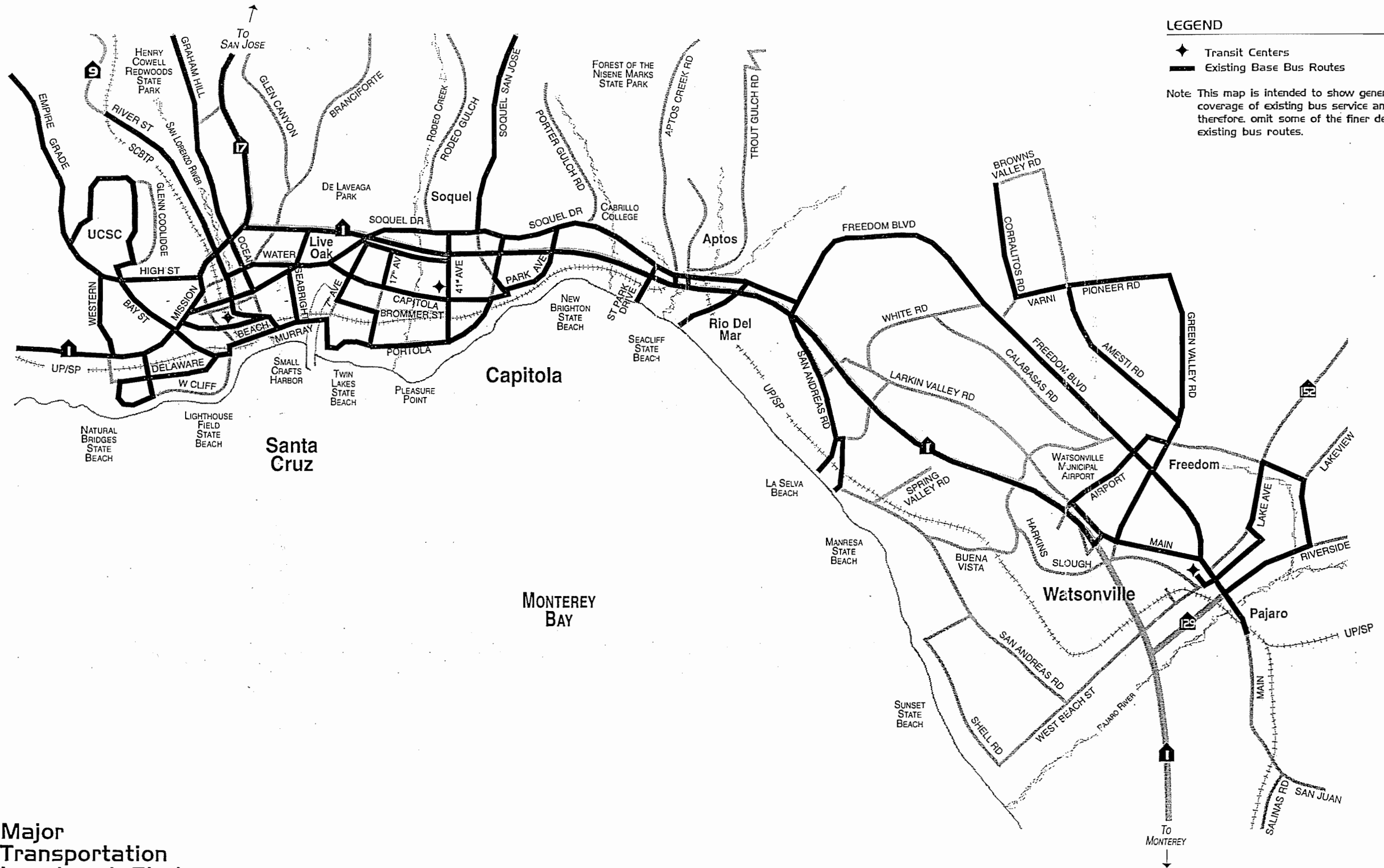
