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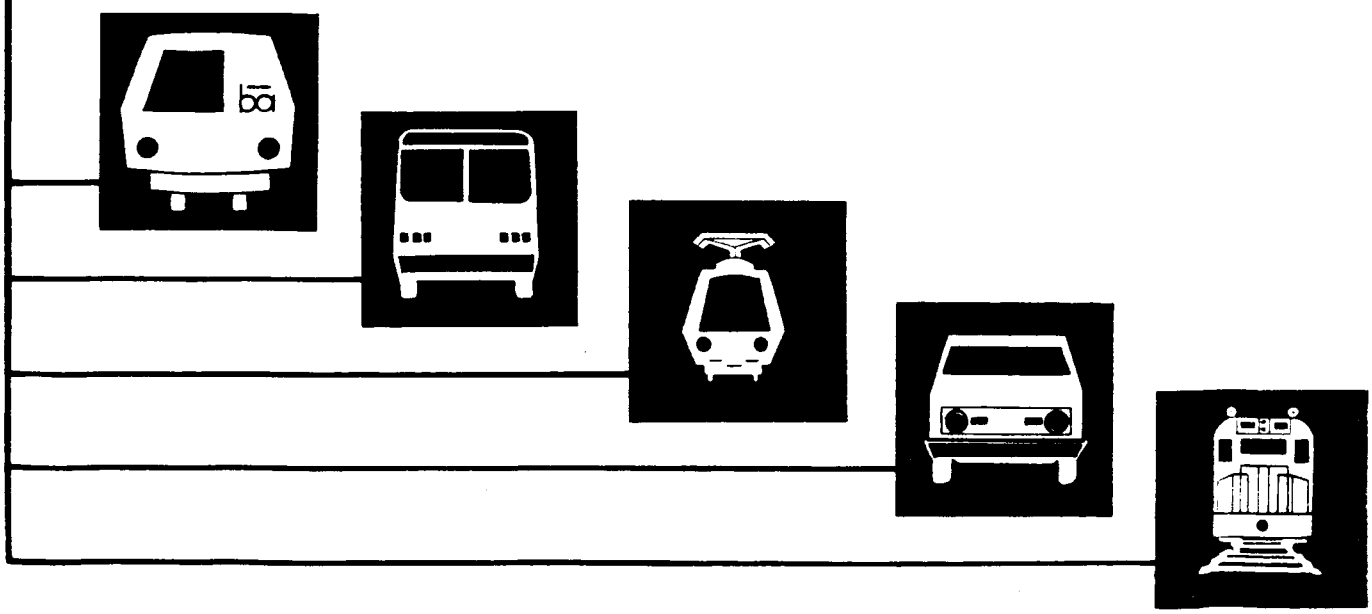
Peninsula Mass Transit Study

Task 1
Alternatives Definition

submitted to
Metropolitan Transportation Commission

prepared by
a joint venture of
Kaiser Engineers (California) Corporation and
Barton-Aschman Associates, Inc.



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July 27, 1984

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1. INTRODUCTION

1.1 BACKGROUND AND PURPOSE

The Peninsula Route 101 corridor between San Francisco and San Jose is one of the most heavily traveled transportation corridors in the region, with most of the highway operating at 85-90% of capacity during peak hours and delays of up to 20 minutes on certain bottleneck sections. Current development and redevelopment proposals along the corridor would increase traffic at least 27%, compounding existing traffic problems.

In response to a growing concern about the future of public transportation in the Peninsula corridor, MTC conducted the Peninsula Transit Alternatives Project (PENTAP) study which was completed in 1977. This study evaluated over 20 corridor transit alternatives and recommended a series of short-range improvements to the Southern Pacific commuter rail service to provide better passenger facilities, modern equipment, and improved schedules. Other relevant studies include two BART extension studies--one to the San Francisco Airport and one beyond the airport to Menlo Park--and the Guadalupe Corridor light rail transit studies and development program in Santa Clara County. Despite these significant transit studies major questions still remain concerning the type of mass transit system or systems that will provide the best Peninsula rail service at the most reasonable costs over the long term.

Recently MTC identified over $900 million in new rail starts and extensions related to this corridor, including the following:

- BART extension in San Mateo County to a location west of Route 101 adjacent to the San Francisco International Airport or under the airport garage
- CalTrain commuter rail service improvements, including an extension into downtown San Francisco to a location at or near the Transbay Terminal.
- Muni Metro LRT extension to 4th and Townsend Streets
- Guadalupe Corridor LRT extension to the Lockheed Corporation facilities
- Relocation of the CalTrain Terminal in San Jose

Before it is possible to proceed with these projects, their scopes, costs, and staging plans will have to be redefined. In addition, there are several significant issues to be resolved:

- 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?

To this end, Senate Concurrent Resolution No. 74 requests MTC to develop a Mass Transit Plan for the corridor in cooperation with the Department of Transportation, the transit operators, and local governments. The resolution defines the Peninsula Corridor as extending from a rail terminal in San Francisco to a rail terminal in San Jose. The plan is intended to identify the route, the vehicle type, operational characteristics, institutional arrangements, and an incremental staging plan by March 1, 1985. The legislation also specifies certain rail alternatives which MTC is required to analyze in preparing the mass transit plan.

The Peninsula Mass Transit Study will also lead to the preparation of Alternatives Analysis and Draft Environmental Impact Statement reports. These reports are to be prepared for UMTA by the appropriate transit operator(s) if Section 3 funds are to be used. If, however, portions of the system to be implemented fall within the rail modernization project category, different requirements apply.

In order to facilitate UMTA's authorization for further study and implementation, the alternatives identified by the SCR-74 are being complemented in the Peninsula Mass Transit Study by a transit no-build alternative (Alternative 0), low- and high-cost Transportation Systems Management (TSM) alternatives (Alternatives 1 and 2) and an all-bus solution (Alternative 6).

This report is the product of the first task of the Peninsula Mass Transit Study; its main purpose is to identify alternatives to be studied. Section 1 addresses all the alternatives in general, and

Section 2 describes each of the specific alternatives. The major alternatives discussed in this report include the following:

Alternative 0 - Highway Improvements
Alternative 1 - TSM Actions
Alternaitve 2 - Minimum Rail Service Extension
Alternative 3* - BART to San Jose
Alternative 4* - LRT to San Jose
Alternative 5* - Upgraded Commuter Rail
Alternative 6 - Bus/HOV Lanes
Alternative 7* - BART/LRT Combination
Alternative 8 - BART/CalTrain Combination
Alternative 9 - BART/Bus Combination

*Required by SCR 74

1.2 TRANSPORTATION SYSTEM CHARACTERISTICS

The following sections describe the principal characteristics of the various transportation modes under consideration; the general requirements or assumptions made regarding right of way, facilities, and systems and equipment; and what the order-of-magnitude capital cost estimates will include.

1.2.1 Transportation Modes

The Peninsula Mass Transit Study will include practically all typical modes of public transportation, as well as automobiles:

- Commuter Rail
- Heavy Rail
- Light Rail
- People Mover
- Buses

These are many misconceptions regarding the terms used above to identify the various railway systems and the differences among them. The following definitions and historical notes should clarify most of these misconceptions:

- Commuter Rail: The term "commuter rail" refers to a portion of a regional, interstate, or national railway that forms part of an intercity passenger service and carries passengers within suburban and urban areas. It differs from rail rapid transit in that the commuter rail passenger cars are heavier, seating arrangements do not maximize standee space, the layout and doors do not accommodate fast massive movements of people, and trip are usually longer. Commuter rail usually uses overhead electrification, low or high platforms, and electric or sometimes diesel vehicles that normally operate in multiple units (MUs). This operation is usually run by the railway as part of its mainline service. The CalTrain is a typical example.

- 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 mass transportation). 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 trains) both of which were grouped into the term rail rapid transit. The reappearance of trolley-like vehicles (also knows as streetcars or tramcars) required a modification of the term rail rapid transit. Based on the difference in rail weight that once existed between the intercity services and the urban services or streetcars, the resurrected system was called "light rail," and the metros, subways, and els, which do not use trolleylike vehicles, became known as "heavy rail."

Today, lack of demand and higher density of traffic have caused the disappearance of "light" rails and the same weight rail is normally used for both heavy rail and light rail systems. However, the terms have not been changed because "heavy" and "light" are still applicable in regard to capacity. Heavy rail systems usually have high-capacity self-propelled or married-pair type electric vehicles. They usually use third rail electrification, are fully grade-separated in an exclusive right of way, use high platforms, and are designed for fast movement of a large number of passengers. BART is a typical example of this mode.

- Light Rail: 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. Muni's LRV service is a typical example of this system.

- 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 or cable-operated vehicles with peripheral seats and ample standee space. Because they operate on demand on an exclusive guideway and are totally automatic, they are often referred to as "horizontal elevators," but the term people mover also can include other systems, such as moving walkways. For this study both horizontal elevators and moving walkways will be included as part of the San Francisco International Airport connection to a potential airport station outside of the airport-proper.

The above descriptions are obviously incomplete, but most of the other differences among these rail systems also vary within a particular mode. Generally speaking, each of these transit modes is "best" for a particular application; ultimately, it is a matter of the type of service and capacity required or desired and the amount of capital available. One reason that light rail has become so popular, for instance, is the shortage of available funds for new, more expensive systems.

Superficial comparisons of systems may be deceiving. For instance, a typical above-ground heavy rail system costs about $30 million per mile while an underground version of the same system can cost as little as $55 million per mile or as much as $130 million per mile. On the other hand, a typical light rail system costs about $15 million - $17 million per mile. These figures, as presented, seem to favor light rail. However, if an aerial structure is included, the light rail becomes $36 million - $38 million per mile, which is more than the cost of a heavy rail system. The reason for this is that the structure has to be designed to allow for overhead electrification supports, and the loads of heavy emergency and maintenance equipment, regardless of lighter LRT

wheel loads. Also, the deck width must be greater to allow for proper clearances of outside mirrors to catenary poles and weights. The same would happen for an underground facility; in fact, the difference wouldddd be even greater because of the greater vehicle clearances required by the LRT.

A similar situation occurs when speeds are used as a means to establish the superiority of one system over the other. For instance, the typical maximum speeds the vehicles can usually achieve for each mode are as follows:

	Typical Maximum Speed (mph)
• People mover	7 to 10
• Light rail	55
• Heavy rail	70 to 80
• Commuter rail	80 to 110

The operating speeds for the typical application are as follows:

	Average Low Speed (mph)	Average High Speed (mph)
• People mover	5	10
• Light rail	15	45
• Heavy rail	25	45 - 60
• Commuter rail	35	45 - 60

It is apparent that the difference between what the cars can do and what they actually do is significant. Furthermore, with the exception of the people mover all modes are adequate at the maximum average speed of 45 mph.

The CalTrain actual average speed is between 33 and 38 mph, which is typical for this type of service. BART, on the other hand, has a typical average speed of 36 mph, which is about 10 mph above the typical average speed for this mode. The reason for the higher average BART speed is that most heavy rail systems operate in areas that are more densely populated than the Bay Area and where people are more mass-transit-oriented. Greater demand means more closely spaced stations and longer dwell times.

Capacity is perhaps more significant than vehicle maximum speed. The main factors affecting system capacity are:

- Vehicle capacity
- Platform length
- Headways

Of these three only the platforms are somewhat independent of the car design. Headways are a direct function of:

- The degree of sophistication of the signaling/train control system
- The safe braking distance, which depends upon the vehicle's performance, response, and weight
- Route complexity or constraints
- Station dwell time, which is the time it takes to load and unload passengers; this depends upon the vehicle design

Vehicle capacity depends upon vehicle width, length, and other capacity and circulation design features, which are related to the degree of comfort required. For instance typical widths are as follows:

- People mover — 7 feet
- Light rail — 8.5 to 9 feet (without mirrors)
- Heavy rail — 8 to 10 feet
- Commuter rail — 9.5 to 10.5 feet

The typical design allows:

- People mover — 4 to 7 square feet/passenger
- Light rail — 3.75 to 5.5 square feet/passenger
- Heavy rail — 2.15 to 5.0 square feet/passenger
- Commuter rail — 9 to 11 square feet/passenger

Consequently, for 2-minute headways, the average number of passengers per direction per hour for various U.S. systems is as follows:

- Light rail — 10,000 - 21,000 passengers/hour
- Heavy rail — 29,000 - 48,000 passengers/hour
- Commuter rail — 10,000 - 23,000 passengers/hour

However, typical headways and the number of cars per train vary considerably within each mode. The typical capacities of each system for train lengths and headways similar to those that may be assumed in this study are as follows:

	No. of Cars	No. of Pass./Car	Headways (minutes)	Pass./Hr.
• Light rail	3	180	6	5,400
• Heavy rail	10	200	2	60,000
• Commuter rail	10	145	20	4,350

In reality, a light rail train is restricted to a given number of cars by the length of the street blocks on which it operates. If the blocks are long or if the system does not use city streets, capacity would increase significantly.

A commuter rail system can shorten headways but it would still be restricted by facilities and vehicle design, including performance, response, and weight of the specific vehicles. Even assuming 2-minute headways, its capacity is about the same as that of light rail and below that of heavy rail, as demonstrated above. The actual capacity of vehicles to be considered in this study would be as follows:

- Light rail 160 - 180 passengerd/vehicle
- BART 160 - 230 passengerd/vehicle*
- CalTrain 145 passengers/vehicle

Vehicle operating cost, which is the most significant determinant of systemwide operating cost, depends upon the crew size required by each type of system. Under typical conditions, the commuter rail would be the most expensive and the heavy rail the least expensive. The operating cost of light rail will vary with the maximum number of cars that can be coupled for each train.

The following sections briefly address a few other differences between the modes as well as some of the assumptions made regarding the various alternatives of this study. These sections are not critical to the understanding of the individual alternatives. The reader may wish to proceed to Section 2 where the alternatives are described.

1.2.2 Right-of-Way

Right-of-way needs can be divided into three major categories: public, private, and railroad.

- Public Right of Way: It is assumed that buses will require only public right of way, with the exception of Alternatives 6 and 9, which may require railroad right of way. Special needs for bus bays on streets and layover areas are also assumed to be publicly owned and available at no cost. Right of way for a people mover between various rail systems and the San Francisco Airport is also considered to be free of cost since the airport is public right of way. The other two major public right of way areas involved are Second Street in San Francisco, which would be required for the at-grade LRT, and the area adjacent to the San Francisco Airport, which would be required for the airport station.

- Private Right of Way: The railroad right of way, which is discussed below, is perhaps the only major private right-of-way where acquisition is involved. Special needs for the various rail alternatives related to geometric constraints, station needs, service roads, yards and shops, etc., will be identified in Task 4 of this study. The capacity of the rail system and the availability of existing facilities will significantly impact the cost of this item for each alternative.

