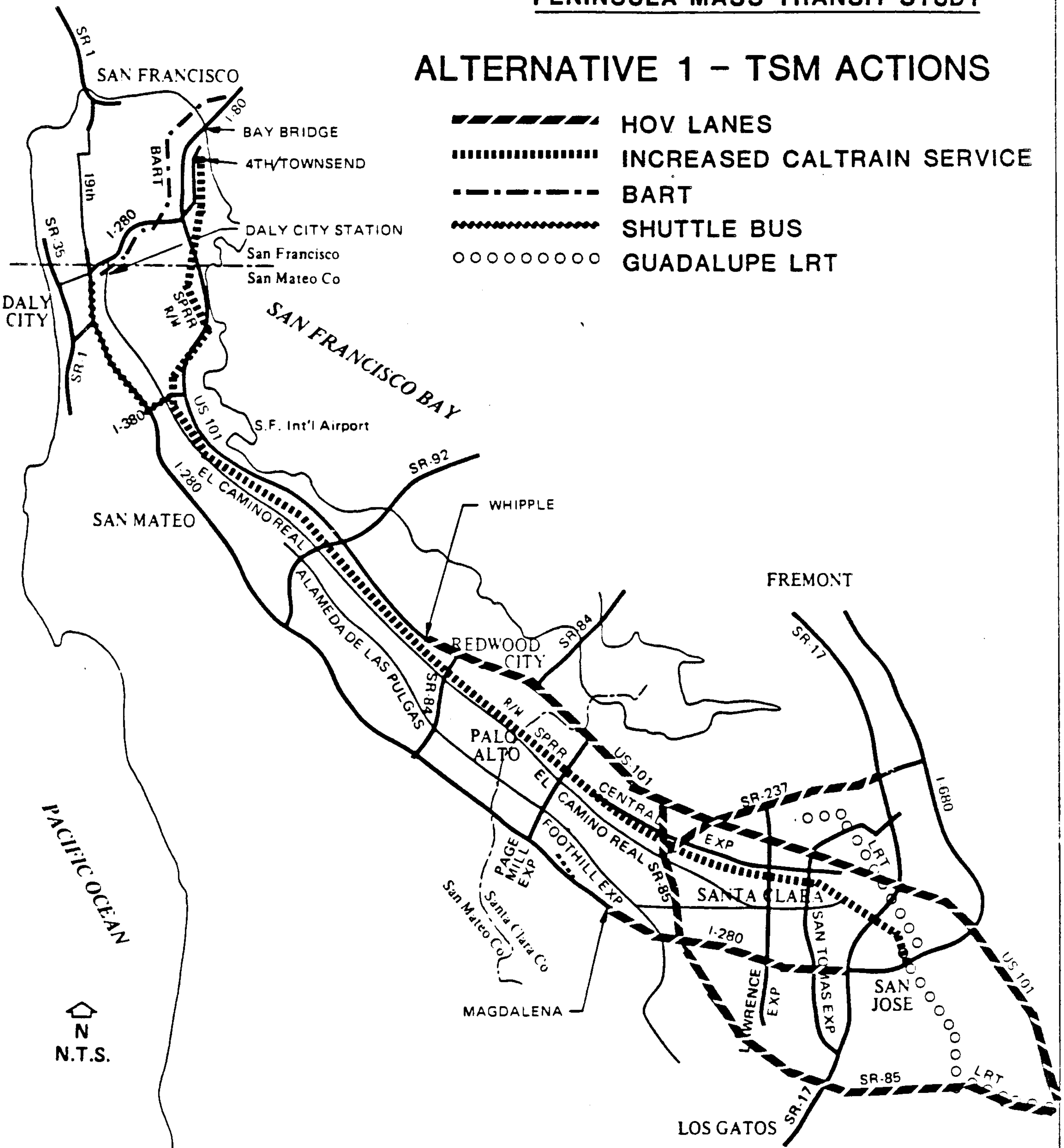
Also, 2,100 daily air passenger trips would be made on BART and CalTrain to the San Francisco Airport.

Capital Costs

The major capital costs for this alternative include the CalTrain Airport Station and shuttle bus ramp over Route 101 to the airport terminals ($10.3 million), and 8 new rail cars for the 68 train schedule ($8.8 million). This alternative also includes projects in the CalTrain modernization program which are part of MTC's list of prerequisite projects, but do not yet have formal funding commitments (e.g., maintenance facility, track rehabilitation, additional station improvements, tower consolidation, etc.). Most of these projects would be implemented in anticipation of higher service levels and have therefore been shown under the TSM Alternative. Also their inclusion in this alternative provides for a clearer comparison of necessary systemwide improvements among the various alternatives. The cost of improvements for the San Jose Terminal was based on the Cahill alternative in the San Jose Multimodal Transportation Terminal Study/DEIS ($47.3 million).

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 1 - TSM ACTIONS



NOTES:

All highway improvements shown for Alternative 0 are included in this alternative. The impact of dedicating a lane on Highway 101 north of Whipple for HOV use will be determined.

Prepared By KE BA

ALTERNATIVE AT A GLANCE

Alternative 1

- Transportation System Management Actions -

SYSTEM OPTIONS

Transit status quo improvements plus the following:

- HOV lanes on Route 101 (Redwood City south), I-280 (Magdalena south), Route 85 and Route 237
- Increased CalTrain service to 68 trains per day; some new rolling stock
- Improved CalTrain San Jose Terminal (Cahill Alternative)
- New CalTrain maintenance facility
- New CalTrain station at San Francisco Airport
- Express bus service on Route 101
- Shuttle bus between Daly City BART station and San Francisco Airport

SERVICE

o Schedule

CalTrain	- peak:	peak direction trains dispatched every 10 minutes serving alternate stations (skip stop) with selected common stations for transfers; non-peak direction trains every 30 minutes, serving all stops
	-off peak:	half hour headways except for freight "windows" in midday
BART	-	2.5 minute train frequencies at Daly City BART Station during peak period, 5 minutes off-peak
Shuttle Bus:		15 minute frequency between Daly City BART Station and Airport, also connecting to CalTrain

o Year 2000 Demand at Maximum Load Point (passengers per hour in peak direction)

CalTrain - 4,350

- Travel Time (peak period, minutes)

	San Jose to S.F.	Redwood City to S.F.	S.F. Airport to S.F.
CalTrain	84.4	52.5	34.0

ALIGNMENT

CalTrain — San Jose to San Francisco (4th and Townsend): 46.9 miles, 12 new grade separations

CAPITAL COST (Millions of Dollars)

- Total System Cost: $155.1
- Other Cost Items of Interest

  San Jose Terminal: $47.3
  Centralized Train Control: $12.0
  8 new gallery cars: $8.8
  Airport Station: $3.8
  Maintenance Facility: $44.0
  Station Improvements: $15.3
  Track Rehabilitation: $3.4
  Tower Consolidation: $4.6

OPERATING COSTS AND REVENUES (Millions of Dollars)

	O&M Costs	Revenue
CalTrain	35.6	11.8
Express buses	5.8	7.0
BART	--	.9

SYSTEM RIDERSHIP (Average Weekday)

- % of Corridor work trips by transit: 13.4
- Fixed Guideway Transit Trips:

  Work: 30,000
  Non-work: 14,000
  Air Passenger: 2,100

- Transit Ridership by Mode

	Work & Non-Work	Air Passenger	Total
BART	20,000	1,400	21,400
CalTrain	24,000	700	24,700
Express Bus	27,000	-	27,000

- Other Patronage Items of Interest:

  In order to evaluate the sensitivity of CalTrain ridership service to the level of SamTrans express bus service to San Francisco on Route 101, two of the four major express routes were eliminated (7R & 7F). Reduction of SamTrans express bus service would decrease daily express bus patronage from 27,000 to 14,000 trips, while CalTrain ridership would increase from 24,000 to 36,000 daily trips.

Alternative 2
Minimum Rail Extensions

Service Concept

This alternative involves limited extensions of existing rail lines or services. BART would be extended to a new station at Serramonte/Colma to relieve overcrowding at the Daly City Station; peak-period CalTrain service would be extended into Coyote Valley (South San Jose) to capture a greater share of workers from this area travelling to jobs along the Southern Pacific right-of-way in northern Santra Clara County; CalTrain would be extended from the 4th and Townsend Station to the Transbay Terminal in a cut and cover tunnel.

As an alternative to extending CalTrain to the Transbay Terminal in San Francisco, other options were also considered for distributing San Francisco CalTrain riders. The first option consisted of a tunnel underneath 2nd Street where the tracks would stub end at Market Street immediately adjacent to the BART Montgomery Street Station. This alignment was selected by the City of San Francisco, Muni, and MTC to test in the study and involves a deep bore tunnel which is slightly shorter than the Transbay alignment and which interfaces with BART rather than the regional bus system. The cost of the 2nd Street alignment was estimated with several different station configurations--also at the request of City and Muni staff. In order for the station footprint to stay within the street right-of-way, the tracks were stacked on top of each other in a 2-2-2 or 2-2 configuration depending on whether 6 tracks or 4 tracks are ultimately needed for the stub end. In the 2-2-2 configuration, a "deep" station configuration was estimated which would have a mezzanine and which would permit the two lower tracks to be extended underneath BART to connect with a crosstown rapid transit system which might ultimately be considered for San Francisco in the far future.

A second option for improving the distribution of train passengers is an extension of the Muni Metro system from the Embarcadero Station on Market Street to the present CalTrain terminal at 4th and Townsend. The Muni Metro extension would break out at the south end of Market Street, come up to the surface, and travel at grade to the CalTrain terminal. The tracks could be extended from the CalTrain terminal to Showplace Square and even down the Peninsula to the San Francisco Airport in the future. The Muni Metro extension would also serve the proposed Mission Bay development.

The CalTrain extension to Coyote Valley was assumed to operate during the peak period only and would use existing tracks. New stations would need to be constructed, but no grade separations are anticipated.

Ridership

This alternative produces an increase in CalTrain ridership of 19,000 daily trips compared to the TSM alternative. Extending CalTrain service to the Transbay Terminal or extending Muni light rail service to 4th and Townsend (Mission Bay) each improve the distribution of passengers destined for downtown San Francisco and are responsible for about 3,000-4,000 new riders compared to the TSM alternative. The extension of service south to Coyote Valley also results in an additional 3,000 passengers being attracted to CalTrain. Finally, in this and subsequent alternatives SamTrans mainline express bus service into San Francisco is reduced in response to the improved line haul rail service. This reduction in service results in 12,000 new patrons using CalTrain. Recent developments in San Francisco, such as the Mission Bay project, could increase patronage beyond what has been assumed in this study. However, the implications of the San Francisco Downtown Plan and the new Mission Bay project on ABAG's projections have not been fully resolved at this time.

With the Transbay Terminal extension, the need for Muni service to and from the 4th and Townsend Station is reduced but not eliminated. It is estimated that Muni patronage would decline by over ten thousand passenger trips which includes transfers. With respect to the Muni Metro extension to 4th and Townsend, the SCR 74 forecast of 7,000 daily users consists of CalTrain transfer passengers plus riders attracted to/from land developments surrounding the 4th and Townsend station. The I-280 Program projected 18,200 daily trips consisting of 11,300 passengers produced from new growth, 4,900 passengers transferring from CalTrain, and 2,000 passengers attracted to an intercept parking program. Intermediate station patronage, from developments between Mission Bay and the Embarcadero, was not included in the KE/BA forecast; nor was patronage associated with intercept parking programs. It should therefore be noted that the SCR 74 patronage forecast is "incomplete" with respect to the Muni Metro extension project.

In comparison with the modeled Muni Metro extension, the impact of a more adverse transfer was also tested which assumed a 1000 foot walk to board Muni instead of an across the platform transfer and payment of a full Muni transit fare instead of no additional fare for northbound riders. The resulting impact of this more adverse set of assumptions is the loss of 5,400 daily passengers going to and from San Francisco in comparison to the Transbay Terminal extension of CalTrain.

Extending BART to a new Serramonte Colma Station would result in an additional 3,000 passengers being attracted to the system. Many passengers would shift to the new station, thereby relieving the overcrowded conditions at Daly City.

Capital Cost

Cost estimates for the CalTrain cut and cover tunnel to the Transbay Terminal and the bored tunnel beneath 2nd Street were prepared by first reviewing existing Caltrans' estimates and tunneling construction methods in San Francisco for BART and the more recent Super Sewer. Tunnel dimensions in both cases are sufficient to allow for operation of bi-level electric cars to preserve future flexibility; costs for the tunnels also include the cost of adequate ventilation. The main differences in the costs between the two tunnels are the length of the route (the 2nd Street alignment is shorter), the construction method (2nd Street is a bored tunnel) and the cost to acquire the property behind the Transbay Terminal to make room for the 6 track underground station (about $60 million). Both tunnel costs assume that there would be an underground station near the present 4th and Townsend Terminal to serve the proposed Mission Bay development.

The Muni Metro extension costs assume the new turnaround facility at the end of Market Street is completed and that this facility provides a portal for extension of the Muni tracks to the 4th and Townsend CalTrain terminal. These tracks would be at grade. The cost estimate of $24.5 million therefore includes the costs of the at grade trackwork, street modifications and utility relocations, station modifications at 4th and Townsend, power, and signalling and communication systems necessary for preferential transit operation on city streets. It is recognized that many of these necessary street modifications will take place under the Embarcadero/King Surface Road Project in the I-280 Transfer Concept Program. Only $9.2 million would be required for the Muni

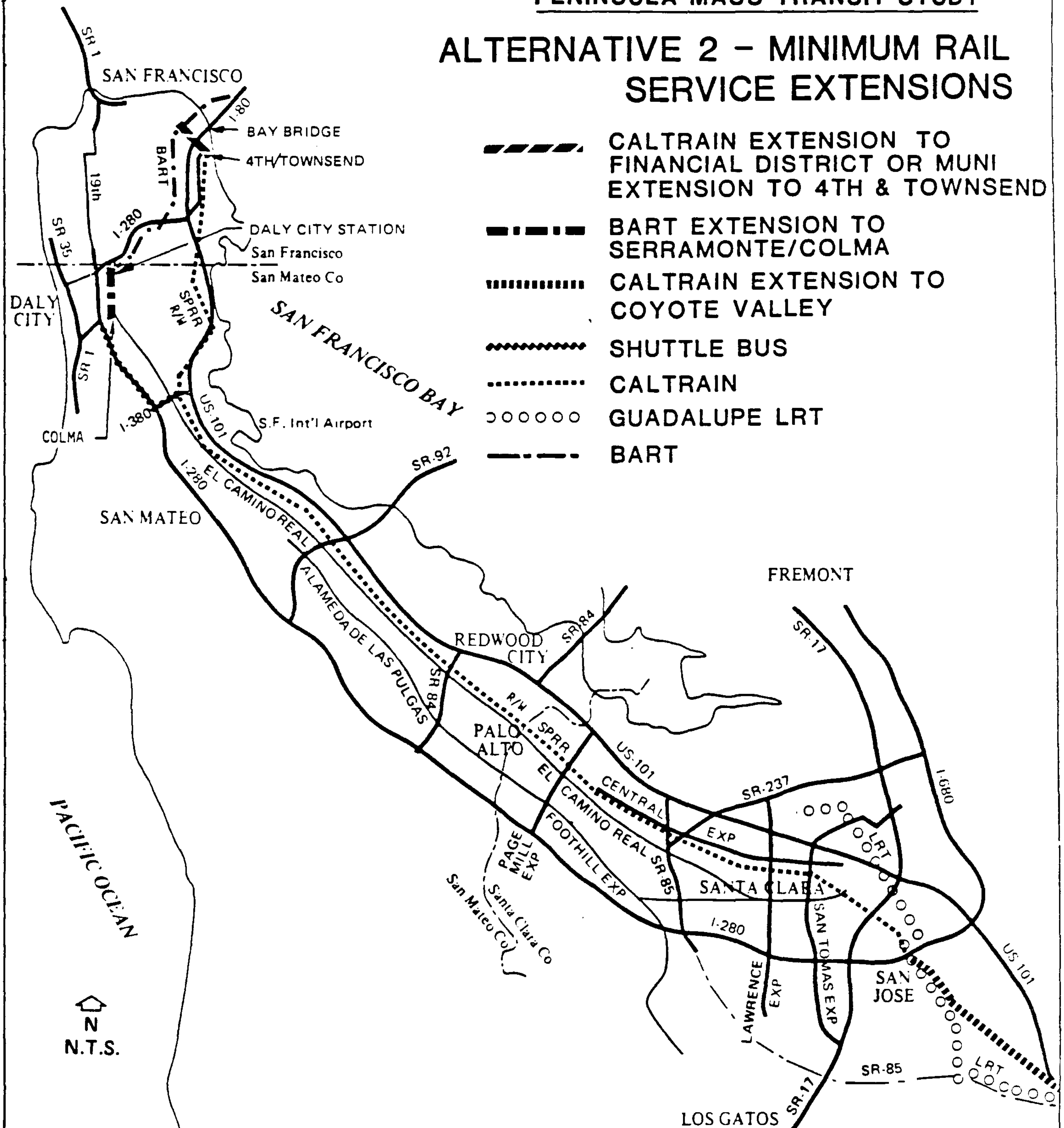
Metro extention after completion of this project. The San Francisco P.U.C. indicates that the additional vehicles needed to operate this extension would be obtained through a reallocation of the existing fleet and no new vehicle purchases would be necessary.

The capital costs for the Coyote Valley extension includes the cost of five new stations, trackwork, surface modification and utility relocation, and signals and communications.

Construction of major capital improvements contemplated in this alternative, such as the new San Francisco terminal for CalTrain, may require long term control of the right-of-way extending at least the minimum life of the facility. This control could be established either through purchase of the right-of-way or a long term lease with the Southern Pacific Transportation Company. No cost is included in this alternative for such control, pending further resolution of this issue.

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 2 – MINIMUM RAIL SERVICE EXTENSIONS



NOTES:

All highway improvements shown for Alternative 0 are included in this alternative.

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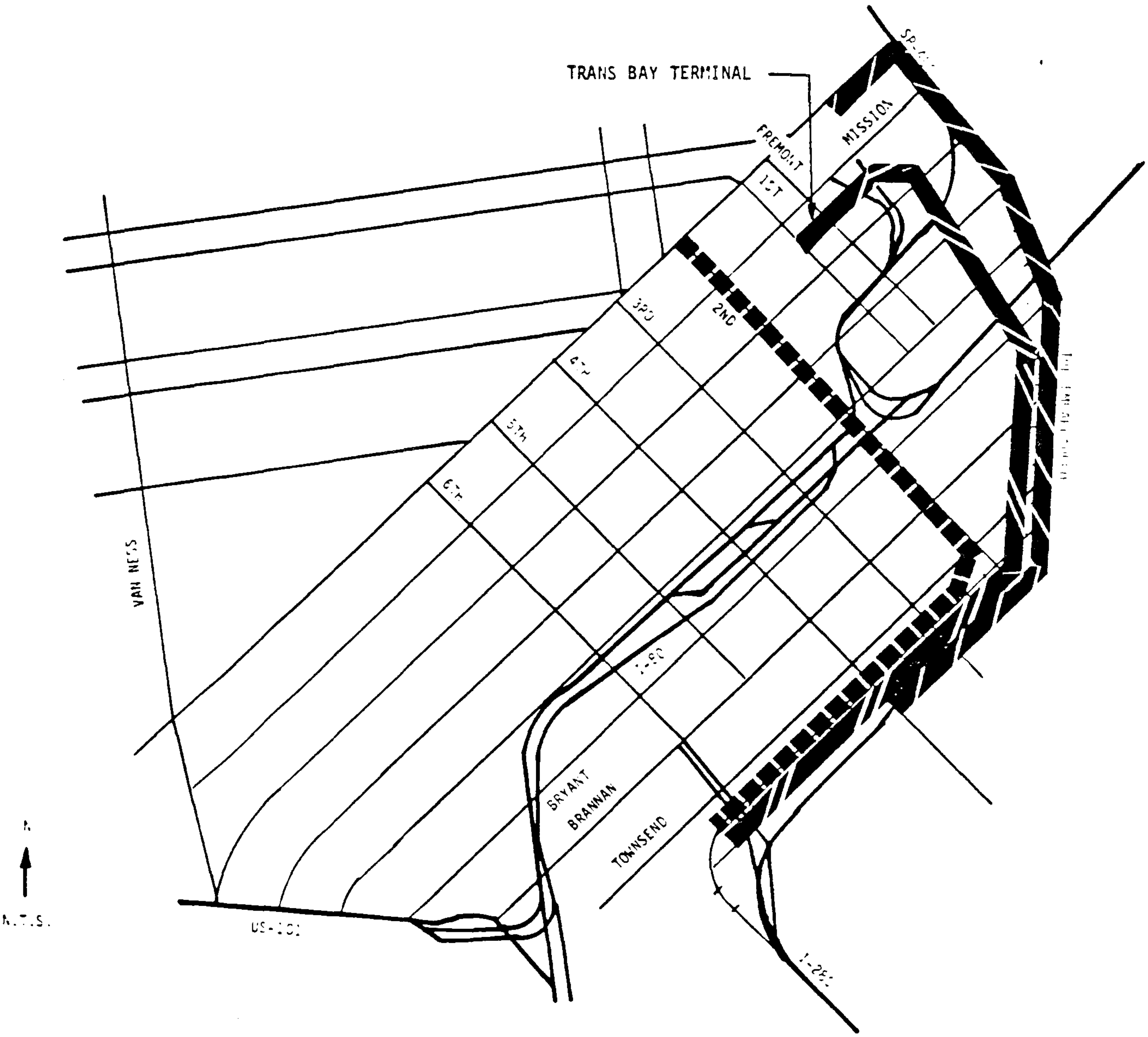
PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 2 - CALTRAIN EXTENSION TO FINANCIAL DISTRICT

- 2ND ST. ALTERNATIVE
- TRANSBAY TERMINAL ALTERNATIVE
- MUNI METRO EXTENSION



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ALTERNATIVE AT A GLANCE

Alternative 2

- Minimum Rail Extensions -

SYSTEM OPTIONS

Baseline	Option 1	Option 2
- CalTrain to Transbay Terminal - BART to Serramonte/Colma - CalTrain Service to Coyote Valley (peak only)	- CalTrain to BART under 2nd St. in San Francisco	- Muni Metro to CalTrain 4th and Townsend Terminal in San Francisco

SERVICE

o Schedule

CalTrain -peak: peak direction trains dispatched every 10 minutes serving alternate stations (skip stop) with selected common stations for transfers; non-peak direction trains dispatched every 30 minutes serving all stops

-off peak: half hour headways except for freight "windows" in midday

BART - 2 lines extended to Serramonte/Colma station; service every 3.75 minutes in peak period and 7.5 minutes in off-peak

o Year 2000 Demand at Maximum Load Point(passengers per hour in peak direction)

CalTrain - 4,500

o Travel Time (peak period, minutes)

	San Jose to S.F.	Redwood City to S.F.	S.F. Airport to S.F.
CalTrain	75.4	43.5	25.0

ALIGNMENT

CalTrain

- Coyote Valley: 12.8 miles, no grade separations
- San Jose to San Francisco mainline: 46.9 miles, 12 new grade separations
- Transbay extension; 1.5 miles, cut and cover subway
- 2nd Street extension: 1.3 miles, bored tunnel
- Muni Metro Extension to 4th and Townsend: 1.6 miles (1.2 miles new track at grade)

BART to Serramonte/Colma: 0.6 miles new track work, but revenue service extended 1.7 miles from Daly City

CAPITAL COSTS (Millions of Dollars)*

- o Total System Cost:

  Baseline: $710

  Option 1: (CalTrain under 2nd St.): $658

  Option 2: (Muni Metro to 4th/Townsend): $352

- o Other Cost Items of Interest:

  Transbay Terminal extension, including Transbay Station: $306.4
  Transbay Terminal Station: $129.7, including right-of-way
  2nd Street extension: $253.7
  Muni Metro extension: $24.5**
  CalTrain extension to Coyote Valley: $40.8
  BART extension to Serramonte: $61.6
  Grade separations (12): $53.8

OPERATING COSTS AND REVENUE (Millions of Dollars)

	O&M Cost	Revenue
CalTrain:	44.9	21.9
BART:	.6	1.4
Express Bus:	2.5	2.0

SYSTEM RIDERSHIP (Average Weekday)

- o % of Corridor work trips by Transit: 13.4

- o Fixed Guideway Transit Trips:
  Work: 46,000
  Non-work: 20,000
  Air Passengers: 2,500

- o Transit Ridership by Mode

	Work & Non-Work	Air Passenger	Total
BART (Serramonte and Daly City)	23,000	1,100	24,100
CalTrain	43,000	1,400	44,400
Express Bus	13,000	-	13,000

- o Other Patronage Items of Interest:

Patronage attributed to reduced express bus service:	12,000
Patronage attributed to CalTrain Terminal extension:	4,000
Patronage attributed to Muni Metro extension:	3,000
Patronage attributed to Coyote Valley extension:	3,000
Patronage attributed to BART Serramonte Extension:	3,000
Patronage on Muni Metro Extension to 4th and Townsend (includes CalTrain riders and local riders attracted to 4th and Townsend Station to use Muni service):	7,000

* Includes rolling stock, right-of-way, engineering/management/owner costs, and contingency

** Required financing for the Muni Metro extension would be only $9.2 million after completion of the Embarcadero/King Street road improvements to be performed under the I-280 Transfer Concept Program.

Alternative 3
BART to San Jose

Service Concept

In this alternative, CalTrain would be replaced by BART on the Peninsula. The BART extension would be fully grade-separated and would generally follow the Southern Pacific San Bruno branch line from the end of the Daly City tail track and would then follow the Southern Pacific mainline to San Jose. Alternatively, the BART alignment would deviate from the railroad mainline in San Bruno (I-380) proceed underground through the Airport Garage and then return to the Southern Pacific right-of-way in Millbrae. Stations would include Serramonte/Colma, Chestnut Street (eliminated by the BART Board but included in this study for planning purposes), Tanforan, the Airport, and most of the CalTrain stations south to San Jose.

The external airport station would be at-grade connected to the Airport Terminal by an elevated people mover system above this station. The people mover system was designed to circle the outside of the Airport terminals, placing the air passenger close to the ticketing and baggage check-in facilities and giving the air passenger the impression of being "at the airport" after making the transfer at the Airport Station. The people mover would operate on demand, much like a normal elevator.

Since CalTrain diesel service would be discontinued in this alternative, two alternatives were included to provide transit access north of the San Francisco Airport, where significant development is taking place adjacent to Route 101. The first consists of a local bus route from the external Airport Station, traveling on Route 101, and terminating in the Financial District. The second concept consists of an extension of Muni Metro in San Francisco, down the Southern Pacific right-of-way, to the intermodal Airport Station where it would connect with BART. Both systems enable passengers to transfer at the airport to the Bayshore corridor transit service.

Ridership

This alternative, as tested, provides the most frequent service and a four station distribution system in downtown San Francisco. The alignment to Daly City (rather than along the Bayshore corridor) adds eight to ten minutes of travel time for San Mateo County residents living south of San Bruno, who are destined to the Financial District compared to Alternatives 2, 4 and 5. Nevertheless, the frequent service and all stop service pattern attract 90,000 new patrons to BART each weekday.

Former express bus and CalTrain patrons constitute almost fifty percent of this ridership market but importantly, new persons are attracted to public transportation. Many of these patrons are reverse commuters traveling southbound during morning commuter periods. Compared to the TSM alternative, 18,000 work trips (two-way) are removed from automobiles in the corridor.

Extending Muni light rail service from San Francisco to the airport would attract some 26,000 daily patrons while comparable bus service in the Bayshore corridor running in mixed traffic would attract some 10,000 daily patrons. The difference in patronage is largely due to the speed advantage of the light rail service operating in an exclusive right-of-way.

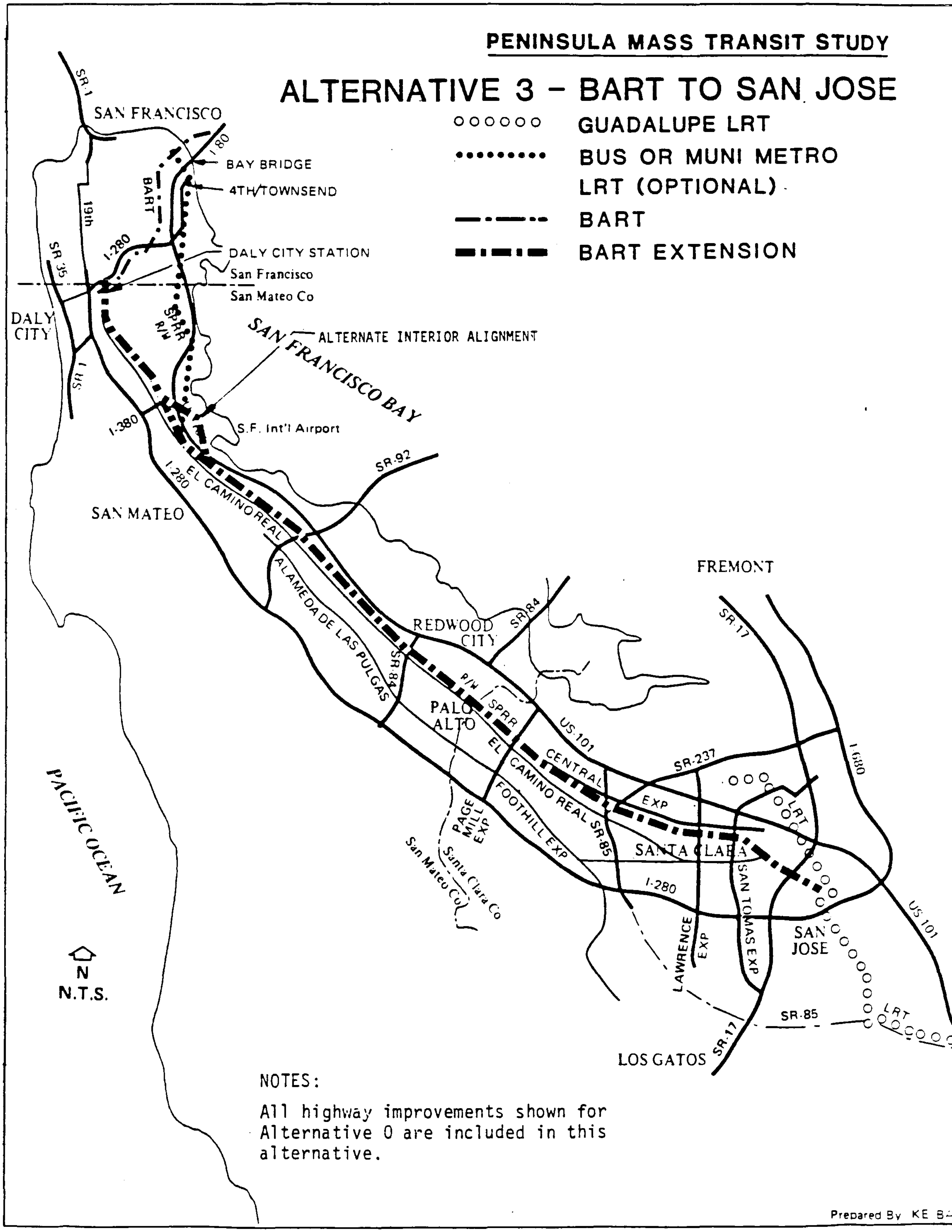
About 7,700 daily air passengers would use BART to the San Francisco Airport. Differences in perceived utility between the airport station under the parking garage (internal airport alignment) and external people mover system would be minor. This is because the internal alignment saves time to the airport proper, but the people mover would provide more direct access to the ticket counters once the passenger has reached the airport. Also, the people mover would operate "on-demand", so there would be very little transfer delay.