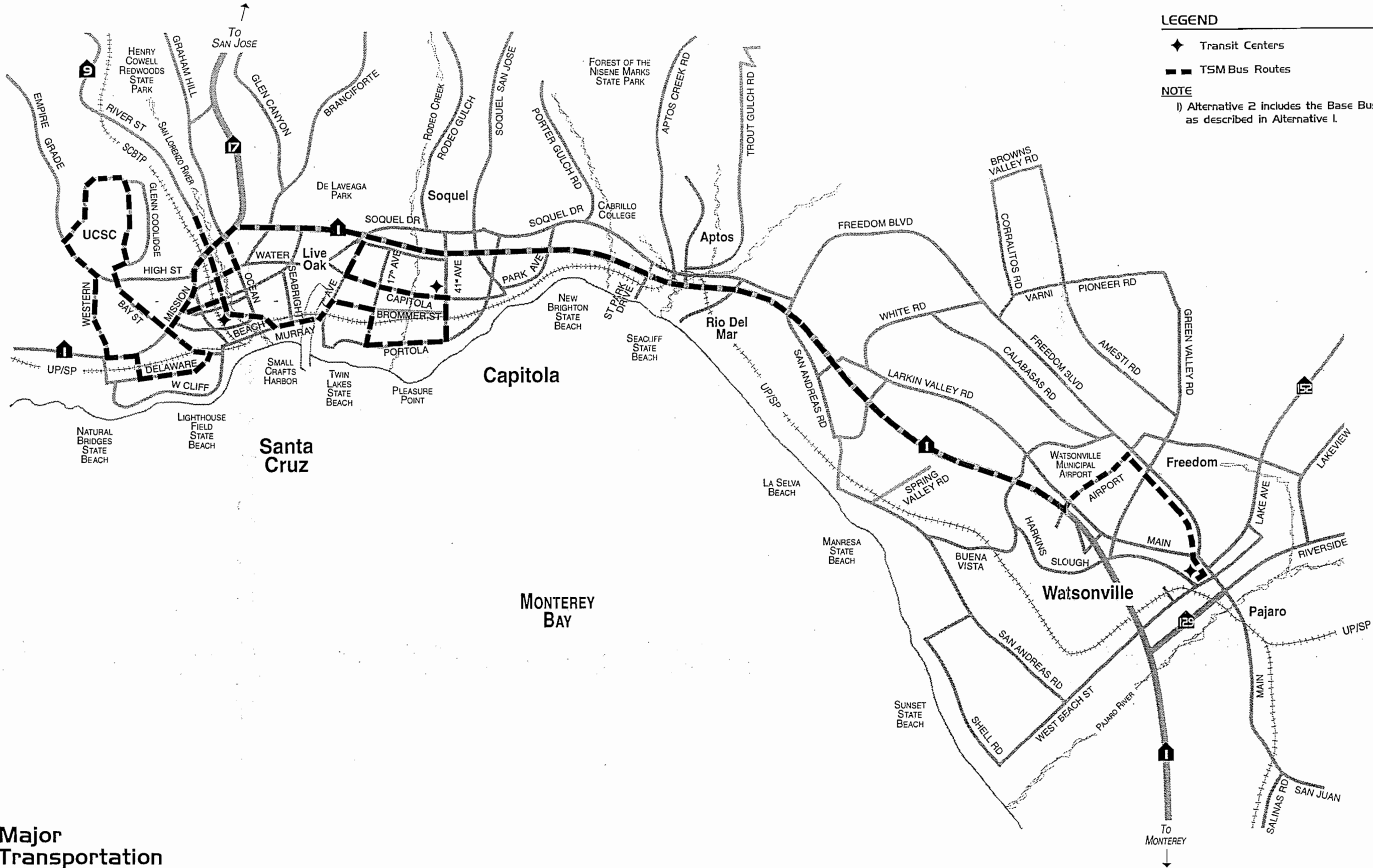