*BART's A and B cars have a 160-passenger crush-load capacity, and the C-cars will be able to carry a crush load of 230 passengers.

- Railroad Right of Way: With the exception of Alternatives 0 and 1, it is assumed that railroad right of way will need to be acquired for all alternatives, including Alternative 2. This is because it is unlikely that significant Federal funds can be invested in improving private property.

  The cost of real property and damages compensation to freight customers will be also considered in the cost of the railroad right of way. In addition, when a third track is required in order to maintain separate freight service, the costs associated with taking over and operating the freight service will be considered as part of the cost of the right-of-way (less the earned revenue).

  When determining the right-of-way width required for each mode, appropriate clearances and compensations for geometry, superelevation, fabrication, construction, and maintenance tolerances will be taken into account, as well as vehicle design and emergency and maintenance equipment requirements. Modes with overhead catenaries will require more land than those using a third rail, particularly if the vehicles are equipped with outside mirrors.

1.2.3 Facilities

1.2.3.1 Trackway: All alignments will be defined giving preference to at-grade solutions. Aerial solutions will be a second choice and underground construction will be used only when it is absolutely necessary. However the following are fixed:

- LRT on Second Street: at-grade
- BART into the airport terminal: underground
- People mover into the terminal: aerial
- Busway or HOV lanes on Highway 101 north of Whipple Avenue: aerial

Trackways will include appropriate train storage and refuge tracks, walkways, service roads, hi-rail and emergency access, drainage, transit utilities, fencing, clearances, etc. Track spacing will include all clearances and compensations, as well as maintenance, safety, and other regulatory requirements.

1.2.3.2 Stations. Platform lengths and widths will vary according to the demand and capacity of the mode and fire/safety requirements. All modes will have adequate access for elderly and handicapped persons and safety features compatible with the type and frequency of service. All BART platforms will be high platforms. All CalTrain platforms will remain as currently planned (6 inches above the existing platform), and LRT platforms will be either high or low as required.

All LRT stations will be simple, as is typical for LRT systems. All BART stations will be similar to existing stations. All CalTrain stations are to be reviewed for adequacy for Alternatives 5 and 8.

All alternatives, except for 0, 1 and 6, will have an airport station and a people mover and/or shuttle bus connecting the airport station to the airport terminal. This station will not have parking, and will be accessible to emergency vehicles.

The shuttle bus would serve cargo and maintenance areas and would provide a backup service to the single-track people mover between the airport station and the airport terminals. The Alternative 2 station does not include a people mover.

All BART extensions to the airport will include a terminal station at Millbrae with adequate parking and turnback facilities

1.2.3.3 Yard and Maintenance Facilities. All yards and maintenance facilities will be defined according to the typical requirements of the mode, its capacity and fleet size and will take into account present facilities that could be used, if any (so long as they are owned by the operator). Their location will be determined based only on the needs of the Peninsula Corridor, and non-revenue mileage will be computed accordingly for the purpose of comparing operating costs.

1.2.3.4 Major Structures. Major structures include refurbishing or altering bridges, tunnels, viaducts, etc., as well as new facilities of this type. All major structures will consider clearances and compensations as well as the loads of each mode. Full access for standard railroad maintenance equipment will be assumed, unless the operator has sufficient "special" maintenance equipment now in use. All structures will include full emergency and maintenance walkways and access. All aerial structures will include handrails and room for noise abatement barriers.

Some major structures are already identified. These include:

- Tunnel for the upgraded CalTrain
- Aerial structure for the people mover from the airport station to the airport terminal
- Aerial structure and ramps for HOV lanes on Highway 101, north of Whipple Avenue
- Underground structure or tunnel for BART's interior airport terminal alignment

1.2.3.5 Trackwork. All modes with the exception of the people mover and the local freight service will be double tracked. They will use standard gauge, except perhaps for BART.

The track structure for the CalTrain will be in accordance with applicable railroad standards, but modified if required. All track structures should provide adequate electrical, noise, and vibration isolation and

should accommodate and transfer all stress and forces to the subgrade or supporting structure. Continuous welded rail will be assumed for all modes.

All modes operating at 15-minute or shorter headways will have the necessary trackwork provision for reverse moves and bypassing. All modes will be provided with refuge, storage, and turnaround tracks as required. All modes operating at a greater frequency than those now in use assume a third track for local freight use, including the upgraded commuter rail in Alternative 5.

All special trackwork for the upgraded commuter rail will be in accordance with applicable railroad turnout standards. All special trackwork for BART and the LRT will be American Railway Engineering Association (AREA) type, according to BART standards for BART and with no turnouts smaller than number 10 and 6 for the LRT mainline and yard, respectively. All special trackwork is to be adequately interlocked, as required.

All tracks will be adequately isolated for systems using DC current, regardless of mode.

1.2.3.6 Street/Road Modifications. All streets where LRT is to be operated will be rebuilt from property line to property line. The airport station access from Highway 101 will consider all of the Caltrans modifications now planned for I-380 and Highway 101. All necessary crossings of and modifications to the highway network will be according to Caltrans standards. Determinations as to the need for grade separations of local streets will be based on traffic volumes for automobiles and the LRT or the upgraded commuter rail. BART is to be fully grade-separated.

1.2.3.7 Utility Relocations. Existing aerial utilities must comply with the proper electrical and physical clearances or be removed or modified. All underground facilities are to have adequate cover or protection and no utilities will be allowed under new tracks when they run parallel to the tracks. Crossings are assumed to be adequately protected.

Utilities requiring maintenance operations that would interfere with high-frequency service will be assumed to be relocated. Private utilities are to be relocated at the owner's expense.

1.2.4 Systems and Equipment

1.2.4.1 Rolling Stock. All LRT vehicles will be assumed to be articulated and use overhead electrification. All BART vehicles are assumed to be the new C-cars now being manufactured. All commuter rail vehicles will be of the type now being purchased for the CalTrain, except for Alternative 5, where electric rolling stock is assumed. All people mover vehicles are fully automated and will function on demand.

1.2.4.2 Electrification and Distribution. Substation size and spacing is to be determined for all modes. The LRT substations are to be of the self-contained at-grade type unless specific conditions require them to be underground. All BART equipment will be compatible with its near-future service upgrading. Voltage and type of current for the LRT and commuter rail systems are to be determined. BART is the only mode to use third rail electrification, with the possible exception of the people mover. The LRT and upgraded commuter rail would use overhead electrification distribution.

All DC systems will be adequately isolated to prevent stray current corrosion.

1.2.4.3 Signals and Communications. Train control and communications requirements will be based on the level of service and mode in question. However, the following should be noted:

- BART will use the same system and equipment that is planned for installation in the near future.

- The LRT and upgraded commuter rail will pre-empt all grade crossings and have full protection from the freight operations.

1.2.4.4 Maintenance Vehicles and Equipment. All the maintenance equipment and vehicles necessary to maintain the facilities and transit cars will be included, unless the facilities currently owned clearly exceed the needs of the operator. All maintenance vehicles and equipment will be assumed to be standard, except for BART, where special needs exist due to its different track guage.

1.3 COST ESTIMATING

Whenever possible, capital cost estimates will be based on actual bids for similar elements. Contingencies will vary for each line item, depending upon level of confidence and the variations or unknowns of each case. Estimates will cover right-of-way, facilities, systems and equipment, and other costs.

1.3.1 Right-of-Way

Cost associated with both private and railroad rights-of-way will be included. It is assumed that public easements and rights of way will have no purchase cost. The railroad right-of-way cost will include real property; damages or compensations to third parties; utility relocations due to new ownership (if any); related agreement costs; and abandonment costs, including labor compensation costs (if any). The costs associated with establishing a private freight operation in order to take over the local freight deliveries, including rolling stock and associated facilities, would also be included.

It is assumed that all required right of way is available and that no costs or delays due to condemnation will be considered.

1.3.2 Facilities

The following elements will comprise the facilities cost estimates:

- Trackway costs will include the cost of ducts, manholes, catenary pole foundations, and other such elements necessary for transit utilities. Also included will be fencing, access roads, drainage, and all other elements below the sub-ballast.

- Station costs will include all elements related to the station and its adjacent related facilities, including access roads, traffic signals, parking, lighting, landscaping, and equipment such as elevators, escalators, and fare collection equipment.

- Yard and maintenance shop costs will include all elements of these facilities, such as utilities, catenary pole foundations, ducts, and manholes for transit use. Also included will be all equipment and tools required to maintain the vehicles. Only trackwork, electrification, and signals and communications will not be included.

- Major structures costs will include guideways and modifications to existing structures and structures related to providing access to and from a highway or any other facility. Tunnel costs for the relocation of the CalTrain terminal in San Francisco will be estimated for an electrified system and an alternate using diesel equipment. The costs of the people mover structure will include its stations.

- Trackwork costs will include the yard tracks, except for those inside the shop, grade crossings, hi-rail vehicle access ramps,

sand boxes, bumpers, and similar items, but will exclude the sub-ballast, which will be part of the trackway. Paved track costs will include paving materials, crosswalks, and other elements within the track area.

- Street and road modification costs will exclude utility relocations; structures, parking lots, and roads within stations and yards; and grade crossings and paved track areas. The costs of having LRT tracks on streets will include all modifications from property line to property line.

- Utility relocation costs will exclude the costs of relocating utilities within the railroad right of way when the relocation is due to new ownership or agreement with the railroad rather than as a direct result of the new rail facility. It will be assumed that all private utility relocations will be performed by the owner at no cost.

1.3.3 Systems and Equipment

The cost estimates for systems and equipment will be the following:

- Rolling stock costs will include spare parts and manuals.

- Electrification and distribution costs will include the cost of obtaining power and bringing it to the transit facility.

- Signals and communications costs will include a separate central control facility if necessary; traffic signal modifications; and equipment related to at-grade crossings of LRT and the upgraded commuter rail.

- Maintenance vehicles and equipment costs will include the cost of maintenance-of-way equipment and tools, i.e., everything that is not for the maintenance of the transit vehicles, which will be included in the cost of the repair and maintenance shop.

1.3.4 Other Costs

The estimate for "other costs" will include:

- Engineering and consulting
- Community relations and public involvement
- Marketing, public relations, and advertising
- Procurement and construction management
- Insurance and legal costs
- Start-up, testing, and training
- Contingencies
- Escalation

These costs will not necessarily be itemized in the estimates but they all will be reflected in the totals.

2. THE ALTERNATIVES

2.1 ASSUMPTIONS

All alternatives assume the highway expansion and improvements shown on Alternative 0. All alternatives assume the completion of the Guadalupe LRT and a connection to the Peninsula Corridor rail system in San Jose.

All alternatives assume the current general station locations along the railroad right of way, and new station locations as recommended in the Caltrans station improvement study.* Most of the alternatives include a station west of the airport; it would be connected to the airport terminals and maintenance areas by a people mover and/or a shuttle bus. If more stations are to be considered, they will be spaced according to the typical spacing of each mode, unless specific sites are identified by all interested parties.

All alternatives, except those where the rail service level does not significantly increase along the railroad right of way, assume the need for a third track to accommodate and separate local freight deliveries.

All alternatives that require a significant investment within the railroad right-of-way, including Alternative 2, assume the purchase of the necessary right-of-way because public funds probably would not be available for improving a privately owned facility. All alternatives assume that railroad and other required right-of-way is available.

All alternatives with high-occupancy-vehicle (HOV) lanes assume that the highway expansion shown on Alternative 0 will allow new lanes to be designated as HOV lanes, except for the Guadalupe Corridor. All alternatives with HOV lanes north of Whipple Avenue assume the need of an aerial structure on or adjacent to Route 101 and I-280, unless it can be demonstrated that the Southern Pacific right-of-way would provide a better facility.

In general the need for areawide local and express bus services is assumed to increase according to population and employment for all alternatives, except for Alternative 0. Feeder bus service to the rail system stations will be restructured as appropriate. SamTrans express bus service to downtown San Francisco will be reduced in alternatives that provide their own downtown distribution, such as BART, or where the relocation of the CalTrain terminal provides equivalent service and convenience.

In order to connect BART to the Peninsula rail system, shuttle bus service from the Daly City BART station to the San Francisco Airport is included for alternatives that do not extend BART to the airport.

*Caltrans Commuter Rail Station Location and Improvement Study, Barton-Aschman Associates, Inc., June 1982.

Most LRT alternatives into San Francisco assume a mall-type terminal near 2nd Street and Market Streets and no auto traffic on 2nd Street, where the LRT could operate at-grade. An exception to this arrangement is Alternative 3, in which it is assumed that the LRT service in the Bayshore Corridor would be an extension of the Muni Metro service on Market Street.

All BART extensions to the airport are assumed to terminate at a Millbrae station, which will have parking and improved access from Route 101. The airport station located west of Route 101 will be aerial, connected to the terminal by an aerial people mover and a service road for a shuttle bus, which will serve all maintenance and cargo areas as well as serving as a backup system to the single-track people mover. The airport station will have no parking facilities.

All BART extensions will require adequate turnaround and storage facilities.

2.2 ALTERNATIVE 0 - HIGHWAY IMPROVEMENTS

2.2.1 Service Concept

This alternative consists of the existing Peninsula transit system (i.e., no major new BART or CalTrain facilities), the Guadalupe Corridor LRT, and an expanded highway system. Highway 101 and I-280 would be expanded to eight lanes, and new auxiliary lanes would be constructed in some locations. HOV lanes for buses and carpools are assumed on highways and expressways in Santa Clara County, where a decision has already been made to include such lanes as part of the route development plan. BART headways to Daly City are assumed to be reduced from 4 minutes to 2.5 minutes.

2.2.2 Right of Way and Facilities

The following highway improvements are included in this alternative. It is assumed that the required right of way is available.

- Highway 101 would be expanded from six lanes to eight lanes south of Whipple Avenue in San Mateo County to Gilroy (south of San Jose).
- I-280 in Santa Clara County would be expanded from six lanes to eight lanes east of Magdalena, with two auxiliary lanes (10 lanes total) between Route 85 and the Lawrence Expressway.
- Route 85 would be constructed as a six-lane freeway along the West Valley Transportation Corridor between Highway 101 in Mountain View and Highway 101 south of San Jose.
- The Guadalupe Corridor Expressway (four lanes) would be constructed in Santa Clara County.
- Route 237 would be expanded from four lanes to six lanes, would be upgraded from expressway to freeway status (i.e., fully grade-separated), and would incorporate HOV lanes between Highway 101 and Highway 17.
- The I-80 merge lanes in San Francisco would be improved (structures widened) between the Bay Bridge and Highway 101 and I-280.