Capital Costs

Because of the third rail type of electrification, BART would be fully grade separated. The assumed BART alignment down the Peninsula consists of 15.9 miles of aerial guideway, 0.8 miles of subway, and the remainder of the alignment would be at grade. There would be a total of 27 new stations, 16 of which would be aerial, 10 at grade, and one underground. Comparing the outer airport alignment with the tunnel beneath the Airport Garage, it would cost about $270 million more to tunnel under the Airport Garage and then return to the SP right-of-way at Millbrae. The Consultant's review of structural provisions for BART under the Airport Garage indicate that only part of the garage has been modified to accept BART (essentially involving the spacing of the support columns) and substantial further modifications would be required to traverse all of the airport structures. The airport tunnel would not affect existing homes as it would be bored deep beneath the ground as it crosses San Bruno to the airport.

The exterior BART alignment could include a people mover system to the airport terminals if air passenger and airport employee levels warranted. This system would be fully automated and operate on demand, stopping at seven different locations. The total people mover cost including stations, guideways, turnback loop, yard and shop is estimated to be $147 million.

Other significant BART system costs include the cost of a new yard and maintenance facility in San Jose for the Peninsula line ($43.7 million), the cost of a separate track for freight ($379 million), traction power and distribution ($176 million), and new rolling stock ($243.2 million). The complete system cost for the Muni Metro extension from San Francisco to the airport intermodal station is $451 million, including a new yard and maintenance shop and supplemental car storage in San Francisco.



NOTES:

All highway improvements shown for Alternative 0 are included in this alternative.

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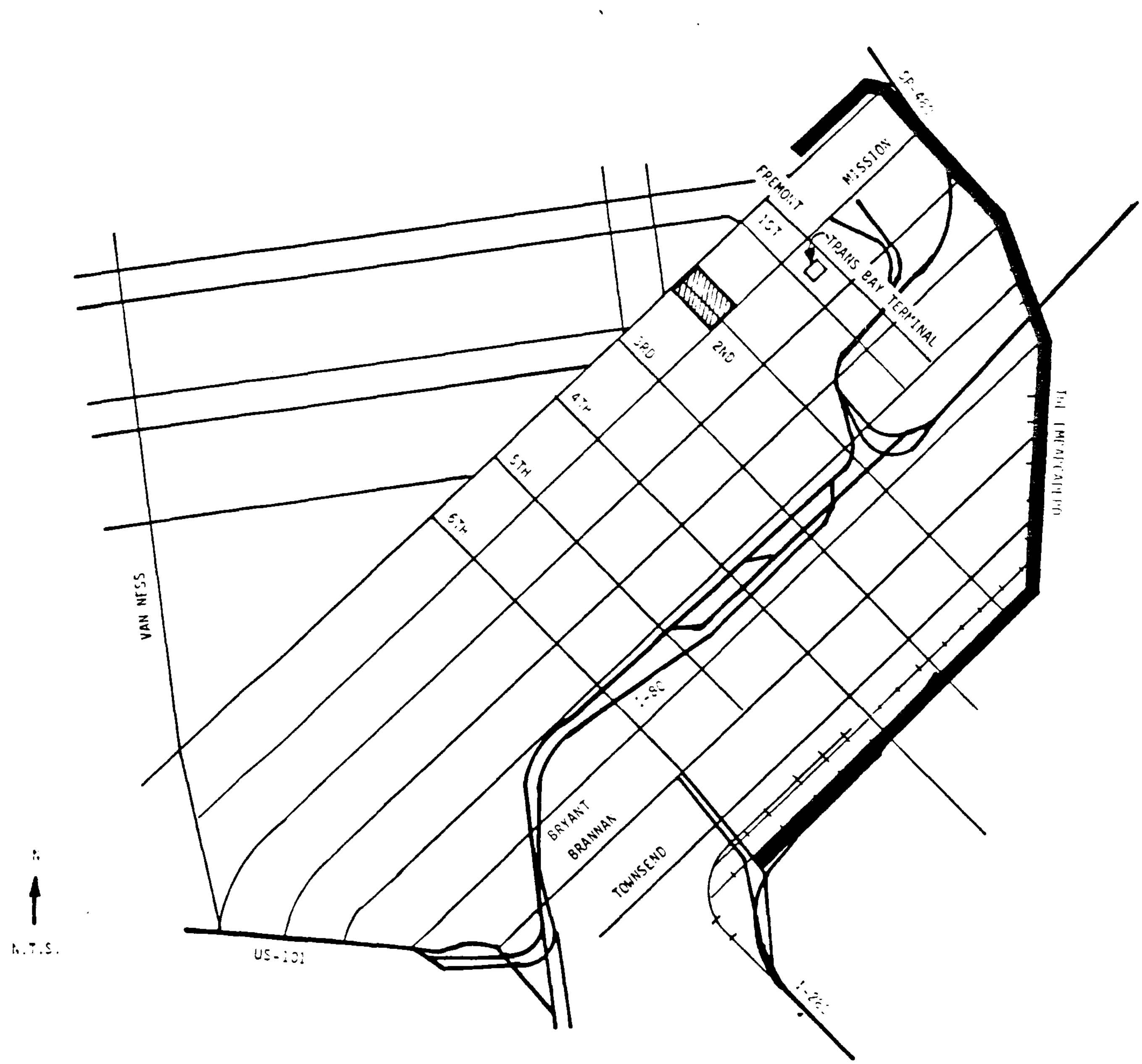
PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 3 - MUNI METRO LRT ALIGNMENT IN DOWNTOWN SAN FRANCISCO

MUNI METRO LRT



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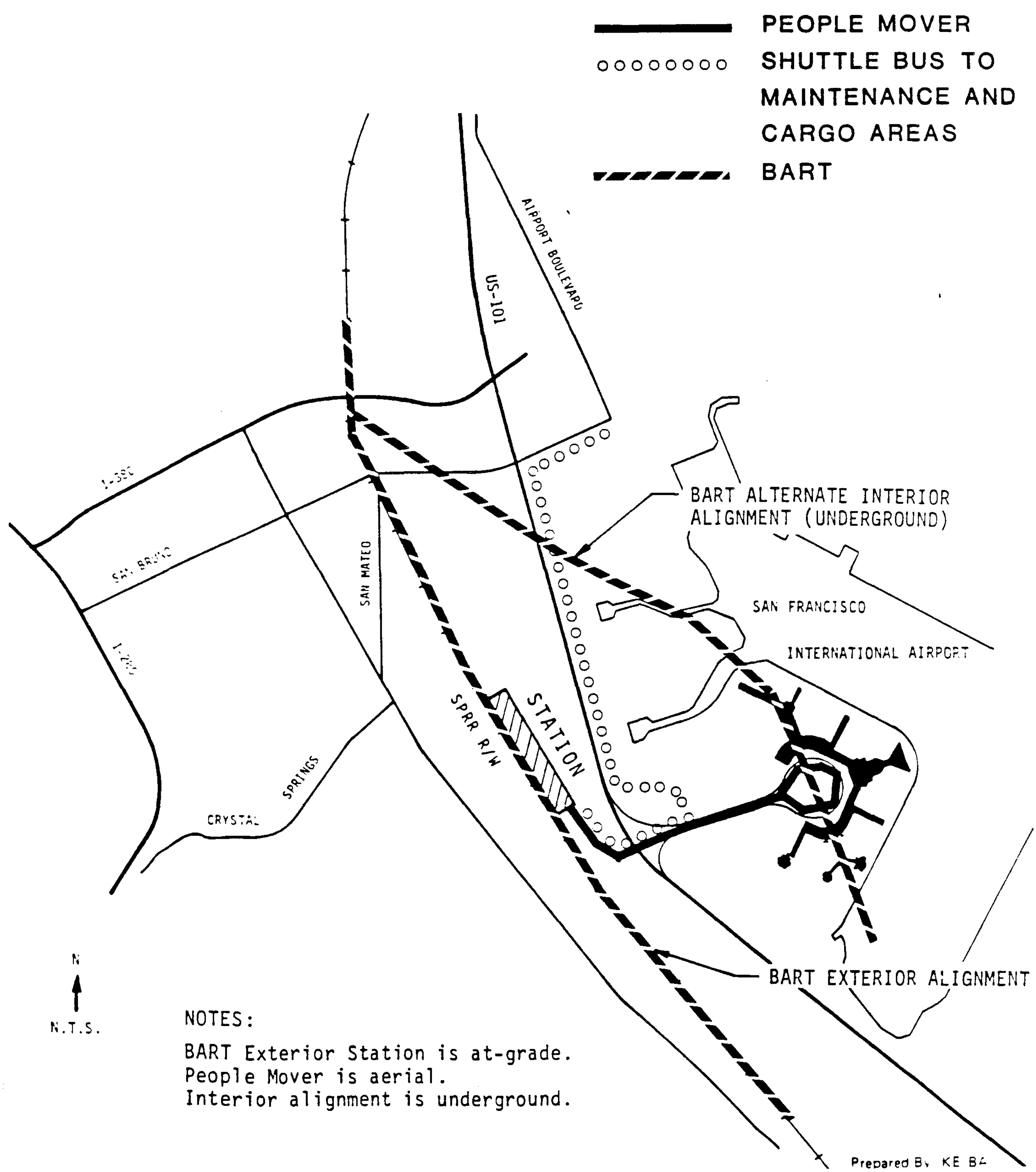
PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 3 – PEOPLE MOVER CONNECTION



NOTES:

BART Exterior Station is at-grade.
People Mover is aerial.
Interior alignment is underground.

ALTERNATIVE AT A GLANCE

Alternative 3

- BART to San Jose -

SYSTEM OPTIONS

Baseline	Option 1	Option 2
- BART to San Jose via external Airport alignment - People mover to Airport Terminals - Local bus from external Airport Station to S.F. Financial District	- Muni Metro extended from Market St. to S.F. Airport, instead of local bus	- BART to San Jose via internal Airport alignment under parking garage

SERVICE

o Schedule

BART - 2 lines extended from Daly City; service every 3.75 minutes in peak and 7.5 minutes in off peak period

People mover - On demand

Local bus in Bayshore Corridor - Serves intermediate destinations in route to San Francisco Financial District (16 miles)

o Year 2000 Demand at Maximum Load Point (passengers per hour in peak direction)

BART - 10,700

o Travel Time (peak period, minutes)

	San Jose to S.F.	Redwood City to S.F.	S.F. Airport to S.F.
BART	82.3	52.9	33.7
Muni Metro (Option 1)	----	----	32.1

ALIGNMENT

BART - Daly City to San Jose: 41.4 miles total (includes 15.6 miles of aerial guideway and 0.8 miles of subway.) Alignment would be completely grade separated.

Peoplemover - 2.5 miles of aerial guideway from external Airport Station, on west side of Route 101, around terminal, and back to the station, excluding track for maintenance and storage facilities.

CAPITAL COSTS (Millions of Dollars)*

o Total System Cost:

	Low**	High
Baseline (External Airport alignment)	$1,758	1,988
Option 1 (Muni Metro extension)	$2,187	2,439
Option 2 (Internal Airport alignment)	$1,887	2,111

o Other Cost Items of Interest

Airport People Mover	$146.9
Muni Metro Extension in Bayshore Corridor to Airport	$451.4
Third Track for Freight	$378.8

OPERATING COSTS AND REVENUES (Millions of Dollars)

	O&M Costs	Revenue
BART	79.3	62.2
Express Buses	2.5	2.2

SYSTEM RIDERSHIP (Average weekday)

o % Work Trips by Transit: 14.2%

o Fixed Guideway Transit Trips (Baseline):
  Work: 71,000
  Non-Work: 39,000
  Air Passenger: 7,700

o Transit Trips by Mode (Baseline - Local Bus in Bayshore Corridor)

	Work & Non-Work	Air Passenger	Total
BART	110,000	7,700	117,700
Local Bus	10,000	-	10,000
Express Bus	4,000	-	4,000

o Transit Trips by Mode (Option 1 - Muni extension in Bayshore Corridor)

	Work & Non-Work	Air Passenger	Total
BART	110,000	2,200	112,200
Muni LRT	26,000	5,500	31,500
Express Bus	4,000	-	4,000

o Other Patronage Items of Interest:

  Muni Metro extension to Airport (Option 1): 26,000

* Includes rolling stock, right-of-way, engineering/management/owner costs, and contingency.

** Low costs reflect reduced right-of-way costs, elimination of the people mover where appropriate, and lower freight track costs due to reduced lateral clearances between the freight track and BART track compared to the stated SP requirement.

Alternative 4
Light Rail to San Jose

Service Concept

In this alternative, CalTrain would be replaced with a light rail type transit system having overhead electrification and operating with one to four car trains. The LRT would connect with BART in San Francisco and the Guadalupe Corridor LRT in San Jose.

Within San Francisco, the LRT alignment would be at grade as it runs from Market Street down 2nd and King Streets. Second Street would be converted to a pedestrian-oriented transit mall, with limited traffic access. The alignment would follow the Southern Pacific mainline from San Francisco to Sunnyvale, where it would then turn to the median of the Central Expressway, serve the San Jose Airport, and continue along Route 87 to connect with the Guadalupe Corridor LRT in San Jose.

Other alignment options include:

- Continuing along the SP right-of-way instead of diverting to the Central Expressway, or
- Departing the SP right-of-way in the vicinity of Route 237 and swinging north to connect to the Guadalupe LRT line where it will end at Tasman Drive.

The LRT would need to be grade separated at heavily travelled local streets because of the anticipated frequency of service--5 minutes in each direction during peak hours. A people mover at the airport is also an option with this alternative to connect the exterior airport station with the terminals.

Ridership

This alternative, like BART (Alternative 3), provides frequent all day, all stop service throughout the Peninsula Bayshore corridor. Speeds are almost the same as BART, but travel times to and from San Francisco are shorter than BART due to the more direct Bayshore alignment. This alternative, as tested, ends at a single point of distribution in downtown San Francisco but travels closer to many jobs in Silicon Valley along its Central Expressway alignment.

These factors combine to produce an estimated 105,000 daily trips on the LRT line between San Francisco and San Jose. Northbound, home-to-destination trips, constitute 53% of these trips while southbound travel accounts for 47% of the patronage. As with BART, one-half of these patrons will shift from other transit modes assumed in the "Transit Status Quo" alternative; but, some 15,000 to 25,000 work trips (two-way) would shift from automobile use compared to the TSM and Transit Status Quo Alternatives respectively. About 1,300 air passengers would continue to use BART to the San Francisco Airport (via the shuttle bus) and 5,500 air passengers would use the LRT service daily.

Capital Costs

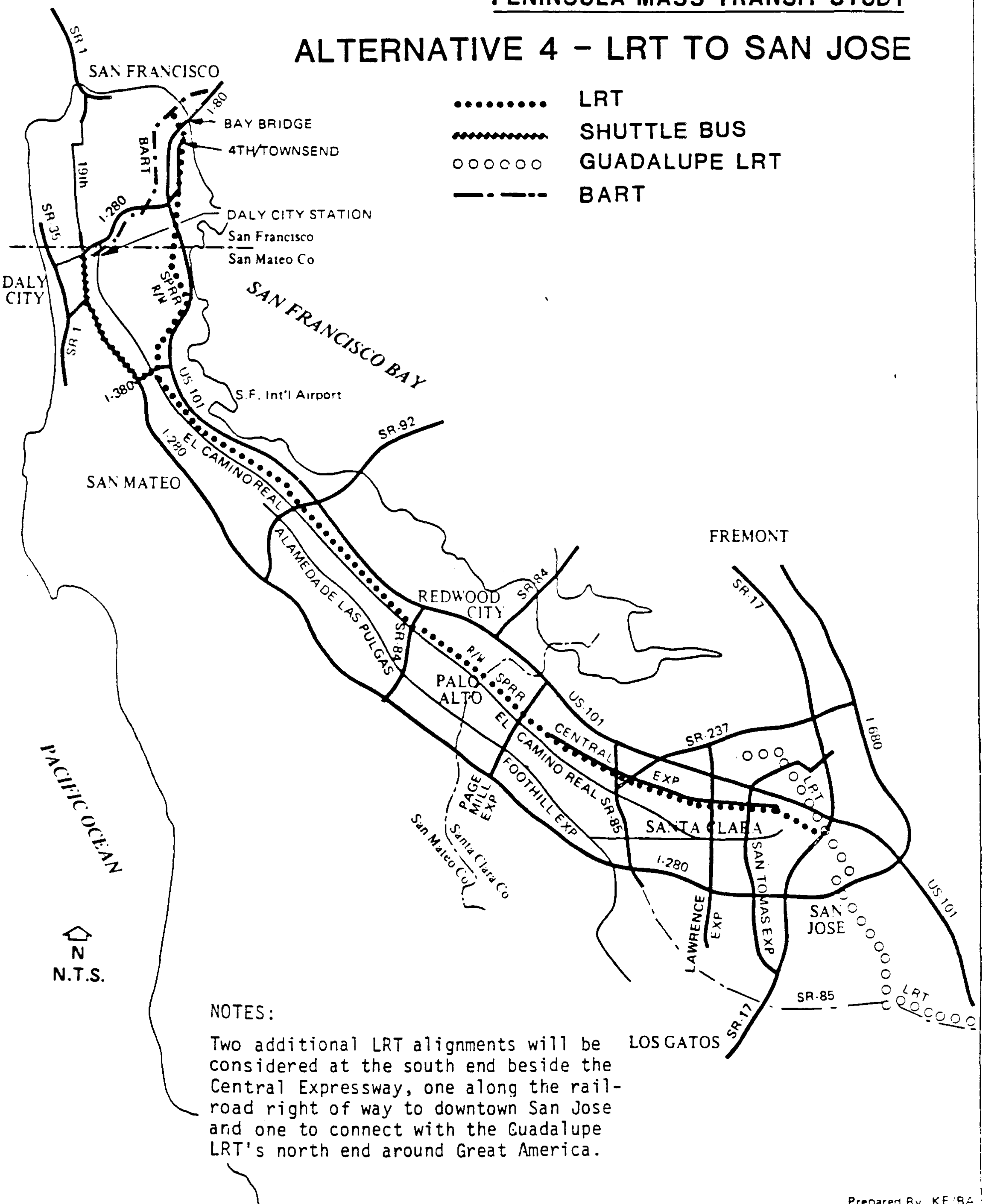
Although the LRT system would have the same track gauge as the existing railroad tracks, new trackage would need to be laid along the corridor in order for the tracks to withstand the higher density of traffic associated with the LRT system and to electrically isolate the tracks if DC current is used (the rails are used as the negative return); also new tracks would need to be laid along 2nd Street in San Francisco where none now exist. Providing a separate track for freight would cost $338 million including modifications to tunnels and other structures along the right-of-way. As explained in Chapter VI, provision of a third track may not be necessary if the operator of the transit system has control over the freight schedules. This alternative also assumes purchase of the right-of-way in order to make the necessary capital expenditures.

Peninsula communities have, on a number of occasions, expressed concern that increased rail service could impact local east-west traffic across the rail tracks. In order to assess the need for new grade separations in this study, a simplified approach was used to guage the amount of conflict which would occur between train and auto traffic. This criteria involved the calculation of an exposure factor, which is the product of daily trains and daily auto traffic. Because of the assumed increase in density of service, the LRT alternative resulted in 45 new grade separations. The cost of grade separation was estimated to be $210 million, including 11 miles of aerial trackage. In actual practice, a number of other factors would need to be considered for each potential grade separation candidate, including the physical geometry of each intersection and projected future auto traffic. However, the cost of grade separations would probably be at least $53,000,000 for the 12 most critical streets in the corridor.

Of the three alignments in the southern part of the corridor, the connection at Tasman Drive to the Guadalupe Corridor LRT would be the least expensive ($138 million), followed by the Central Expressway leg ($252 million), and the Southern Pacific right-of-way leg ($292 million). The latter alignment is highest because of the right-of-way costs. Other cost items of interest include the cost of traction power and distribution ($203 million for a 1500 Volt DC power system),the cost of rolling stock ($271 million), the cost of signals and communication ($212 million) and the costs of a new yard and maintenance shop and supplemental car storage facility in San Francisco ($69 million). These costs are based on the Central Expressway alignment.

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 4 - LRT TO SAN JOSE



NOTES:

Two additional LRT alignments will be considered at the south end beside the Central Expressway, one along the railroad right of way to downtown San Jose and one to connect with the Guadalupe LRT's north end around Great America.

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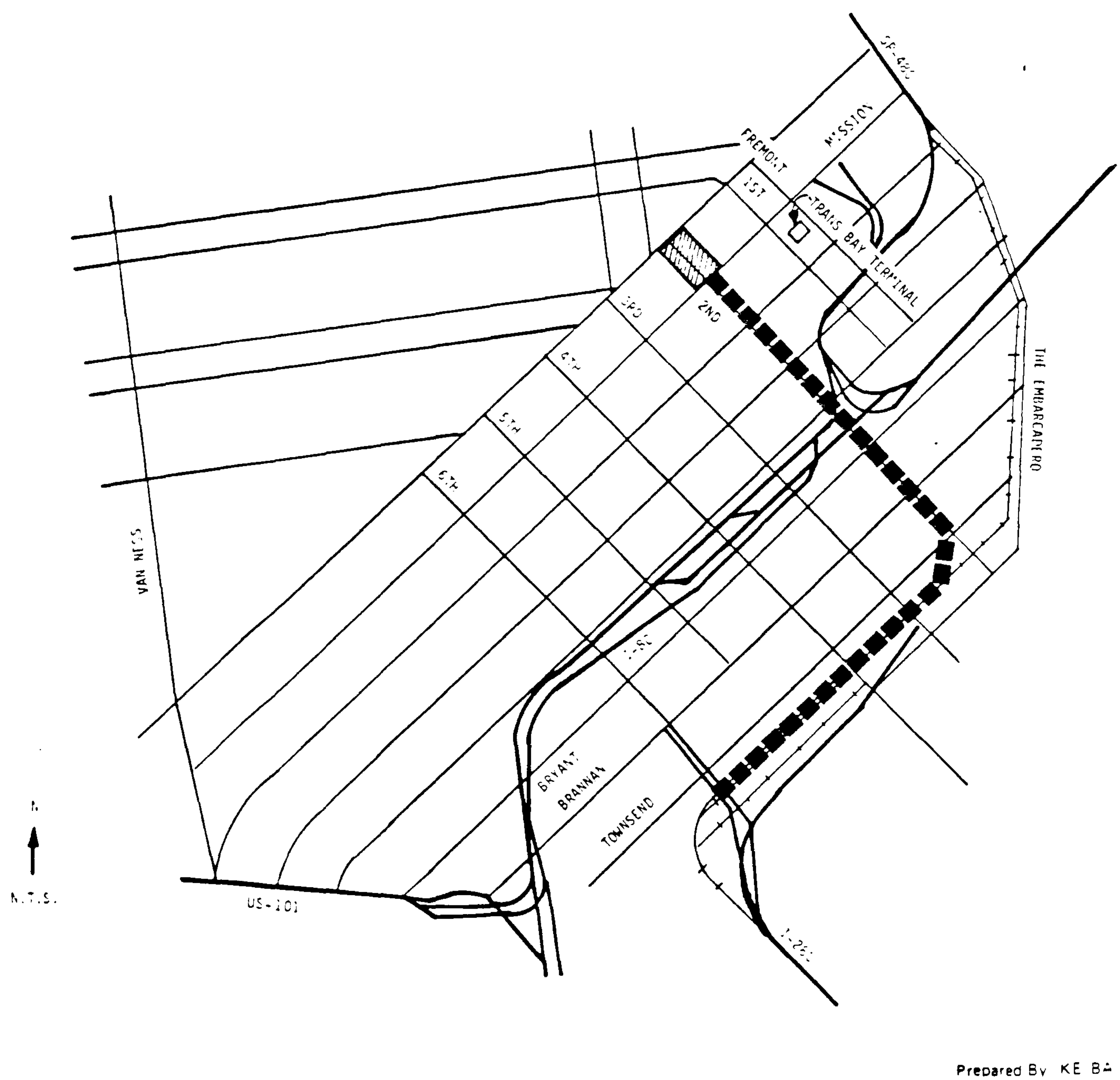
PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 4 - LRT ALIGNMENT IN DOWNTOWN SAN FRANCISCO

■■■■■■ LRT



Prepared By KE BA

ALTERNATIVE AT A GLANCE

Alternative 4

- LRT to San Jose -

SYSTEM OPTIONS

Baseline	Option 1	Option 2
- LRT from 2nd/Market St. (Montgomery BART Station) to San Jose via SP mainline and Central Expressway - People mover to Airport Terminals - Shuttle bus to Daly City BART	- LRT uses SP ROW, not Central Expressway, and terminates at Alma St. Guadalupe LRT Station	- Same as baseline south to Sunnyvale, then east to connect with Guadalupe LRT at Tasman Drive

SERVICE

o Schedule

LRT - 5 minute service in peak period stopping at all stations, 10 minute service in the off-peak

o Year 2000 Demand at Maximum Load Point (passengers per hour in peak direction)

LRT - 6,840

o Travel Time (peak period, minutes)

	San Jose to S.F.	Redwood City to S.F.	S.F. Airport to S.F.
LRT (baseline)	80.3	45.3	26.0

ALIGNMENT

Baseline (Central Expressway) - 50.9 miles SF to SJ (includes 12 miles aerial), with 45 new grade separations.

Option 1 (SP R-O-W) - 52.8 miles SF to SJ (Alma Station)

Option 2 (Great America) - 44.8 miles SF to Guadalupe LRT at Tasman Drive

CAPITAL COSTS (Millions of Dollars)*

o Total System Cost:

	Low**	High
Baseline (Central Expressway):	$1,127	$1,644
Option 1 (SP R-O-W):	1,184	1,721
Option 2 (Connect to Guadalupe LRT):	1,142	1,589

o Other Cost Items of Interest (all options)

Airport People Mover	$146.9
Third Track for Freight	$338.4
Central Expressway Leg	$252.2
Southern Pacific ROW Leg	$292.3
Great America Leg	$137.5
Grade Separations (Baseline)	$210.0

OPERATING COST AND REVENUE (Millions of Dollars)

	O&M Cost	Revenue
LRT	65.7	43.3
Express Buses	2.5	1.2
BART	--	2.9

SYSTEM RIDERSHIP (Average Weekday)

o % Corridor Work Trips by Transit: 14.0%

o Fixed Guideway Transit Trips: (Baseline)
Work: 78,000
Non-work: 43,000
Air Passenger: 6,800

o Transit Ridership by Mode

	Work & Non-Work	Air Passenger	Total
LRT	105,000	5,500	110,500
BART	16,000	1,300	17,300
Express Bus	8,000	-	8,000

* Includes rolling stock, right-of-way, engineering/management/owner costs, and contingency.

** Low costs reflect reduced right-of-way costs, elimination of airport people mover, and elimination of third track for freight.

Alternative 5
Electrified Commuter Rail

Service Concept

This alternative involves electrification of the Peninsula commuter rail system to provide faster, more frequent rapid transit type service along the corridor. Optimum performance would be achieved by converting the entire fleet of CalTrain cars to self propelled by-level electric multiple units; (EMUs) however, a mixture of EMUs and electric locomotives hauling non-powered galley cars (which Caltrans is currently purchasing) would be another option. The electrified system would be extended from the 4th and Townsend Station in San Francisco underground to the Transbay Terminal or to BART's Montgomery Street Station under 2nd Street as described in Alternative 2. In San Jose the electrified rail system would connect to the Guadalupe Corridor LRT. The San Francisco airport station could be connected to the terminals via an automated people mover system as with the other alternatives.

Ridership

Electrification of the commuter rail line will allow trains to accelerate and decelerate more quickly, thereby reducing travel time, and reducing headways. Over the length of the corridor, this service alternative provides the shortest travel times in large part due to the skip-stop service pattern with which this alternative has been tested. The skip stop service, however, also means that fewer station pairings are satisfied by each train.

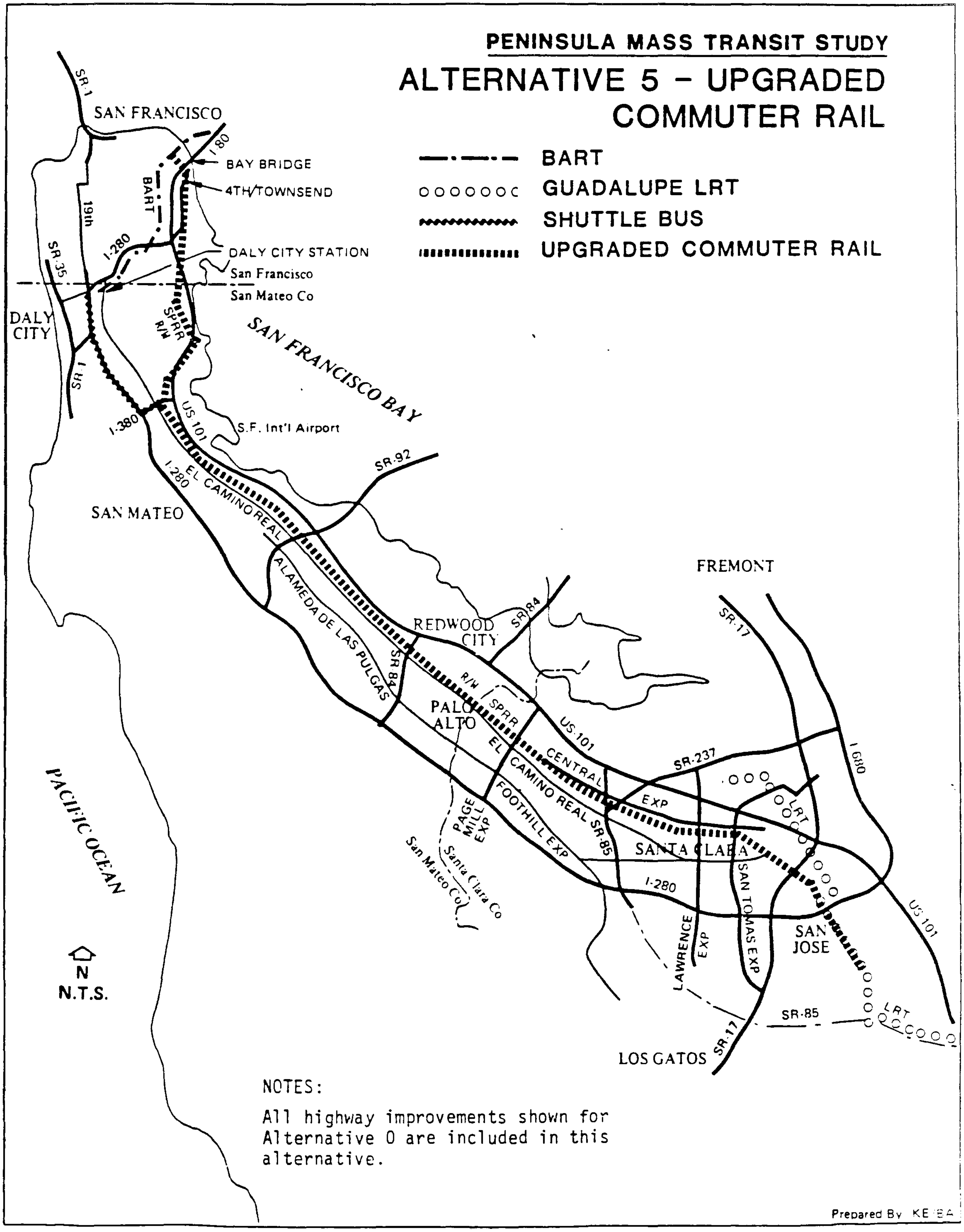
Service frequencies on this alternative are less than BART (Alternative 3) and this situation coupled with the above factors produces fewer transit patrons (despite the travel time advantage). It is estimated that 91,000 patrons would be attracted to the upgraded commuter rail service daily, an increase of 67,000 passengers compared to the TSM alternative. Ten to 20,000 work trips (two-way) would shift from automobile use to the train service compared to the TSM and Transit Status Quo alternatives respectively. This alternative would attract a similar number of air passenger users as Alternative 4, or about 6,800 riders per day.