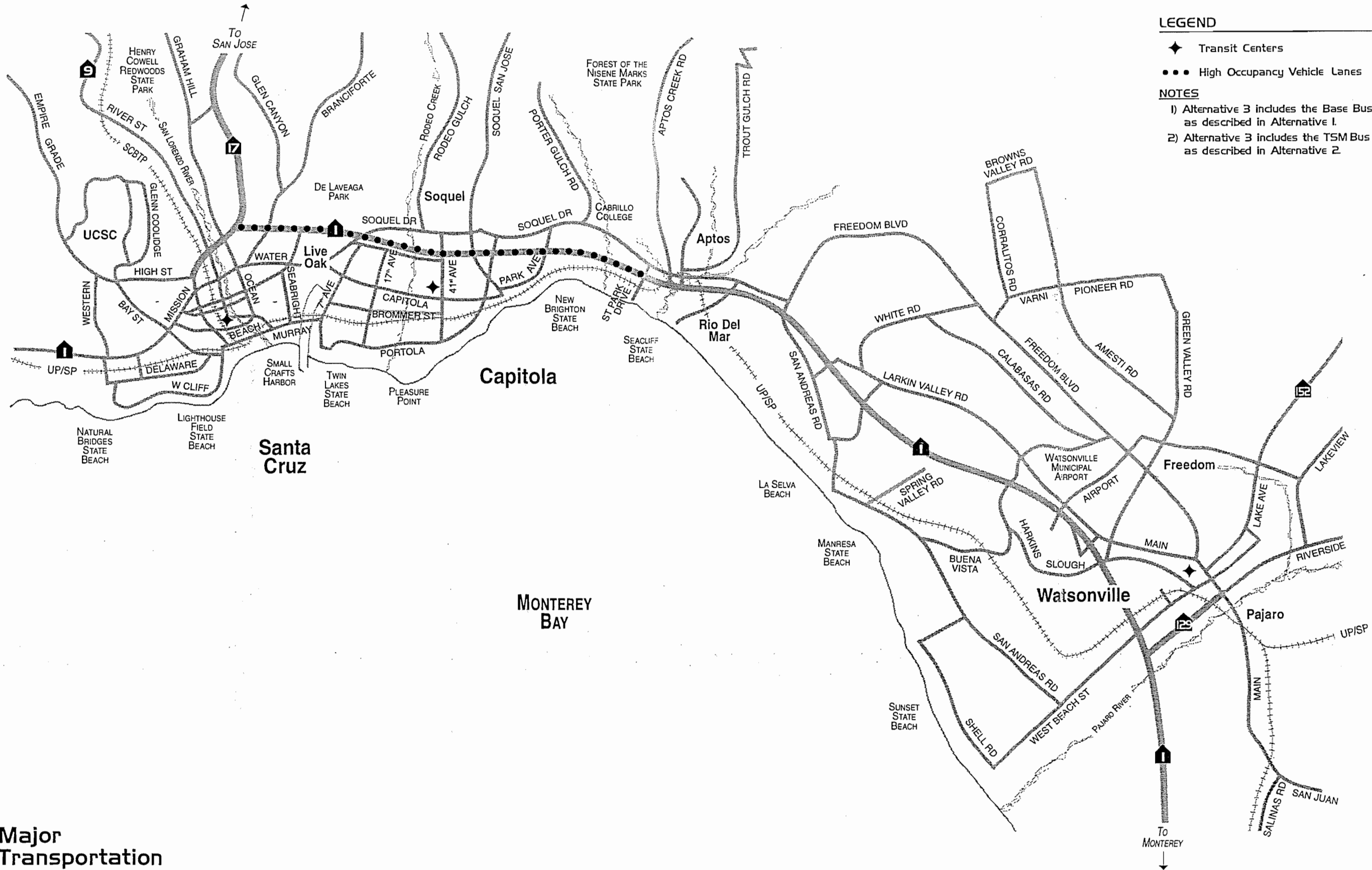