BART and CalTrain facilities are assumed to remain as they currently exist and the Guadalupe Corridor LRT is assumed to be in place.

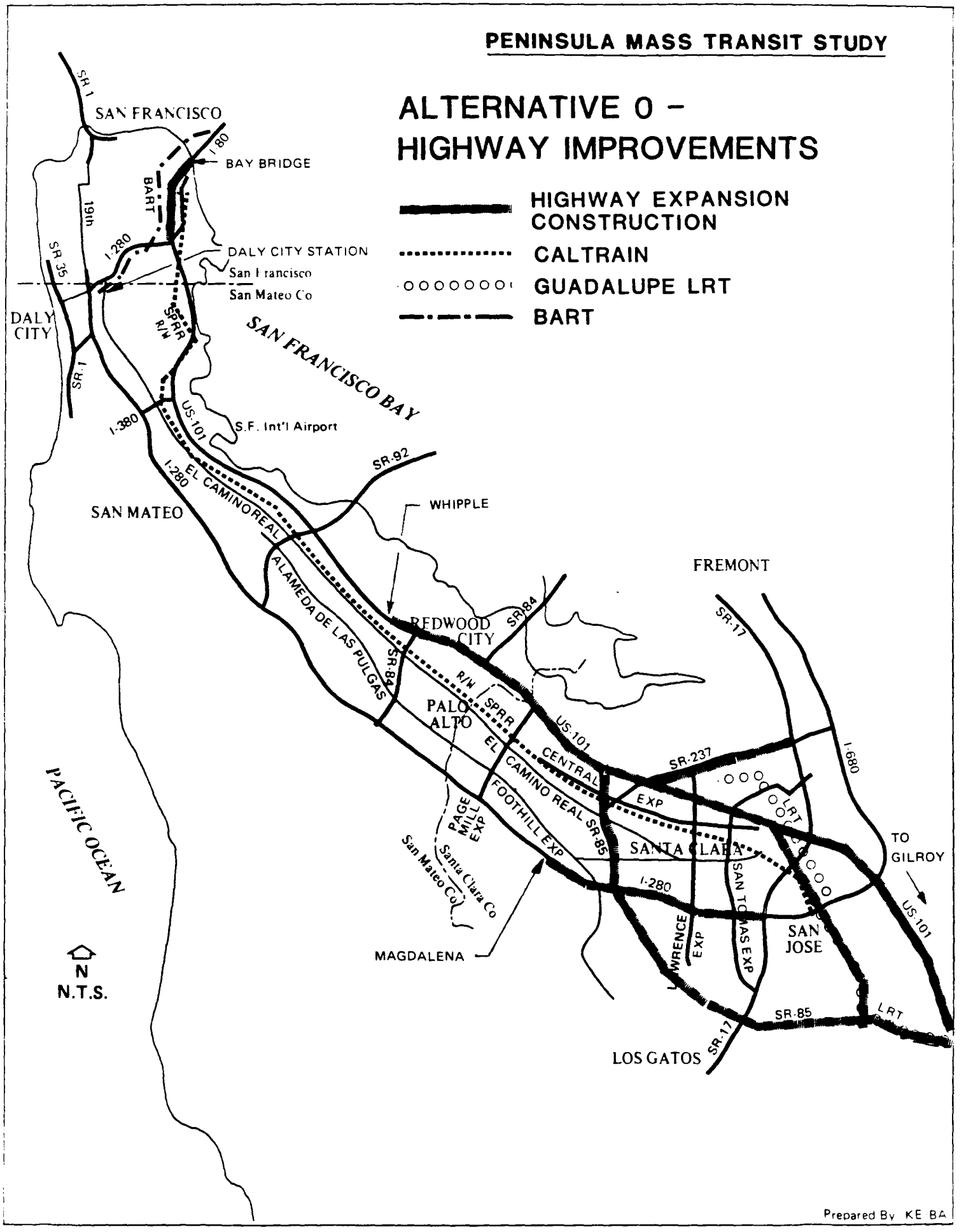
2.2.3 Systems and Equipment

The CalTrain fleet would remain as it currently exists, the BART fleet is assumed to include the new C-cars, and the UTDC LRV is assumed for the Guadalupe Corridor LRT.

2.2.4 Operating Characteristics

CalTrain service is expected to remain as it currently exists; BART headways to Daly City would be reduced from 4 minutes to 2.5 minutes due to planned improvements in the train control system, and the Guadalupe Corridor LRT will provide service as programmed.

PENINSULA MASS TRANSIT STUDY



Prepared By KE BA

2.3 ALTERNATIVE 1 - TSM ACTIONS

2.3.1 Service Concept

The TSM concept incorporates low-level capital improvements in the overall transit system. It is considered the minimum cost alternative. Alternative 1 includes HOV lanes designated for use by buses, carpools, and vanpools during commute hours along all the highway improvements shown in Alternative 0, except for the Guadalupe Corridor Expressway; BART and CalTrain service would be improved; CalTrain would connect with the Guadalupe Corridor LRT in San Jose; park-and-ride lots would be developed along Highway 101 and I-280 for peak and off-peak express bus services; Muni bus service to and from the 4th and Townsend CalTrain terminal would be provided to support the additional trains; local, feeder and express bus service would be improved in San Mateo and Santa Clara counties; and increased shuttle bus service would be provided between BART and the San Francisco Airport to accommodate passengers and airport employees. This bus route would also connect BART with CalTrain to provide for transfers between the two systems.

2.3.2 Right of Way and Facilities

HOV lanes would be located along Highway 101 south of Whipple Avenue to south of San Jose; along I-280 between Magdalena and Highway 17; along Route 85 between Highway 101 in Mountain View and Highway 101 in San Jose; and along Route 237 between Highway 101 and Highway 17. The CalTrain alignment would run from the 4th and Townsend Street terminal to a new terminal at Alma or Bassett Street. The BART alignment would remain unchanged, terminating at Daly City (with a new tail track). The Guadalupe Corridor LRT is assumed as planned in Santa Clara County.

Right of way requirements include CalTrain station acquisition and parking facility expansions as per the Caltrans station location and improvement study (41% funded); a CalTrain maintenance base in a location to be determined (unfunded); possible relocation of the San Jose CalTrain terminal to Bassett or Alma Streets (separate but related and unfunded project); park-and-ride lots for additional SamTrans and SCCTD express bus services; and a satellite park-and-ride lot for the Daly City BART station (funded).

CalTrain operations will also require track rehabilitation (35% funded), tower consolidation (unfunded), and station boarding improvements (unfunded).

2.3.3 Systems and Equipment

In addition to the planned Guadalupe Corridor LRV fleet and the current and planned BART fleet, the following rolling stock would be required to provide the improved CalTrain and bus service described in Section 2.3.1:

- 73 new gallery cars for CalTrain seating 139 to 148 passengers (78% funded)
- 46 used gallery cars for CalTrain (funded), refurbished and equipped with trainlines for auxiliary power, and train control (unfunded)
- 20 new conventional diesel locomotives (78% funded)
- New buses for SamTrans to provide express bus service along Highway 101 and I-280 (unfunded)
- New buses for SamTrans to increase local and feeder bus services (unfunded)
- New buses for SCCTD to increase local, feeder, and express bus services (unfunded)
- Shuttle buses to connect the new airport CalTrain station to the terminal and maintenance areas.

Ancillary equipment requirements for CalTrain operations include provision of standby power (funded) and installation of centralized train control (unfunded).

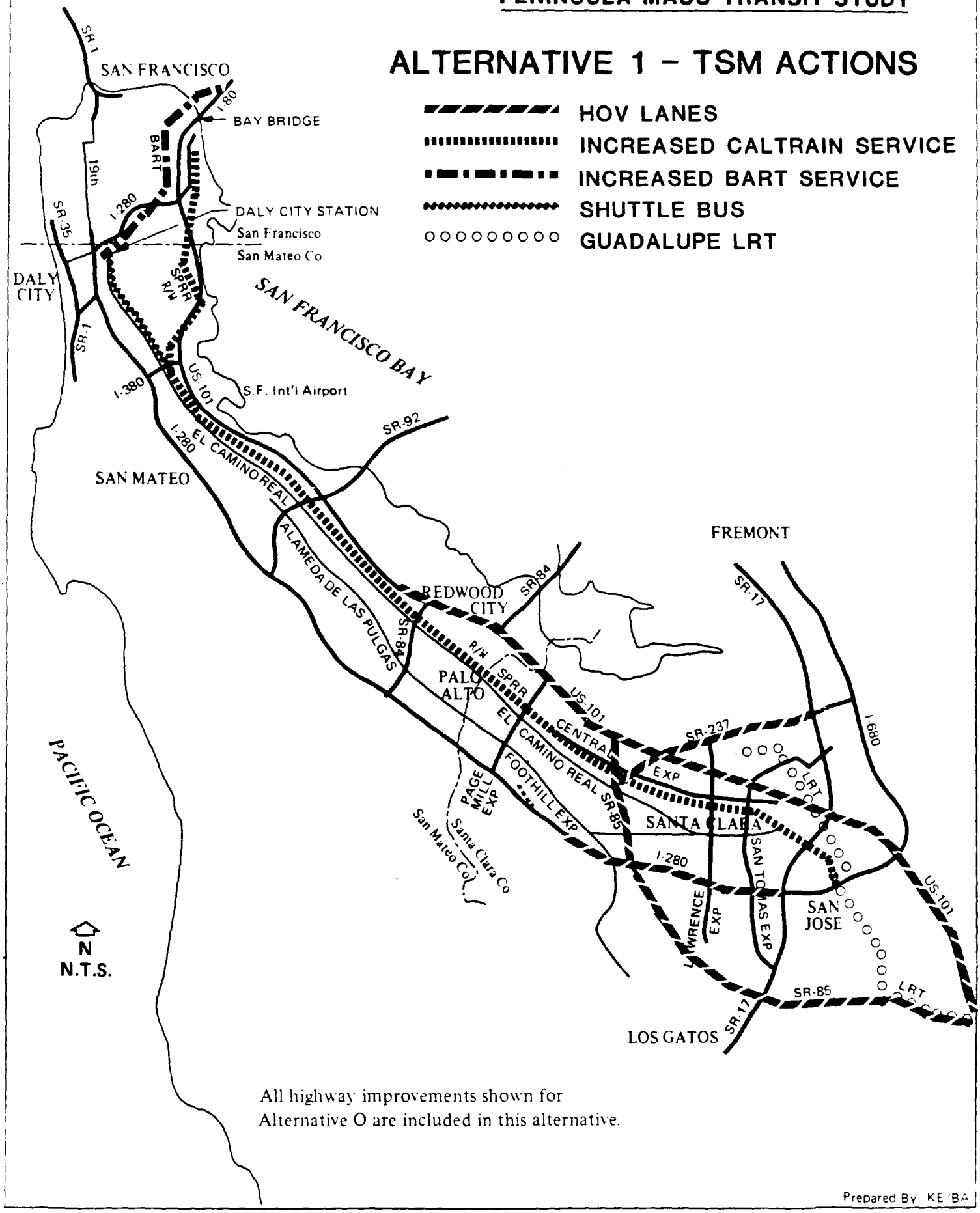
2.3.4 Operating Characteristics

Guadalupe LRT service would be provided as currently planned, and BART headways at Daly City would be reduced from 4 minutes to 2.5 minutes during peak periods.

CalTrain service would increase from 46 to 60 trains on weekdays. Three additional trains would be added during the peak commute, and four additional off-peak/reverse-commute trains would be added. All-stop service would decrease from 23 to approximately 17 stations, which will be determined during the course of this study, and peak-period skip-stop and zone express service would continue. A BART fare structure algorithm would be used for CalTrain service.

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 1 – TSM ACTIONS



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

Prepared By KE BA

2.4 ALTERNATIVE 2 - MINIMUM RAIL SERVICE EXTENSIONS

2.4.1 Service Concept

This alternative would provide increased convenience to passengers by extending existing rail service. In addition to the TSM actions described in Alternative 1, BART would be extended to a new station at Serramonte/Colma; peak-period CalTrain service would be extended south of San Jose into Coyote Valley (or at least to IBM) in order to capture a greater share of riders from this area to jobs along the Southern Pacific right-of-way in northern Santa Clara County; CalTrain tracks would be extended to the Transbay Terminal or to the San Francisco financial district, or would be connected to the Muni Metro LRT via an extension of Muni Metro to the 4th and Townsend Station; and a new CalTrain station would be constructed adjacent to the San Francisco Airport.

Shuttle bus service would be provided between the CalTrain station adjacent to San Francisco Airport and both the airport terminals and the maintenance and cargo areas as in Alternative 1. Other changes in bus service would include provision of feeder or local bus service to CalTrain stations south of San Jose; a significant reduction in Muni bus service to the San Francisco CalTrain station at 4th and Townsend and reduction of SamTrans' corridor bus service to the Transbay Terminal; and restructuring of SamTrans' north San Mateo County feeder bus to serve both the Daly City and the new Serramonte/Colma BART stations.

2.4.2 Right-of-Way and Facilities

The right of way requirements for this alternative include:

- Short segment of SP San Bruno branch line for the BART extension to Serramonte/Colma
- New station, parking, and accessways for Serramonte/Colma station with tail track and storage for layovers.
- San Francisco Airport station overcrossing to the airport proper.
- New CalTrain stations with parking south of Cahill Street at Alma, Curtner, Capitol, Branham, Blossom Hill and Bernal
- Land adjacent to Transbay Terminal for the CalTrain extension to San Francisco financial district. Acquisition of land would not be required if the alignment follows 2nd Street in tunnel configuration or if the Muni Metro extension is built.