Capital Cost

Like the LRT system, new tracks should be installed along the corridor for higher service densities. The electrified commuter rail service also assumes that the right-of-way would be purchased to allow further publicly funded capital improvements required for this alternative. A separate third track for freight would cost $365 million, but this cost may be avoidable as discussed in Chapter VI. Using the criteria for grade separations discussed under Alternative 4 would also result in the need to provide 45 new grade separations along the corridor due to the high number of trains crossing local streets (190 compared to the current 46). The total cost for grade separation would be $220 million, including 11 miles of aerial structure. However the determination of the actual number of grade separations would involve a case-by-case study of individual intersections, their geometry and projected traffic growth. The cost of grade separation would probably be at least $53,000,000 for the 12 most critical streets in the corridor.

Electrification costs assume a 1500 volt DC power supply and include the cost of the primary feeder service to get the utility company power to the transportation facility for distribution to the rail line (this cost is roughly $90 million of the $273 million total cost). Although DC power generally requires more substations than a 25,000 volt AC system -- such as found in service in other railroad applications -- reliability in the case of substation failure and catenary clearances make DC current a better solution in the ultimate analysis. This clearance requirement is particularly critical though the tunnels in San Francisco where the Port of San Francisco intends to lower the tracks to permit trains with two stacked containers on a flat car to proceed through the tunnel. Also DC power could provide flexibility in transitioning from electric locomotives to a light rail system. (A recent review of New Jersey Transit costs for electrification of a system of comparable length reveals AC electrification costs are slightly lower than those for the DC system assumed here. However, the cost of modifying existing tunnels and other facilities to provide the proper electrical clearances would exceed the cost savings.)

The patronage forecasts assumed a fleet composed of one hundred percent double deck EMU (self-propelled electric multiple unit) cars based on the travel time advantages inherent in such equipment. About 106 electric multiple units (EMUs) would be needed for this alternative, including spares. A mixture of MU cars and electric locomotives hauling non-powered gallery cars (as are now being acquired by Caltrans) may be more realistic. The EMUs could be used for the skip-stop service, and the electric locomotives and gallery cars for the local runs.



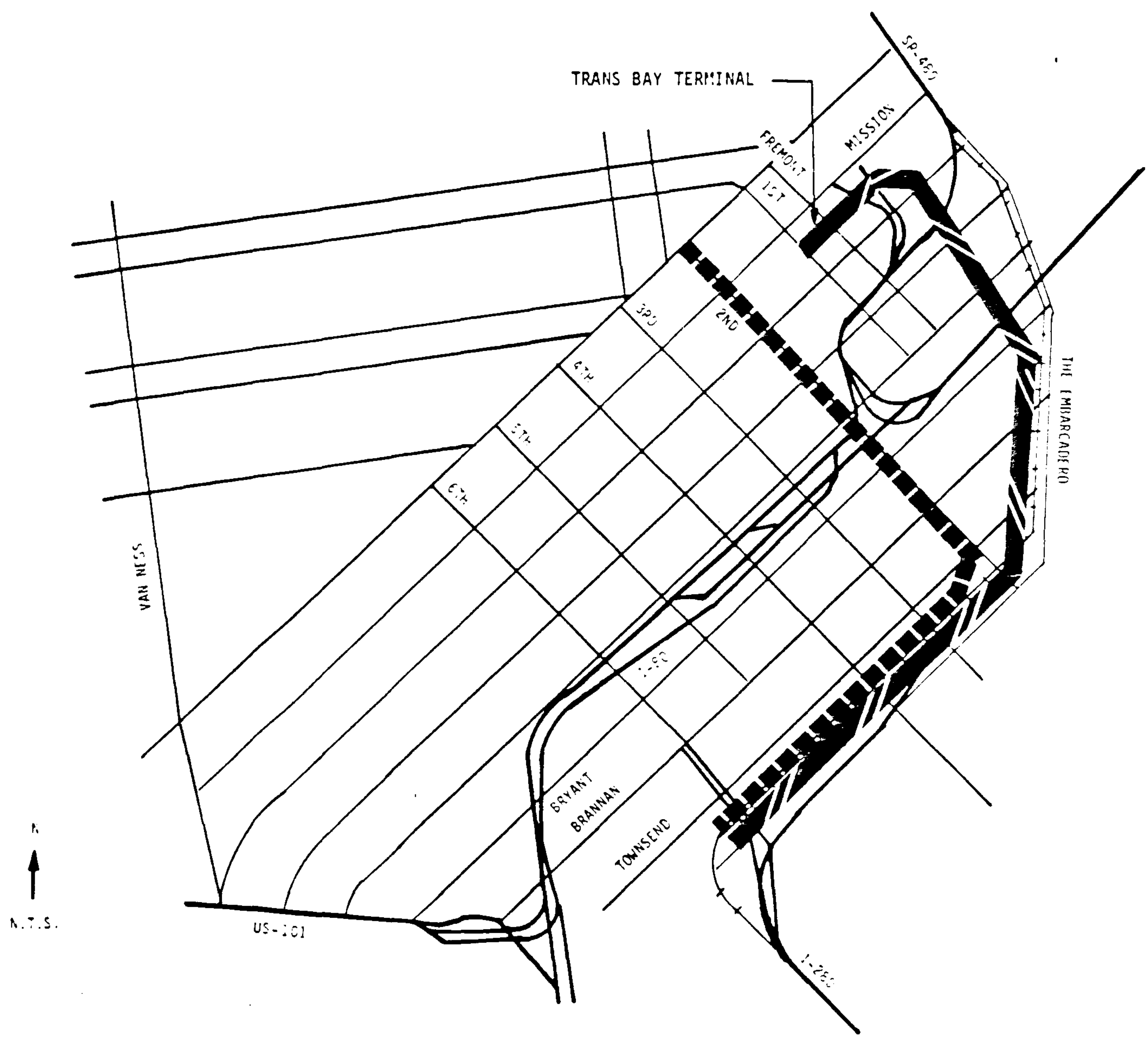
NOTES:

All highway improvements shown for Alternative 0 are included in this alternative.

ALTERNATIVE 5 - COMMUTER RAIL EXTENSION TO FINANCIAL DISTRICT

2ND ST. ALTERNATIVE

TRANSBAY TERMINAL ALTERNATIVE



Prepared By KE BA

ALTERNATIVE AT A GLANCE

Alternative 5

- Upgraded Commuter Rail -

SYSTEM OPTIONS

Baseline	Option 1	Option 2
- Electrified Commuter Rail from Transbay Terminal to San Jose	- Alignment under 2nd St. in San Francisco with deep, 6 track station	- Alignment under 2nd St. in San Francisco with shallow, 6 track station

- 190 passenger trains/day
- People mover to Airport Terminals

SERVICE

o Schedule - 5 minute service in peak period to alternating (skip stop) stations in both directions; in off-peak period, trains make all stops at 15 minute intervals.

o Year 2000 Demand at Maximum Load Point (passengers per hour in peak direction)

Commuter Rail - 6,480

o Travel Time (peak period, minutes)

	San Jose to S.F.	Redwood City to S.F.	S.F. Airport to S.F.
Commuter Rail	68.4	40.1	24.1

ALIGNMENT

Baseline (Transbay Terminal) - 48.7 miles from San Jose to Transbay Terminal (includes 12.9 miles aerial), with 45 new grade separations.

Options 1 and 2 - 1.3 miles for 2nd Street extension compared to 1.5 miles to Transbay Terminal

CAPITAL COSTS (Millions of Dollars)*

o Total System Cost:

	Low**	High
Baseline (Transbay Terminal)	$1,448	$2,009
Option 2 (2nd St., 6 track shallow station)	1,426	1,988

- Other Cost Items of Interest

Third Track for Freight	$365.6
Electrification	$276.4
Grade Separations	$219.6
Transbay Terminal extension	$358.8
2nd Street Tunnel (Deep Tunnel, 6 tracks)	$338.8
2nd Street Tunnel (Shallow Tunnel, 6 tracks)	$303.6
2nd Street Tunnel (Shallow Tunnel, 4 tracks)	$279.1

OPERATING COSTS AND REVENUE (Millions of Dollars)

	O&M Cost	Revenue
CalTrain	76.1	45.3
Express Buses	2.5	1.4
BART	--	.1

SYSTEM RIDERSHIP (Average Weekday)

- % of Corridor Work Trips by Transit: 13.8

- Fixed Guideway Transit Ridership:
  Work: 70,000
  Non-work: 38,000
  Air Passenger: 6,800

- Transit Ridership by Mode

	Work & Non-Work	Air Passenger	Total
Commuter Rail	91,000	5,500	96,500
BART	17,000	1,300	18,300
Express Bus	9,000	-	9,000

* Includes rolling stock, right-of-way, engineering/management/owner costs, and contingency.

** Costs reflect reduced right-of-way cost, elimination of a separate track for freight and elimination of the Airport people mover.

Alternative 6
Bus/HOV Lane

Service Concept

This alternative replaces rail service in the corridor with an all-bus mass transit system and satisfies UMTA's planning requirements for a comprehensive bus evaluation. In Santa Clara County, buses would operate on freeways and expressways on specially designated high occupancy vehicle lanes. The HOV lane on Route 101 would extend north to Redwood City (Whipple Ave.) where buses would then cross over to an exclusive busway constructed on the Southern Pacific right-of-way. This busway would be grade separated and would be about 36 miles in length. There would be 12 aerial stations along this busway. The busway would descend into a tunnel in San Francisco to accommodate the large number of buses without major disruption to surface traffic. For the purpose of this study, it was assumed the tunnel would be along 6th and Mission with four underground stations for passenger distribution in San Francisco.

Initially buses in San Mateo and Santa Clara Counties would collect passengers on the local routes, enter the HOV lane and busway, and then carry passengers to the various stations. Additional bus demand beyond the capacity of the bus lane could be satisfied by scheduling supplemental express service on I-280 and on Route 101.

Ridership

This alternative is significantly different from the others in that it provides the opportunity for many persons to enjoy a one transit vehicle ride from their origin to their destination. In San Mateo County, more trip origins and destinations lie along El Camino Real than the SP right-of-way and bus stops are frequent. Along the guideway itself, the eight routes using the facility combine to provide one to two minute headways during peak hours to any station. In Santa Clara County, the express bus routes fan out to collect and distribute passengers in multiple corridors.

It is therefore not surprising to see this alternative attract a large number of patrons - 121,000 daily - on the express bus routes. Forty percent of these patrons shift from other transit modes available in the Transit Status

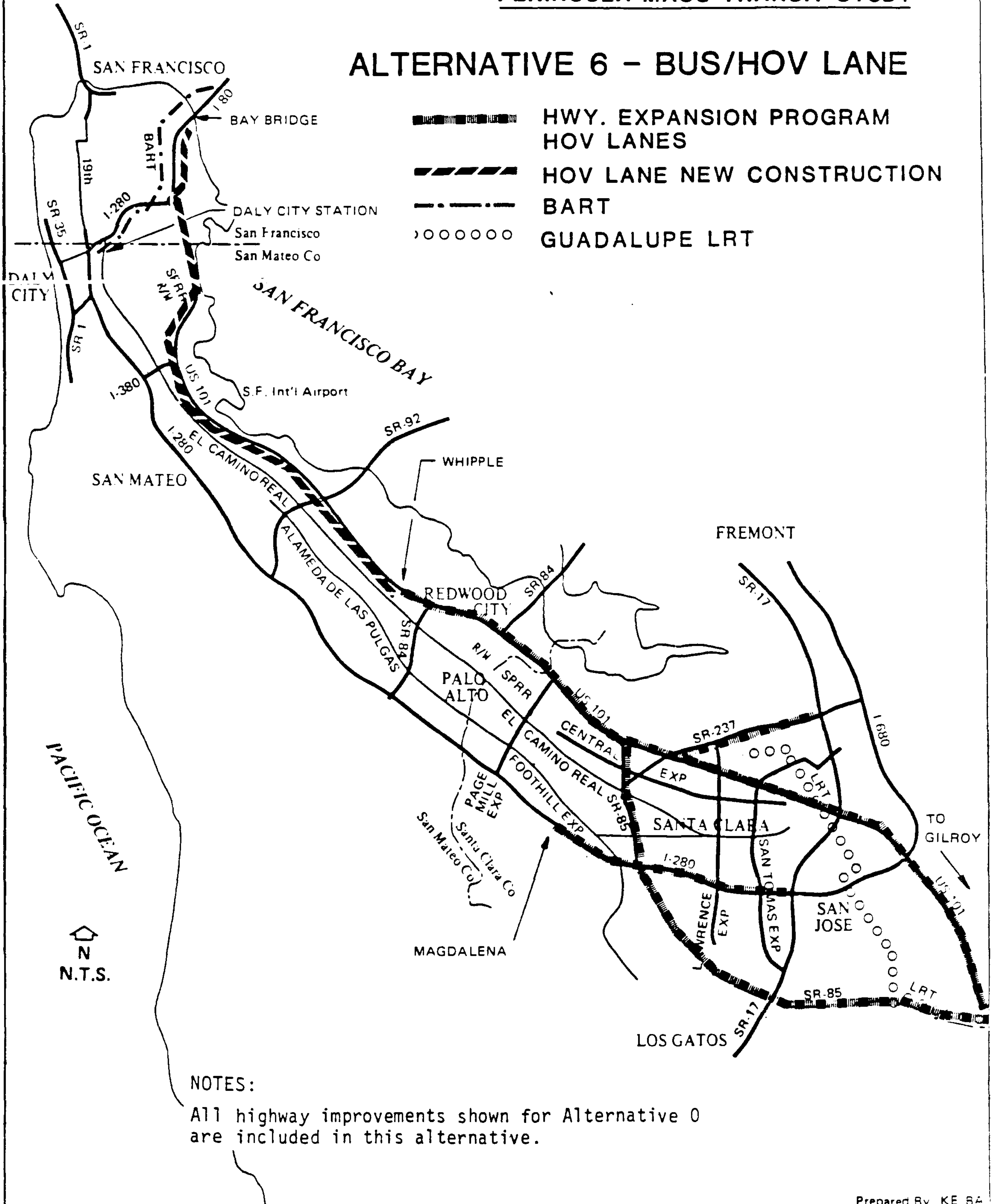
Quo alternative, but 28,000 to 38,000 new work trips are attracted to transit compared with the TSM and Transit Status Quo alternatives. The bus alternative would only be expected to serve 1,200 daily air passengers, significantly less than the other alternatives.

Capital Costs

New facilities and equipment for this alternative include the grade separated busway at a cost of $663 million including stations, the tunnel and bus turnaround facility in San Francisco ($327 million), over 550 new buses ($83 million), a new maintenance facility ($22 million) and additional park-and-ride lots ($16 million). A freight track must also be provided in the Southern Pacific right-of-way, and the cost associated with the track would be about $245 million, including modifications to existing tunnels and structures, signalling for reverse movements, and other trackwork related costs.

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 6 - BUS/HOV LANE



NOTES:

All highway improvements shown for Alternative 0 are included in this alternative.

ALTERNATIVE AT A GLANCE

Alternative 6

- Bus/HOV Lanes -

SYSTEM OPTIONS

Baseline

- Rail service in corridor replaced by buses
- Buses use HOV lanes on Route 101 between San Jose and Redwood City (Whipple Ave.), then use a grade separated busway in SP right-of-way north to San Francisco. In San Francisco buses would enter a tunnel down 6th and then Mission with several underground stations for passenger loading and unloading.
- New park/ride lots for buses.

SERVICE

o Schedule - 8 bus routes would operate during the peak period at an average of 3 minute headways for each route. Routes will leave HOV lane for collection/distribution, but use HOV lane for most of trip, with skip-stop service at aerial stations along busway. During peak periods, there will be approximately two buses per minute operating in each direction on the guideway.

o Year 2000 Demand at Maximum Load Point (passengers per hour in a peak direction)

Buses - 11,580

o Travel Time (peak period, minutes)

	San Jose to S.F.	Redwood City to S.F.	S.F. Airport to S.F.
Bus	144.4	45.4	29.7

ALIGNMENT

36.2 miles of exclusive, grade separated busway in SP right-of-way (20 miles aerial).

CAPITAL COSTS (Millions of Dollars)*

	Low**	High
o Total:	$1,374	$1,422

o Other Cost Items of Interest:

Busway and stations (Redwood City to San Francisco): $663.2
Tunnel in San Francisco: $327.0
Park/Ride lots: $16.0
Third Track for Freight: $245.0
550+ Buses: $82.8
Maintenance Facility: $21.5

OPERATING COSTS AND REVENUE (Millions of Dollars)

	O&M Cost	Revenue
Guideway Buses	90.0	36.3

SYSTEM RIDERSHIP

o % Corridor Work Trips by Transit: 14.2

o Fixed Guideway Transit Ridership:
Work: 111,000
Non-work: 26,000
Air Passenger: 2,200

o Transit Ridership by Mode

	Work & Non-Work	Air Passenger	Total
BART	16,000	1,100	17,100
Guideway Bus	108,000	1,100	109,100
Express Buses	13,000	-	13,000

* Includes rolling stock, right-of-way, engineering/management/owners costs, and contingency.

** Low costs reflect reduced cost for right-of-way

Alternative 7
BART/LRT Combination

Service Concept

This alternative involves a combination of two systems:

- A BART extension from Daly City to San Francisco Airport
- A light rail line from the Airport, south to San Jose as in Alternative 4.

The San Francisco Airport extension would include stations at Serramonte/Colma, Chestnut (South San Francisco), Tanforan (San Bruno), the San Francisco Airport (external station is adjacent to San Bruno), and Millbrae. The Millbrae and San Francisco Airport stations would provide for transfers between light rail and BART and the Airport station would also provide for a transfer to the airport people mover to the terminals. The baseline alternative, as defined in the SCR 74 legislation, uses the BART system to distribute passengers in San Francisco, but would require passengers to transfer at the airport. A local bus route is assumed to serve the Bayshore Corridor which would permit riders from the south to reach development along Route 101 north of the airport. Another option studied was a continuation of the LRT system into San Francisco along 2nd Street to stub end at BART as described in Alternative 4, thereby providing an uninterrupted ride along the whole corridor as well as an interface with BART at the San Francisco Airport.

The question of where and how to end BART if it were extended to the San Francisco Airport is one that has traditionally concerned communities in northern San Mateo County. To explore this issue further, four different station concept strategies were proposed for ending BART in the vicinity of San Francisco Airport; each would have different traffic and parking implications:

- BART terminates at a Millbrae Station; no parking at the Airport Station.
- Parking demand split between a Millbrae Station and the Airport Station.
- BART terminates at the Airport Station, and all parking is provided at this station.
- BART terminates at the airport, but no parking is provided; intermediate stations between Daly City and the airport share Peninsula parking requirements.

The calculated parking requirements for the different station combinations are shown in the "Alternatives at a Glance" section.

Ridership

Total ridership for this alternative is inflated by passengers transferring between BART and the LRT line segments. Eliminating this bias, overall work trips by transit increase 22,000 compared to the Transit Status Quo alternative and 12,000 compared to the TSM alternative. BART patronage benefits significantly through the connection to the LRT system operating between the Airport and San Jose which facilitates reverse commuting by transit.

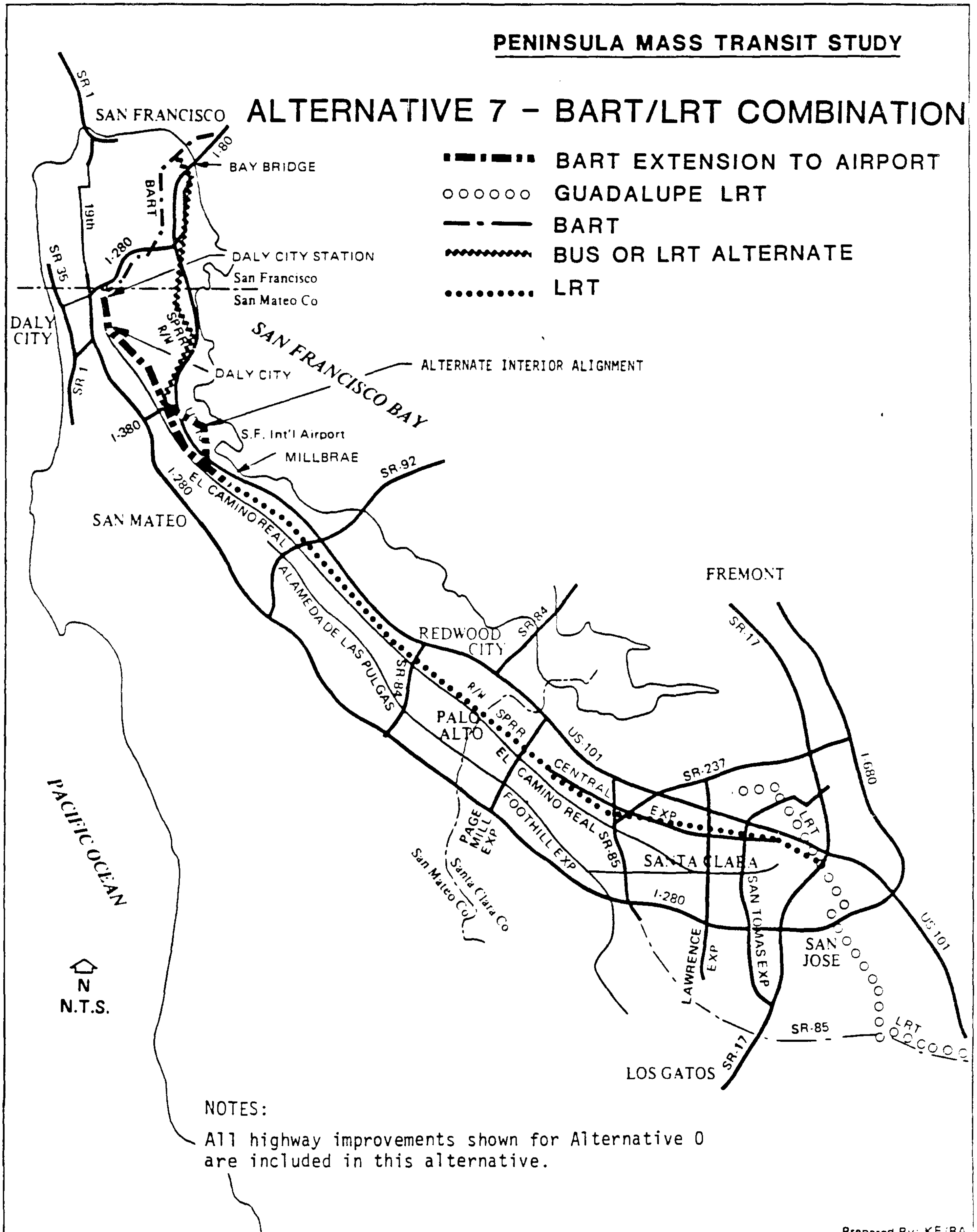
Provision of LRT service the length of the corridor between San Francisco and San Jose (Option 3) increases LRT ridership significantly (from 68,000 to 105,000 daily trips) while decreasing BART's patronage from 71,000 to 62,000 for the Pennisula service. Many of the apparent new riders switch from local bus routes in San Mateo County. Air passenger use of transit in this alternative is the highest of any alternative at 8,100 daily riders.

Capital Cost

Previous MTC hearings on New Rail Starts and Extensions have focussed on the cost of different BART extensions to the San Francisco Airport, including the cost of a subway alignment underneath the airport garage and an exterior alignment using the SP right-of-way on the west side of Highway 101. The subway alignment under the Airport Garage to Millbrae was estimated to cost about $833 million, compared to the outer airport alignment to Millbrae along the Southern Pacific right-of-way, which would cost about $563 million. No houses would be adversely affected by the internal BART airport alignments because of the deep bore tunnel into the Airport. If BART was terminated at the Airport Station in San Bruno, instead of continuing to Millbrae, this extension would cost about $53 million less than the longer Millbrae extension, or about $510 million. Choosing not to build any intermediate BART stations between Daly City and the airport would only save about $9 million in current dollars and would significantly affect overall patronage. The airport intermodal station to connect BART, LRT, and the people mover would cost about $9 million.

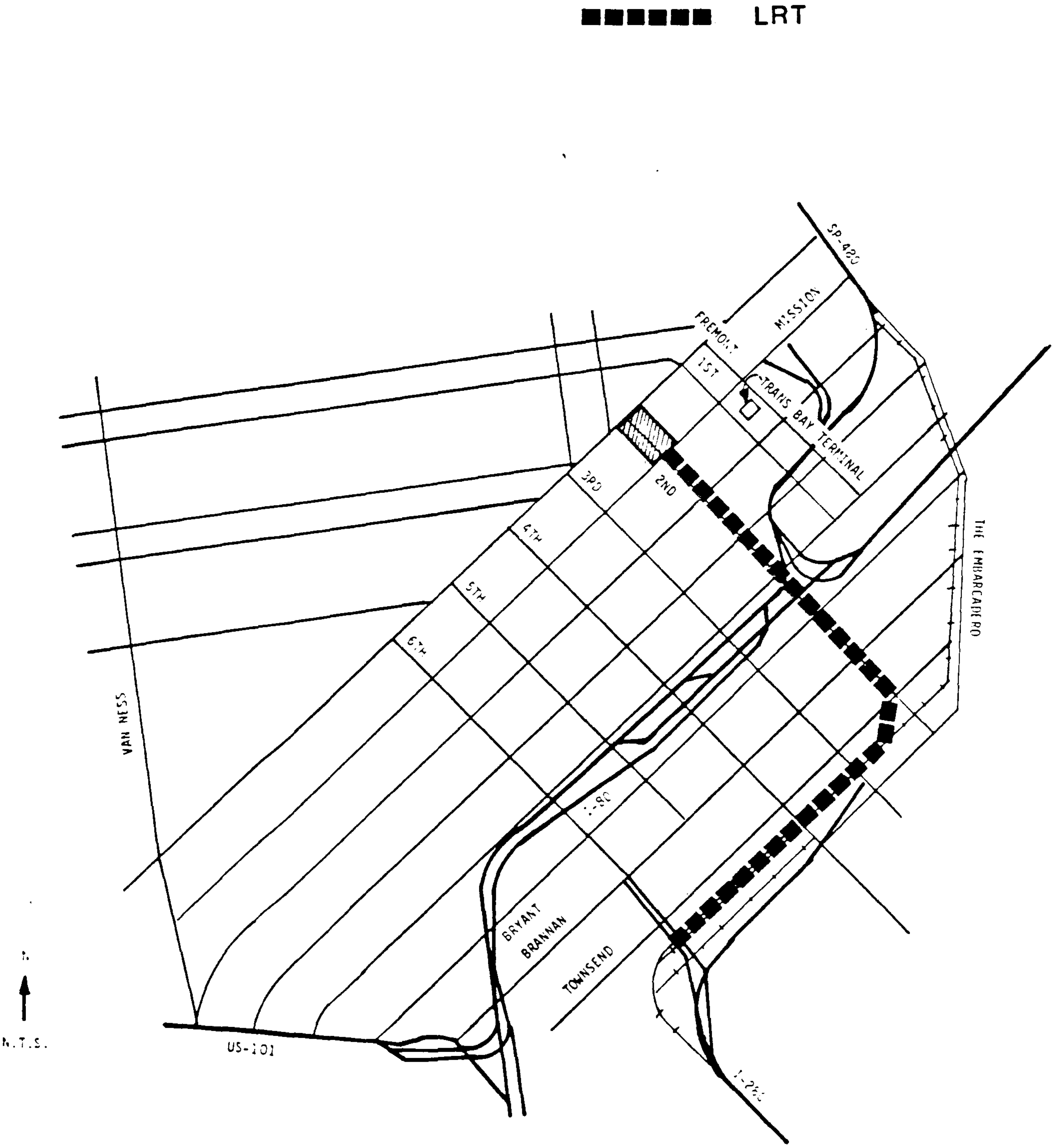
The new Daly City maintenance and storage yard would be adequate for most of the additional equipment needed for this 6.5 - 8.5 mile extension, but some limited storage capacity should be provided behind the end station. As an option, the outer airport alignment could include a people mover system which would provide for the transfer of air passengers to the airport terminals; the complete people mover project was estimated to cost $147 million.

The 34 mile light rail line from the San Francisco Airport to San Jose would need a new yard and maintenance shop, while the full system from San Jose to San Francisco would need two yard and shop facilities. Overall, the partial system to the airport would cost about $951 million, while the full corridor system would cost $1,444 million.