APPENDIX B
MAPS OF ALTERNATIVES







LEGEND

- ◆ Transit Centers
- High Occupancy Vehicle Lanes

NOTES

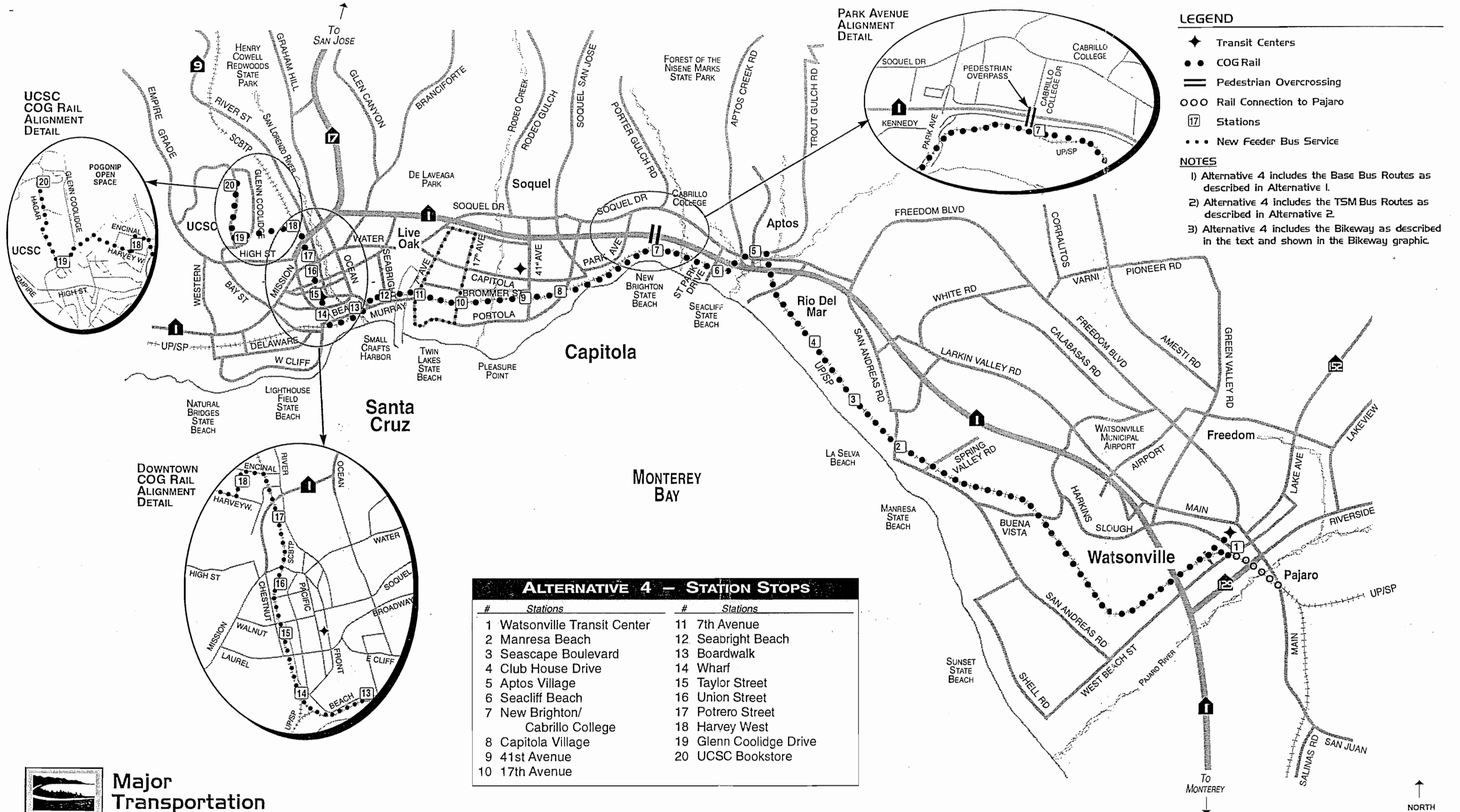
- 1) Alternative 3 includes the Base Bus Routes as described in Alternative 1.
- 2) Alternative 3 includes the TSM Bus Routes as described in Alternative 2.