2.4.3 Systems and Equipment

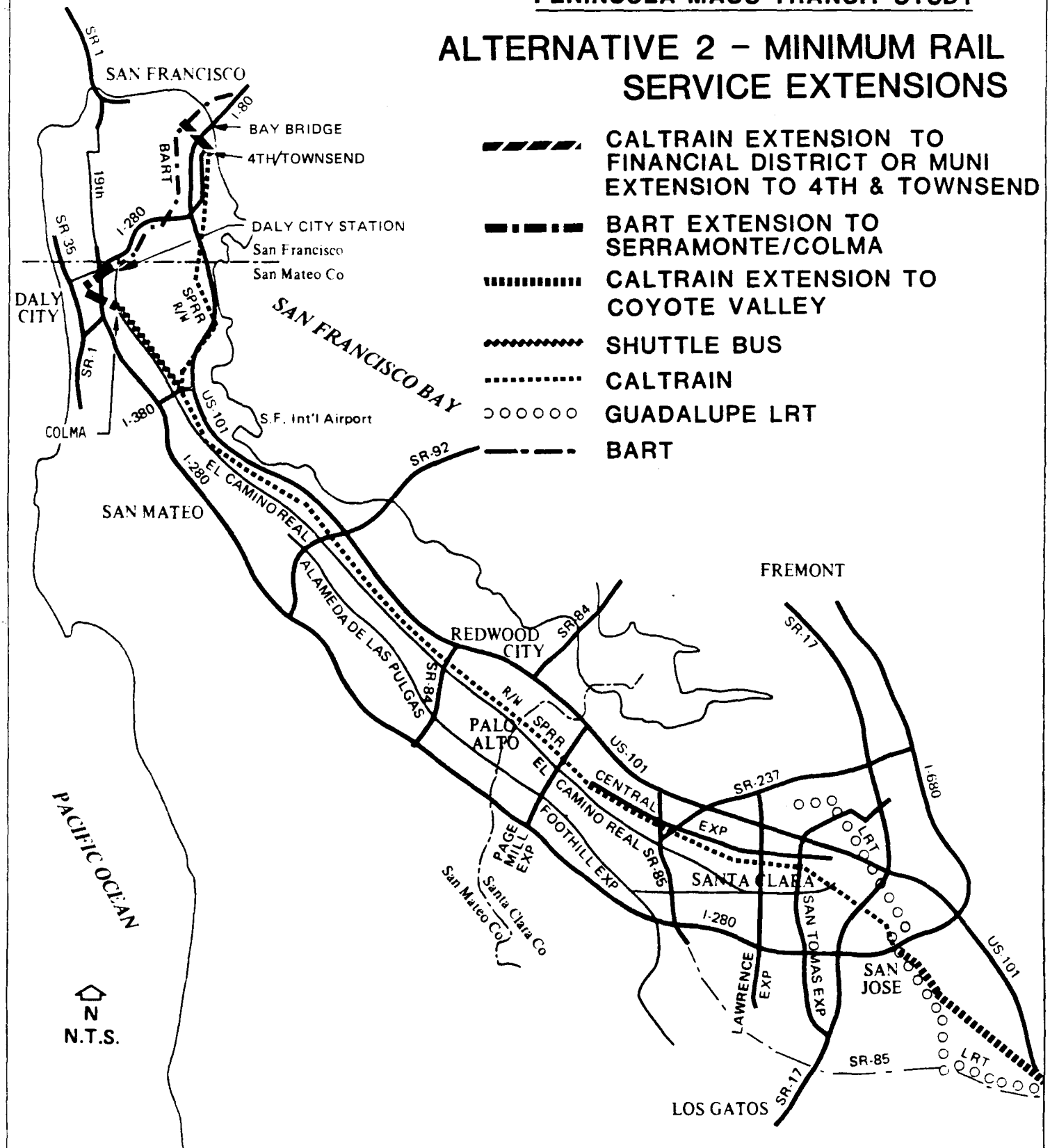
There are no equipment requirements peculiar to this alternative except that the potential electrification of the CalTrain tunnel extension in downtown San Francisco would require the purchase of dual propulsion locomotives (diesel and electric).

2.4.4 Operating Characteristics

BART's 2.5-minute headways would be provided to the Serramonte/ Colma station; CalTrain Coyote Valley service would be provided during peak commute periods only; and CalTrain service to the San Francisco Airport station would consist of all-stop service at 60-minute headways during midday and selected trains at 20-minute headways during peak periods.

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 2 – MINIMUM RAIL SERVICE EXTENSIONS



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

Prepared By KE BA

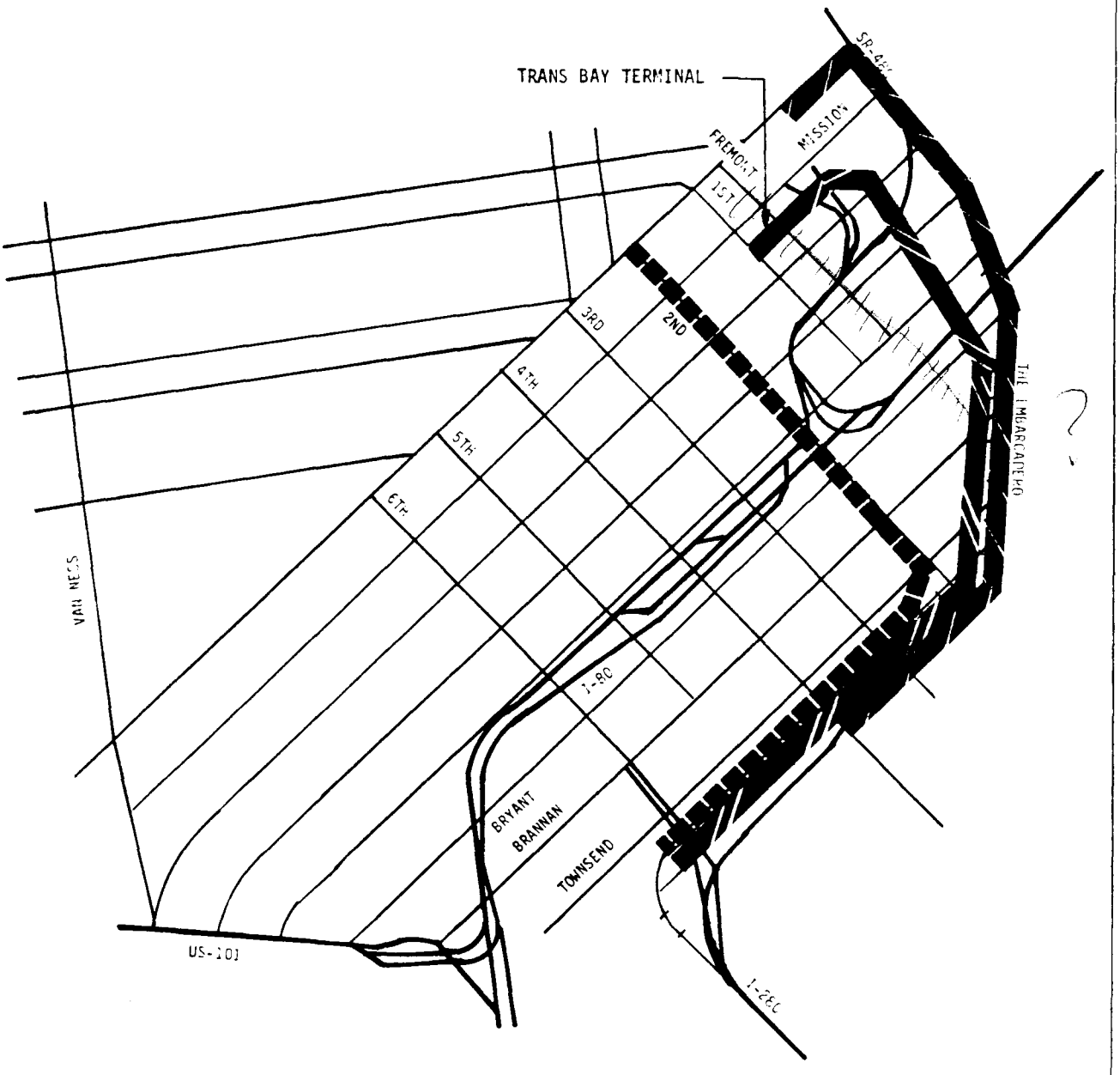
PENINSULA MASS TRANSIT STUDY

CALTRAIN EXTENSION TO FINANCIAL DISTRICT

2ND ST. ALTERNATIVE

TRANSBAY TERMINAL ALTERNATIVE

MUNI METRO EXTENSION



Prepared By KE·BA

2.5 ALTERNATIVE 3 - BART TO SAN JOSE

2.5.1 Service Concept

This alternative assumes implementation of the highway improvements noted in Alternative 0 and the HOV lanes described in Alternative 1 for highway expansion and new highway construction projects. The CalTrain system would be replaced by the BART Daly City line which would be extended to San Jose via the San Francisco Airport. A people mover system would connect the airport station with the passenger terminals. Peak and off-peak service in both directions would be more frequent than current CalTrain service. The BART system would connect with the Guadalupe LRT in San Jose and would distribute passengers in San Francisco using the existing BART stations along Market Street and elsewhere. East Bay and San Francisco Airport passengers and employees could ride BART directly to the airport, where the line either would run adjacent to the airport (with access to the airport provided by an automated people mover system) or would run directly to the airport to a station under the central parking garage. Two alternatives will be considered for providing service along the Bayshore corridor north of the airport, where CalTrain service would be discontinued: a transfer to a local bus route serving the corridor and the Transbay Terminal; and an extension of the Muni Metro LRT service to interface with BART at an airport station. A shuttle bus from the BART line could also be operated to the San Jose Airport terminal from the Santa Clara station.

The changes in bus service required by this alternative are as follows:

- Supplemental shuttle bus service could be provided between the BART San Francisco Airport station and the United Airlines maintenance and cargo areas.
- Additional feeder bus services would be provided in San Francisco, San Mateo, and Santa Clara Counties.
- Additional express bus services would be provided by SCCTD.
- Muni bus service to San Francisco Caltrain station would be discontinued.
- Corridor express bus services provided by SamTrans to the Transbay Terminal would be reduced.

2.5.2 Right of Way and Facilities

The BART extension would be fully grade-separated and would generally follow the Southern Pacific branch line from the end of the Daly City tail track to I-380 and would then follow the Southern Pacific mainline to San Jose. In addition to the people mover system at the airport, an overcrossing of Highway 101 would be constructed to serve west side development. (Alternatively, the BART alignment would deviate from the railroad mainline alignment at the San Francisco Airport (I-380) in order to serve the passenger terminals directly before proceeding to the

Millbrae station.) Stations would include Serramonte/Colma, Chestnut Street (eliminated by the BART Board but included in this study for planning purposes), Tanforan, the airport, and existing all-stop CalTrain stations south to the Bassett Street Terminal in San Jose. Parking would be provided at all stations except the airport station. A BART storage yard/maintenance base would be located in Santa Clara County. If the Muni Metro LRT is extended to the airport, it would operate at-grade along the Southern Pacific right of way. Muni Metro LRT stations would be spaced at approximately 0.5-mile intervals, generally with no parking provided.

2.5.3 Systems and Equipment

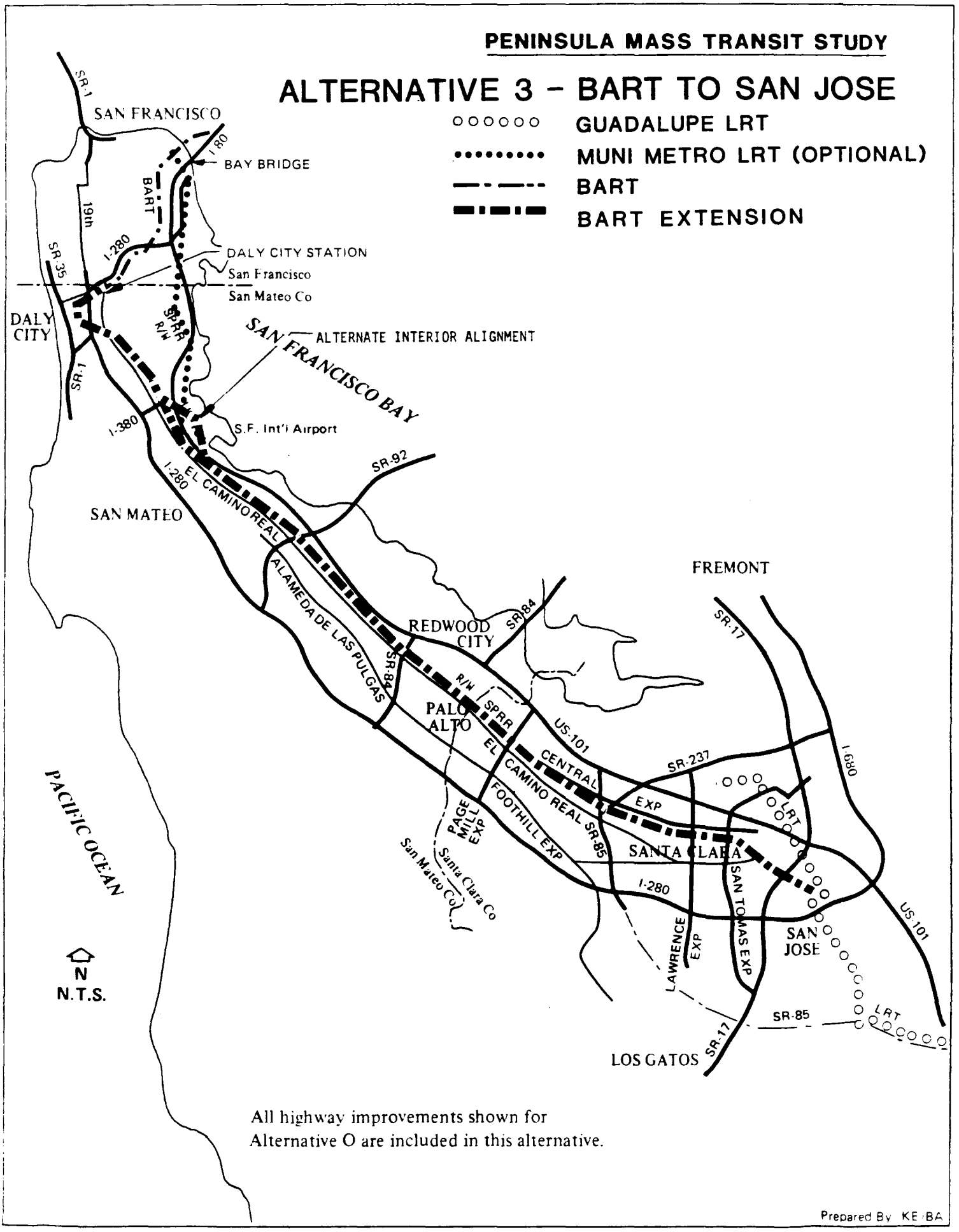
New rolling stock would be required for both BART and Muni Metro LRT operations. New buses would be required for SCCTD to increase feeder and express bus service. SamTrans will increase local and feeder bus services and reduce its express service to San Francisco. New vehicles will be required for the people mover.

2.5.4 Operating Characteristics

Both BART and Muni Metro LRT service would be to all stations. Muni Metro headways would be 5 minutes during peak hours and 10 minutes during off-peak hours. Along the entire line south of Daly City, BART peak headways would average 3.75 minutes, off-peak headways would average 7.5 minutes, and evening service (after 8 pm) would be every 20 minutes.