PENINSULA MASS TRANSIT STUDY
ALTERNATIVE 7 - BART/LRT COMBINATION
BART EXTENSION TO AIRPORT
GUADALUPE LRT
BART
BUS OR LRT ALTERNATE
LRT
SAN FRANCISCO
SR 1
I-80
BAY BRIDGE
BART
19th
I-280
SR 35
DALY CITY STATION
San Francisco
San Mateo Co
DALY CITY
SPRR R/W
SAN FRANCISCO BAY
DALY CITY
ALTERNATE INTERIOR ALIGNMENT
I-380
S.F. Int'l Airport
MILLBRAE
SR-92
I-280
EL CAMINO REAL
SAN MATEO
FREMONT
ALAMEDA DE LAS PULGAS
REDWOOD CITY
SR-84
SR-84
SR-17
R/W SPRR
PALO ALTO
US-101
I-680
EL CAMINO REAL
CENTRAL EXP
SR-237
LRT
PACIFIC OCEAN
PAGE MILL EXP
FOOTHILL EXP
SR-85
SANTA CLARA
San Mateo Co
Santa Clara Co
I-280
SAN TOMAS EXP
LAWRENCE EXP
SAN JOSE
US-101
N
N.T.S.
SR-85
LRT
SR-17
LOS GATOS
NOTES:
All highway improvements shown for Alternative 0 are included in this alternative.
Prepared By: KE/BA

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 7 – LRT ALIGNMENT IN DOWNTOWN SAN FRANCISCO



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ALTERNATIVE AT A GLANCE

Alternative 7

- BART/LRT Combination -

SYSTEM OPTIONS

Baseline	Option 1	Option 2	Option 3	Option 4
- BART to Millbrae Station with people mover to Airport Terminals - LRT from SF Airport to San Jose via Central Expressway - Local bus to Financial District	- Same as Baseline, except BART ends at Airport Station	- Same as Baseline, except BART under Airport Garage to Millbrae Station	- BART to external Airport Station - LRT from San Francisco to San Jose - People mover to Airport Terminals	- BART to external Airport Station - No intermediate stations between Daly City and Airport - People mover to Airport Terminals

SERVICE

o Schedule

BART - Same as Alternative 3, BART at 3.75 minutes in peak, 7.5 minutes off-peak, south of Daly City.

LRT - Same as Alternative 4, LRT at 5 minutes during peak, 10 minutes in off-peak, serving all stations

o Year 2000 Demand at Maximum Load Point (passengers per hour in peak direction):

BART - 10,700
LRT - 4,740

o Travel Time (peak period, minutes)

	San Jose to S.F.	Redwood City to S.F.	S.F. Airport to S.F.
BART	----	----	33.7
LRT	80.3	45.3	26.0

ALIGNMENT

o BART - Daly City to Millbrae Station is 8.0 miles via external Airport alignment
- Daly City to Millbrae under airport garage is 8.5 miles (3.5 miles of subway)
- Daly City to outer Airport Station is 6.5 miles

- o LRT
  - SJ to Millbrae Station is 34.2 miles (8.3 miles aerial)
  - SJ to outer Airport Station is 35.7 miles (9.2 miles aerial)
  - SJ to SF is 49.2 miles (10.3 miles aerial)

- o People mover - 2.5 miles, all aerial (assumed in all cases except Option 2, BART under Airport Garage)

CAPITAL COSTS (Millions of Dollars)*

o Total System Cost:

	Low**	High
Baseline (BART to Millbrae via exterior alignment)	$1,248	$1,671
Option 1 (BART to Airport via exterior alignment)	1,221	1,644
Option 2 (BART under Airport Garage to Millbrae)	1,479	1,799
Option 3 (LRT continues to S.F. Financial District)	1,633	2,164
Option 4 (BART to Airport/No intermediate stations)	1,210	1,633

o Other Cost Items of Interest:

BART to Millbrae Station (Exterior alignment)	$ 563
BART to Millbrae (via interior alignment under Airport Garage)	833
BART to Airport Station (Exterior alignment)	511
BART to Airport Station (Exterior alignment/ No intermediate stations)	501
Airport People mover	147
LRT (Airport to San Jose)	951
LRT (San Francisco to San Jose)	1,444
Grade Separations (LRT)	169

* Includes rolling stock, right-of-way, engineering/management/owner costs, and contingency.

** Low costs reflect reduced right-or-way costs, elimination of the airport people mover where appropriate, and elimination of the third track for freight (LRT).

OPERATING COSTS AND REVENUE (Millions of Dollars)

	O&M Cost	Revenue
BART	14.4	25.6
LRT to Airport	48.0	22.5
Express Buses	2.5	2.6

SYSTEM RIDERSHIP

o % Corridor Work Trips by Transit: 13.9

o Fixed Guideway Transit Ridership (Baseline)

	Baseline	Option 3
Work:	90,000	108,000
Non-work:	49,000	59,000
Air Passenger:	8,100	8,100

o Transit Ridership by Mode (Baseline - LRT from Airport South)

	Work & Non-Work	Air Passenger	Total
BART	71,000	5,900	76,900
LRT	68,000	2,200	70,200
Express Bus	17,000	-	17,000

o Transit Ridership by Mode (Option 3 - LRT in Whole Corridor)

	Work & Non-Work	Air Passenger	Total
BART	62,000	2,600	64,600
LRT	105,000	5,500	110,500
Express Bus	6,000	-	6,000

o Other Patronage Items of Interest:

Parking demand for the various station-ending configurations for BART to the San Francisco Airport is shown below. This table indicates parking demand without parking constraints. The number of spaces provided at each station together with feeder bus service could serve to control demand and therefore traffic impacts.

Station Parking Scenario	Alternative	Millbrae	S.F. Airport (San Bruno)	San Bruno
Split Demand (1)	7a	1360*	330	160
	7b	1320*	330	140
Milbrae End (2)	7a	1690*	-	160
of BART Line	7b	1650*	-	140
Airport End (3)	7a	660**	1030*	160
of BART Line	7b	380**	1270*	140
San Bruno (4)	7a	660**	-	1190*
BART Parking	7b	380**	-	1410*

1 BART terminates at Millbrae, parking provided at Airport.
2 BART terminates at Millbrae, no parking provided at Airport.
3 BART terminates at Airport, parking provided at Airport.
4 BART terminates at Airport, no parking provided at Airport.
* Assuming unconstrained demand, KE/BA recommends provision of 2,000 parking spaces based on the observed experience of BART's other end of the line stations.
** Parking associated with LRT system.

Alternative 8
BART/CalTrain Combination

Service Concept

The service concept for Alternative 8 combines the two major proposals from MTC's New Starts hearings in early 1984, extension of BART to the San Francisco Airport together with increased CalTrain service (68 trains per day) and the Transbay Terminal extension. As in Alternative 2, additional options for distributing riders in San Francisco were tested including a bored tunned beneath 2nd Street terminating at BART's Montgomery Street Station on Market Street, and the Muni Metro extension to 4th and Townsend. Both the Transbay extension and 2nd Street extension assume an underground station at Mission Bay to serve new development proposed for this area. An intermodal station at San Francisco Airport would enable passengers to transfer between CalTrain and BART, and between both systems and a possible airport people mover system.

Ridership

This alternative has the effect of shifting passengers from one corridor transit mode to another rather than generating many new trips by transit. Compared to Alternative 2, only two thousand new work trips are attracted to transit. BART ridership increases by 22,000 trips but CalTrain ridership decreases by 5,000 trips (excluding the Coyote Valley extension) and express bus patronage falls by 4,000 daily trips. Some patrons transfer between these three modes and are thus double counted.

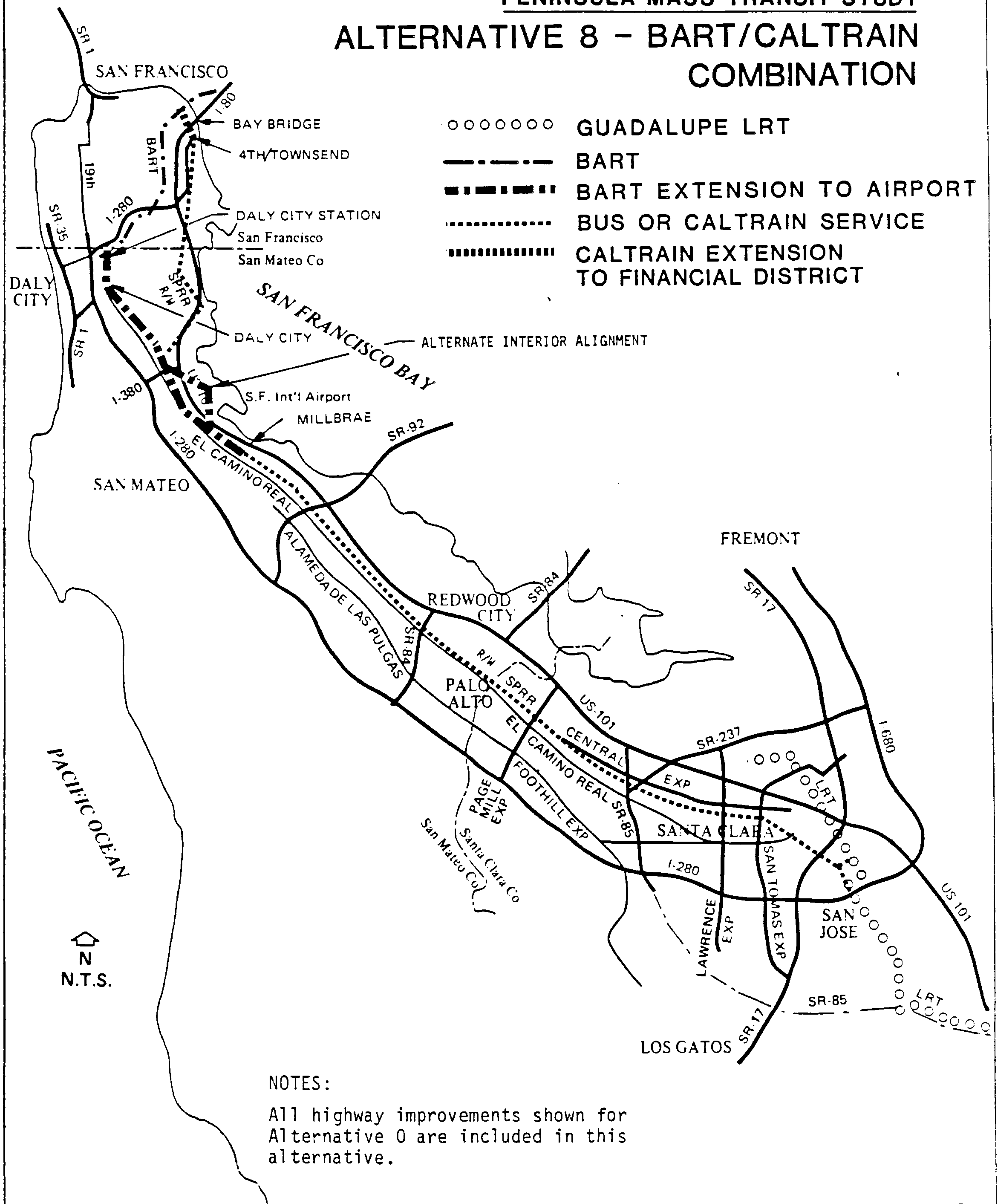
The difference between Alternative 8 and 2 CalTrain patronage can be explained by the removal of service to Coyote Valley and the competition provided by BART for northern San Mateo County transit riders. This submodal transit competition is similar to that observed between peninsula rail modes and express bus services provided by SamTrans.

Capital Cost

The capital cost for this alternative essentially involves a combination of BART costs discussed in Alternative 7 and the CalTrain costs from Alternative 2. The intermodal station at the San Francisco airport for CalTrain, BART, and the airport people mover would cost about $9 million.

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 8 - BART/CALTRAIN COMBINATION



NOTES:

All highway improvements shown for Alternative 0 are included in this alternative.

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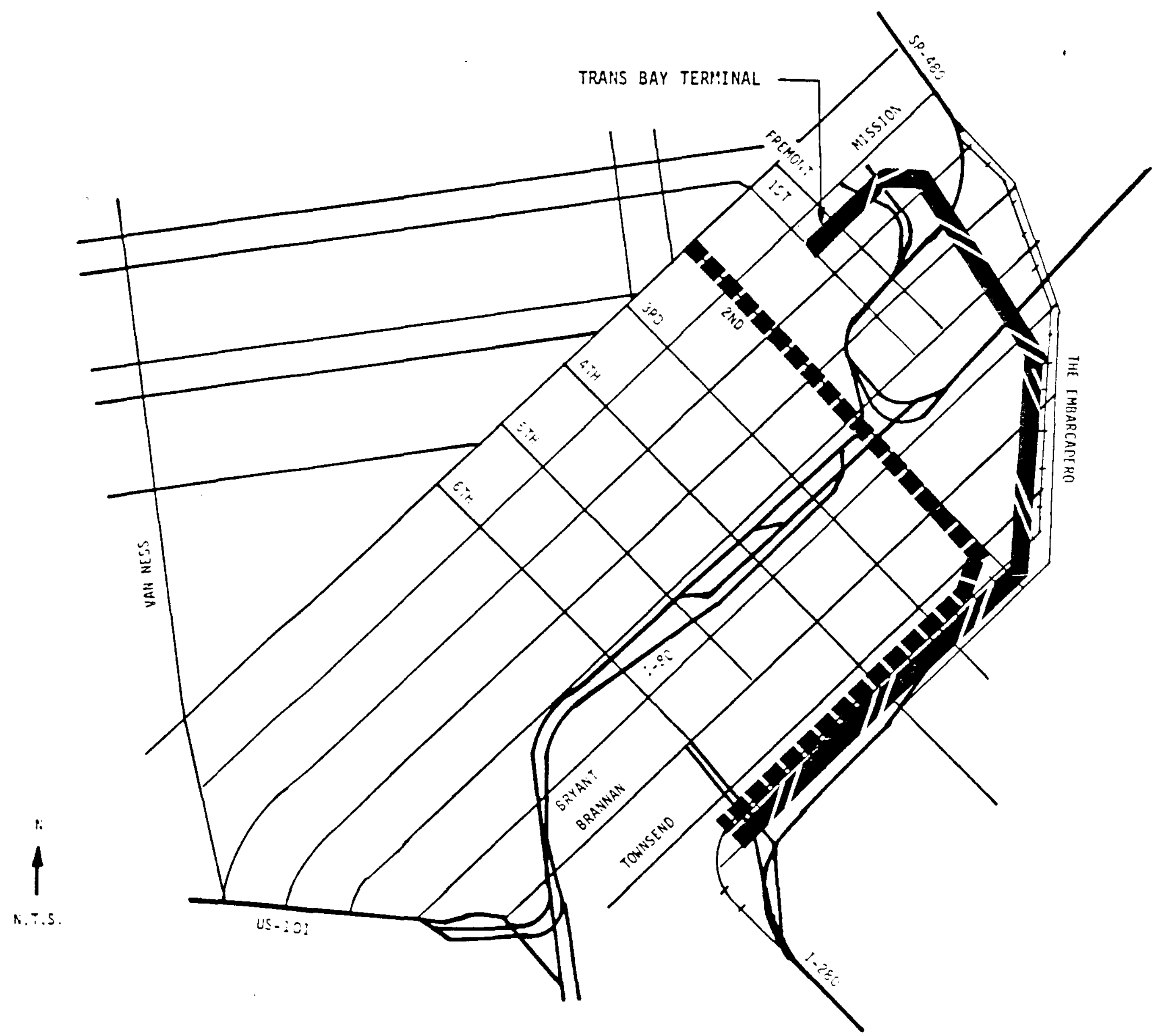
PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 8 – CALTRAIN EXTENSION TO FINANCIAL DISTRICT

▪▪▪▪▪▪ 2ND ST. ALTERNATIVE

▬▬//▬▬ TRANSBAY TERMINAL ALTERNATIVE



Prepared By KE BA

ALTERNATIVE AT A GLANCE

Alternative 8

- BART/CalTrain Combination -

SYSTEM OPTIONS

Baseline	Option 1	Option 2
- CalTrain from Transbay Terminal to San Jose - BART to Millbrae Station via external airport alignment - People mover to Airport Terminals	- Muni Metro extended to CalTrain 4th and Townsend Station in San Francisco	- CalTrain extended under 2nd/Market St., ending in 6 track shallow station

SERVICE

o Schedule

BART - Service south of Daly City every 3.75 minutes in peak, 7.5 minutes in off-peak

CalTrain - In peak period, peak direction, trains dispatched every 10 minutes serving alternative (skip stop) stations with selected common (all stop) stations for transfers; in off-peak, trains dispatched every 30 minutes and make all stops.

o Year 2000 Demand at Maximum Load Point (passengers per hour in peak direction)

BART - 9,000
CalTrain - 3,600

o Travel Time (peak period, minutes)

	San Jose to S.F.	Redwood City to S.F.	S.F. Airport to S.F.
BART	----	----	33.7
CalTrain	75.4	43.5	25.0

ALIGNMENT

BART - Daly City to Millbrae Station 8.0 miles via outer Airport alignment (also see other BART alignment options in Alternative 7)

CalTrain - San Jose to Transbay Terminal is 48.7 miles
- Extension to Transbay Terminal is 1.5 miles
- Extension under 2nd St. to Market is 1.3 miles
- Muni Metro extension to 4th and Townsend is 1.6 miles

CAPITAL COSTS (Millions of Dollars)*

- Total System Cost:

	Low**	High
Baseline (CalTrain to Transbay Terminal)	$1,159	$1,321
Option 1 (Muni Metro to 4th and Townsend)	859	1,021
Option 2 (CalTrain under 2nd/Market)	1,108	1,269

- Other Cost Items of Interest:

Tunnel to Transbay Terminal	$306.4
Tunnel to 2nd/Market, 6 shallow	$253.7
Muni Metro to 4th and Townsend	$ 28.4

OPERATING COSTS AND REVENUE (Millions of Dollars)

	O&M Costs	Revenue
CalTrain:	36.5	16.1
BART:	14.4	12.4
Express Buses:	2.5	1.4

SYSTEM RIDERSHIP

- % Corridor work trips by Transit: 13.5

- Fixed Guideway Transit Ridership

	Baseline	Option 1
Work:	54,000	57,000
Non-work:	26,000	28,000
Air Passenger:	6,800	6,800

- Transit Ridership by Mode (Baseline-CalTrain to Transbay Terminal)

	Work & Non-Work	Air Passenger	Total
BART	45,000	5,700	50,700
CalTrain	35,000	1,100	36,100
Express Bus	9,000	--	9,000

- Transit Ridership by Mode (Option 1 - Muni Metro Extension)

	Work & Non-Work	Air Passenger	Total
BART	51,000	5,700	56,700
CalTrain	34,000	1,100	35,100
Express Bus	11,000	--	11,000

* Includes rolling stock, right-of-way, engineering/management/owners costs, and contingency.

** Low cost estimates reflect reduced right-of-way costs and elimination of people mover to Airport Terminals.

V. COMPARISON OF TRANSIT TECHNOLOGIES

The previous section of this report described the major corridor-level alternatives, but did not specifically discuss the transit technologies being considered in each alternative. The purpose of this section, therefore, is to compare and contrast each of the transit technologies evaluated to serve year 2000 transit demand on the Peninsula, including

- CalTrain - diesel
- CalTrain - electrified
- BART
- Light Rail Transit (LRT)
- Buses on Exclusive Guideways

Generally, each transit technology is reviewed with respect to performance/capacity, capital improvements, and operating costs. Based on information developed in the patronage task of this study, peak period capacity requirements could be as high as 12,000 passengers per hour by 2000. Additional capacity may be needed beyond this level to accommodate future growth in transit ridership on the Peninsula.

Because the patronage forecasts involve different service patterns for different technologies in the year 2000, comparisons between technologies can be misleading. This section of the report includes a "normalized" cost comparison for the various modes by assuming similar service levels -- 5 minute headways between trains on the line during peak periods and 10 minutes during the off peak. Patronage estimates were then adjusted and these adjustments resulted in modified estimates for capital costs and operating costs for the individual modes. The resulting calculations are rough estimates -- since the correct approach would be to re-run the travel model with the new service pattern to determine new patronage forecasts -- but can be used for general comparisons between technologies.

CALTRAIN-DIESEL

Performance/Capacity

- o Diesel trains pulling heavy, double decker gallery cars have low acceleration rates compared to other rail modes, therefore travel times will be slower unless skip stop or zone express type service is provided. This service pattern affects potential patronage as fewer station pairings are satisfied by each train.

- o As a practical matter, diesel trains would probably not be scheduled closer than 5 minutes apart for extended periods of time. The capacity of 10 car trains at 5 minute headways would be 17,400 passengers per hour,using the existing gallery cars (145 seats per car). To operate 10 car trains closer together would require attention to safe braking distance requirements. To our knowledge, there are no existing systems which operate 10 car commuter rail equipment at 5 minute headways; more typical headways for such systems are in the order of 10-20 minutes.

- o The above capacity exceeds the year 2000 demand, therefore adding cars to diesel trains provides expansion capability for this type of system.

Capital Improvements

- o The capital investment required to expand the all-diesel system would be less than for other rail modes. The chief impact of denser service would be on the signal system, track bed, and on the need for additional grade separations for local streets. The track should be reconstructed with new ties and continuous welded rail to accommodate heavier use. New grade separations would be needed for local streets with heavy automobile traffic. Station improvements would be minimal, with the exception of additional parking and self-service fare collection. Installation of a central train control system should take place to permit expanded passenger service and accommodate occasional daytime freight trains. A new maintenance facility has also proposed as part of Caltrans' current modernization program.

- The location of the San Francisco train Terminal at 4th and Townsend and the need for riders to transfer to local buses to reach their final destination is considered a major drawback of the existing service. The singlemost extensive improvement proposed for the current service is the relocation of the existing San Francisco Terminal at 4th and Townsend to the Transbay Terminal. The cut and cover tunnel would be 1.5 miles long, would have adequate ventilation for diesel trains, and would be large enough for possible future conversion to bi-level electric multiple units. Another tunnel option examined in this study was a bored tunnel under 2nd Street to the BART/Montgomery Street Station on Market Street. Extension of Muni Metro's light rail line from Market Street to the 4th and Townsend terminal would also improve the distribution of train riders in San Francisco.

Operating Costs

- Under current labor agreements, the operating cost of expanded diesel service would be steep, given train crew sizes, pay rates, and union work rules, making this an expensive system to operate. For example, 10 car trains would need a crew of 7 to operate them, whereas most rapid transit systems would have only a single train operator.

- Future negotiations with the railroad unions could lead to cost efficiencies, including installation of a self service fare collection system, modified work rules, and a reduction in crew size to 1 or 2 persons per train. Productivity could be increased while using existing employees to operate more trains. Still, operating costs are likely to be significantly higher than those for the BART or LRT transit systems, even with improved productivity.

Summary

- Major issues associated with long-term reliance on an all-diesel system include train performance compared to other rail modes, higher operating costs, the number of grade separations required and the need for relocation of the San Francisco terminal.

CALTRAIN-ELECTRIC

General

- The rationale for conversion from diesel service to an electrified commuter rail system hinges on potential operating and maintenance cost savings, decreased running times, and environmental factors.
  - Decreased Running Time. Because of the faster acceleration of electrically propelled vehicles (called electric multiple units, or EMUs), travel time savings are significant -- at least 12 minutes from San Jose to San Francisco. This travel time savings represents an important benefit in attracting new riders. Additional station stops could be added in the future without incurring unacceptable loses in travel time.
  - Operating Cost Savings. Theoretical savings exist due to the lower cost of electricity versus diesel fuel and reduced crew requirements since fewer trains and crews are needed to perform the peak schedule. These costs are offset by higher vehicle maintenance costs (for EMUs) and additional costs for maintenance of the power and catenary system which does not exist with the diesel system.
  - Environmental. Electrically propelled vehicles do not emit diesel fumes and are quieter -- two important points when discussing increased train frequencies through Peninsula communities.

- While an overhead caternary system is not as visually attractive as a third rail electrification system, it eliminates the need for complete grade separation of the line as is required for BART.

Performance/Capacity

- An electrified CalTrain system could consist of electric locomotives pulling non-powered gallery cars, self propelled electric multiple units (EMUs), or a combination of the two types of equipment. An all-EMU fleet would have better performance characteristics and bi-level EMUs generally carry more passengers than the current gallery cars. A one-way capacity of 21,600 passengers per hour could be achieved by operating 10 car EMUs at 5 minute headways (assuming 180 passengers per EMU versus 145 for today's gallery cars). At "crush" loads these EMUs could carry 250 passengers or more.

- o The faster travel times could enable all stop, skip stop, or zone express service options. EMUs could likely operate more frequently than once every 5 minutes, hence the potential capacity would be greater than indicated above. The weight of the EMUs and safe braking distance required would govern the closest train spacing. No attempt has been made in this study to calculate what this minimum headway could be as the potential capacity significantly exceeds projected year 2000 demand. Electric locomotives hauling non-powered gallery cars could not be scheduled as frequently as EMUs, because safe braking distance would be greater. Neither mode would be expected to achieve the same minimum headways as BART equipment because BART cars are lighter and brake more quickly.

Capital Improvements

- o The electrified commuter rail system should be less expensive than BART. This is because:
  - the guideway should be less costly because the overhead catenary system would not require complete grade separation as does BART
  - stations are less elaborate and would look much like existing stations
  - freight can operate on the same tracks as the commuter trains, thereby avoiding the cost of right-of-way and modifications of structures for a "third track" as is necessary with BART.

- o Existing tracks would need reconstruction for the higher level of train service and the rails should be insulated to prevent corrosion of utilities and structures if DC current is used. Additional grade separations for local streets would be required because of the higher rail service levels and need to minimize interference with local automobile traffic.

- o Electrification could use AC or DC current, but the costs are not expected to be significantly different. In the case of AC current, catenary clearance requirements would necessitate expensive modifications to the four tunnels in San Francisco, unless the Port of San Francisco were to make these modifications as part of their current project to increase clearances for higher container loads. Signalling and communication costs should be significantly lower than for BART or the LRT type systems.

- The electrified CalTrain system would also benefit from the proposed terminal relocation in San Francisco. The tunnel extension to the Transbay Terminal would be large enough for conversion to future electric equipment as mentioned earlier.

Operating Costs

- Like the diesel service, railroad equipment implies use of railroad union personnel. Self service fare collection, liberalized work rules, and a transition to 1 - 2 person train crews are critical elements of a successful service. As with the diesel service, overall operating and maintenance costs for a commuter rail system would probably remain significantly higher than for a BART or LRT-type system.

Summary

- The chief question concerning the electrified commuter rail service is whether the benefits of electrification, in terms of new riders attracted, can be shown to be cost effective when considered together with the long-term prospects for reducing system operating costs. A second significant question concerns the number of new grade separations that would need to be added as a result of increased service.

BART

General

- o BART is contrasted with the electrified commuter rail system above in that it involves third rail electrification (instead of an overhead catenary system), the system is fully grade separated, and cars are designed for fast movement of a large number of passengers travelling on shorter trips (commuter rail equipment usually has more spacious and more comfortable seating for longer trips).

- o The preferred profile for BART on the Peninsula would be either at grade or elevated, as is typical on the East Bay and in existing railroad rights-of-way.

Performance/Capacity

- o The lighter weight BART cars are individually powered and accelerate and decelerate quickly. With improvements in BART's train control system, trains will be able to run 2.5 minutes apart in the future. The BART alternative, as tested, adds about 8 minutes of travel time for San Mateo County residents living south of San Bruno who are destined for the Financial District.

- o Because of BART's current service to Daly City, there are a number of service and capacity options available for the Peninsula depending on future demand. Assuming 10 car trains, 2.5 minutes headways and cars that carry 180 passengers in the peak ("crush" load capacity would be up to 230 passengers depending on the type of car), then the capacity would be as shown below:

- Every other Daly City train continuing south (5 minute headways in peak)	21,600 passengers per hour
- Two of the three transbay lines continue south (3.75 minute average headways in the peak)	28,800 passengers per hour

- All three transbay lines continue south (2.5 minute headways in peak) — 43,200 passengers per hour

Thus BART's potential capacity would exceed forecasted demand by a large amount.

Capital Improvements

- o Construction costs for BART are higher than for commuter rail or light rail because of the grade separation requirements, signalling and communication, and station treatment. Also as mentioned previously, BART's track guage is different from the standard railroad guage, thus the BART system incurs the cost of the freight track while LRT and the electrified commuter rail do not.

- o The location of stations and station spacing (to optimize train performance) are important decisions for the BART system as each station represents a fairly substantial facility. This contrasts with the more austere, barrier-free stations typical of a light rail or commuter rail system which have self service fare collection machines and typically less parking. BART stations, however, serve an important fare collection function by physically separating the paid and unpaid station areas; other transit systems may eventually need to consider on-board conductors or station modifications to obtain comparable levels of fare enforcement.

- o Electrification costs would be lower for BART than for other modes because of the existing Daly City feeder station (BART only needs three new feeder services, whereas LRT and electrified commuter rail need four) and the shorter route length.

- o Extending BART to the San Francisco Airport would cost $510-$833 million depending on whether the alignment went beneath the Airport Garage or terminated outside the airport across from the terminals. The end of the line station, whether it be at Millbrae, the Airport (San Bruno), or at Tanforan (San Bruno), should provide at least 2,000 parking spaces. A station at the Airport could provide for transfers between the Peninsula rail service and BART and a possible airport people mover; however, according to the patronage projections performed for this study, this connection would not significantly affect overall corridor transit use.

- o An automated airport people mover system is an optional method for connecting the off airport station to the terminals by circling the outside of the terminal where passengers would have convenient access to the ticket counters. This system was estimated to cost $90-$147 million; a shuttle bus operating between the outer Airport Station and terminals using a new overcrossing of Route 101 could be substituted for the airport people mover system, but would provide less convenient door-to-door service for the air passenger.

Operating Costs

- o BART's operating and maintenance costs per vehicle-mile are projected to be slightly higher than those for a light rail system, while the administrative costs would probably be lower because of the existing administrative structure already in place. For the purposes of this study, it is assumed that systemwide train schedules could be designed with appropriate train lengths to serve the Peninsula line without the need to constantly change train consist lengths at Daly City . (This may need further study at the time a detailed operating plan is prepared.) Projected operating costs and revenue result in a fairly low subsidy per passenger.

Summary

- o BART's projected operating cost/revenue picture appears favorable. The central issue is the need for the higher capital cost investment and the long term capacity potential this investment provides.

LIGHT RAIL

General

- Light rail systems use narrower vehicles than heavy rail and are very much like the old streetcars, trolleys, or tramcars, except that the vehicles are now longer and may be articulated. Light rail systems usually use overhead electrification, short trains (two or three cars), high or low platforms, and self-service fare collection. They can either be grade-separated or operate on city streets with the regular traffic. The resurgence of interest in light rail is due in large part to municipalities and the federal government seeking lower cost solutions to urban transportation problems compared to the heavy rail modes which have been constructed in a number of cities.

- LRT systems are most commonly found in an urban environment where they serve relatively short trips as opposed to long-haul systems. Typical maximum speeds are in the order of 55 mph, compared to over 75mph for heavy rail and commuter rail systems. There is no reason why the trackbed and vehicle seating and access/egress configuration cannot be designed to provide a comfortable ride for longer distance trips, or why the maximum speed cannot be increased.

- This type of system is more amenable to using alternative route alignments because of its flexibility in operating on city streets and expressways with automobile traffic and because of its ability to accommodate close station spacings.

Performance/Capacity

- LRT systems have good acceleration/deceleration capabilities which allow this mode to make frequent stops without unduly impacting travel speeds. The capacity of the LRT system is lower than BART or the electrified commuter rail due to the smaller vehicles and (typically) shorter trains. The capacity of a 4-car train operating at 5 minute headways would be 7,680 passengers per hour one-way (assuming 160 passengers per car), compared to 21,000 for electrified commuter rail and upwards of 40,000 for BART.