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Figure B-3



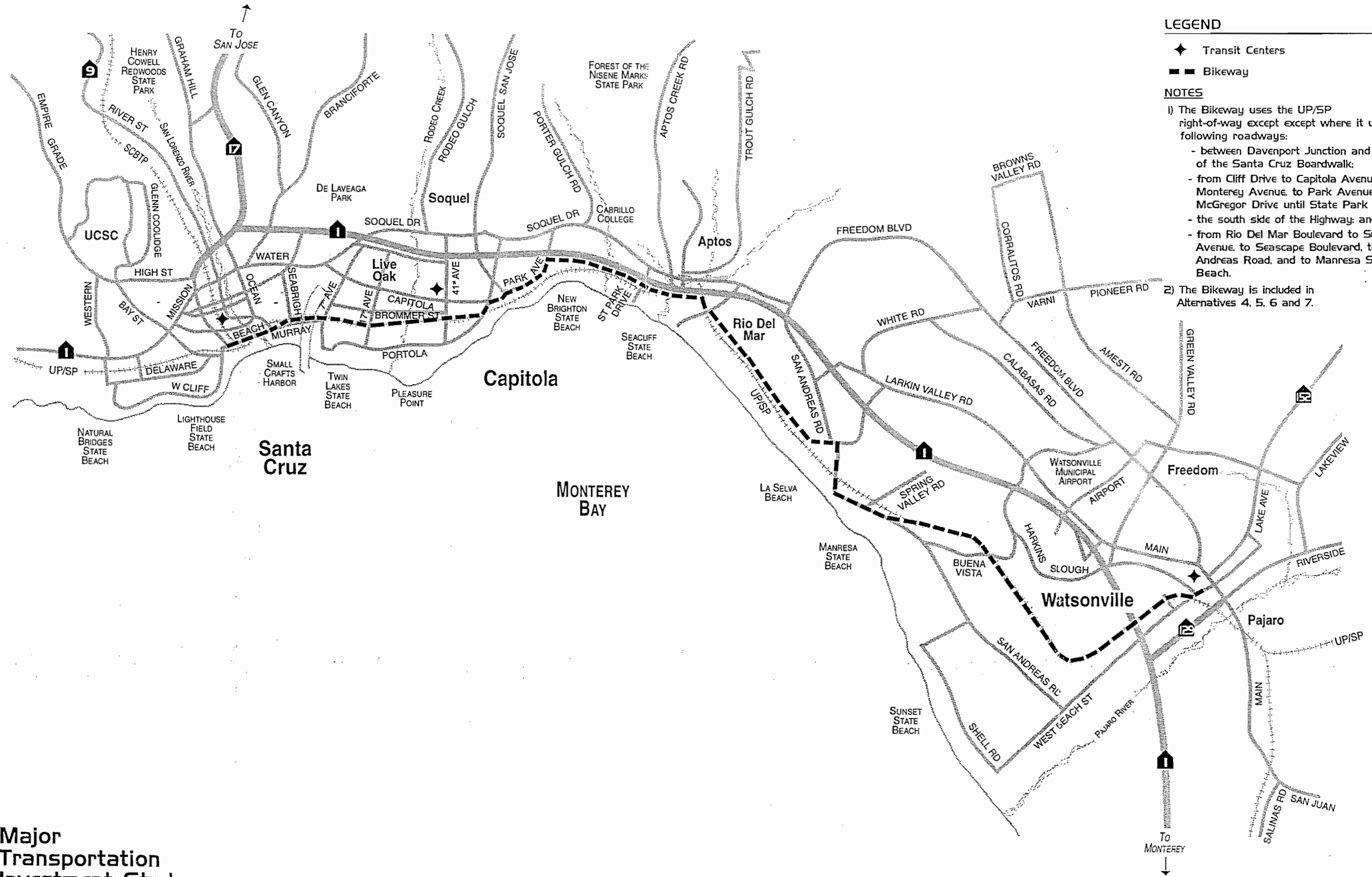
| ALTERNATIVE 4 - STATION STOPS | | | |
|-------------------------------|-----------------------------------|----|----------------------|
| # | Stations | # | Stations |
| 1 | Watsonville Transit Center | 11 | 7th Avenue |
| 2 | Manresa Beach | 12 | Seabright Beach |
| 3 | Seascape Boulevard | 13 | Boardwalk |
| 4 | Club House Drive | 14 | Wharf |
| 5 | Aptos Village | 15 | Taylor Street |
| 6 | Seacliff Beach | 16 | Union Street |
| 7 | New Brighton/ Cabrillo College | 17 | Potrero Street |
| 8 | Capitola Village | 18 | Harvey West |
| 9 | 41st Avenue | 19 | Glenn Coolidge Drive |
| 10 | 17th Avenue | 20 | UCSC Bookstore |