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 3 - BART TO SAN JOSE



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

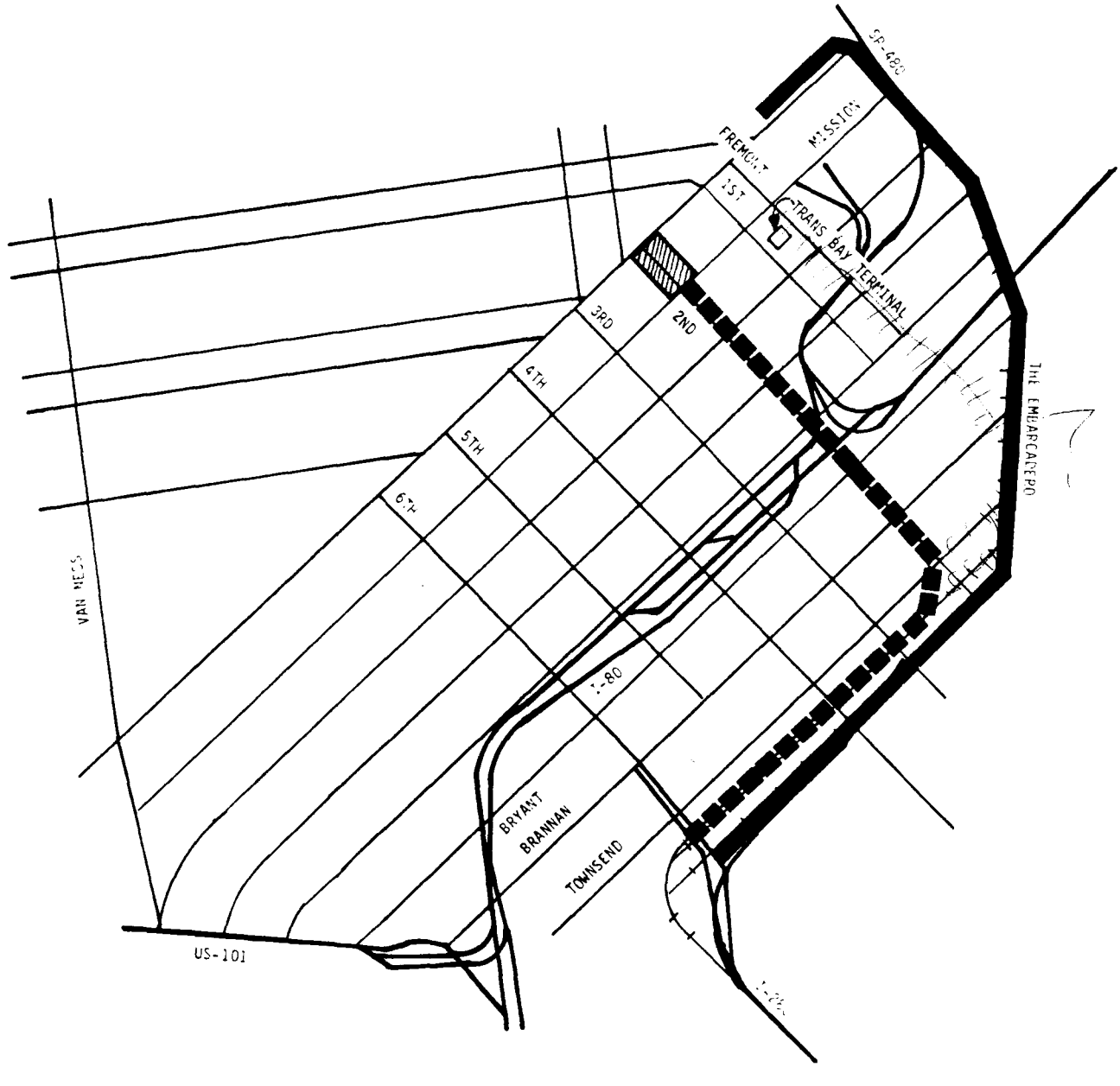
Prepared By KE·BA

PENINSULA MASS TRANSIT STUDY

LRT ALIGNMENT IN DOWNTOWN SAN FRANCISCO

LRT AT GRADE

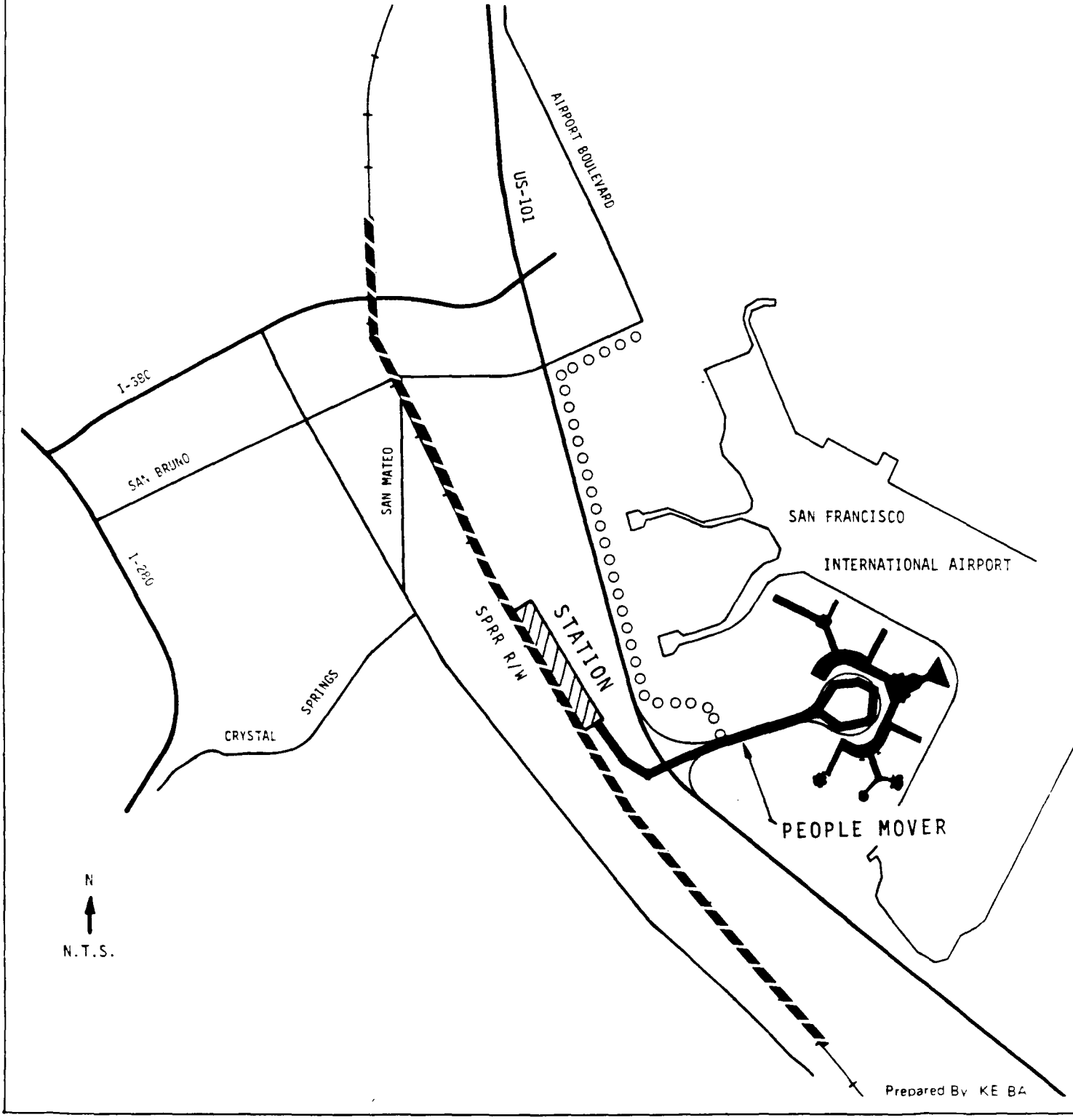
ALTERNATE ALIGNMENT



Prepared By KE BA

PENINSULA MASS TRANSIT STUDY

PEOPLE MOVER CONNECTION



2.6 ALTERNATIVE 4 - LRT TO SAN JOSE

2.6.1 Service Concept

This alternative incorporates the highway improvements of Alternative 0 and the HOV lanes designated in Alternative 1. CalTrain would be replaced by LRT service, and local, feeder, and express bus services would be improved.

This alernative assumes LRT would use 2nd Street in San Francisco and stub end at the BART tracks. After traveling along 2nd Street at-grade the LRT would follow the same general corridor as CalTrain, but would run in the median of the Central Expressway starting at Sunnyvale (Lawrence Expressway), serve the San Jose Airport terminals, and continue to Bassett Street via Route 87, re-entering the Southern Pacific right of way to then interface with the Guadalupe LRT. It would have a San Francisco Airport station with a people mover system connecting the station with the passenger terminals as in the previous alternative. Shuttle bus service between the BART Daly City station and the San Francisco Airport would also serve to connect BART with the LRT.

Bus service would be affected as follows:

- Supplemental shuttle bus service would be provided between the San Francisco Airport station and the maintenance and cargo areas.
- Increased, more direct shuttle bus service would be provided by SamTrans between the Daly City BART station and the San Francisco Airport.
- Additional local and feeder bus services in San Francisco, San Mateo, and Santa Clara Counties would be provided.
- Additional express bus services would be provided by SamTrans and SCCTD.
- Muni bus service to the San Francisco CalTrain station would be reduced, however some lines would need to continue serving other areas of San Francisco not on the LRT alignment.

2.6.2 Right-of-Way and Facilities

Within San Francisco, the alignment would be at grade from the Market Street terminus along Second 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 (Lawrence Expressway), where it would follow the median of the Central Expressway to the San Jose Airport terminal. After leaving the airport, the alignment would either return to the Southern Pacific mainline and connect with the Guadalupe Corridor LRT at Alma or terminate at Bassett Street in downtown San Jose, also connecting to the LRT. The alignment would be grade-separated as necessary to alleviate traffic congestion and avoid serious impacts to the traffic

signal network. Sensitivity analyses will also consider ridership impacts associated with using the Southern Pacific right of way for the entire route between San Francisco and San Jose.

In addition to the people mover system that would connect the San Francisco Airport station with the passenger terminals, a crossing of Highway 101 for shuttle buses would be built to the west of the airport. No parking will be provided at the airport station.

Right of way requirements thus include the Southern Pacific mainline from San Francisco to San Jose; all-stop CalTrain stations and parking facilities per Alternative 1 (between San Francisco and Route 237) and existing CalTrain stations within San Francisco; an LRT storage yard/ maintenance base in a location to be determined; and easements for the Central Expressway, San Jose Airport, and Route 87.

2.6.3 Systems and Equipment

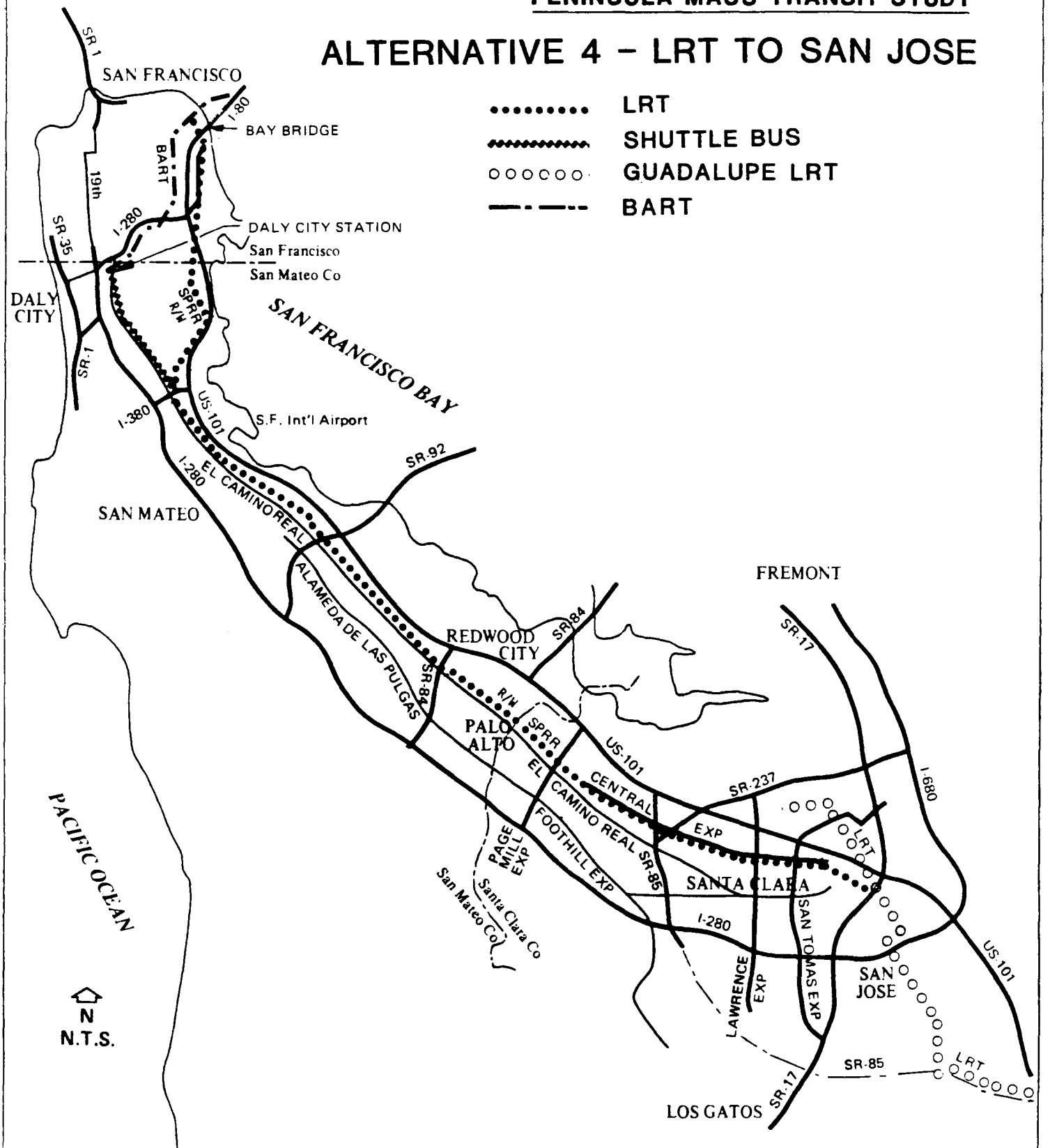
New LRT rolling stock would be required, although the fleet size has not yet been determined. New buses would be required by SamTrans and SCCTD to increase local, feeder, and express bus service. New vehicles would be required for the people movers.