- To achieve higher capacity levels than assumed in this study, would involve scheduling longer trains or reducing headways below five minutes. When operating on city streets, such as proposed in San Francisco, the expansion capability of LRT is primarily limited by the length of city blocks (which restricts the train length) and conflicts with surface auto traffic resulting from shorter headways. To achieve higher capacity levels than mentioned above, consideration would need to be given to terminating the LRT at 4th and Townsend prior to entering the main downtown area, undergrounding the LRT beneath 2nd Street (or to the Transbay Terminal) to accommodate longer trains, or providing a surface loop in San Francisco to permit trains to run more frequently. (A stub end turnback, as assumed in this study, becomes less reliable as headways are reduced.)

- Making the Peninsula rail system an extension of either the Guadalupe Corridor LRT or Muni-Metro LRT system appears to have significant operational and service implications and would warrant more study to resolve the technical issues associated with such a system.

Capital Improvements

- Construction costs for an LRT system are lower than for BART but similar to the electrified commuter rail system. Complete track rehabilitation is required for LRT service as for electrified commuter rail because of the density of service. Structurally, the track would be similar to the commuter rail, owing to the track loads imposed by heavy emergency and maintenance equipment which would need to use the tracks from time to time. Similar grade separation requirements would exist for the LRT and electrified commuter rail mode. Electrification costs for light rail are lower than the electrified commuter rail because of lower power requirements.

- Construction of a tunnel in San Francisco would result in a total capital cost nearly equivalent to that of the electrified CalTrain service.

- A separate track for freight would not be needed as freight could be accommodated on the LRT tracks which would have the same guage.

Operating Costs

- Operating and maintenance costs per vehicle mile should be similar to those for BART and lower than those for the electrified commuter rail system. This is because a light rail system would operate in a transit labor environment as opposed to a railroad labor environment. There should be no significant difference in the maintainability of the LRT, BART, or electrified commuter rail equipment per se. Labor costs for light rail could increase significantly as could station costs if the barrier-free, self-service fare collection system were to prove unsuccessful.

Summary

- Not surprisingly, the LRT system is estimated to be the most cost effective of the rail modes in a number of categories -- total cost per rider, lowest subsidy per passenger, etc. The main issues that need to be considered relative to an LRT system are the advantages of operating in a transit labor environment and the capability of an LRT type system to meet long-range capacity needs of the corridor. In this regard, the feasibility of the proposed 2nd Street surface alignment in San Francisco compared to other alternatives such as a tunnel or surface loop need to be explored in greater detail to determine the long-term effects on LRT capacity. As with the commuter rail alternatives, another significant issue concerns the number of new grade separations needed along the Peninsula to ensure the capacity potential of the system can be realized.

BUS/HOV

General

- The Bus/HOV lane concept envisions a mass transit system composed of articulated diesel buses operating on special highway lanes or grade separated busways throughout the corridor. Buses would pick-up passengers close to their origin on local routes, enter an exclusive highway HOV lane or busway structure along the corridor to increase travel speed, and then distribute passengers on a local route after leaving the exclusive bus lane.

- This service concept is significantly different from the other rail service systems in that it couples frequent service with the opportunity for many persons to enjoy a one-seat ride from origin to destination. For example, individual bus routes originating in San Mateo County and running at 5 minute intervals in the peak would provide collection and distribution service along El Camino Real and access the busway at Redwood City, Foster City, San Mateo and San Bruno. Line-haul routes originating in Santa Clara County with similar headways would operate express from park-and-ride lots in "Silicon Valley" to employment concentrations and then express to access the busway structure in Redwood City.

Performance/Capacity

- The capacity of such a bus system is a function of the number of routes accessing the exclusive bus lanes and the headway on the individual routes. Along the bus guideway itself, it is assumed that Samtrans/SCCTD routes using the facility would provide one to two minute headways during peak hours to any station. To serve year 2000 demand would result in a bus every 30 seconds on the guideway. Since each articulated bus accommodates 100 passengers, the estimated one-way capacity would be 12,000 passengers per hour.

- Distribution of this large number of buses in San Francisco clearly presents a logistical problem because of the existing heavy traffic on San Francisco streets. As mentioned in Section IV, this study assumes buses would exit the guideway in San Francisco into a ventilated tunnel under

Mission Street and off load passengers at several underground stations. A turnaround facility would be provided at the end of Mission Street. In addition, modifying the four existing train tunnels in San Francisco to accommodate both the busway and the rail tracks for continued freight operations would be costly.

- While the busway would have a theoretical capacity for handling buses spaced less than 30 seconds apart, the practical capacity may actually be more limited. Additional express bus capacity in the corridor could be achieved by scheduling more buses on I-280 and Route 101. If HOV lanes on Route 101 south of Redwood City are heavily used by carpools, bus capacity may also be affected.

Capital Improvements

- Construction costs for the grade separated busway from Redwood City into San Francisco (36 miles) are relatively high since State construction standards require that any preferential facility for buses be designed for rail loads (in the event conversion to a rail system is eventually contemplated). Vehicle requirements and bus maintenance facility requirements are extensive because of the large (550+) fleet of buses, including spares. Further, the bus fleet would need replacement about every 12 years, whereas the useful life of a rail vehicle ranges from 30 to 50 years.

Operating Costs

- The bus mode exhibits the highest operating and maintenance cost and a high operating subsidy per passenger because it is relatively labor intensive, i.e., one driver carries 100 passengers versus 1,800 or more passengers for a 10 car train.

Summary

- The key to the long-term viability of this alternative is the high operating cost, the environmental consequences of large numbers of diesel buses operating in close proximity to residential neighborhoods, the potential for future expansion, and the feasibility of various solutions for handling large numbers of buses in downtown San Francisco.

Table 1

COMPARISON OF TRANSIT TECHNOLOGIES

(5 Minute Headways in Peak, 10 Minutes in Off-Peak)

	Weekday Ridership[1]	Capital Cost[2] ($000)	Operating Cost[3] ($000)	Revenue ($000)	Farebox Return (%)	Subsidy Per Rider ($)	Annualized Cost Per Rider[5] ($)
CALTRAIN-Diesel							
- with Transbay Ext.	81,000[4]	1,012,022	109,633	37,634	34.3	3.01	7.51
- with Muni Ext.	80,000[4]	734,022	111,613	37,169	33.3	3.15	6.45
CALTRAIN-Electric							
- with Transbay Ext.	93,000[4]	1,440,007	89,757	43,209	48.1	1.70	7.26
- with Muni Ext.	92,000[4]	1,162,007	92,249	42,745	46.3	1.82	6.36
BART	105,000	1,731,766	76,554	54,602	71.3	.71	6.64
LRT							
- on surface in S.F.	105,000	1,118,831	65,722	43,310	65.9	.72	4.56
- in Tunnel in S.F.	105,000	1,398,866	65,722	43,310	65.9	.72	5.52
BUS/HOV	108,000	1,374,065	90,030	34,170	38.0	1.75	6.32

1. Work and non-work trips only.
2. Low cost estimate used.
3. Same costs per vehicle mile as in Table 2-B, except CalTrain diesel is $8.6 per vehicle mile.
4. Peak period service pattern involves skip stop service to alternate stations, whereas other modes are assumed to serve all stations.
5. (Annualized capital cost + operating cost - revenue) divided by annual ridership (weekday x 295)

(9759P)

VI. COMPARISON OF ALTERNATIVES

This section provides a comparison of the major alternatives and their options, by summarizing information in Section IV - Description of Alternatives in a more convenient form. New information is included on various cost effectiveness measures which can be derived from the patronage forecasts and the estimates of capital and operating costs.

In order to provide a better context for understanding the summary tables, a brief discussion is included on the following areas:

- o Ridership Projections
- o Capital Costs
- o Operating Costs and Revenues
- o Other Evaluation Factors

Summary Comparison of Alternatives

Table 2 provides a useful comparison of all the baseline alternatives and their options by presenting key information on a single sheet.

Ridership

Table 3 presents a summary of the patronage forecasts for the nine mass transit alternatives and the major options.

The patronage projections provided in this report are a product of three important factors. The future year forecast of travel patterns, represented by a "trip table" is the most important element. This trip table remained constant for all alternatives; but since it is based on 1980 travel characteristics and accessibility levels, it may under represent the potential for future upgraded rail and express bus services. Projected county-to-county work trips by transit are shown in Appendix C.

The second important factor is the mode choice model. As noted under the key assumptions used in the forecasting process, this Bay Area model has been developed and refined over the years and is socioeconomic based; i.e., a high proportion of its predictive powers are dependent on socioeconomic variables as opposed to transportation system characteristics. As this model is calibrated against transit use observed in 1980, it will under or over predict future transit use if the underlying propensity of travelers to use transit changes. This situation would not be expected in San Francisco but could occur in San Mateo and Santa Clara Counties.

Table 2-A
Operating Data for Baseline Alternatives
(Year 2000)

	Existing (1984)	Alt. 0 Status Quo	Alt. 1 TSM	Alt. 2 Min Ext.	Alt. 3 BART to SJ	Alt. 4 LRT to SJ	Alt. 5 Elect Rail	Alt. 6 Bus/HOV	Alt. 7 BART/LRT	Alt. 8 BART/CalTrain
1. System Length (miles)	47	47	47	63[a]	41	44	49	36[b]	8/36	8/49
2. Train Size (No. Cars)										
a. Peak	5	5	5	5	4	4	3	NA	4/4	4/5
b. Off-Peak	3	3	3	3	4	4	3	NA	4/4	4/3
3. Max. Load Point Demand[c] (Pass/Hr.-Peak Dir)		2,640	4,320	4,500	10,700	6,840	6,480	11,580	10,700/4,740	9,000/3,600
4. Service Frequency (min)										
a. Peak	4- 8	10[d]	10[d]	10[d]	3.75	5	5[d]	1	3.75/5	3.75/10[d]
b. Mid-day	60-120	60-120	30-60	30-60	7.5	10	15	30	7.5/10	7.5/30-60
c. Evening	90-120	120	60	60	20	10	30	30	20/10	20/60
5. Peak Travel Time (min)										
a. SF to SJ	66- 85[e]	82	84	75	82	80	68	144	89	75
b. RC to SF	29- 50[e]	50	53	44	53	45	40	45	54	44
c. SF to SFO	25	NS	34	25	34	26	24	29	32	25
6. Daily Ridership (Year 2000)[f]										
a. BART	18,000	20,400	21,400	24,100	117,700	17,300	18,300	17,100	76,900	50,700
b. Commuter Rail	16,000	19,700	24,700	44,400	-	-	96,500	-	-	36,200
c. LRT	-	-	-	-	-	110,500	-	-	70,200	-
d. Express Bus	11,600	33,000	27,000	13,000	14,000	8,000	9,000	122,100	17,000	9,000
e. Total	45,600	73,100	73,100	81,500	131,700	135,800	123,800	139,200(g)	164,100	95,800
7. Daily Transferring Riders		-	-	-	-	-	-	-	33,000	9,000
8. Annual Ridership (000's)[h]		21,690	21,690	24,220	39,370	40,540	37,000	44,190	39,220	26,080
9. Percent of Corridor Work Trips by Transit		13.0	13.4	13.4	14.2	14.0	13.8	14.2	13.9	13.5
10. VMT Reduction[i]			Base	-15,000	-187,000	-119,000	-124,000	-135,000	-125,000	-20,000
11. Annual Passenger-Miles (millions)[j]			249.8	282.7	623.4	504.3	510.9	401.5	520.0	324.3

(a) Includes BART to Serramonte: 1.7 miles; CalTrain to Transbay Terminal: 1.5 miles; CalTrain SF to Coyote Valley: 60 miles
(b) Grade separated busway, Redwood City to San Francisco
(c) Maximum peak hour load on system, given service frequency on Line 4
(d) Skip-stop service. Frequency is that of trains on the line; A & B trains stop at alternate stations, with selected "all stop" stations for transfers between trains.
(e) Depending on whether trains are local or zone express.
(f) Work, non-work, and air passenger trips.
(g) The feasibility of accommodating large numbers of buses in San Francisco to serve this projected demand remains to be determined
(h) Daily work and non-work trips multiplied by 295; daily air passenger trips multiplied by 365.
(i) Reduction in automobile vehicle miles traveled (VMT) in corridor during peak hour due to transit improvements.
(j) Passengers x miles traveled; includes work, non-work, and air passenger trips on line haul modes.

(9715P)

Table 2-B
Cost Figures for Baseline Alternatives
($000)

	Alt. 1 TSM	Alt. 2 Min Ext.	Alt. 3 BART to SJ	Alt. 4 LRT to SJ	Alt. 5 Elect. Rail	Alt. 6 Bus/HOV	Alt. 7 BART/LRT	Alt. 8 BART/CalTrain
Capital Cost [a]								
1. Total - Low[b]	N/A	N/A	N/A	971,052	1,209,781	N/A	1,132,892	N/A
- Mid[b]	155,143	709,606	1,758,768	1,127,033	1,447,570	1,374,145	1,247,771	1,159,633
- High	N/A	N/A	1,987,922	1,644,789	2,008,815	1,421,545	1,670,728	1,321,151
2. Annualized Cost - Low[c]	16,457	75,274	186,569	119,555	153,557	145,760	132,363	123,013
- High[c]	-	-	210,885	174,478	212,223	150,796	177,229	140,147
3. Annualized Cost/Rider($) - Low	.76	3.11	4.74	2.95	4.15	3.30	3.37	4.72
- High	-	-	5.35	4.30	5.74	3.41	4.52	5.37
Operating Cost								
4. Cost/Vehicle Mile ($)[d]	9.49	9.49	4.79	4.67	8.6	3.84/5.07	4.79/4.67	4.79/9.49
5. Total Annual	41,442	47,893	81,715	68,177	78,773	90,030	64,776	53,366
6. Cost/Rider ($)	1.91	1.98	2.08	1.68	2.12	2.04	1.65	2.05
7. Cost/Pass. Mile ($)	.17	.17	.13	.14	.15	.22	.12	.16
Revenue								
8. Total Annual	19,731	25,276	64,394	47,411	46,821	36,323	50,695	29,948
9. Operating Deficit[e]	(21,711)	(22,617)	(17,321)	(20,766)	(31,952)	(53,707)	(14,081)	(23,418)
10. Farebox Return (%)[f]	47.6	53.8	78.8	69.5	59.4	40.3	78.3	56.1
11. Subsidy Per Rider ($)	1.00	.93	.44	.51	.86	1.22	.36	.77
Total System Cost								
12. Annualized Cost/Rider ($)[g]	1.76	4.04	5.18/5.80	3.05/3.46/4.82	4.54/5.01/6.60	4.51/4.63	3.42/3.73/4.88	5.61/6.27
13. Annualized Cost/New Rider ($)[h]	Base	22.0	9.37/10.75	4.54/5.42/8.33	8.48/9.63/13.46	7.17/7.39	5.48/6.18/8.74	27.79/23.89
14. Annualized Cost/Pass-Mile ($)	.15	.35	.33/.37	.25/.28/.39	.33/.36/.48	.50/.51	.26/.28/.37	.45/.50
15. Annualized Cost/New Pass-Mile[i]	Base	1.68	.44/.51	.34/.40/.62	.50/.56/.79	1.06/1.09	.35/.40/.57	1.41/1.64

(a) Capital Costs are in $ 1984 and include track work, stations, structure (including grade separations), maintenance equipment and yards, surface modification and utility relocation, signals and communication, power, rolling stock, right-of-way, engineering, management, and owners costs (11-28%) and contingency (20%).
(b) Mid-costs generally reflect reduced right-of-way costs, elimination of separate track for freight (except Alternatives 3 and 6), and elimination of airport people mover (Alternatives 3, 4, 5, 7, 8). The low cost is similar to the mid-cost except that significantly fewer grade separations would be provided.
(c) Assumes 30 year life of facilities and equipment and 10% discount rate.
(d) All costs include administration. Alternatives 4 and 5 assume new entity operates system. Operating costs for existing commuter rail system across the country range from $6-$12 per vehicle mile, depending on many local variables. Alternative 5 costs assume labor savings from new equipment, elimination of station personnel, and two man crews.
(e) Line 8 minus Line 5
(f) Line 8 divided by Line 5
(g) (Annualized Capital Cost + Operating Cost - Revenue) divided by Annual Riders, excluding transfers. Ranges are due to range in capital costs.
(h) Annualized cost for each alternative minus annualized cost for TSM alternative divided by new riders attracted beyond those attracted in TSM alternative.
(i) Same as h, except costs are divided by new passenger miles attracted beyond those attracted in TSM alternative. (9717P)

Table 2-C
Cost Figures for Major Options
($000)

	Alt. 1 TSM	Alt. 2 Min. Rail Ext. -Muni Metro Ext.-	Alt. 3 BART to SJ -Muni Metro. to- SF Airport	Alt. 7 BART/LRT -LRT to SF-	Alt. 8 BART/CalTrain -Muni Metro Ext.-
Capital Cost[a]					
1. Total - Low[b]		N/A	N/A	1,518,121	N/A
- Mid[b]		352,000	2,187,000	1,633,000	859,000
- High		N/A	2,439,000	2,164,000	1,021,000
2. Annualized Cost - Low[c]		37,340	231,996	173,227	91,122
- High[c]		-	258,727	229,555	108,307
3. Annualized Cost/Rider($) - Low		1.56	5.26	4.08	3.24
- High		-	5.89	5.41	3.85
Operating Cost					
4. Cost/Vehicle Mile ($)[d]		9.49	4.79	4.79/4.67	4.79/9.49
5. Total Annual		51,758	101,450	82,535	57,237
6. Cost/Rider ($)		1.99	2.38	1.94	1.91
7. Cost/Pass. Mile ($)		.17	.17	.15	.15
Revenue					
8. Total Annual		24,036	57,827	50,115	33,878
9. Operating Deficit[e]		(27,722)	(43,623)	(32,420)	(23,359)
10. Farebox Return (%)[f]		46.4	57.0	60.7	59.2
11. Subsidy Per Rider ($)		1.16	1.02	.76	.83
Total System Cost					
12. Annualized Cost/Rider ($)[g]		2.72	6.47/7.10	4.56/4.84/6.17	4.07/4.68
13. Annualized Cost/New Rider ($)[h]		10.21	11.36/12.63	7.47/8.06/10.77	11.31/13.97
14. Annualized Cost/Pass-Mile ($)		.23	.47/.51	.36/.38/.48	.32/.37
15. Annualized Cost/New Pass-Mile[i]		.64	.71/.78	.53/.57/.76	.68/.84

(a) Capital Costs are in $ 1984 and include track work, stations, structure (including grade separations), maintenance equipment and yards, surface modification and utility relocation, signals and communication, power, rolling stock, right-of-way, engineering, management, and owners costs (11-28%) and contingency (20%).

(b) Mid-costs generally reflect reduced right-of-way costs, elimination of separate track for freight (except Alternatives 3 and 6), and elimination of airport people mover (Alternatives 3, 4, 5, 7, 8). The low cost is similar to the mid-cost except that significantly fewer grade separations would be provided.

(c) Assumes 30 year life of facilities and equipment and 10% discount rate.

(d) All costs include administration. Alternatives 4 and 5 assume new entity operates system. Operating costs for existing commuter rail system across the country range from $6-$12 per vehicle mile, depending on many local variables. Alternative 5 costs assume labor savings from new equipment, elimination of station personnel, and two man crews.

(e) Line 8 minus Line 5

(f) Line 8 divided by Line 5

(g) (Annualized Capital Cost + Operating Cost - Revenue) divided by Annual Riders, excluding transfers. Ranges are due to range in capital costs.

(h) Annualized cost for each alternative minus annualized cost for TSM alternative divided by new riders attracted beyond those attracted in TSM alternative.

(i) Same as h, except costs are divided by new passenger miles attracted beyond those attracted in TSM alternative. (9717P)

The third important input to the forecasting process was the level and type of service pattern assumed for each alternative. Alternatives with more service generated more patrons as expected. If in the future, more or less service was tested for any modal alternative, patronage would increase or decrease depending on the new service in the corridor. Table 4 shows the service pattern tested for each mode.

With the above caveats in mind, the Consultant observed the following with respect to year 2000 patronage potential:

- The forecasting process indicated a strong potential for "reverse" trip commuting. Alternatives providing equal service in both directions generated almost equal directional patronage, north versus south home based oriented.

- There exists strong competition among transit modes for potential transit patrons. Increased rail services attract former express bus patrons and vice versa.

- Overall transit use on the Peninsula does not vary significantly when measured on a percentage basis of all trips. In looking at trips potentially captured by north-south fixed quideway service, the effect of service improvements are more dramatic. These are best illustrated by the change in passenger miles shown on Table 5.

- Of the trips using the transit guideway modes, approximately 30% are produced in or attracted to San Francisco County, 35-40% are attributed to San Mateo County, and 30-40% to Santa Clara County. These values vary by alternative.

- Attraction of air passenger trips to San Francisco Airport are estimated in the range of 3,000 to 9,000 passengers a day by transit. This represents 4 to 10% of all air passengers. Experience elsewhere suggests that 15% or 10,000 air passengers would be the maximum potential. Many of these new patrons would be attracted from existing Airport bus services.

  Table 5 presents a summary of other patronage related items of interest for each of the alternatives. Appendix D contains detailed information on station boardings and parking demand by alternative.

Table 3-A
Patronage Forecasts for Baseline Alternatives

	Existing (1984)	Alt 0 Status Quo	Alt. 1 TSM	Alt. 2 Mini Rail Ext.	Alt. 3 BART to SJ	Alt. 4 LRT to SJ	Alt. 5 Elect. Rail	Alt. 6 BUS/HOV	Alt. 7 BART/LRT	Alt. 8 BART/CalTrain
CALTRAIN		10(s)	10(s)	10(s)			5(s)			10(s)
Work		13,000	17,000	31,000			59,000			25,000
Non-Work		6,000	7,000	12,000			32,000			10,000
Air Passenger		700	700	1,400			5,500			1,100
TOTAL	16,000	19,700	24,700	44,400			96,500			36,100
BART		2.5[1]	2.5[1]	3.75[2]	3.75	2.5[1]	2.5[1]	2.5[1]	3.75	3.75
Work		12,000	13,000	15,000	71,000	10,000	11,000	10,000	46,000	29,000
Non-Work		7,000	7,000	8,000	39,000	6,000	6,000	6,000	25,000	16,000
Air Passenger		1,400	1,400	1,100	7,700	1,300	1,300	1,100	5,900	5,700
TOTAL	18,000	20,400	21,400	24,100[3]	117,200	17,300	18,300	17,100	76,900	50,700
LRT						5.0			5.0	
Work						68,000			44,000	
Non-Work						37,000			24,000	
Air Passenger						5,500			2,200	
TOTAL						110,500			70,200	
EXPRESS BUS										
Work		26,000	22,000	10,000	10,000	6,000	7,000	101,000	13,000	7,000
Non-Work		7,000	5,000	3,000	4,000	2,000	2,000	20,000	4,000	2,000
Air Passenger		---	---	---	---	---	---	1,100	---	---
TOTAL	11,600	33,000	27,000	13,000	14,000	8,000	9,000	122,100	17,000	9,000
System Total	45,600	73,100	73,100	81,500	131,700	135,800	123,800	139,200	164,100	95,800
Daily Transferring Riders									33,000	9,000

Note: Numbers opposite modes are train frequencies in minutes;
(s) Donates skip stop service to alternate stations. Station headways are twice number shown.
1. BART headways at Daly City Station.
2. BART headways at Serramonte/Colma Station.
3. Combined patronage for Serramonte/Colma BART Stations.

Table 3-B
Patronage Forecasts for Major Options

	Existing (1984)	Alt 2 Mini Rail Ext -Muni Metro Ext.- to 4th & Town.	Alt. 3 BART to SJ -Muni Metro to- SF Airport	Alt. 7 BART/LRT -LRT to SF-	Alt. 8 BART/CalTrain -Muni Metro Ext.- to 4th & Town.
CALTRAIN		10(s)			10(s)
Work		30,000			24,000
Non-Work		12,000			10,000
Air Passenger		1,400			1,100
TOTAL	16,000	43,400			35,100
BART		3.75	3.75	3.75	3.75
Work		15,000	71,000	40,000	33,000
Non-Work		8,000	39,000	22,000	18,000
Air Passenger		1,100	2,200	2,600	5,700
TOTAL	18,000	24,100	112,200	64,600	56,700
LRT					
Work			17,000	68,000	
Non-Work			9,000	37,000	
Air Passenger			5,500	110,500	
TOTAL			31,500	110,500	
EXPRESS BUS					
Work		10,000	3,000	5,000	9,000
Non-Work		3,000	1,000	1,000	2,000
Air Passenger		---	---	---	---
TOTAL	11,6000	13,000	4,000	6,000	11,000
System Total	45,6000	80,5000	147,700	181,100	102,800
Daily Transferring Riders			5,050	39,000	9,000

Note: Numbers opposite modes are train frequencies in minutes;

(s) Denotes skip stop service to alternate stations. Station headways are twice number shown.

Table 4

Guidway Transit Headways

Alternative	Mode	Peak Period Station Headway		Operation	Off Peak Station Headway		Operation
		Peak Direction	Non Peak Direction		Base Period	Evenings	
0	Commuter Rail	20*	30	Skip Stop-Peak Direct. All Stop-Off Non-Peak Direct.	60-120	120	All Stop
1&2	Commuter Rail	20*	30	Skip Stop-Peak All Stop-Off Peak Direct.	30-60	60	All Stop
	BART (Daly City or Serramonte)	2 1/2	2 1/2	All Stop	5	15	All Stop
3	BART	3 3/4	3 3/4	All Stop	7 1/2	20	All Stop
	Muni LRT (CBD-SFO)	6	6	All Stop	6	10	All Stop
4	LRT	5	5	All Stop	10	30	All Stop
5	Commuter Rail	10*	10*	Skip Stop-Peak Direct. All Stop-Off Non-Peak	15	30	All Stop
7	BART to SFO	Same as Alternative 3			Same as Alternative 3		
	LRT	Same as Alternative 4			Same as Alternative 4		
8	BART to SFO	Same as Alternative 3			Same as Alternative 3		
	Commuter Rail	Same as Alternaitves 1 & 2			Same as Alternatives 1 & 2		

* Train headways are 1/2 of that noted.

Table 5

Comparison of Systemwide Patronage Impacts

Alternative	Work % Transit	Work Pass.Miles on Transit	Travel Time Savings(Min)[1]	Transit Passengers[2]	Transit Work Trips[3]	Peak Hour VMT Reduction[4]	Annual Revenue ($M)
1-TSM	13.0	Base	Base	78,000	319,000	Base	18.4
2-Min Rail Ext.							
o Transbay Terminal	13.4	+62,000	+73,000	79,000	320,000	15,000	23.5
o Muni Extension	13.4	+62,000	+55,000	78,000	320,000	15,000	22.6
3-BART to San Jose							
o LRT in Bayshore Corridor	14.2	+671,000	+1,063,000	140,000	337,000	181,000	53.4
o Bus in Bayshore Corridor	14.1	+692,000	+991,000	124,000	336,000	187,000	59.6
4-LRT to San Jose	14.0	+440,000	+835,000	129,000	334,000	119,000	44.6
5-Upgraded Commuter Rail	13.8	+459,000	+613,000	107,000	330,000	124,000	43.7
6-Express bus	14.2	+495,000	+1,137,000	137,000	339,000	135,000	36.3
7-BART/LRT							
o LRT in Bayshore Corridor	14.0	+557,000	+873,000	173,000	330,000	151,000	45.5
o Bus in Bayshore Corridor	13.9	+409,000	+736,000	156,000	331,000	110,000	45.8
8-BART/Caltrain							
o Transbay Terminal	13.5	+74,000	+252,000	89,000	321,000	20,000	25.8
o Muni Extension	13.5	+146,000	+233,000	96,000	322,000	39,000	30.0

[1] Work Purpose Trips
[2] Peninsula Corridor Work + Non-work Purpose (includes transfers)
[3] West Bay Transit Productions
[4] Automobile Vehicle Miles Traveled Removed from Highway System during Peak Hour

Capital Costs

Cost estimates for each alternative are affected by a number of factors, some of which are institutional in nature and some of which cannot be fully resolved until more detailed engineering and cost studies are completed. Cost estimates in this study include the following costs elements: trackwork, stations (including parking), major structures (including grade separations for local streets), surface modification and utility relocation, power, signals and communication, maintenance yards, rolling stock, right-of-way, engineering/management and owner's costs, and contingency.

Table 6 shows the total cost for each of the baseline alternatives and the major options. The low estimate contains adjustments for right-of-way costs, freight track costs, and the cost of the airport people mover and probably represents the more realistic cost estimate. Table 7 summarizes the cost estimates by cost element for each of the baseline alternatives. Table 8 lists other cost estimates that are of specific interest to study participants and the general public. The more significant cost considerations are discussed below.

- Grade Separations. Additional grade separations for rail and local auto traffic will need to be considered for all alternatives, but particularly for those that significantly increase the number of trains above current levels provided on the Peninsula. The potential number of new grade separations for each alternative was determined using an exposure factor criteria reflecting the number of trains and autos competing for time at local street crossings. This factor was calculated as the product of daily autos times daily trains and is shown in Appendix E for Peninsula streets. The number of new grade separations actually to be built could vary from 12 (Alternatives 1, 2, and 8) to 45 for Alternatives 4, 5, and 7 (Alternative 3 requires complete grade separation for BART). Many streets would require grade separation, not because of the local traffic volumes, but because of the inability of the transit system to ascend or descend to grade prior to the next street requiring grade separation. The cost of the LRT Alternative (4) and the Electrified Commuter Rail Alternative (5) might be reduced in cost by at least 150 to 166 million dollars if further detailed investigations demonstrate that only the minimum number of grade separations (12) are required for the level of service finally selected.