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Figure B-4



LEGEND

- ◆ Transit Centers
- Bikeway

NOTES

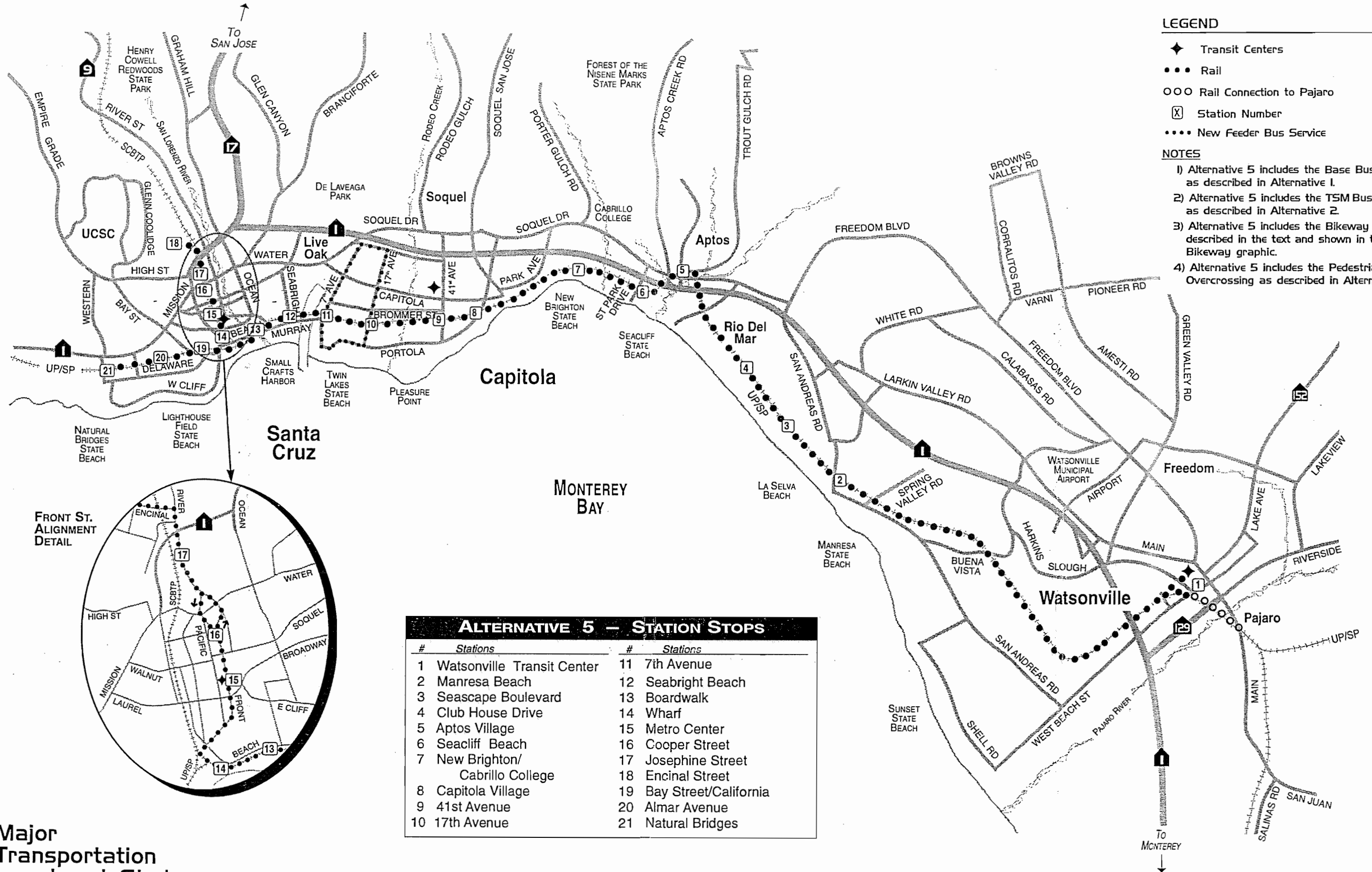
- 1) The Bikeway uses the UP/SP right-of-way except where it uses the following roadways:
 - between Davenport Junction and the end of the Santa Cruz Boardwalk;
 - from Cliff Drive to Capitola Avenue, to Monterey Avenue, to Park Avenue, to McGregor Drive until State Park Drive;
 - the south side of the Highway; and
 - from Rio Del Mar Boulevard to Sumner Avenue, to Seascapes Boulevard, to San Andreas Road, and to Manresa State Beach.
- 2) The Bikeway is included in Alternatives 4, 5, 6 and 7.