2.6.4 Operating Characteristics

Peak period headways would be 6 minutes to any destination, although the LRVs would be dispatched every 3 minutes, with all-stop and skip-stop (A and B) trains alternating. Off-peak headways would be 15 minutes. Train lengths will be consistent with the length of the street blocks when operating on city streets. The LRT will utilize self-service fare collection and an algorithm of the BART fare structure.

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 4 - LRT TO SAN JOSE



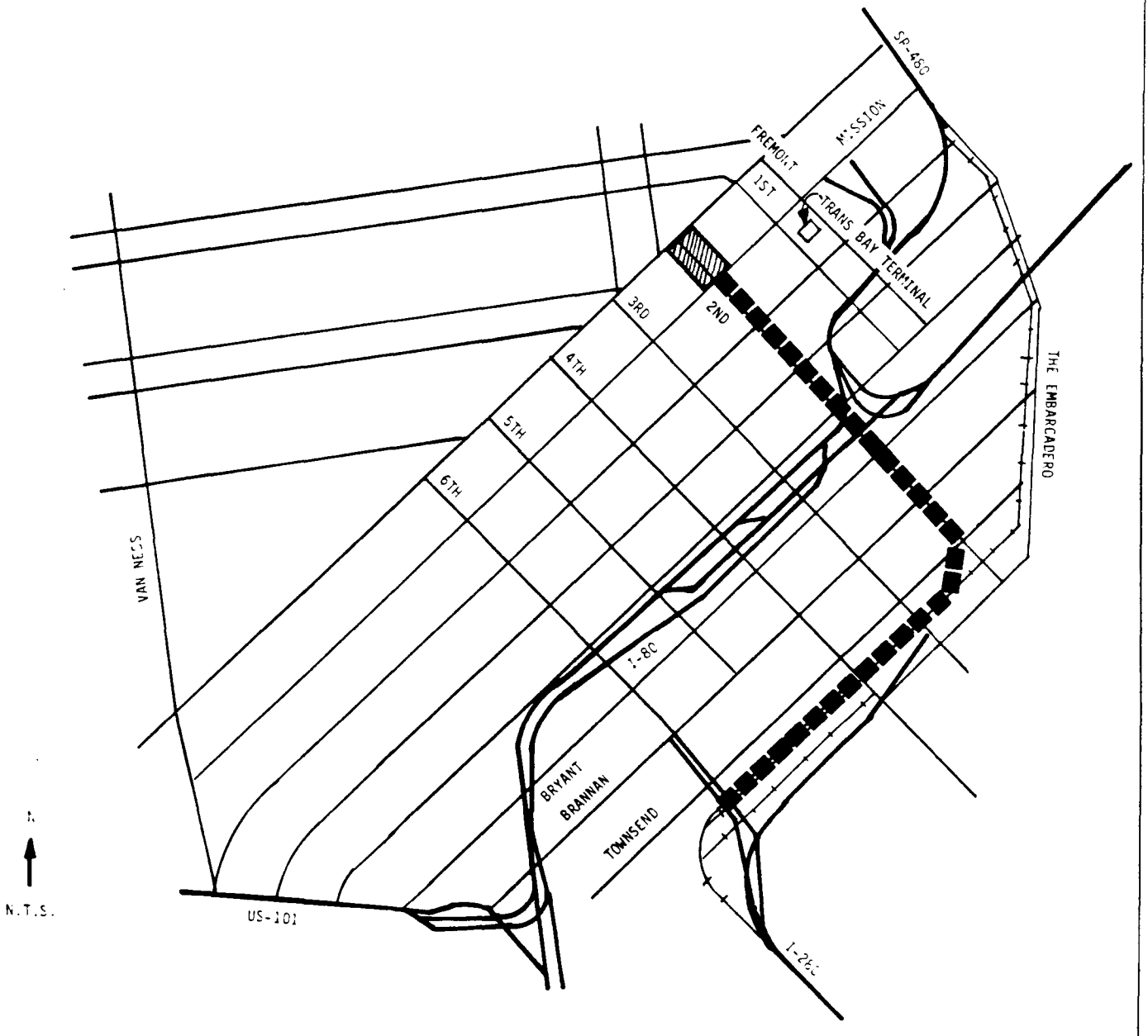
All highway improvements shown for Alternative O are included in this alternative.

Prepared By: KE/BA

PENINSULA MASS TRANSIT STUDY

LRT ALIGNMENT IN DOWNTOWN SAN FRANCISCO

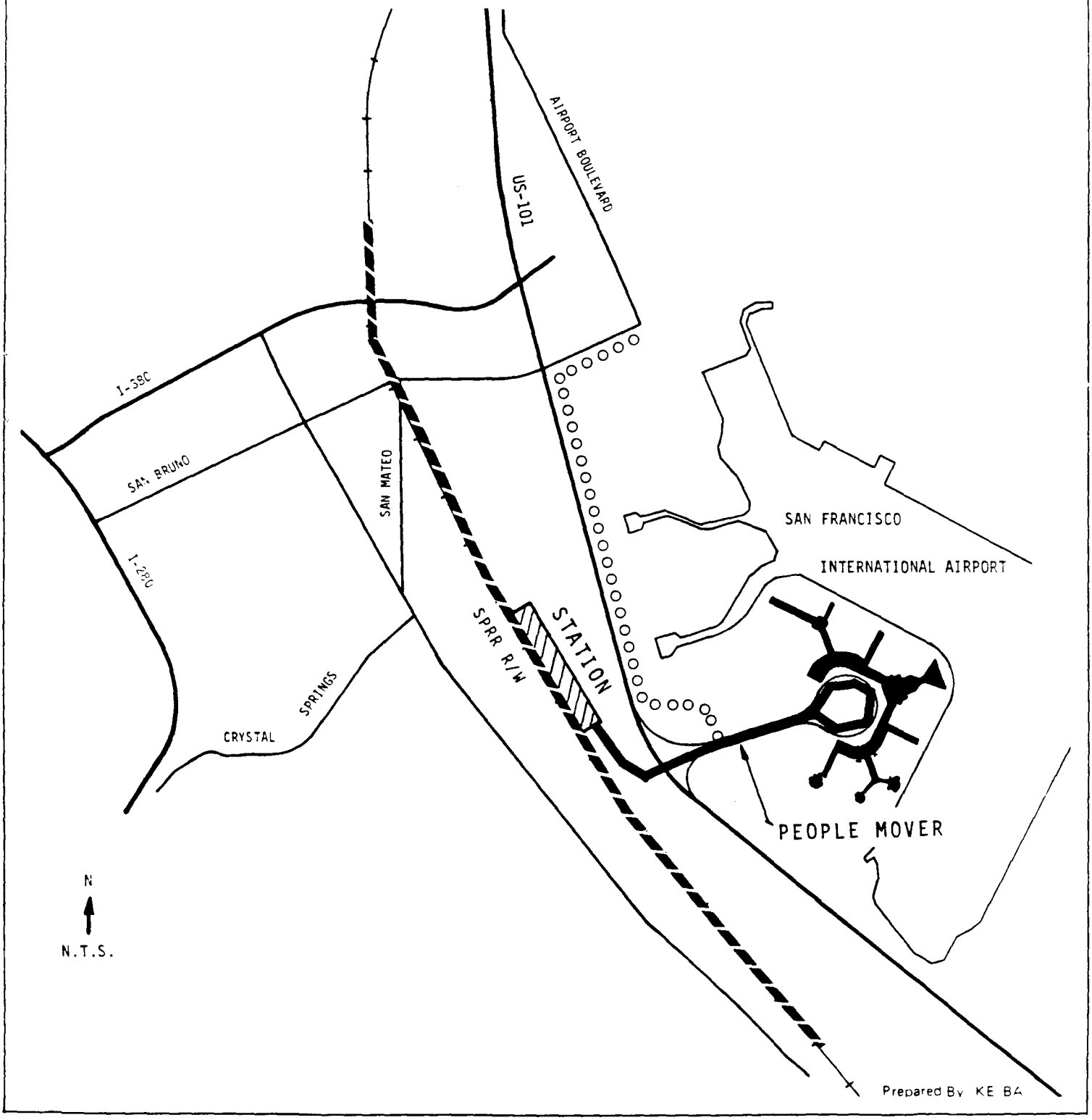
■■■■■■ LRT AT GRADE



Prepared By KE BA

PENINSULA MASS TRANSIT STUDY

PEOPLE MOVER CONNECTION



2.7 ALTERNATIVE 5 - UPGRADED COMMUTER RAIL

2.7.1 Service Concept

This alternative assumes the implementation of Alternative 0 highway improvements and the 1 HOV lanes. The upgraded commuter rail alternative would use the existing right of way and stations, train service would be increased to 15-minute headways, and travel times would be improved due to the use of electric locomotives and zone express service during peak periods. An improved feeder/ distributor bus system would be developed to augment the improved line haul service. The San Francisco CalTrain terminal would be relocated to the Transbay Terminal or to a posible terminal at 2nd and Market Streets. A people mover would connect the airport station with the passenger terminals.

Bus service would be provided as follows:

- Shuttle bus service would be provided between the San Francisco Airport station and the maintenance and cargo areas.
- Increased, more direct shuttle bus service between the Daly City BART station and the San Francisco Airport would connect BART to the commuter rail service.
- Muni bus service to the existing San Francisco terminal at 4th and Townsend would be reduced.
- Additional local, feeder, and express bus services in San Mateo and Santa Clara Counties would be provided.

2.7.2 Right-of-Way and Facilities

This alignment would continue to follow the Southern Pacific mainline between San Francisco and San Jose. The San Francisco terminus would be extended from 4th and Townsend to the Transbay Terminal via tunnel or to a proposed terminal at 2nd and Market Streets. The San Jose terminus would be extended to interface with the Guadalupe Corridor LRT at Bassett or Alma Street.2nd and Market Streets.

Grade separations would be provided where necessary to alleviate traffic congestion and to avoid serious impacts on the traffic signals network.

The right of way requirements would be as follows:

- Southern Pacific mainline from San Francisco to San Jose.
- CalTrain station acquisition and parking facility expansions as per Alternative 1.
- Maintenance base for upgraded commuter rail service.

- Relocation of San Jose terminal to Bassett or Alma Street.
- Satellite park-and-ride lot for Daly City BART station.

It is assumed that the downtown San Francisco tunnel for the service extension will not require right of way but would require relocation of utilities.

In addition to the people mover system, an overcrossing of Highway 101 would be built to serve west side development and the CalTrain San Francisco Airport station. No parking will be provided at the airport station.

2.7.3 Systems and Equipment

The following equipment would be required in order to implement this alternative:

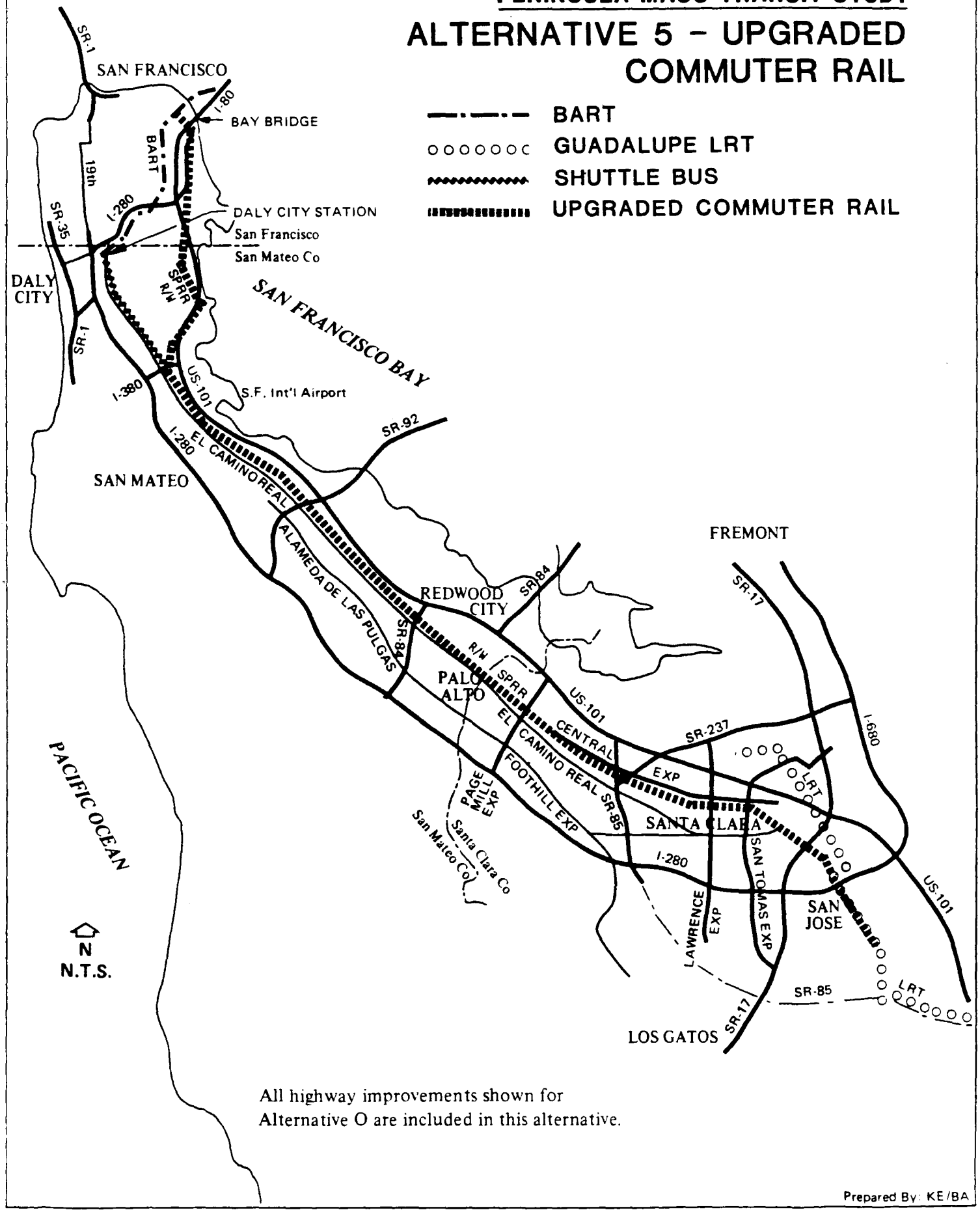
- 73 new gallery cars for CalTrain (78% funded)
- 50 to 60 new electric self-propelled bi-level cars equipped for multiple unit operation (unfunded)
- 10 new electric locomotives (unfunded)
- New buses for SamTrans to increase local and feeder bus service
- New buses for SCCTD to increase local, feeder, and express bus services
- New vehicles for the people mover system.