Table 6

Summary of Cost Estimating Options
(Costs in millions of dollars)

Alternative	Baseline	Option 1	Option 2	Option 3	Option 4
(0) Transit Status Quo	o Highways expanded o CalTrain modernization o BART D.C. Turnback/Yard o Guadalupe LRT [$ 0]				
(1) TSM Actions	o HOV lanes on highways o CalTrain at 68 trains/day o San Jose Terminal o New Airport Station o Shuttle bus to BART D.C. [$153]				
(2) Minimum Rail Extensions	o CalTrain underground to Transbay Terminal o CalTrain to Coyote Valley o BART to Serramonte/Colma [$707]	o CalTrain underground beneath 2nd St. in S.F. [$658]	o Muni Metro extension to CalTrain Terminal [$352]		
(3) BART to San Jose	o External Airport alignment o People mover to Airport Terminals (a) o Shuttle bus in Bayshore Corridor to S.F. [$1,758 - $1,988]	o Shuttle bus replaced by Muni Metro extension to SFO Airport in Bayshore Corridor [$2,187 - $2,439]	o Same as baseline, but Internal Airport alignment underneath Airport Garage [$1,887 - $2,111]		
(4) LRT to San Jose	o 2nd St. in S.F. o Central Expressway alignment to San Jose o People mover to Airport Terminals (a) [$ 971 - $1,644]	o SP right-of-way to San Jose [$1,020 - $1,713]	o Great America alignment (connects to No. terminus of Guadalupe Corridor LRT) [$ 978 - $1,581]		
(5) Electrified Commuter Rail	o Underground to Transbay Terminal o People mover to Airport Terminals [$1,281 - $2,009]	o Underground beneath 2nd St. in S.F. (6 tracks, deep station) [$1,260 - $1,988]	o Underground beneath 2nd St. in S.F. (6 tracks, shallow station) [$1,210 - $1,958]	o Underground beneath 2nd St. in S.F. (4 tracks, shallow station) [$1,206 - $1,933]	
(6) Bus/HOV Lanes	o HOV lanes on freeways in Alternative 1 o Busway on SP right-of-way No. of Redwood City o New bus fleet and maintenance yards [$1,374 - $1,422]				
(7) BART/LRT Combination	o BART to Millbrae via outer Airport Station o People mover to Airport Terminals (a) o LRT So. of Airport to S.J. o Shuttle bus in Bayshore Corridor to S.F. [$1,133 - $1,671]	o Same as baseline, but BART ends at outer Airport Station [$1,106 - $1,644]	o Same as baseline, but BART to Millbrae underground beneath Airport Garage [$1,364 - $1,799]	o Same as baseline, but LRT continues to S.F. via 2nd Street [$1,518 - $2,164]	o Same as Option 1, but no intermediate stations between Daly City and Airport Station [$1,095 - $1,633]
(8) BART/ CalTrain	o BART to Millbrae via outer Airport Station o CalTrain to TransBay Term. o People mover to Airport Terminals (a) [$1,151 - $1,313]	o Same as baseline, but Muni Metro extension to CalTrain Terminal in S.F. [$ 851 - $1,013]	o Same as baseline, but CalTrain underground beneath 2nd St. in S.F. (6 tracks, shallow station) [$1,100 - $1,261]		

(a) People mover not included in low estimates.

(9631P)

Table 7

CAPITAL COST BREAKDOWN FOR BASELINE ALTERNATIVES
(Millions of 1984 $)

	Alt. 1 TSM	Alt. 2 Min Ext.	Alt. 3 BART to SJ	Alt. 4 LRT to SJ	Alt. 5 Elect. Rail	Alt. 6 Bus/HOV	Alt. 7 BART/LRT	Alt. 8 BART/CalTrain
TRACK & STRUCTURES[1]	9,000	329,077	729,850	597,872	798,083	1,152,205	645,526	598,617
STATIONS	72,458	198,477	296,700	72,854	260,956	29,612	140,812	280,050
POWER	---	5,965	191,750	218,694	288,693	---	189,689	54,255
SIGNALS & COMMUNICATION	13,452	17,858	224,980	203,694	57,760	---	193,395	82,882
ROLLING STOCK	11,647	34,763	278,719	306,887	229,553	110,290	293,720	111,043
MAINT. YARD and EQUIPMENT	44,000	44,000	104,251	105,138	120,330	23,638	87,130	83,904
OTHER	4,536	4,536	---	---	---	---	---	4,586
RIGHT-OF-WAY	---	74,880	161,400	139,920	253,440	100,800	120,360	105,720
TOTAL-HIGH	155,143	709,606	1,987,922	1,644,789	2,008,815	1,421,545	1,670,728	1,321,151
(RIGHT-OF-WAY)			(75,120)	(66,360)	(85,320)	(47,400)	(55,560)	(14,640)
(THIRD TRACK FOR FREIGHT)			(7,226)	(304,518)	(329,047)		(220,519)	---
(AIRPORT PEOPLE MOVER)			(146,878)	(146,878)	(146,878)		(146,878)	(146,878)
TOTAL-MID[2]			1,758,698	1,127,033	1,447,570	1,374,145	1,247,771	1,159,633
(GRADE SEPARATIONS)				(155,981)	(165,789)		(114,879)	
TOTAL-LOW				971,052	1,281,781		1,132,892	

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Notes: 1. Includes surface modification and utility relocation.

2. Low cost estimate calculated by subtracting items shown in parentheses.

(9769P)

Table 8

OTHER COST COMPONENTS OF GENERAL INTEREST

The following costs include Engineering and Management, Owner's costs and Contingency. They also include a prorated share of applicable systemwide costs where appropriate.

	Cost
Alternative 0 - Transit Status Quo	
o BART - "C" Cars	$ 73,269,000
- Daly City Turnback	94,869,000
o CalTrain - Station Acquisition	8,000,000
o Samtrans - Satellite Park & Ride Lot	7,500,000
o Muni - Muni Metro Embarcadero Turnaround	43,600,000
Alternative 1 - TSM Actions	
o CalTrain - 8 Rail Cars	8,774,000
- Centralized Train Control	11,987,286
- San Jose Terminal	47,300,000
- Station Improvements	15,344,000
- Maintenance Facility	44,000,000
- Track Rehabilitation	3,413,000
- Tower Consolidation	4,586,000
Alternative 2 - Minimum Rail Extension	
Tunnel to Transbay Terminal, including Transbay Station	306,399,100
Tunnel on 2nd Street to Market (6 Shallow)	253,670,500
Muni-Metro Extension to CalTrain Terminal	24,500,000*
BART Extension to Serramonte	61,631,000
CalTrain Extension to Coyote Valley	40,768,078
Transbay Terminal Station (Underground)	129,696,200
Mission Bay Station (Underground)	51,829,300
Grade Separation (CalTrain Baseline)	53,819,000
Alternative 3 - BART to San Jose	
Peoplemover to Airport Terminal	146,878,200
Muni-Metro Extension in Bayshore Corridor to Airport	451,411,000
Third Track for Freight	378,750,300
Alternative 4 - LRT to San Jose	
Central Expressway Leg	252,163,000
Southern Pacific Leg	292,315,000
Great America Leg	137,522,000
Peoplemover to Airport	146,878,200
Third Track for Freight	338,353,400
Grade Separation	209,800,000

Table 8 (Continued)

Alternative 5 - Electrified Commuter Rail	Cost
Tunnel to Transbay Terminal	358,845,800
Tunnel on 2nd Street, 6-deep	333,801,900
Tunnel on 2nd Street, 6-shallow	303,662,500
Tunnel on 2nd Street, 4-shallow	279,143,600
Electrification	276,369,900
Third Track for Freight	365,607,700
Grade Separation	219,607,700
Alternative 6 - Bus/HOV Lanes	
Elevated Bus Lanes No. of Whipple Ave. Including Stations	663,211,000
Park & Ride Lots	16,004,500
Third Track for Freight	245,021,000
Buses	82,800,000
Maintenance Facilities	21,500,000
Alternative 7 - BART/LRT	
BART to Millbrae Station (External)	562,966,100
BART to Millbrae (Through Airport Garage)	832,553,000
BART to Airport Station (External)	510,449,000
BART to Airport Station (External) - No Intermediate Stations	501,449,000
Peoplemover	146,878,200
LRT - Airport to San Jose	950,965,000
LRT - San Francisco to San Jose	1,444,241,000
Grade Separation (LRT)	168,697,500
Alternaitve 8 - BART/CalTrain	
BART to Millbrae Station (External)	562,966,000
BART to Millbrae (Through Airport Garage)	832,553,000
BART to Airport Station (External)	510,449,000
BART to Airport Station (External) - No Intermediate Stations	501,499,000
Peoplemover	146,878,200
Airport Intermodal Station	9,244,800
Bus Fleet Bus Maintenance Facilities**	
Buses	47,000,000
Maintenance Facilities	15,000,000

* Required financing for the Muni Metro extension to 4th and Townsend would be only $9.2 million after completion of Embarcadero/King Street road improvements to be performed under the I-280 Transfer Concept Program.

** Equipment and facilities required to handle assumed growth in Samtrans and SCCTD areawide bus service which supports mass transit service in the Corridor.

KE/BA suggests that during subsequent stages of the project an attempt be made to investigate, in each case, the feasibility of partially lowering the crossing streets and partially raising the railroad right-of-way using a landscaped embankment. This selection, when possible, will eliminate the need for aerial structures, improve the appearance of the crossings, and likely reduce the cost even further. (This consideration, however,does not apply to the BART Alternative 3, which must be fully grade-separated.) If a partial raising and lowering is not possible, the tracks can also be lowered beneath the street, but this solution will be significantly more costly.

- o Third Track for Freight Train Use. Alternatives 3, 4, 5, and 7 assume the dedication of a third track for bidirectional freight traffic. A third track requires at least the modification of three existing SP tunnels (a total length of 7,728 ft.) and about 20 existing bridge structures for Alternative 3 and about 25 for Alternatives 4, 5, and 7. In addition, it will require a new signal system to allow reverse moves, and modifications to the existing trackway, drainage, and sidings.

The cost of the third track is at least 316 million dollars for Alternative 3, 364 million dollars for Alternative 4, and 338 million dollars for Alternative 5.

It is KE/BA's opinion that it would be more desirable for the transit operating entity to take over the freight service from SP and contract with a short-line operator to perform freight operation over the transit tracks, rather than provide a separate third track for SP freight only. For the transit operating entity to have complete control over both transit and freight operations would have several benefits besides the elimination of the substantial cost of the freight-only third track and the modifications of existing structures. These benefits would be in the areas of land requirements, insurance liability, safety, reliability, and labor relations.

Elimination of the third track for Alternatives 4, 5, and 7 may not be one hundred percent feasible, but this could only be determined after detailed study of the sidings that would be retained and an in-depth consideration of the operational and geometrical requirements of each of them.

Taking over the freight service would bring some savings even in the case of the BART alternative (Alternative 3), because single ownership would eliminate the need for the 20-ft. lateral distance (SP requirement) to separate the adjacent tracks of the two operations, and many existing structures may not require modification. However, the third track is unlikely to be eliminated, because in this case the wide track gauge of the BART system would make it impractical to run freight trains on the same tracks. Only a detailed investigation could determine the order of magnitude of the possible savings in this case.

- Right-of-Way. As indicated in other documents of this study, the Southern Pacific Transportation Company has maintained its previous position--that it is willing to sell the San Bruno branch line and one half of its right-of-way from San Bruno to San Jose -- but wishes to retain all property north of San Bruno. Only the CalTrain Alternatives 1, 2, and 8 are assumed to require no right-of-way from the SP.

  Several attempts were made during the course of the study to identify the estimated value of the SP property by different methods. However, there was not sufficient time and funds to gather all pertinent information and perform a preliminary appraisal. In order to proceed with the estimate, a total cost of 210 million dollars for all railroad property required on the San Bruno Branch line and the mainline from San Francisco to Coyote Valley was assumed. This cost is based on previous public statements by the Southern Pacific company. The right-of-way costs shown in the estimates reflect a prorated cost for the specific segments of the right-of-way involved in each alternative. The actual cost of the property, in the opinion of KE/BA, depends upon the agreement that can be negotiated with the SP more than on speculative estimates or formal appraisals.

  To obtain some general idea of property value, a preliminary estimate based on averages of certain market values at specific locations and the currently assessed value of SP's operating and non-operating property was performed. This cursory evaluation resulted in a second figure for the cost of the above-mentioned right-of-way of about 112 million dollars.

Again, this figure is still speculative and does not represent an actual appraisal nor does it necessarily reflect the many other factors that should be taken into account prior to the determination of the value of the real property involved. Much research is needed prior to a serious attempt to appraise the SP property, and the actual value determined through negotiation could be less than the new figure mentioned above.

Unless the SP property can be secured by agreement, and true control over the property gained on a long-term basis (at least the useful life of the facilities to be built), serious consideration should be given to negotiating the purchase of the entire SP right-of-way.

- Airport People Mover. The capital cost of the airport people mover for Alternatives 3, 4, 5, 7, and 8 was estimated at about 147 million dollars, based on a specific system chosen from the great variety of technologies and features available. Operating costs would be $.8 million or less.

  If such a system is feasible, it may be determined that a less expensive system is appropriate, when more definition regarding required features, capabilities, capacity, level of service, and reliability is available during subsequent stages of the project. People movers have been traditionally implemented through a turnkey contract incorporating only limited definition and performance guidelines. This allows competition among the different domestic and foreign manufacturers of this highly specialized equipment which can range from a simple cable car to a highly sophisticated air-cushion or magnetic levitated vehicle. Thus, depending upon the final selection, the system could cost anywhere between 90 and 200 million dollars.

  It should also be mentioned that the participation of private capital or a manufacturer who is eager to promote a new product or break into the American market can sometimes result in attractive contractual arrangements or substantial savings. Future stages of this project should involve a marketing investigation of presently available technologies and the identification of potential suppliers prior to deciding on the basic features of the system to be specified.

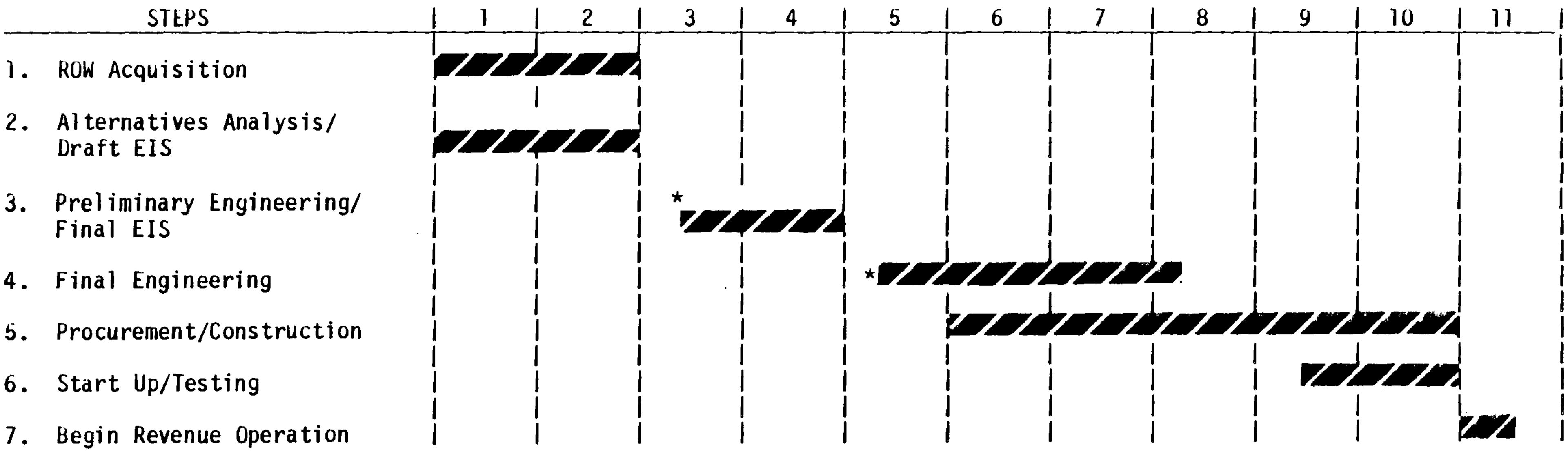
- Construction Time Frame. Figure 4 shows the general time frame required for implementation of a major new mass transit system on the Peninsula, including the following elements:

  - Alternatives Analysis/DEIS (2 years)
  - Preliminary Engineering/FEIS (1.5 years)
  - Final Design (3 years)
  - Procurement/Construction (5 years)
  - Testing (accomplished concurrently with construction)
  - Revenue Operation (0-3 months following completion of all construction)

The early part of the schedule is guided by the federal planning process if federal funds are going to be requested. It includes preparation of an Alternatives Analysis report and draft federal Environmental Impact Statement (EIS). If UMTA approves, Preliminary Engineering and the final EIS can then be prepared. Final Design normally will begin after receipt of a Letter of Intent which documents UMTA's intention to obligate funds for the project. Early steps can be taken in procuring land, materials, and equipment as early as 6-8 months from the beginning of Final Design. Assuming adequate funds have been secured and committed to the project, construction for a major new system such as BART, LRT, or electrified commuter rail would take about five years. There are no major differences in terms of construction difficulty between the alternatives that would significantly affect this general time allocation. Testing of vehicles for revenue operation would normally occur during construction and actual revenue service could commence anytime after completion of all construction.

Figure 4

CONCEPTUAL SCHEDULE FOR CONVERSION TO A NEW PENINSULA RAPID TRANSIT SYSTEM
(UMTA PLANNING PROCESS)



Notes:

1. ROW acquisition assumes use of State/local funds.

2. Assumes existing service is continued throughout construction phases.

3. There are essentially no differences in construction difficulty relative to a BART, LRT, or electrified commuter rail system upgrade program.

* UMTA approval required.

Operating Costs and Revenues

- Operating Cost. The methodologies used to calculate operating costs for CalTrain, BART and LRT systems are all similar. In each case, the annual car miles was calculated for each alternative based on the patronage forecasts and the number of trains and cars required for weekday and weekend service. The number of car miles was then multipilied by a unit cost for each system representing current or anticipated costs performance of the Bay Area transit operators or that of other transit properties operating similar kinds of equipment. Administration costs are included where appropriate; however, the costs do not include depreciation. While this simplified approach does not yield the same level of accuracy as would be the case if a detailed operating plan were developed for each alternative, it provides a reasonable basis for comparison between alternatives at this level of decision making.

  CalTrain costs for the diesel service in Alternatives 1, 2, and 8 assume some new cost efficiencies but no major change in the existing contract with Southern Pacific; also administration costs are included to provide a better comparison with other alternatives. Both the electrified commuter rail and LRT system costs assume a new authority would operate the system. One man crews are assumed for BART and the LRT, and two man crews for the commuter rail mode. The Airport peoplemover costs were developed similarly to the rail operations except that the unitary cost was derived by averaging operations costs for the AIRTRANS, Atlanta, Seattle, and Tampa Airports systems. These airport systems are all operationally similar to the proposed San Francisco Airport system.

  Operating costs for express buses on Route 101 and on the HOV lane/busway in Alternative 6 are based on mileage and current SamTrans and SCCTD unit costs per bus mile. Also, in Alternative 6, some HOV lane enforcement costs were added on Route 101 to ensure that the preferential bus lanes on the highway provide a high level of service for the express buses using them.

- Revenues. As explained in the Task 3 - Operational System Definition Report -- revenue for each line haul mass transit mode was derived by applying BART's distance based fare algorithm. For each alternative and each mode within the alternative the average distance travelled and average fare were computed for work and non-work trips. Total system revenue was then obtained by adding all of these elements. Revenue for air passenger trips to San Francisco Airport on transit was calculated separately, but using essentially the same methodology.

Other Evaluation Factors

Other evaluation factors, besides simply ridership and cost measures, will ultimately be of major importance in identifying a locally preferred mass transit option for the Peninsula Corridor. The following list of measures developed by the SCR 74 Advisory Committee can be compared qualitatively for each alternative. A more detailed evaluation would be expected in follow-on engineering and environmental studies required by UMTA in order to obtain federal funding. Table 9 summarizes the various factors for all alternatives and indicates relative differences between alternatives (a positive, neutral, or negative rating system was employed).

- Implementation - The implementation factor assesses the relative difficulty in implementing the various alternatives considering key steps in the process -- planning and environmental documentation, obtaining local reviews and approvals, and obtaining financing. The TSM type improvements in Alternative 1 do not represent major capital investments and should be relatively easy to implement, while in comparison extension of BART down the Peninsula would be a complex and possibly lengthy process. Alternatives 7 and 8, involving a BART extension to the San Francisco Airport in conjunction with a light rail transit system or upgraded CalTrain system, received a neutral rating because of the relatively short length of the BART extension and the possibility of resolution of local concerns on a step-by-step basis. The LRT (Alternative 4) and electrified commuter rail system (Alternative 5) also received neutral ratings because of the major decisions that would need to be made in converting to a new technology and resolving local issues relating to station area parking and traffic, the need for additional grade separations, financing and the like. In Alternative 2, the Muni Metro extension was judged to be easier to implement than the CalTrain extension to the Transbay Terminal or CalTrain extension under 2nd Street.

- Potential for Connection to Other Regional Rail Starts - The three key rail interfaces in the corridor are with BART and Muni Metro in San Francisco, with the Guadalupe LRT system in Santa Clara County, and with the Route 237 rail corridor in the Fremont-South Bay Study. Neither the Transit Status Quo alternative (Alternative 0) nor the

TSM alternative (Alternative 1) provide any better rail connections to BART or Muni Metro in San Francisco. The Muni Metro extension to 4th and Townsend (Alternative 2) would interface with BART but requires two transfers, whereas the extension of CalTrain to BART (2nd Street alignment) or Transbay Terminal would be more direct and require only one transfer. Extension of BART down the Peninsula is the most integrated rail alternative because of BART's Transbay service to the East Bay and ultimate potential for connecting BART around the Bay. All alternatives are assumed to be on an equal footing with respect to the Fremont-South Bay Route 237 corridor, pending resolution of the particular route alignment and technology selection in this corridor.

- Environmental Factors - The environmental rating considers the relative potential of individual transit alternatives to reduce corridor auto travel and thereby help achieve regional energy conservation and air quality objectives. A positive effect on energy and air quality may be off set by more adverse environmental considerations relating to visual, noise, or natural habitat impacts. From this perspective, all alternatives result in a higher percentage of corridor work trips using transit because of upgraded service. Also, there would be some visual, noise, and natural habitat impacts associated with all alternatives; however, it would be difficult to differentiate among alternatives at this stage. The primary reason for a negative rating for the Bus/HOV alternative is the appearance of the aerial busway and assumed use of diesel bus equipment.

- Potential for Stimulating Locally Desired Development - Given a basic level of "transit" service, development potential around transit stations in largely a function of local initiative more than the characteristics of the transit service per se. Generally higher patronage would be correlated with higher development interest, including joint development of transit operator station property, giving the BART, LRT, and upgraded commuter rail alternatives a higher rating. Relatively minor service changes as in Alternative 1, were judged not to have any effect on station area development potential, whereas the bus alternative (Alternative 6) was seen as having as negative impact, due to the type of stations that would be constructed and the use of freeway HOV lanes in a portion of the corridor.

- <u>Station Area Impacts</u> - An inability of local stations and roads to accommodate the estimated surface traffic and off-street parking demand would be considered a negative system impact. All transit alternatives which provide upgraded service will attract more patronage and therefore have a "negative" station area impact compared to existing traffic conditions. No attempt has been made at this stage of the planning process to determine appropriate traffic mitigation measures for individual stations; however, such measures should be explored in the future in cooperation with local governments to alleviate potential problems. The Minimum Rail Extension Alternative (Alternative 2) received a positive rating owing to the improvement of traffic circulation in San Francisco which would result from either the Muni Metro Extension or CalTrain terminal relocation and owing to the construction of the Serramonte BART Station to relieve BART's Daly City Station. The bus/HOV lane alternative was rated negatively because of the questionable feasibility of accommodating large numbers of buses in San Francisco during peak commute periods.

- <u>Disruption During Construction</u> - Construction impacts consider the amount of disruption to local traffic circulation and the noise, vibration and dust produced as a result of system construction. Fortunately, since most options under consideration would use the existing SP right-of-way, the need to relocate homes and businesses would be minimal throughout the corridor. All alternatives require major new construction along the SP right-of-way, except the Transit Status Quo alternative (Alternative 0) and TSM alternative (Alternative 1). In the Minimum Rail Extension alternative (Alternative 2), new construction would be confined to San Francisco and the Serramonte area for the new BART station, as opposed to the other alternatives which would require new trackwork and facilities along the entire length of the corridor. Appropriate construction techniques would be applied in all alternatives to ensure that existing rail freight, rail passenger, and auto traffic would not be interrupted, hence the major adverse impacts experienced would center around noise and intermittent traffic delays associated with moving construction personnel, materials, and heavy equipment to and from the local construction site.

- Rider Acceptance - This is a subjective measure of the appeal of alternative mass transit modes to riders for generally longer distance trips, compared to the present diesel service operating on the existing roadbed at current train frequencies. Alternatives which provide more convenient terminals, such as Alternative 2 (Transbay extension and new BART Serramonte station) and those which involve electrified equipment operating at higher frequencies (BART, LRT, upgraded commuter rail, and combinations of these modes) were rated higher. The Bus/HOV alternative, while providing a convenient local collector service, was not rated highly because of the existing rider acceptance of rail service and expectation of continued rail service in the corridor.

- Accessibility for Handicapped/Bikes - Some system facilities and equipment can be made accessible to the handicapped and bikes more readily than others. Existing and newly ordered CalTrain equipment will have some limitations for wheelchair access due to the lack of lift technology available, but it is assumed that these problems would be rectified in the future and not apply to the Electrified Commuter Rail alternative (Alternative 5). BART would represent the most accessible technology, and various types of lift equipment are available for light rail vehicles. Lifts on buses receive only a neutral rating in the Bus/HOV Alternative (Alternative 6) because of the overall current dependability of this type of equipment.

- Long Term Capacity Potential. This factor considers the capacity potential of each technology within the context of each alternative considering train size, car size, and minimum headways. By definition the Transit Status Quo alternative has no further potential because investment in transit is constrained to current commitments. CalTrain diesel service is expandable in the peak hours by adding cars to individual trains and increasing reverse commute service. The same is true of off peak service; however, to realize this capacity potential current scheduling constraints in the Caltrans/SP contract would need to be removed. BART and an electrified CalTrain system would effectively be equivalent since both systems could easily handle peak loads for the year 2000; however, BART's ultimate capacity would be larger than for the electrified train system because of the potential to run trains at closer spacings. The main constraint on the LRT system (Alternative 4) is that imposed by running the system on the surface in San Francisco which limits the train length to 4 car trains. If the LRT were to be undergrounded in San Francisco, this constraint would be removed; however, the LRT capacity would still not match that of BART or the electrified commuter rail system. The Bus/Hov lane alternative is given a low rating due to the density of traffic forecast for the year 2000 on the busway and the lack of a good solution for accommodating the large number of buses entering San Francisco in the peak hours.

o Institutional Considerations. Institutional considerations relate to the types of decisions which would need to be made in terms of governing, managing and financing an improved Peninsula mass transit system, with particular attention to the following issues:

- Incremental Improvement of CalTrain. The SCR 74 Study could recommend that the existing diesel train service be incrementally improved without changing to a new technology (e.g., light rail or electrification of the line). Institutional changes may need to be considered to provide more local control and involvement in the provision of service. Improved service will also require additional financial commitments from agencies that currently subsidize the service. The possibility of purchasing the right-of-way and renegotiating train crew sizes, labor union work rules and pay rates to lower operating costs needs to be considered.

- Extension of BART into San Mateo/Santa Clara Counties. In San Mateo County, voter approval will be required for any interconnection to the BART system, requiring the resolution of several long-standing issues. Local governments have expressed concerns over the design of the system (preferred route and track profile), station area traffic impacts, possible relocation of homes and businesses, and financing arrangements. Specific mitigation measures will need to be better defined at the appropriate planning stage. While BART legislation restricts the use of district funds outside the three BART Counties (district funds are discretionary funds controlled by BART), other funding sources such as federal, state, and local funds could be used for extensions. BART and the counties can also consider other forms of affiliation to the district as alternatives to formal annexation.

- Introduction of a New Technology. Several alternatives under study would replace the current diesel locomotive service with a new light rail transit system or an electrified commuter rail system for all or a portion of the Corridor. Some improvements might be extensions of existing transit systems, such as a Muni Metro light rail extension to the San Francisco Airport or an extension of the Guadalupe Corridor light rail transit system north to the San Francisco Airport. These changes would suggest only minor modifications to the existing funding and institutional structure. Corridor-wide systems would, however, require an examination of broader alternatives for managing and operating such a system, including Caltrans, a new District, or a joint powers arrangement between existing transit operators. Important areas to consider in relation to a new institution or operating arrangement include the ease of implementation, impact on funding of current transit operators, need for new funding sources or taxing authority, possible cost efficiencies associated with new labor contracts, the expertise a new entity might bring to the operation, and a method for local representation and control of the service.

Table 9
OTHER EVALUATION FACTORS

Alternative or Sub-Alternative	0 Transit Status Quo	1 TSM	2 Min. Rail Ext.		3 BART to San Jose	4 LRT to San Jose	5 Upgraded Commuter Rail	6 Bus/ HOV	7 BART/ LRT	8 BART/ CalTrain
			Muni Metro Ext.	Tunnel Ext.						
Factor										
Implementation	++	++	+	0	-	0	0	-	0	0
Connection to Other Rail Systems	-	-	0	+	++	+	+	0	+	+
Environmental	0	0	+	+	+	+	+	-	+	+
Development Stimulation	0	0	+	+	++	++	++	-	+	+
Station Area Impacts	0	0	+	+	-	-	-	-	-	-
Disruption During Construction	0	0	0	0	-	-	-	-	-	-
Rider Acceptance	0	0	0	+	++	++	++	-	++	+
Accessibility to Handicapped	-	-	-	-	++	+	0	0	+	-
Long Term Capacity Potential	-	+	+	+	++	+	++	-	+	+
Institutional Considerations	++	++	+	+	0	0	0	0	0	0

Legend

The legend used in this chart is intended to reflect relative differences between alternatives and is based largely on the judgment of the Consultants and MTC staff.

0 Neutral
- Negative
+ Positive
++ Very Positive

(9704P)

VII. APPENDIX

APPENDIX A

Transit Operator Comments

STATE OF CALIFORNIA—BUSINESS AND TRANSPORTATION AGENCY

GEORGE DEUKMEJIAN, *Governor*

DEPARTMENT OF TRANSPORTATION
BOX 7310
SAN FRANCISCO 94120
(415) 557-1840

February 8, 1985

Lawrence D. Dahms
Executive Director
Metropolitan Transportation Commission
101 Eighth Street
Oakland, CA 94607

Dear Mr. Dahms:

SUBJECT: SCR 74 RIDERSHIP PROJECTIONS

Caltrans has some concerns regarding the ridership projections distributed at the January 30, 1985 meeting. Caltrans' concerns with items other than the trip table are continuing to be discussed at staff level. A basic problem continues to be that the trip table used for modeling reflects the 1980 trip characteristics.

We recognize the need for using a common base (1980 trip characteristics) for all the ongoing MTC studies, however, there are some shortcomings which are recognized by the involved parties. For example, new long distance commute travel to San Francisco has virtually been ignored. In our experience results of traffic projection models are evaluated and where appropriate manual adjustments are made. With the pressure of a tight dead line, we have not had the opportunity to evaluate the ridership data in depth and; therefore, we must react on the basis of summary data furnished.

The methodology used does not reflect the change in travel patterns which could be expected with a new transit-level, major corridor facility imposed on the Peninsula where none now exists. While the model may not be unrealistic for alternatives 0, 1, 2, and 8, it may not be a realistic assessment of future conditions under alternatives 3, 4, 5, 6, and 7.

The expressed belief that UMTA will accept only this methodology even though the future picture may not be realistic is disturbing to Caltrans. If this is indeed so, then a written explanation of the differences which might be expected, based on the professional judgement of Barton-Aschman Association, should be included in any public documents regarding ridership projections.