2.7.4 Operating Characteristics

Service to all stations would be provided at 15 minute intervals, supplemented by peak direction zone express trains during peak hours. The fare collection system would be self-service and would utilize a BART fare structure algorithm. Additionally, new work rules would be negotiated to allow for a two-person train crew.

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 5 - UPGRADED COMMUTER RAIL



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

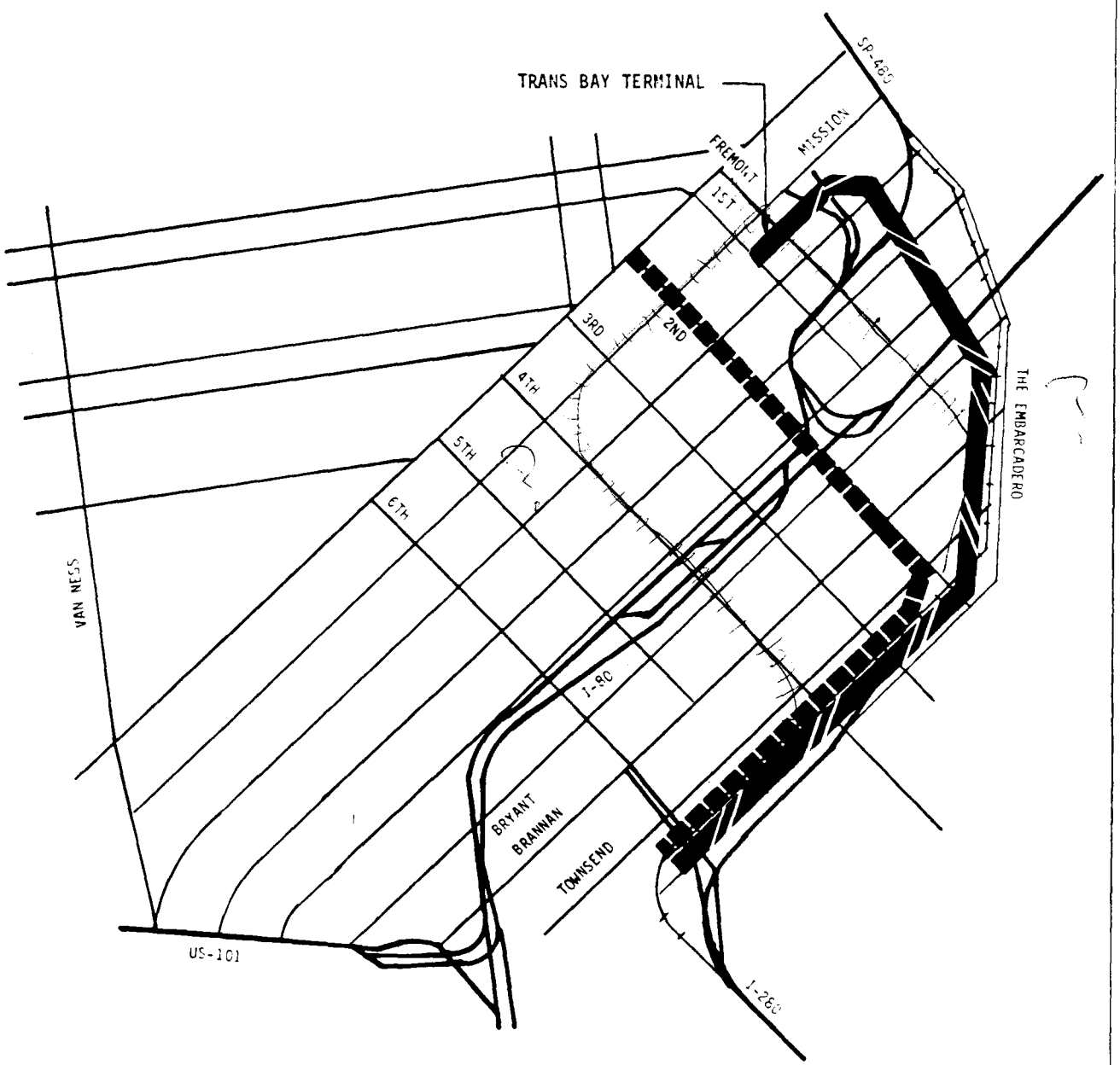
Prepared By: KE/BA

PENINSULA MASS TRANSIT STUDY

COMMUTER RAIL EXTENSION TO FINANCIAL DISTRICT

2ND ST. ALTERNATIVE

TRANSBAY TERMINAL ALTERNATIVE



Prepared By KE BA

2.8 ALTERNATIVE 6 - BUS/HOV LANE

2.8.1 Service Concept

This alternative creates a continuous system of HOV lanes and replaces rail service with bus service throughout the corridor. It fulfills the UMTA planning guidelines that require the analysis of an all-bus alternative. CalTrain service would be discontinued, the highway improvements of Alternative 0 and the HOV lanes described in Alternative 1 would be implemented; and, in order to separate buses from mixed flow traffic, elevated bus lanes would be constructed on Highway 101 north of Whipple Avenue to I-280 and on I-280 from Route 1 to 6th Street in San Francisco. Exclusive bus lanes would be located along 6th Street or along a parallel street. Buses would collect passengers on surface streets, access the HOV lane for most of the trip, and would leave the HOV lanes to distribute passengers on surface streets, serving the Transbay Terminal, the financial district, and other significant business and employment centers. Local bus service would also be increased for shorter trips, but these buses would not necessarily use the HOV lanes. SamTrans would provide increased bus service between the BART Daly City station and the airport, and Muni bus service to the CalTrain terminal would be eliminated. Alternatively, the Southern Pacific right of way could be used instead of Highway 101 north of Whipple Avenue.

2.8.2 Right of Way and Facilities

The HOV alignments would include:

- Highway 101 south of Whipple Avenue to south of San Jose
- I-280 between Route 85 and Highway 17 (I-880)
- Route 85 between Highway 101 and Highway 101

The new elevated bus lane alignments would include:

- Highway 101 north of Whipple Avenue to I-280
- I-280 from State Route 1 to 6th Street in San Francisco (elevated structure), with exclusive bus lanes on 6th Street or a parallel street, distributing on surface streets, and serving major employment and business areas, including the Transbay Terminal. Major ramps and flyovers will be needed to access the elevated structures.

The right of way requirements include park-and-ride lots for additional SamTrans and SCCTD express bus services, satellite park-and-ride lot for the Daly City BART station, and additional bus maintenance bases for SamTrans and SCCTD.

2.8.3 Systems and Equipment

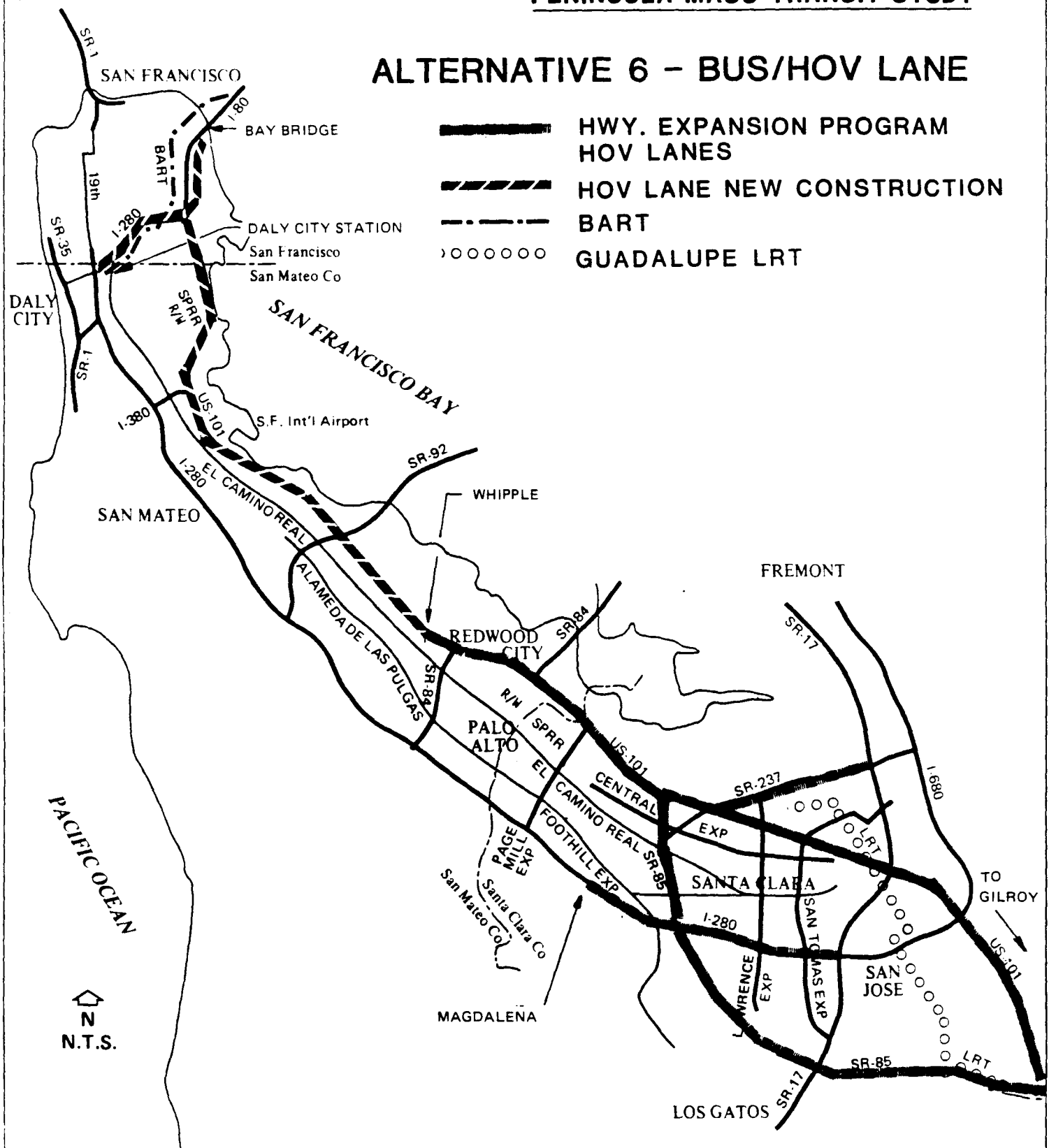
SamTrans and SCCTD would require new buses in order to increase local and express bus services, and a signal priority/preemption plan would be implemented.

2.8.4 Operating Characteristics

Express buses would operate in both the collection and the distribution mode over surface streets and in the line haul (no stop) mode in elevated bus/HOV lanes to concentrations of employment. Local corridor bus services would be increased significantly to accommodate short distance trips. Peak period BART headways to Daly City would be reduced from 4 minutes to 2.5 minutes. A BART fare structure algorithm would be utilized for express bus trips.

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 6 - BUS/HOV LANE



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

Prepared By: MTBA

2.9 ALTERNATIVE 7 - BART/LRT COMBINATION

2.9.1 Service Concept

This alternative incorporates the highway improvements listed in Alternative 0 and the HOV lanes described in Alternative 1. The Daly City BART line would be extended to a station at Millbrae, with a station at San Francisco Airport, and a people mover system would connect the airport station with the passenger terminals. Passengers could transfer between LRT and BART at either the Millbrae station or the airport station. LRT service would connect San Francisco Airport with San Jose. This alternative has the advantage of using BART as the distribution system in San Francisco, but it would require passengers traveling between points south of the airport and downtown San Francisco to transfer near the airport if the LRT is not extended to downtown San Francisco. As in Alternative 3, two service concepts will be considered in the Bayshore corridor north of the airport, one using local buses terminating at the Transbay Terminal and one extending the LRT to connect downtown San Francisco to the airport.

Bus service would be affected as follows:

- Supplemental shuttle bus service would be provided between airport station and maintenance cargo areas.
- Additional local and feeder bus services in San Francisco, San Mateo, and Santa Clara Counties would be provided.
- Express bus services provided by SamTrans would be reduced.
- Additional express bus services would be provided by SCCTD.
- Muni bus service to the San Francisco CalTrain station would be reduced.

2.9.2 Right-of-Way and Facilities

The LRT alignment would be the same as that given in Alternative 4. The BART airport extension would generally follow the Southern Pacific San Bruno branch line from the end of the Daly City tail track to I-380 and would then follow the Southern Pacific main line to the Millbrae station. The alignment would be fully grade-separated and a tail track would be provided at Millbrae.

The San Francisco Airport LRT and BART stations would provide direct interface between systems and airport terminals via an automated people mover system.

The right of way requirements would be as follows:

- Southern Pacific mainline fron San Francisco to San Jose and San Bruno branch line from Colma to I-380
- BART stations at Serramonte/Colma, Chestnut Avenue, Tanforan, and San Francisco Airport. Parking provided at all stations except San Francisco Airport station
- LRT stations as noted in Alternative 4
- BART storage yard expansion at Serramonte/Colma
- LRT storage yard/maintenance base with location to be determined
- Right-of-way easements for the Central Expressway and San Jose Airport and Route 87

Additionally, a Highway 101 overcrossing at the San Francisco Airport would be constructed to serve west side development and the BART/LRT station.

2.9.3 Systems and Equipment

New rolling stock required for this alternative would include all new LRT rolling stock for revenue service and spares as in Alternative 4; all new BART rolling stock for revenue service and spares; new buses for SamTrans to increase local, feeder, and possibly express bus services; new buses for SCCTD to increase local, feeder, and express bus services; and new people mover vehicles.