Sincerely yours,

BURCH C. BACHTOLD
District Director

By

ROBERT H. JAHRLING
Deputy District Director

cc: SamTrans, SCCTD, MUNI, BART

STATE OF CALIFORNIA—BUSINESS AND TRANSPORTATION AGENCY GEORGE DEUKMEJIAN, *Governor*

DEPARTMENT OF TRANSPORTATION
BOX 7310
SAN FRANCISCO 94120
(415) 557-1840

February 21, 1985

Lawrence D. Dahms
Executive Director
Metropolitan Transportation Commission
101 Eighth Street
Oakland, CA 94607

Dear Mr. Dahms:

Caltrans is pleased with the many changes in both the ridership projections and the capital costs that have resulted from staff level discussions. However, there are still many items which have not been resolved. My letter of February 8, 1985 covered Caltrans' concern with the methodology used for ridership projections. Following are other concerns that we believe need to be addressed prior to releasing the study material for public review.

RIDERSHIP PROJECTIONS

° Alternative 1 should have only one version of the ridership projections. This version should be the one in the original definition of the alternatives that assumes the continuation of SamTrans' Express busses. It is our understanding that this would produce 17,000 work trips and 7,000 non work trips with the total ridership projection for CalTrain of 24,000. It should be noted that Alternative 1 maybe based on 48.8 one-way miles for CalTrain. If so, this is in error because extension to Alma was not to be considered under Alternative 1.

° Caltrans is concerned that the San Francisco freeway and street capacity required for Alternative 6 is inadequate to generate the ridership projected for the express busses.

° Caltrans does not agree with the comparison of ridership generated by the MUNI Metro Extension Alternative 2b vs. the CalTrain Relocation to a Downtown Terminal Alternative 2a. Alternative 2 includes extension of CalTrain to Coyote Valley. This extension should generate more than the 1,000 patronage differential between 2a and 2b. It is not reasonable that the same or less people would be attracted to San Francisco if they had to transfer to MUNI Metro rather than a single ride to a downtown location within walking distance of their work.

- The Alternative 5b version of ridership projections should be the only Alternative 5 shown. There should not be an Alternative 5a.

- The CalTrain ridership shown for Alternative 8 is not reasonable. Caltrans does not believe that extending BART to the airport will decrease ridership to CalTrain by 10,000. Comparison with Alternative 2 indicates to us that the CalTrain ridership under Alternative 8 and indeed the total ridership under the Alternative 8 should be increased by 10,000.

- Caltrans believes it is inappropriate to show the systemwide BART passenger miles. The passenger mile table, for comparison purposes, should limit the figures to the Peninsula only. This would give a zero base for BART.

CAPITAL COST

- The cost estimates for electrification appear to include replacement of existing rail. We do not agree. The 5-Year Plan already includes upgrading of the track to continuous welded rail.

- It is our understanding that the Alternative 5 Rolling Stock costs will be lowered from the initial $548,000,000, to a final figure of $127,200,000. This latter figure seems much more reasonable although it still anticipates total replacement of the existing fleet. Caltrans still does not agree that total replacement of the existing fleet is necessary.

- Caltrans does not agree that a second maintenance facility is necessary to Alternative 5. We do agree that some costs for conversion to electrification is appropriate.

- The maintenance facility figures are not consistent between Alternatives 1 & 2. Alternative 1 added $44 million to recognize the 5-Year Plan cost. Alternative 2 made no adjustment to that, therefore it appears Alternative 2 may be $10 million too low.

- Alternative 1 added and subtracted from the subtotal figure. Alternatives 2 and 5 added and subtracted from the bottom line total. We assume these inconsistencies will be adjusted in the final report.

- The EMU and light rail cars are estimated at about $1.2M each. The BART cars appears to be estimated at less than $1M each. The BART cars should be estimated at closer to $1.5M.

- Caltrans does not agree that aerial structures are appropriate forAlternative 5.

- Caltrans still believes there has been inadequate analysis of the need for grade separations. We cannot either agree or disagree with the numbers used in the low and high estimates without a better analysis of needs. Current conditions in the Peninsula suggest a far greater tolerance for at-grade crossings given preemptive signals for rail than your study recognizes. This could apply specifically to LRT/commuter rail alternatives.

- The single major deficiency remains the absence of a low-cost, incrementally upgraded commuter rail alternative. Such an alternative provides additional choices to a "low" or "high" cost range, and offers the opportunity to incrementally upgrade the system at any future point in time conditioned on need and availability of funds.

Sincerely yours,

BURCH C. BACHTOLD
District Director

By

Original signed by

R. H. JAHRLING
Deputy District Director

cc: SamTrans,SCCTD,MUNI,BART

STATE OF CALIFORNIA—BUSINESS AND TRANSPORTATION AGENCY GEORGE DEUKMEJIAN, *Governor*

DEPARTMENT OF TRANSPORTATION
BOX 7310
SAN FRANCISCO 94120
(415) 557-1840

Note: Page numbers referenced in this letter may not agree with page numbers in report due to subsequent revisions.

March 18, 1985

Lawrence D. Dahms
Executive Director
Metropolitan Transportation Commission
101 Eighth Street
Oakland, CA 94607

Dear Mr. Dahms:

CALTRANS has the following concerns about the Peninsula Mass Transit Study's "Summary Report", released at the February 22 PENTAP Meeting.

- Page 11, line 6: The sentence "No attempt has been made to assess the effect of the transportation improvements themselves on future commuting patterns", indicates the key flaw in the ridership estimates for the Peninsula Study. If applied to the Concord - San Francisco Corridor in 1960, the patronage forecasting methodology in SCR 74 would not have correctly predicted travel behavior in 1980. The consultant and much of the Technical Committee freely admit that the methodology, based on the trip tables, does not reflect the anticipated change. Yet the study continues to stick to this methodology. The argument to support this decision is that UMTA won't accept anything else even if it is more "correct". CALTRANS doubts this. But even if true, we still want acknowledgement to be made that major transit capital projects, such as those proposed in Alternatives 3, 4 and 5 have profound effects on people's travel behavior. This is a demonstrable and quantifiable fact.

- Page 13, last two lines and page 14, first two lines: "In the case of the non-work and non-home-based trip purposes, person trips were estimated using the applicable trip generation and distribution models, followed by application of the non-work and non-home based mode split models." Are these sentences true? Wasn't off-peak patronage determined by estimate, based on BART experience and current commuter rail experience?

- Page 24, under "Transit Improvements": should read "Caltrain - 46 trains/day, 18 new locomotives," not "8 new locomotives"

- Page 30, bottom of page: The paragraph under "Other Patronage Items of Interest:" should be deleted. First, evaluating "the sensitivity of CalTrain ridership to the level of SamTrans express bus service to San Francisco on Route 101" was never and should never have been part of the consultant's assignment. Alternative 1 was specifically defined as leaving these buses in. They were supposed to be deleted only in other alternatives.

  Second, the sentence, "Reduction of SamTrans bus service would decrease daily express bus patronage from 27,000 to 14,000 trips, while CalTrain ridership would increase from 24,000 to 36,000 daily trips," is questionable. In order to accept this statement as valid, you must begin with the assumption that the train and the bus are competitors. But since the two systems do not have the same fares, travel times nor service areas, the assumption that the needs of their respective customers are the same is difficult to accept. Given other assumptions, at least as valid as those in evidence here, it's easy to imagine that discontinuance of bus service could result in no diversion to the train.

- Page 32, "Service Concept", second bullet.
  A long range plan, as this study purports to be, needn't concern itself with "freight windows" artificially guaranteed by the current CALTRANS/SP contract.

- Page 32, 4th bullet and 4th line under ridership: The increased bus service in the bullet doesn't agree with the line which says, "SamTrans mainline express patronage declines by 6,000 daily trips compared to the null alternative".

- Page 34, SERVICE
  Again, freight "windows" are subject to future negotiations.

- Page 35, OPERATING COSTS AND REVENUE
  CalTrain operating costs are $8.4 million higher than Alternative 1 even though no additional trains are allowed. CALTRANS has calculated additional operating cost with a Downtown terminal should be less than $1 million.

- Page 35,"Other Patronage Items of Interest",: in the first line, the 12,000 here again assumes that buses and trains are competitors, an assumption Caltrans doesn't agree with. However, they become more competitive in this alternative because the trains are extended Downtown to the terminus for the buses. In other words, without the terminal relocation diversion from bus to train is unlikely. With it, train travel time is lowered, and transfer and fare penalties are eliminated making trains a more competitive choice. That is why, in the Alternatives Definition phase of this study, it seemed reasonable to eliminate express bus service in Alternatives 2 through 8 only. The relative patronage estimates for the "CalTrain Terminal extension" and the "Muni Metro extension" do not adequately reflect the penalty for continuing the transfer at 4th and Townsend nor the benefit of eliminating it.

- Page 39, last sentence, "Tunnel dimensions in both cases are sufficient to allow for operation of bi-level electric cars to preserve future flexibility;" Since this is true, no additional costs for this purpose should appear in Alternative 5.

- Page 46, last line:
  "The alignment to Daly City (rather than along the Bayshore corridor) adds eight minutes of <BART> travel time for San Mateo County residents living south of San Bruno, who are destined to the Financial District compared to Alternatives 2, 4 and 5." This implies that 2, 4 and 5 have the same travel times. But according to your data, Alternative 2 is 9 minutes faster from the airport and Alternative 5 is 10 minutes faster.

- Page 53, 4th paragraph: The assertion in this paragraph about the "need" for grade separation is not acceptable to Caltrans. MTC has accepted this as a requirement without any substantiation or defensible criteria, and despite a preponderance of verifiable arguments to the contrary. In addition, the technical committee was under the distinct impression that MTC's original agreement was to produce a low cost version of Alternatives 4 & 5 with only twelve separations. A draft version of this summary was produced which contained only the twelve in the "low" estimates. MTC then unilaterally changed that understanding by reinstating the 33 separations, still without defensible selection criteria.

- Page 54, Capital Costs
  Caltrans doesn't agree that all new track would have to be laid for Alternative 4 or 5, any more than it would be necessary for Alternatives 1, 2 or 8.

- Page 55, last paragraph
  Caltrans shares Peninsula communities' concern about the impact to east-west traffic of increased rail service. Alleviating these concerns, however, may not require grade separating almost the entire rail line, regardless of cost or other criteria. In advocating 45 grade separations for the Peninsula, MTC is promoting the highest cost solution to a problem which many transit systems have solved through other lower cost measures. Furthermore, by making this determination without defensible criteria which include queuing capacity, time of delay, availability of alternative routes and cost, MTC has reduced this determination to assertion rather than analysis. The California PUC uses "exposure factor" in its grade separation program, but only as an index to compare competing projects, never as a way of saying yes or no to individual projects. Indeed, multiplying vehicle crossings by train crossings has no meaning as a measure of crossing activity.

- Page 56 SERVICE - The number 6,480 is not year 2000 "capacity" because trains could be run closer together, or have more cars. This number was determined by setting fleet sizes and train consists after a prediction of probable demand.

- Page 56, CAPITAL COSTS
  CALTRANS believes that the original capital costs contained in the "red book" were too high (see attachment). Some of these costs have been changed, but others remain. The structure and format of the estimates have

also changed, however, making adjustments difficult to trace. As near as we can determine, however, capital costs for the "Low" estimate are still $ 647 million too high. The "High" estimate was never acceptable to Caltrans and still is not.

- Page 57, "Other Cost Items of Interest"
  The "Third Track for Freight" is unnecessary under either alternative. "Electrification" at this cost would make this the most expensive project of this kind in the history of railroading, at least three times higher than it should be. Costs for "Grade Separations" are excessive and the "Transbay Terminal extension" costs $52.4 million more here than in Alternative 2 for no apparent reason.

- Page 57, <u>OPERATING COSTS AND REVENUE</u>
  These are derived from cost per car mile figures gathered from other similar commuter rail properties. The consultant found costs for "comparable" systems ranging from $5 to $11. He set CalTrain costs at $11.05 based on the difficulty he sees in conquering institutional barriers to cost-cutting. Because these institutional barriers, although formidable, have been conquered elsewhere, and because other comparable commuter rail systems, such as the electrified Chicago, South Shore and South Bend railroad, have costs as low as $6/car mile, including large crews and administration costs, CALTRANS believes a range of operating costs should be shown so that decision makers can understand that commuter rail does not have to be expensive by definition. At least a footnote to this effect was agreed to at a TAC meeting.

- Page 60, <u>Ridership</u>, 2nd Paragraph
  The 91,000 ridership figure for this alternative is a product of the limitations imposed during the alternatives definition phase of the study, not any inherent limitations of the mode. Electric trains could run three minutes apart like steam trains did. Skip-stop need not be used if a faster accelerating and decelerating electric car is specified. Nowhere in this report is the scheduling flexibility of commuter rail acknowledged nor the advantages this offers in tailoring service to demand. This is missing despite repeated CALTRANS requests.

- Page 61 - see previous grade separation discussion.

- Page 61, second paragraph, eleventh line: "Also a DC source could provide flexibility in transitioning from electric locomotives to a light rail system." This sentence suggests a bias, evident throughout the study, that light rail is inherently superior to commuter rail. This study is supposed to be asking whether such a "transition" would ever be necessary, not decide in advance that it is desirable. The study has so far not shown, except on the shakiest of technical data, that any mode is superior to any other. CALTRANS' contention that upgraded commuter rail can be implemented faster and more cheaply than any other high frequency rail alternative has so far not been disproven.

- Page 61, last paragraph - The "low" cost estimate should assume that the 63 gallery cars, now being acquired by CALTRANS, continue in service, requiring only 43 additional EMUs.

- Page 67, "550 new buses required to provide corridor service at a cost of $83 million." Because buses, unlike rail vehicles, must be replaced every 12 years, this cost should be expressed as a life-cycle cost for the alternative.

- Page 73, third paragraph, third line from the bottom: CalTrain is not part of this alternative.

- Page 80, Alternative 1, first bullet. The first sentence, "The current Caltrans purchase-of-service agreement with Southern Pacific would need to be renegotiated to operate more than 60 trains,"is not true. Renegotiation must take place for any service level above 52 trains. There is no 60-train limit in the contract. CALTRANS believes that there is no reason to establish, at this or any other time, an "upper limit on the number of passenger trains SP will permit".

- Page 83, first bullet- "Essentially the same as Alternative 4." What is essentially the same as Alternative 4?

- Page 83, second bullet - railroad unions will play a strong role in negotiations regardless of which rail alternative is chosen. This report should not pretend that Alternative 5 is the only place where this would happen.

- Page 86, Table 1B

  If adjustments are made to the low estimate on line 1, as Caltrans believes they should be the new number should be approximately $780 million. (See attachment on capital cost.)

  Operating costs, line 4, are arbitrary. The Technical Advisory Committee placed all costs for commuter rail alternatives at the same level, $8.60/car mile regardless of motive power or crewing. CALTRANS agreed to this arbitrary number only if a footnote was added to the table explaining that a range of costs per car mile is possible depending upon future events. According to the consultant, this range is $5 to $11. CALTRANS cannot accept figures at the high end of this range since the alternative was defined in Task I as having unmanned stations and two-person train crews. Comments or projections on the likelihood of these economies happening are therefore irrelevant. Furthermore, since, on page 98, second paragraph, a new authority is assumed to operate the system, any cost determination which has the existing CALTRANS/SP contract as its basis is also improper. Operating cost assumptions should be similar to those for light rail, except for differences in technology, which the consultant agrees are minor.

- Page 88, Alternative 2 - Just as in Alternative 5, "Grade Separation (CalTrain Baseline)" costs should be eliminated from this alternative because the separations were chosen without adequate criteria.

- Page 89, Alternative 5 - Tunnel to Tranbay Terminal is $52 million higher here than in Alternative 2 and there is no explanation.

- Page 90, Grade Separations, eleventh line: "Many streets would <u>require</u> grade separation, not because of the local traffic volumes, but because of the inability of the transit system to ascend or descend to grade prior to the next street <u>requiring</u> grade separation". (CALTRANS underlining). First, no grade separations are "required" for efficient transit operation. As discussed in CALTRANS' Long Range Plan, many rail systems run faster or more frequently than proposed for CALTRAIN and are not grade separated. But separations may be desirable to alleviate east-west vehicular traffic congestion if the benefits derived from individual projects can be achieved at reasonable cost. The "need" to grade separate additional streets where congestion isn't a problem but trains need to climb to aerial structures could conceivably tip the balance against separating any particular street.

- Page 90, final sentence, first paragraph: This sentence falsely conveys the impression that the low cost estimate contains costs for only twelve grade separations.

  It should be changed to read, "A $200 million commitment to grade separation need not be made, if other less expensive means are provided to deal with east-west traffic congestion caused by the high frequency service provided in Alternatives 4 and 5. Therefore, in order to provide policymakers with the proper range of costs, $0 for grade separations is shown in the "low" estimates."

- Page 90, second paragraph: Before any of the steps (raising tracks, lowering streets) in this paragraph are performed, meaningful criteria should be established for deciding whether grade separation is necessary.

- Page 104, Table 6: This table is strictly unsupported opinion and should be eliminated. If it stays however, it contains the following errors:

  - Environmental: equal rankings for CALTRAIN and Muni Metro extension improperly assumes the same ridership for either. Alternative 4 should have no higher a ranking than 3 or 5.

  - Development Stimulation: Extension of trains downtown makes train station air rights more attractive. Extension of Muni Metro will not "stimulate" development of Mission Bay. These two alternatives should therefore not be ranked the same.

- <u>Station Area Impact</u>: Muni Metro Extension would not improve traffic circulation unless it could attract more transit ridership from the Peninsula than the train extension. It can't so it wouldn't.

- <u>Construction Disruption</u> - It is silly to rank Alternatives 3 through 8 equally in this category.

- <u>Rider Acceptance</u> - Riders of light rail between San Jose and San Francisco would sacrifice comfort, capacity and speed in favor of frequency. This would not be necessary with Alternatives 3 & 5.

- <u>Long Term Capacity</u> - A Muni Metro Extension hasn't the same capacity potential as a commuter rail extension because 4-car Metro trains cannot accommodate fully loaded 10-car commuter trains.

- Page 101, Station Area Impacts, sixth line: "No attempt has been made at this stage of the planning process to determine appropriate traffic mitigation measures at stations;" This is not true. MTC and the consultant are recommending 45 grade separations at this stage of the planning process.

In our January 4th letter to you commenting on the Operational System Definition Phase of the study, CALTRANS expressed our mutual desire for a fair and impartial study. Fairness is still important and for that reason we have made our comments for the record. CALTRANS has always been willing to compare the commuter rail options to the best that BART, bus and light rail transit have to offer. But the comparison should be a fair one which also shows the commuter rail alternatives in their best light, not in a way that is arbitrarily chosen as "reasonable" or "realistic". Comparisons have repeatedly been made during this study in a way that has penalized commuter rail. As examples we can cite:

<u>Vehicle operating characteristics</u>: Commuter rail vehicles have been wrongly characterized as slow in acceleration and deceleration. This influenced ridership numbers.

<u>Headways</u> - BART was allowed 2-1/2 minute headways, better than that system has ever done in the past. Electrified

commuter rail was assigned 5 minute headways, far worse than SP trains performed with steam and diesel locomotives. This also adversely impacted ridership on commuter rail alternatives.

Capital Costs - When in doubt, the most expensive possible components have been assigned to commuter rail alternatives' costs. This is evidenced in the discussions of grade separation and electrification, and the amazing rolling stock costs that have BART cars costing $300,000 each less than electrified commuter rail cars.

Operating Costs - BART and light rail are assigned costs based on the best of existing systems. Upgraded commuter rail was assigned the worst of a wide range of costs.

In a study containing an alternative with the slowest vehicles, longest headways, equal capacity and highest cost, it isn't hard to predict the results. While these features may characterize some existing commuter rail systems, they needn't limit the one described in Alternative 5 and for fairness' sake, they shouldn't. Indeed, in Alternative 2, where the comparison is between CALTRANS' downtown extension and the Muni Metro extension, the Muni line is not a "real" extension, but one that has no transfer penalty, no fare penalty, no capacity constaints and no travel time difference. Again, CALTRANS must question the fairness of the study's assumptions.

We have tried not to be self-serving in our study participation. We have given on the issues of crewing and levels of service in Alternatives 1 & 2. We have given on fare collection systems and on per car capacities in Alternative 5. We compromised on the grade separation and operating cost issues only to have those compromises abandoned by MTC. We've done these things in order to keep the study moving. Now, however, with the study drawing to a close, CALTRANS wonders if commuter rail will be treated correctly.

CALTRANS has repeatedly expressed the belief that a fair and impartial study will show that an incrementally upgraded commuter rail line can handle any level of

Peninsula transit demand faster, more efficiently and more cheaply than any other mode. We could be wrong in this and a study based on solid data and valid assumptions might show we are wrong. But without those data, no valid conclusions can be drawn. CALTRANS hopes that it isn't too late to make the SCR 74 effort the clear evaluation of all alternatives that the legislature intended. We will continue to help to make it so.

Sincerely,

BURCH C. BACHTOLD
District Director

By

R. H. JAHRLING
Deputy District Director

Attachment

The following capital costs could be reduced or eliminated for the baseline commuter rail Alternatives 1, 2, 5 & 8:

1. *Since there is no requirement for a third track, costs for "Trackway (At-grade)" should be the same for Alternative 5 as for the other three commuter rail alternatives. Deduct $19.4 million from Alternative 5.

2. Under "STATIONS", Alternative 2 should be identical to Alternative 1, except for costs associated with the San Francisco and San Jose extensions which set these two alternatives apart. Deduct $7.0 million from Alternatives 2 & 8.

3. Because CALTRANS believes it is inappropriate to include costs for grade separations without having defensible criteria, all costs for "STATIONS, Aerial" should be deleted from each alternative. Deduct $5.1 million from Alternatives 2 & 8. Deduct $23 million from Alternative 5.

4. Under "YARD AND MAINTENANCE SHOPS" CALTRANS already has a $44 million maintenance facility (including right-of-way purchase) under "Committed Funds". This facility will be designed to accommodate our expansion plans and to allow for future electrification. $34.1 million included in Alternatives 2 & 8 should be deleted. Alternative 5 will have additional costs above those committed, however, they can also be reduced from the $34.1 million shown.

5. Because there is no requirement for a third track, and because there are no electrical clearance problems with existing tunnels, Alternative 5 costs for "MAJOR STRUCTURES, Tunnels" should be the same as Alternative 2 & 8. Deduct $39.8 million from Alternative 5.

6. Costs for "MAJOR STRUCTURES Grade Separations" should be eliminated from all commuter rail alternatives unless defensible criteria are developed for selection of appropriate grade separations. Deduct $2.3 million from Alternatives 2 & 8. Deduct $11.5 million from Alternative 5.

7. CALTRANS cannot accept aerial guideway as necessary or desirable for any of the commuter rail alternatives. Deduct $38.0 million from Alternatives 2 & 8. Deduct $130.9 million from Alternative 5.

8. There should be no "Modification to Existing Facilities" in Alternative 5, Segments 2A3, 4A3 & 5A3, which doesn't also take place in Alternative 2 & 8. Deduct $14.1 million from Alternative 5.

9. ."TRACK WORK/GUIDANCE" costs in Alternatives 2 & 8 should be the same as those for Alternative 1, except for those segments that include the Downtown and San Jose extensions. Deduct $18.8 million from Alternative 2 and 8. Alternative 5 should have costs for these items similar to Alternatives 2 & 8 except that the San Jose Terminal is assumed to be at Bassett. Deduct at least $77.9 million.

10. SURFACE MODIFICATION/UTILITY RELOCATION should be the same for common segments in all alternatives, unless something demonstrably different is being done. Deduct $19.6 million from Alternative 2, $19.5 million from Alternative 8 and at least $39.4 million from Alternative 5.

11. *Rolling Stock estimates under Alternatives 1 & 2 should be no more than $15 million for 13 additional cars. Deduct $94.7 million. Alternative 5 estimate should include the $15 million for these cars plus 130 EMU's at $1.2 million each plus 18 electric locomotives at $2.0 million each. This lowers costs to $207 million and allows us to deduct $341.4 million.

12. All our research, consultation and discussion indicate that electrification of this line could be done for $50 million. The consultant shows "TRACTION POWER & DISTRIBUTION" as $179.2 million. Deduct $80 million from Alternative 5.

13. Signaling cost should be the same for common segments of all alternatives. Committed funds include conversion to CTC. Electrification costs include signalling. Deduct $1 million from Alternative 2, $4.4 million from Alternative 8 and $16.3 million from Alternative 5.

14. *If the low end of a range of right-of-way costs is used instead of the high end, Alternative 5 could be further reduced by $ 75 million.

With these reductions, the old and new commuter rail "SUBTOTAL" line-items are:

	Unadjusted	Adjusted
Alternative 1	$ 117.5 million	$ 22.8 million
Alternative 2	$ 527.1 million	$306.5 million
Alternative 5	$1,606.4 million	$713.6 million
Alternative 8	$ 396.9 million	$267.7 million

If the consultant's percentages for "ENGINEERING & MANAGEMENT", "OWNER COSTS" and "CONTINGENCY" are applied to these new numbers, further reductions in the bottom line costs are possible. In Alternative 1 where the percentages should be the same as in Alternative 2, deduct $55.4 million. In Alternative 2 deduct $65.3 million. In Alternative 5, deduct $399.3 million. In Alternative 8, deduct $30.1 million. When all this is done the following savings result for the commuter rail portions of Alternatives 1, 2, 5 & 8.

	Unadjusted	Adjusted	Savings
Alternative 1	$ 180.4 million	$ 30.4 million	$ 150.0 million
Alternative 2	694.2 million	408.2 million	286.0 million
Alternative 5	2,379.9 million	1,087.2 million	1,292.7 million
Alternative 8	515.7 million	356.5 million	159.2 million

*These overestimates, acknowledged by MTC to be in error in the consultant's original "red book", have been adjusted in the cost estimates contained in the summary report. Rolling stock costs have also been reduced due to lower fleet requirements discovered after patronage estimates. With these adjustments Alternative 2 is now $126 million too high. Alternative 5 is $457 million too high and Alternative 8 $34 million too high. With "Engineering & Management", "owner costs" and "contingency" included, the overestimates are $161 million for Alternative 2, $647 million for Alternative 5 and $36 million for Alternative 8.

BART
BAY AREA RAPID TRANSIT DISTRICT
800 Madison Street
P.O. Box 12688
Oakland, CA 94604-2688
Telephone (415) 464-6000

April 8, 1985

Chris Brittle
Metropolitan Transportation Commission
101 - 8th Street
Oakland, CA 94607

Dear Chris:

BART staff would like to document the following comments and findings concerning the Peninsula Mass Transit Study (SCR 74) which were presented to the Transit Operators Coordinating Committee (3/27/85) and the PENTAP Committee (3/29/85):

1. Expansion Capacity - The PENTAP Committee has requested that the expansion capability of each mode be included in the Operation Data Table of the Summary Report. Although the most recent version of the Summary Report does include a discussion of the expansion capabilities of each mode, the table does not provide corresponding information.

Staff reiterates the original request by PENTAP to include information in a summary form. As examples, attached are a chart with numbers taken directly from the text discussion and a copy of the Operating Data Table with an example of an expansion capacity line item.

2. End of the Line Parking - BART would like to document concerns with the description of parking demand on Page 71 of the Summary Report. We request the text emphasize that the table displays parking demand without parking space constraints and explain that the number of parking spaces provided at each station would serve to control demand and therefore traffic impacts. The report should also note that the purpose of providing parking at the last three stations is to diffuse parking impacts rather than concentrate them at the end-of-the-line station.

3. Electrification Review of the Commuter Rail Alternative #5 - At the March 1st PENTAP meeting Commissioner Doris Kahn requested a BART staff review of the cost estimates and assumptions developed by Kaiser Engineers for an electrified commuter rail system (Alternative #5) on the Peninsula.

The request for a BART review was in response to concerns expressed by representatives of the citizens group, Peninsula Rail 2000, as presented to PENTAP.

BART's Engineering Department reviewed Kaiser's October 31, 1984 Basis of Cost Estimate (84118-040), Table 3.4 and January 14, 1985 Cost Pricing Sheet for Alternative 5 and found that the items described in relation to level, type, spacing, quantities and cost are reasonable in comparison to existing or planned modifications to the BART system. BART's Engineering Department also concluded that the use of the dedicated utility feeders and dual 34.5 KV circuits to the traction substations is considered to be reasonable based upon cost effectiveness and operational reliability.

Thank you for this opportunity to respond to BART's concerns with the Peninsula Mass Transit Study (SCR 74). Please direct any comments or questions to me at 464-6164 or Karen Wallsten at 464-6171.