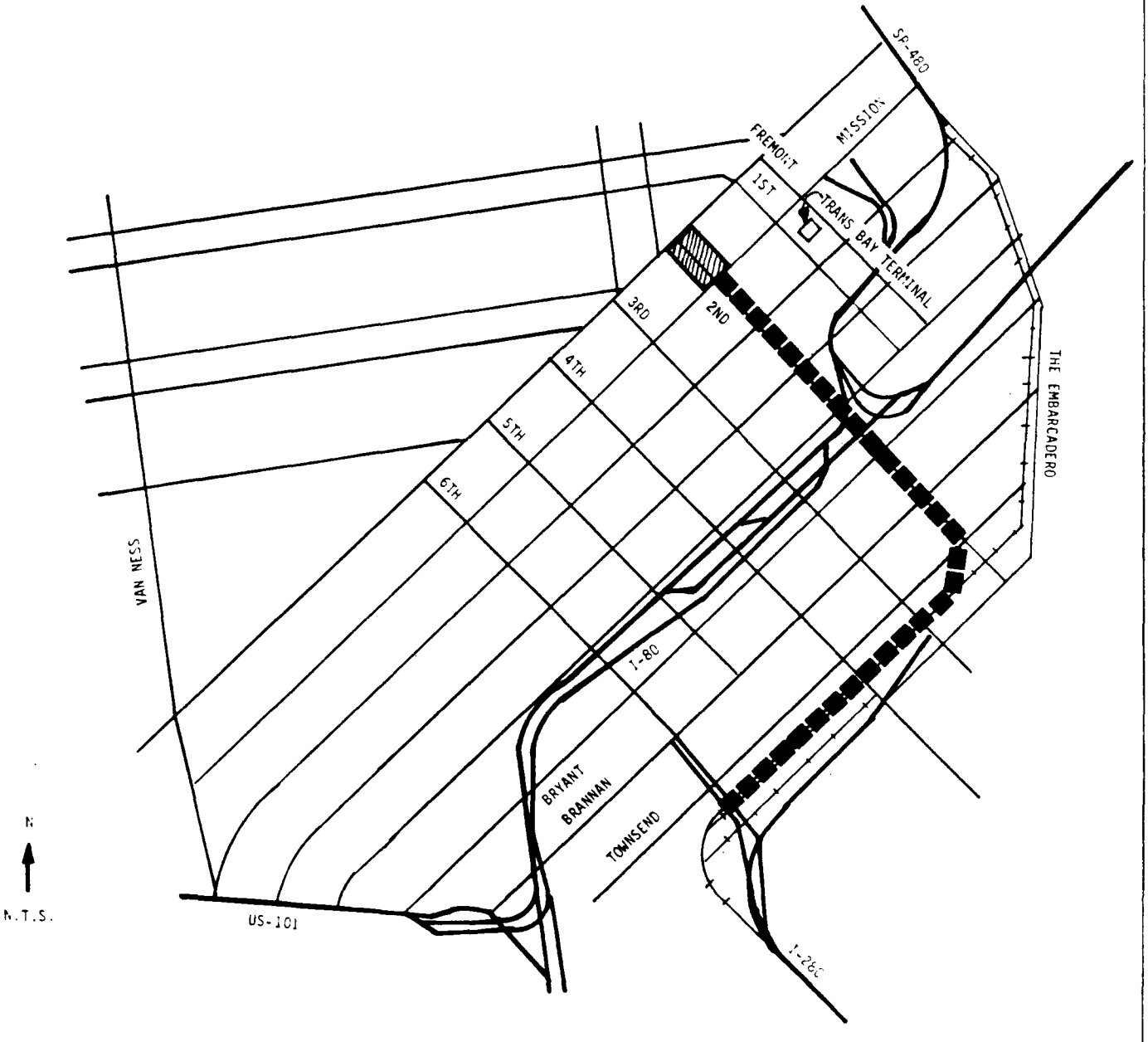
2.9.4 Operating Characteristics

The LRT operating characteristics would be the same as noted for Alternative 4. BART peak-period headways will be 2.5 minutes north of Daly City and 3 to 3.5 minutes between Daly City and the Millbrae station. Off-peak headways would be 7.5 minutes and evening service (after 8 pm) would be every 20 minutes.

PENINSULA MASS TRANSIT STUDY

LRT ALIGNMENT IN DOWNTOWN SAN FRANCISCO

■■■■■■ LRT AT GRADE



Prepared By KE BA

2.10 ALTERNATIVE 8 - BART/CALTRAIN COMBINATION

2.10.1 Service Concept

This alternative would incorporate the highway improvements listed in Alternative 0 and the HOV lanes designated in Alternative 1. The Daly City BART line would be extended to Millbrae as described in Alternative 7. CalTrain service would be improved as noted in Alternative 1. As in Alternative 3, two service concepts will be considered in the Bayshore corridor north of the airport, one using local buses terminating at the Transbay Terminal, and one that continues CalTrain service to the downtown along this corridor. Continuation of CalTrain service north in San Francisco would include the terminal relocation concepts from Alternative 2. The people mover and bus support systems would be as described in Alternative 7.

2.10.2 Right-of-Way and Facilities

The right of way requirements for this alternative would be as follows:

- Southern Pacific San Bruno branch line from Colma to I-380 and a short segment adjacent to the mainline from I-380 to the Millbrae station (with tail track). Stations as noted in Alternative 7.
- CalTrain station acquisitions, parking facilities and maintenance base as per Alternative 1.
- Relocation of the San Jose terminal to Bassett or Alma Streets.
- Land adjacent to Transbay Terminal for CalTrain extension, if the 2nd Street alignment is not used.
- Construction of Highway 101 overpasses would be the same as for Alternative 7.

2.10.3 Systems and Equipment

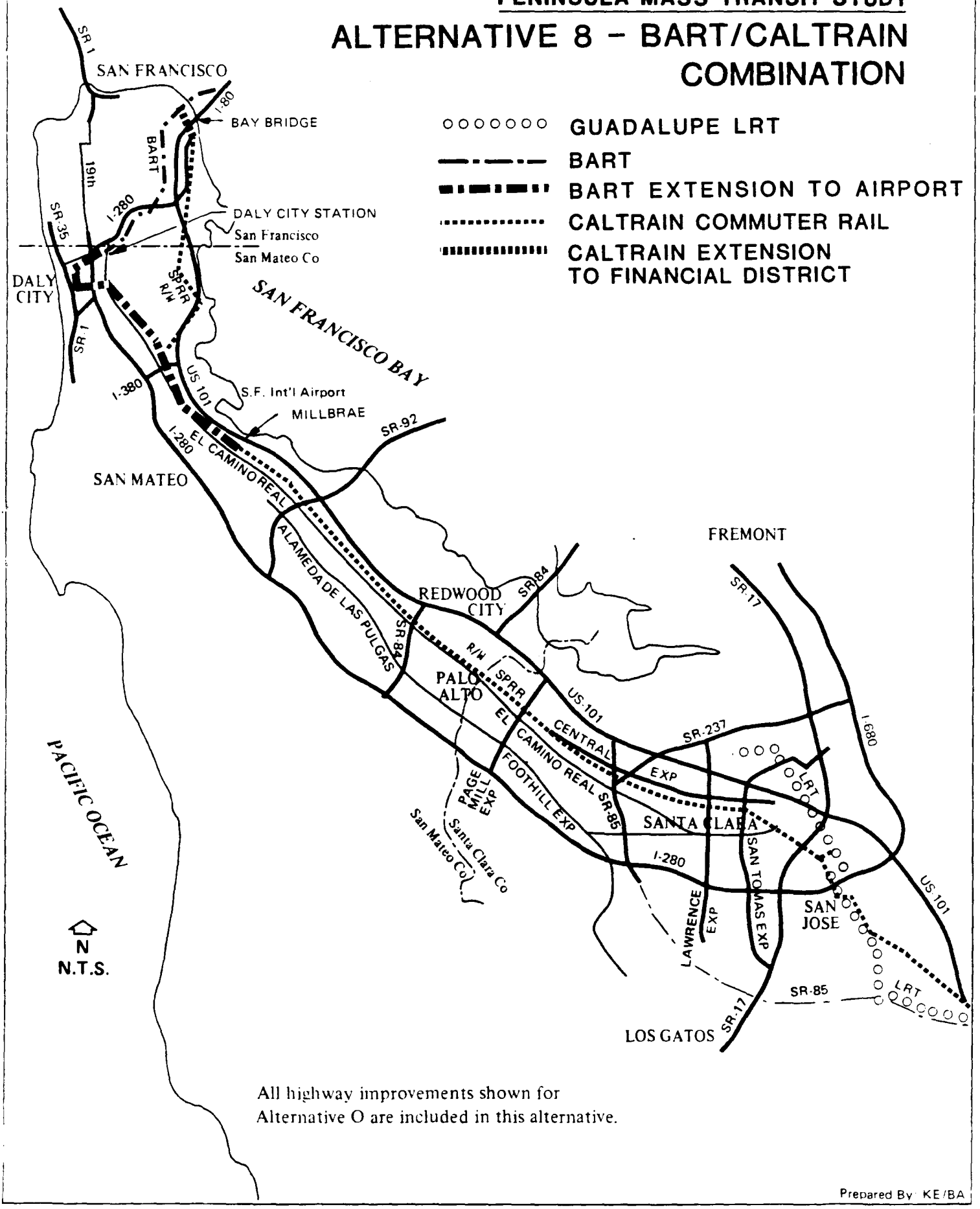
The equipment required to support this alternative includes CalTrain equipment as noted in Alternative 1, with potential purchase of dual propulsion locomotives (diesel and electric); BART rolling stock as required in Alternative 7; new buses for SamTrans to increase local and feeder bus services; new buses for SCCTD to increase local, feeder, and express bus services; and new people mover vehicles.

2.10.4 Operating Characteristics

BART operating characteristics would be the same as described in Alternative 7 and Caltrain would operate as noted in Alternative 1. In the case of the option using buses north of the airport to serve the Bayshore area, the CalTrain system would terminate at the airport station with provisions for turning back.

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 8 - BART/CALTRAIN COMBINATION



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

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2.11 ALTERNATIVE 9 - BART/BUS COMBINATION

2.11.1 Service Concept

This alternative consists of the highway transportation system improvements as noted in Alternative 0; the HOV lanes designated in Alternative 1 on highway expansion and new construction projects; new bus lanes constructed as in Alternative 6; the Daly City BART line extended to a Millbrae station; and improved local, BART feeder, and express bus services. CalTrain commuter rail service would be discontinued as would Muni bus service. to the CalTrain Terminal. Additional local, feeder, and express bus service would be provided by SamTrans, and additional local and express bus service would be provided by SCCTD. Service in the Bayshore Corridor north of the airport would be provided via a transfer to other bus routes at the Millbrae terminal or by a continuation of bus services from the south, which would provide express bus service to this area.

2.11.2 Right-of-Way and Facilities

Bus and HOV lane alignments would be as noted in Alternative 6. The BART alignment would be as noted in Alternative 7.

The right of way requirements would be as follows:

- Southern Pacific San Bruno branch line from Colma to I-380 and a short segment adjacent to the mainline from I-380 to the Millbrae station (with tail track). Stations as noted in Alternative 7.

- Park-and-ride lots and maintenance facilities for additional SamTrans and SCCTD express bus services.

- BART stations and storage yard expansions as noted in Alternative 7.

2.11.3 Systems and Equipment

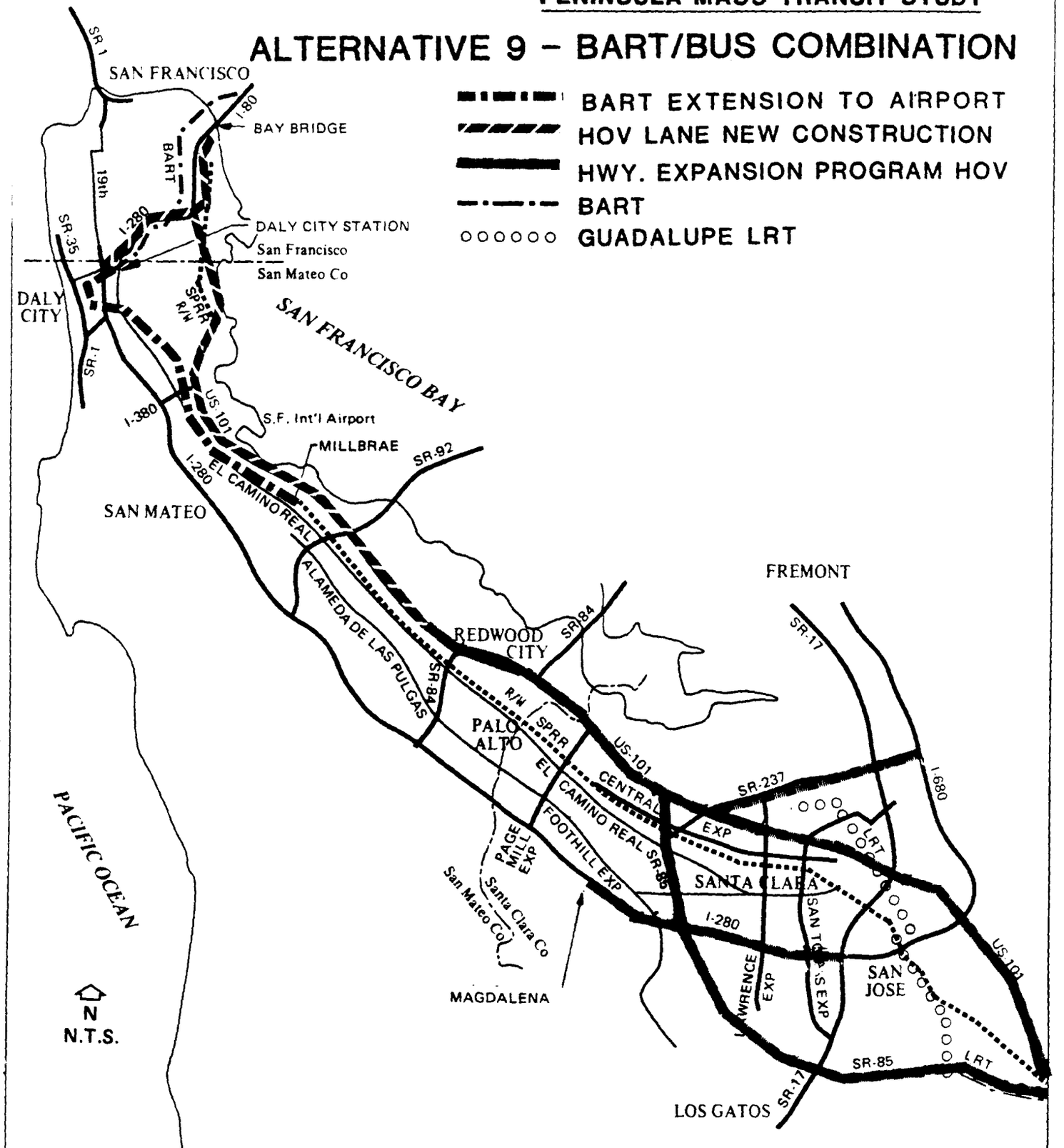
Additional BART rolling stock would be required as well as new buses to enable SamTrans and SCCTD to increase local and express bus service. A signal priority/preemption plan would also have to be implemented.

2.11.4 Operating Characteristics

BART operations would be as described in Alternative 7, and the bus operations would be as described on Alternative 6.

PENINSULA MASS TRANSIT STUDY

ALTERNATIVE 9 – BART/BUS COMBINATION



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

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