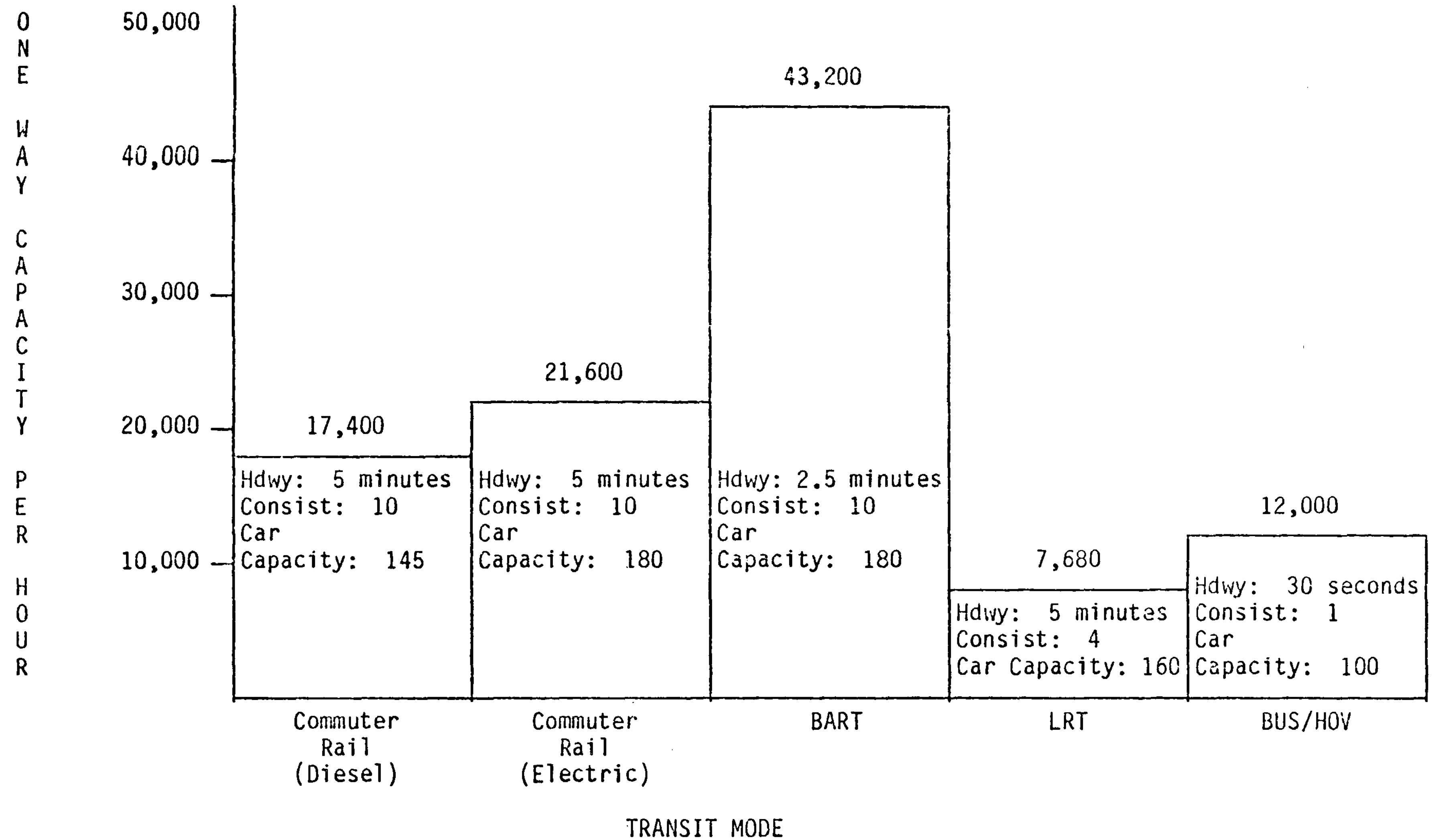
Sincerely,

Karen Wallsten
for Dick Wenzel
Supervisor of Extension Planning/
Transit Subcommittee Member

DW:KW:mjo

cc: G. Garfinkle, Director
K. Bernard
H. Goode
B. Neustadter
K. Wallsten

TRANSIT CAPACITY



BART PLANNING
KW 4/08/85

Source: Peninsula Mass Transit Study

Table 2-A
Operating Data for Baseline Alternatives
(Year 2000)

	Existing (1984)	Alt. 0 Status Quo	Alt. 1 TSM	Alt. 2 Min Ext.	Alt. 3 BART to SJ	Alt. 4 LRT to SJ	Alt. 5 Elect Rail	Alt. 6 Bus/HOV	Alt. 7 BART/LRT	Alt. 8 BART/CalTrain
1. System Length (miles)	47	47	47	63[(a)]	41	44	49	36[(b)]	8/36	8/49
2. Train Size (No. Cars)										
a. Peak	5	5	5	5	4	4	3	NA	4/4	4/5
b. Off-Peak	3	3	3	3	4	4	3	NA	4/4	4/3
EXPANSION CAPACITY*	-	-	-	-	43,200	7,680	17,400	12,000	-	-
3. Max. Load Point Demand[(c)] (Pass/Hr.-Peak Dir)		2,640	4,320	4,500	10,700	6,840	6,480	11,580	10,700/4,740	9,000/3,600
4. Service Frequency (min)										
a. Peak	4- 8	10[(d)]	10[(d)]	10[(d)]	3.75	5	5[(d)]	1	3.75/5	3.75/10[(d)]
b. Mid-day	60-120	60-120	30-60	30-60	7.5	10	15	30	7.5/10	7.5/30-60
c. Evening	90-120	120	60	60	20	10	30	30	20/10	20/60
5. Peak Travel Time (min)										
a. SF to SJ	66- 85[(e)]	82	84	75	82	80	68	144	89	75
b. RC to SF	29- 50[(e)]	50	53	44	53	45	40	45	54	44
c. SF to SFO	25	NS	34	25	34	26	24	29	32	25
6. Daily Ridership (Year 2000)[(f)]										
a. BART	18,000	20,400	21,400	24,100	117,700	17,300	18,300	17,100	76,900	50,700
b. Commuter Rail	16,000	19,700	24,700	44,400	-	-	96,500	-	-	36,200
c. LRT	-	-	-	-	-	110,500	-	-	70,200	-
d. Express Bus	11,600	33,000	27,000	13,000	14,000	8,000	9,000	122,100	17,000	9,000
e. Total	45,600	73,100	73,100	81,500	131,700	135,800	123,800	139,200(g)	164,100	95,800
7. Daily Transferring Riders		-	-	-	-	-	-	-	33,000	9,000
8. Annual Ridership (000's)[(h)]		21,690	21,690	24,220	39,370	40,540	37,000	44,190	39,220	26,080
9. Percent of Corridor Work Trips by Transit		13.0	13.4	13.4	14.2	14.0	13.8	14.2	13.9	13.5
10. VMT Reduction[(i)]			Base	-15,000	-187,000	-119,000	-124,000	-135,000	-125,000	-20,000
11. Annual Passenger-Miles (millions)[(j)]			249.8	282.7	623.4	504.3	510.9	401.5	520.0	324.3

(a) Includes BART to Serramonte: 1.7 miles; CalTrain to Transbay Terminal: 1.5 miles; CalTrain SF to Coyote Valley: 60 miles
(b) Grade separated busway, Redwood City to San Francisco
(c) Maximum peak hour load on system, given service frequency on Line 4
(d) Skip-stop service. Frequency is that of trains on the line; A & B trains stop at alternate stations, with selected "all stop" stations for transfers between trains.
(e) Depending on whether trains are local or zone express.
(f) Work, non-work, and air passenger trips.
(g) The feasibility of accommodating large numbers of buses in San Francisco to serve this projected demand remains to be determined
(h) Daily work and non-work trips multiplied by 295; daily air passenger trips multiplied by 365.
(i) Reduction in automobile vehicle miles traveled (VMT) in corridor during peak hour due to transit improvements.
(j) Passengers x miles traveled; includes work, non-work, and air passenger trips on line haul modes.

*ONE WAY CAPACITY PER HOUR

(0707Z)

PUBLIC UTILITIES COMMISSION
CITY AND COUNTY OF SAN FRANCISCO

DIANNE FEINSTEIN, Mayor
RUDOLF NOTHENBERG, General Manager

UTILITIES ENGINEERING BUREAU
LEO JED, Deputy General Manager and Chief Engineer

SAN FRANCISCO MUNICIPAL RAILWAY

HETCH HETCHY WATER AND POWER

SAN FRANCISCO WATER DEPARTMENT

March 26, 1985

Ms. Doris Kahn
3259 Clay Street
San Francisco, California 94115

Subject: CALTRAIN Electrification Study
Comments

Dear Ms. Kahn:

I have reviewed the subject material from you, which Rudi Nothenberg forwarded to UEB, and agree that the electrification costs appear extremely high for the proposed service. I have made a few comments on the specific alternatives presented, and have noted a few internal descrepancies.

Incidentally, you are wise to question the "type" of electricity used. For the proposed electrified service, high voltage alternating current, such as 25 KV ac, would be a wise selection. In general, direct current (dc) is more costly for new systems. Nowadays, its use is usually limited to extensions of existing dc systems, or to third rails systems. I have attached a paper by H. I. Hayes which touches on this subject.

Memo of February 12, 1985
The facts disagree with the content of this memo. In California, BARTD is the only electrified system which has its own primary service cables on its own right-of-way. Muni, Sacramento, San Diego and Santa Clara all have individual primary service from a nearby local utility source for each substation. Muni doesn't pay extra for dedicated service (I don't know about the others). However, Muni did pay an extra initial charge for the installation of a second service to the six(6) substations serving the underground portions of the system (for reliability); the remaining thirteen (13) Muni substations have single service, (Power outages on Muni are very rare.)

Peninsula Mass Transit Study
The approach described is typical of BARTD, but it is not in accordance with standards practiced by light rail transit. In general, light rail uses single unit substations, with a single primary each from a nearby existing local utility. There is no need for special utility-owned substations, such as 115KV ac to 34.5 KV ac, to provide primary circuits.

693 VERMONT STREET, SAN FRANCISCO, CALIFORNIA 94107 · (415) 558-3821

Reliability and load sharing is accomplished by interconnections of the transit power feeder circuits, the use of dual primary, dual unit substations seems exhorbitant.

Note: This study indicates primary power cables would be buried (Section 1.2), but Alternative 5 indicates power cables would be aerial, on catenary poles (page 10). Which is correct? What about communication cable(s) for signals, telemetry and control (page 25)?

<u>Alternative 5</u>
<u>Substations</u>
There seem to be too many substations. Why are they spaced at 2 mile intervals, if the shortest average train spacing is 9 miles (page 2)? This study shows that substations could be 4 miles apart (page 4). (With high voltage ac, even fewer substations would be needed.) Why have dual units for "maximum" reliability (page 2)? Is this appropriate? (Do we use Mercedes-Benz automobiles for pool cars, or do we use cars with less than "maximum" reliability?)

<u>Support Structures (Catenary Poles)</u>
The description of the spacing (and, therefore, the overall total) is inconsistent; it is shown as both 200 feet (page 10) and 150 feet (pages 12 and 24).

They are both short for catenary construction, as 300 feet is more typical for tangent (straight) runs.

<u>Costs</u>
Substation costs can be reduced if the quantity is reduced, and if single units are used. Why is there a 35% surcharge for this work; how will existing train traffic hinder substation installation?

Catenary costs can be reduced if poles are spaced farther apart, and if the quantity of feeder circuits is reduced commensurate with the level of service. Also, is it appropriate to assume an average of one electric turnout (track switch and switch machine) (pages 24 and 25), and one grade crossing (page 25) per single track mile?

There are several "miscellaneous lots" and an entry of "office equipment" that together contribute about 15-20% to the overall total. It would be helpful if there were more details as to what these items covered, as these costs are not insignificant.

I trust that this comments will help you and the other MTC Commissioners in your review of the CALTRAIN alternatives. If you need further clarification, or have more questions on this subject, please call me, at (415) 558-2281.

Very truly yours,

Galen Sarno

Galen Sarno
Supervisor
Electrical Section

GS:pd

Enclosure

cc: R. Nothenberg
L. Jed
R. Brandt
File - CALTRAIN
Lib File

5. Alternative 1: Ridership under Transit Status Quo (Alternative 0) and TSM Actions (Alternative 1) is projected to remain at 71,000 despite a capital expenditure of $152.6 million. Please explain.

6. Alternative 5: The Director of Caltrans District 4 has indicated in a previous letter that capital cost estimates for Upgraded Commuter Rail are not accurate. We are particularly concerned about the costs assigned to electrification and grade separations. Will you please address these issues?

7. Patronage Projections: There have been several assertions that patronage projections for the year 2000 make no provision for increased congestion on West Bay highways. Will this place the region at a disadvantage in competition for federal funding with regions that have factored future congestion?

Thank you for your attention to this request. The San Mateo County Transit District Board is vitally concerned that inaccurate patronage and cost information in the Mass Transit Study could adversely impact efforts to construct adequate future programs to mitigate West Bay corridor congestion.

Sincerely,

Miriam L. Gholikely
Chairman of the Board

MLG:ts

cc: Robert I, Schroder, MTC Chairman
Lawrence Dahms, MTC Executive Director

Appendix B

PLACE OF WORK VERSUS PLACE OF RESIDENCE
Superdistricts 1-9, 11 (Corridor) Plus 10, 12, 13
(Rest of Santa Clara County)

KEY	
XXX	2000
YYY	1980
ZZZ	1970

PLACE OF WORK

PLACE OF RESIDENCE	1	2	3	4	5	6	7	8	9	11	10	12	13	16	17
1	46,177 35,054 43,279	7,188 5,323 4,499	6,327 4,013 4,287	1,122 918 768	2,741 1,537 1,506	401 256 352	216 147 220	251 187 171	217 103 192	135 65 38	0 0 28	66 28 31	0 0 0	59 30 32	205 169 132
2	56,883 51,740 46,844	28,807 25,518 29,274	13,268 11,393 10,579	3,048 2,793 2,357	4,054 3,232 3,560	1,076 867 524	734 524 482	534 468 444	694 438 163	187 98 112	251 148 49	84 43 10	0 0 14	127 158 90	247 408 306
3	56,537 53,442 43,029	15,134 13,506 12,925	34,244 29,082 35,829	3,644 3,590 3,609	9,341 7,886 6,583	1,788 1,464 940	1,324 959 1,166	498 438 646	855 524 330	88 56 100	35 23 66	145 88 25	0 0 14	286 183 87	677 607 336
4	25,984 25,187 22,612	9,409 8,303 7,357	9,000 7,807 8,222	6,901 6,628 7,718	4,201 3,488 2,257	887 783 359	366 300 400	273 221 338	665 931 159	252 120 50	151 86 24	57 32 1	34 22 9	107 72 34	205 171 96
5	33,984 31,720 23,478	8,970 7,739 6,049	17,122 14,110 15,525	2,885 2,702 2,530	60,007 48,826 36,621	8,505 7,255 5,013	5,076 3,740 3,151	946 816 843	1,515 1,020 479	491 278 156	354 231 59	118 68 54	66 31 16	241 182 65	711 690 312
6	11,800 10,464 8,221	2,263 1,806 1,153	3,948 3,111 3,270	744 694 325	24,828 19,703 14,400	44,850 34,930 24,890	15,582 10,870 7,287	3,524 2,874 1,604	4,079 2,384 698	804 373 173	798 405 102	235 134 57	156 85 25	474 312 98	932 825 388
7	4,504 4,236 4,708	713 556 571	1,621 1,301 1,711	264 267 182	8,817 6,788 6,314	10,785 8,129 6,173	53,191 39,887 35,804	17,815 16,631 12,664	9,435 6,077 2,728	1,127 625 624	2,093 1,108 386	973 512 155	203 110 67	350 281 91	400 380 235
8	1,920 2,070 2,260	175 164 267	198 180 541	92 97 90	1,201 1,177 2,145	1,561 1,471 1,225	8,913 7,299 7,036	49,949 44,924 35,400	21,510 16,541 9,846	3,825 2,369 2,001	4,018 3,003 2,780	977 676 817	904 498 275	414 231 222	186 210 189
9	900 977 1,227	116 111 190	213 203 455	19 23 80	1,260 1,346 2,072	767 753 639	4,766 4,072 3,795	18,758 16,809 13,645	71,666 57,014 32,691	9,558 6,463 6,559	12,614 9,832 5,145	3,317 2,308 1,858	1,475 917 450	504 369 263	138 170 234
11	506 601 515	6 7 143	60 75 255	9 14 36	335 361 731	372 387 312	1,314 1,141 947	5,394 5,096 2,907	36,376 27,230 12,431	48,768 34,422 38,187	16,639 13,423 8,896	11,593 7,901 4,577	9,698 5,668 2,745	1,243 891 827	361 408 268
10	839 1,016 1,105	89 93 214	181 181 587	27 33 122	1,126 1,217 2,289	685 702 580	3,328 3,056 2,827	13,783 13,928 10,109	57,925 48,191 25,004	29,257 22,546 21,529	54,406 44,774 30,819	6,870 5,352 3,309	8,013 5,252 2,295	1,112 832 485	314 360 285
12	714 632 305	34 38 55	313 255 236	0 0 9	1,371 1,058 963	664 513 264	2,161 1,493 1,180	8,510 6,531 3,168	62,796 39,422 9,624	33,284 18,822 12,321	12,649 8,336 2,996	34,967 19,713 10,408	8,625 4,016 818	3,577 1,904 1,126	702 701 354
13	463 491 205	31 24 39	103 104 113	0 0 2	557 541 363	459 318 138	848 617 438	3,807 3,667 1,193	27,865 20,033 5,303	31,934 21,447 10,232	15,416 11,451 4,003	7,319 4,959 1,701	29,264 16,432 5,405	553 421 206	273 331 56
16	5,309 4,294 971	544 453 171	706 573 547	34 26 72	3,190 2,537 1,649	2,167 1,544 443	5,483 3,372 1,690	3,925 2,939 1,592	17,619 9,512 2,333	5,270 2,522 896	2,110 1,191 445	4,233 2,016 442	409 268 94	56,349 35,171 22,066	20,602 17,074 8,794
17	7,129 5,469 4,073	668 514 626	1,649 1,126 1,396	171 109 207	2,076 1,446 2,004	1,667 1,035 632	1,790 986 1,103	785 484 910	4,251 2,061 941	1,446 606 295	642 325 149	1,020 445 188	331 144 9	13,530 7,172 5,445	93,246 62,564 50,387

Appendix C
ORIGINS AND DESTINATIONS OF CORRIDOR WORKERS USING TRANSIT
(Average Weekday)

FROM: \ TO:	SF/CBD	SF/Rest of City	San Mateo County	Santa Clara County	Row Total
SF/CBD			1 - 1,120	1 - 420	0 - 1,540
			2 - 990	2 - 420	2 - 1,410
			3 - 1,600	2 - 540	3 - 2,140
			4 - 1,500	4 - 530	4 - 2,030
			7 - 1,580	7 - 500	7 - 2,080
			T - 5,090	T - 1,000	T - 6,090
SF/Rest of City			1 - 8,210	1 - 2,160	1 - 10,370
			2 - 8,210	2 - 2,220	2 - 10,430
			3 - 11,020	3 - 3,680	3 - 14,700
			4 - 9,950	4 - 3,300	4 - 13,250
			7 - 10,570	7 - 3,200	7 - 13,770
			T - 37,990	T - 7,480	T - 45,470
San Mateo County	1 - 17,170	1 - 5,450	1 - 19,340	1 - 4,710	1 - 46,670
	2 - 17,280	2 - 5,480	2 - 19,340	2 - 4,840	2 - 46,940
	3 - 19,020	3 - 6,230	3 - 22,000	3 - 7,750	3 - 55,000
	4 - 19,430	4 - 6,190	4 - 21,590	4 - 7,220	4 - 54,430
	7 - 18,330	7 - 6,070	7 - 21,910	7 - 7,130	7 - 53,440
	T - 78,020	T - 59,290	T -344,450	T - 73,660	T -555,420
Santa Clara County	1 - 2,450	1 - 410	1 - 3,030	1 - 43,780	1 - 49,670
	2 - 2,500	2 - 410	2 - 3,060	2 - 44,500	2 - 50,470
	3 - 2,730	3 - 480	3 - 3,760	3 - 46,180	3 - 53,150
	4 - 2,870	4 - 500	4 - 3,500	4 - 45,270	4 - 52,740
	7 - 2,470	7 - 460	7 - 3,610	7 - 45,270	7 - 51,810
	T - 7,570	T - 2,390	T - 45,990	T -1,163,080	T - 1,219,030

Legend	Service
1 - Alt. 1/TSM Actions	6 peak hour trains; more northbound than southbound service
2 - Alt. 2/Minimum Rail Extensions	6 peak hour trains; CalTrain to Transbay Terminal, BART to Serramonte, CalTrain to Coyote Valley; more northbound than southbound service
3 - Alt. 3/BART to San Jose	16 peak hour trains; balanced northbound and southbound service
4 - Alt. 4/LRT to San Jose	12 peak hour trains; balanced northbound and southbound service
7 - Alt. 7/BART-LRT Combination	16 peak hour BART trains to SF Airport, 12 peak hour LRT trains from SJ to SF Airport; balanced northbound and southbound service
T - Total Home Based Work Trips	

Table includes workers on all forms of transit including local bus routes; however, differences in figures compared to Alternative 1 are due to changes in the line haul rail modes.

Appendix D-1

DAILY PASSENGERS BY STATION

(Boardings)

	Alt 0	Alt 1	Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Alt 6	Alt 7a	Alt 7b	Alt 8b
San Francisco	-	-	6550	-	-	-	20,000	14,190	-	-	-	-
Mission Bay	4250	6120	3240	9140	3760	-	5380	6240	1440	4890	-	4870
22nd Street	200	210	300	300	860	-	710	370	690	980	-	240
Palou	-	-	-	-	3000	-	4200	2560	3870		-	-
Bayshore	880	820	1220	1190	4290	-	5090	3520	4540	4540	-	800
Butler Road	780	690	1160	1020	2450	-	4500	3330	3490	3770	-	1110
Balboa Park	7820	7930	7810	7930	8020	7980	6880	7270	6700	9480	8490	7480
Daly City	9960	10,150	7950	8,100	10,220	10,160	8770	9240	8530	12,050	10,810	9520
Serramonte	-	-	3540	3490	5350	5210	-	-	-	5420	5380	4950
Chestnut	-	-	-	-	4340	4540	-	-	-	4400	4690	4710
San Bruno	390	160	230	210	5700*	3880	1980	1280	1130	6200*	1710	3200*
SFO	-	1010	1380	1390	5750*	5080	1980	1450	4290	11,120*	16,250*	5060*
Millbrae	880	540	770	830	5320	3780	3780	2910	1370	32,170*	23,060*	11,950*
Burlingame	1110	870	1340	1280	4150	3850	4160	2890	2380	2520	2040	980
San Mateo	500	640	950	950	4000	3740	3850	2680	3150	3720	3570	1070
Hillsdale	1620	1950	2620	2080	5910	6080	5570	4960	3550	5140	4860	2550
Belmont	540	1100	1480	1560	4800	4810	4500	3470	3090	4360	4210	1740
San Carlos	500	990	1410	1410	3820	3760	3550	2750	2960	3460	3330	1370
Redwood City	620	1170	1660	1670	5160	5190	4680	3340	1210	4580	4510	1580
Menlo Park	460	700	1030	940	3630	3640	3280	2690	-	3080	3030	1150
Palo Alto	1090	660	2280	2190	2200	2020	1950	1840	-	1840	1810	1100
California	660	800	1170	1160	4490	4520	3420	2520	-	3290	3240	1300
San Antonio	540	480	710	700	2530	2540	2300	1800	-	2190	2170	810
Mt. View	1070	860	1320	1220	4560	4910	3760	3090	-	2940	2900	1270
Mary	-	-	-	-	-	-	1078	-				
Sunnyvale	1110	1320	1830	1810	4880	5060	3370	3740	-	2590	2570	1910
Lawrence	460	490	740	730	3000	2230	2170	1370	-	1640	1620	680
Bowers	-	-	-	-	-	-	1410	-	-	1120	1120	-
Scott	-	-	-	-	-	-	1500	-	-	640	1100	-
Santa Clara	160	260	520	500	2660	2550	1520	1480	-	1180	1170	390
San Jose	1220	1130	2180	2160	4390	4360	3890	3350		3350	3370	1610
Alma	-	1010	2180	1980	3460	3710	2830	3000	-	2840	2820	1270
Capitol	-	-	1940	1970	-	-	-	-	-	-	-	-
Blossom Hill	-	-	740	740	-	-	-	-	-	-	-	-
Bernal	-	-	320	320	-	-	-	-	-	-	-	-
Bailey	-	-	300	300	-	-	-	-	-	-	-	-

* Includes transfers

Legend: 2a (CalTrain to Transbay); 2b (Muni Metro extension to 4th & Townsend); 3c (BART with Muni Metro in Bay Shore Corridor); 3b (BART with bus in Bayshore Corridor); 7a (BART/LRT combo. with LRT from SF to SJ); 7b (BART/LRT combo. with LRT from Airport to SJ); 8b (BART/CalTrain combo. with Muni Metro extension in SF)

Appendix D-2

NUMBER OF PARKING SPACES

	0	1	2a	2b	3a	3b	4	5	6	7a	7b	8b
BART STATIONS												
Serramonte	N/A	N/A	1610	1590	1690	1680	N/A	N/A	N/A	1740	1700	1540
Chestnut	N/A	N/A	N/A	N/A	910	870	N/A	N/A	N/A	1080	770	1180
PENINSULA STATIONS												
Bayshore	330	370	400	380	-	-	1980	1380	1780	-	-	260
Butler Road	20	60	70	60	-	-	310	230	270	-	-	20
San Bruno	90	20	20	20	380	340	300	200	190	160	140	150
SFO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	330	330	150
Millbrae	280	180	190	190	770	780	870	770	370	1360	1320	1040
Burlingame	280	50	260	270	710	670	740	520	430	440	340	210
San Mateo	150	230	230	240	690	690	720	560	660	640	620	280
Hillsdale	580	820	820	840	1630	1600	1570	1460	970	1380	1280	820
Belmont	220	600	590	600	1710	1610	1640	1280	1220	1570	1510	630
San Carlos	130	280	270	280	690	670	650	590	520	620	600	300
Redwood City	170	280	280	280	880	880	820	600	310	780	770	280
Menlo Park	180	290	290	290	970	986	900	660	N/A	830	810	300
Palo Alto	440	220	210	200	400	380	370	1020	N/A	340	330	260
California	110	120	130	120	420	410	400	270	N/A	370	370	110
San Antonio	140	140	140	140	520	530	520	350	NA	480	480	150
Mt. View	180	150	150	160	520	530	460	340	N/A	360	360	150
Mary	N/A	N/A	N/A	N/A	N/A	N/A	180	N/A	N/A	140	140	N/A
Sunnyvale	620	780	740	730	1640	1680	1340	1330	N/A	1020	1010	730
Lawrence	30	30	30	30	200	200	230	80	N/A	180	170	30
Bowers	N/A	N/A	N/A	N/A	N/A	N/A	350	N/A	N/A	270	270	N/A
Scott	N/A	N/A	N/A	N/A	N/A	N/A	30	N/A	N/A	30	30	N/A
Santa Clara	110	130	140	140	610	620	410	350	N/A	320	320	120
San Jose	780	580	580	570	1420	1310	1350	1150	N/A	1090	1100	660
Alma	N/A	710	540	420	1330	1370	1300	1420	N/A	1090	1090	630
Capitol	N/A	N/A	870	890	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Blossom Hill	N/A	N/A	350	350	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bernal	N/A	N/A	150	150	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bailey	N/A	N/A	160	160	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Legend: 2a (CalTrain to Transbay); 2b (Muni Metro extension to 4th & Townsend); 3a (BART with Bayshore LRT); 3b (BART with Bayshore bus); 7a (BART/LRT combo. with LRT from SF to SJ); 7b (BART/LRT combo. with LRT from Airport to SJ); 8b (BART/CalTrain with Muni Metro extension in SF)

APPENDIX E

Exposure Factors

(Daily Trains x Average Daily Street Traffic)

Street	Date of Count	Vehicles Per Day	Current 52 Trains/day (46 passenger + 6 freight)	Alts. 1 (TSM), 2 (Min. Rail Extns.) 8 (BART/Caltrain) (74 Trains/Day)	Alt. 5 (Elec. Comm. Rail) (196 Trains/Day)
16th Street	1984	5,000	260,000	370,000	980,000 (c)
Mariposa	1984	6,000	312,000	444,000	1,176,000
San Bruno**	1983	21,000	1,092,000	1,544,000 (c)	4,116,000 (c)
San Mateo**	1983	6,400	332,800	473,600 (c)	1,254,400 (c)
Angus	1983	4,100	213,200	303,400 (c)	803,600 (c)
Millbrae**	1978	40,000	2,080,000	2,960,000 (c)	7,840,000 (c)
Broadway**	1975	21,000	1,092,000	1,554,000 (c)	4,116,000 (c)
Oak Grove	1976	2,800	145,600	207,200	548,800 (c)
North Lane	1984 est.	3,000	156,000	222,000	588,000 (c)
South Lane	1984 est.	500	26,000	37,000	98,000 (c)
Howard	1984	5,000	260,000	370,000	980,000 (c)
Bayswater	1983	2,200	114,400	14,800	431,200 (c)
Peninsula**	1976	12,000	624,000	888,000	2,352,000 (c)
Villa	1976	900	46,800	66,600	176,400 (c)
E. Bellvue	1976	1,120	58,200	82,880	219,520 (c)
1st St.**	1979	2,200	114,400	162,800	431,200 (c)
2nd St.**	1979	2,200	114,400	162,800	431,200 (c)
3rd St.	1979	14,800	769,600	1,095,200	2,900,800 (c)
4th St.	1983	10,900	566,800	806,600	2,136,400 (c)
5th St.	1979	5,000	260,000	370,000	980,000 (c)
9th St.**	1979	8,900	462,800	658,600	1,744,400 (c)
E. 25th St.	1979	9,200	478,400	680,800	1,803,200 (c)
Ralston**	1979	25,000	1,300,000	1,850,000 (c)	4,900,000 (c)
Harbor	1979	11,000	572,000	814,000 (c)	2,156,000 (c)
Holly	1982	18,000	936,000	1,332,200 (c)	3,528,000 (c)
Howard	1982	11,000	572,000	814,000	2,156,000
Whipple**	1976	28,000	1,456,000	2,072,000 (c)	5,488,000 (c)

**Possible grade separation suggested by City Public Works Department.

Notes: (c) Candidate for grade separation. Some streets would have to be grade separated due to need for an adjacent street to be grade separated, and inability of transit system to return to grade prior to reaching next street.
Daily trains include 6 freight movements per day, which is the current number.
Factors do not include growth in local street traffic or freight service.

APPENDIX E (Continued)

Exposure Factors

(Daily Trains x Average Daily Street Traffic)

Street	Date of Count	Vehicles Per Day	Current 52 Trains/day (46 passenger + 6 freight)	Alts. 1 (TSM), 2 (Min. Rail Extns.) 8 (BART/Caltrain) (74 Trains/Day)	Alt. 5 (Upgr. Comm. Rail (196 Trains/Day)
Brewster	1976	12,000	624,400	888,000	2,352,000 (c
Broadway	1976	12,000	624,000	888,000	2,352,000 (c
Jefferson	1976	16,000	832,000	1,184,000	3,136,000 (c
Maple	1976	3,000	156,000	222,000	588,000 (c
Main	1976	8,000	416,000	592,000	1,568,000 (c
Chestnut	1976	10,000	520,000	740,000	1,960,000 (c
5th Ave.**	1984	15,100	785,200	1,117,400	2,959,600 (c
Fair Oaks	1981	3,300	171,600	244,200	646,800
Watkins	1981	1,600	83,200	118,400	313,600
Encinal	1982	2,500	130,000	185,000	490,000
Glenwood**	1982	6,000	312,000	444,000	1,176,000 (c
Oak Grove	1982	11,000	572,000	814,000	2,156,000 (c
Ravenswood**	1982	20,000	1,040,000	1,480,000 (c)	3,920,000 (c
Alma St.	1984	16,400	852,800	1,213,800	3,214,400 (c
Churchill	1984	10,700	556,400	791,800	2,097,200
Meadow Dr.	1981	11,100	577,200	821,400	2,175,600
Charleston	1981	16,300	847,600	1,206,200	3,194,800 (c)
Rengstorff**	1985	24,500	1,274,000	1,813,000 (c)	4,802,000 (c)
Castro**	1985	27,100	1,409,200	2,005,400 (c)	5,311,600 (c
Mary**	1982	16,000	832,000	1,184,000	3,136,000 (c
Sunnyvale	1982	16,700	868,600	1,235,800	3,273,600 (c

**Possible grade separation suggested by City Public Works Department.

Notes: (c) Candidate for grade separation. Some streets would have to be grade separated due to need for an adjacent street to be grade separated, and inability of transit system to return to grade prior to reaching next street.
Daily trains include 6 freight movements per day, which is the current number.
Factors do not include growth in local street traffic or freight service.