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Figure B-5



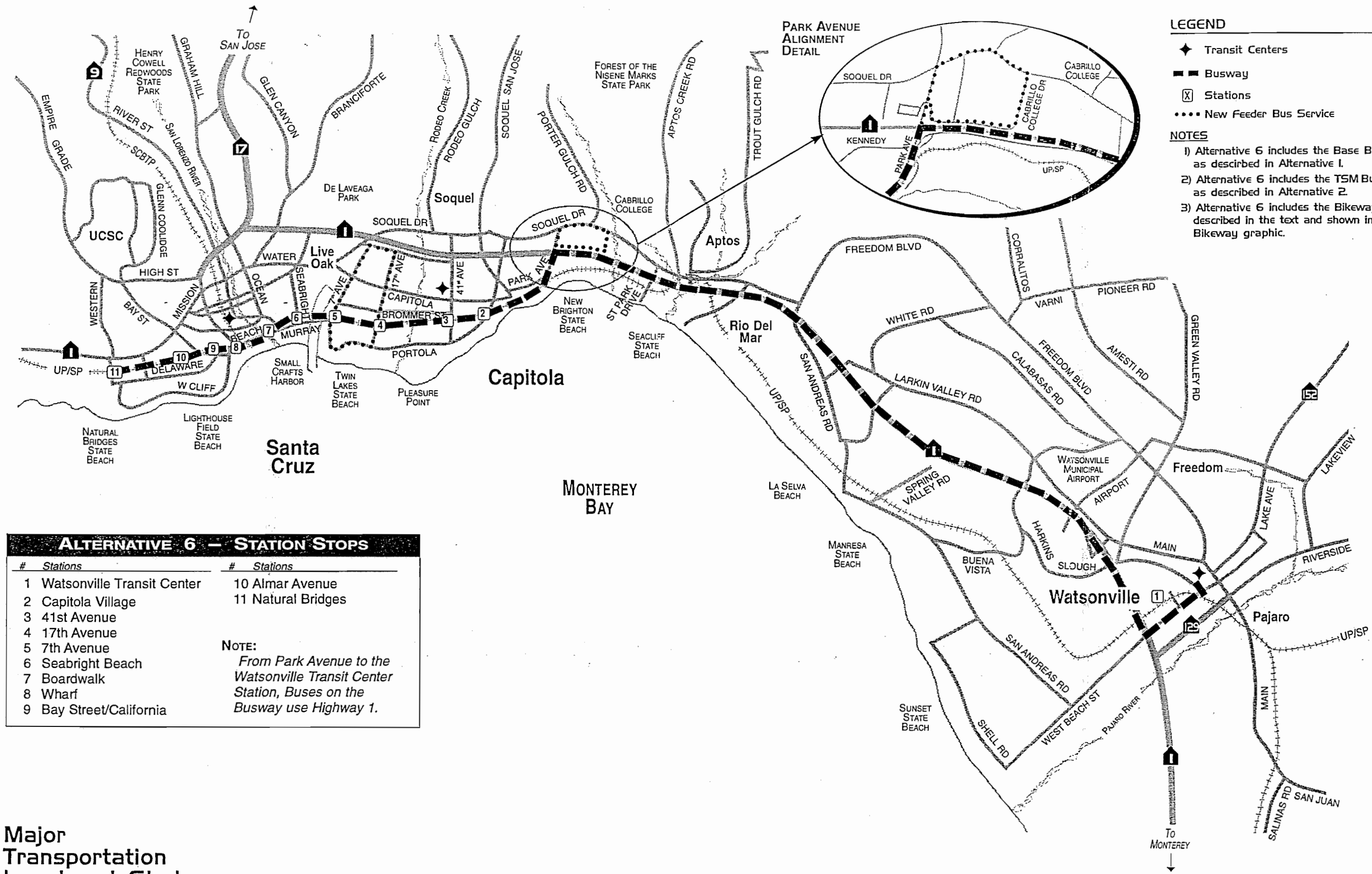
LEGEND

- ◆ Transit Centers
- Rail
- ○ ○ Rail Connection to Pajaro
- ⓧ Station Number
- New Feeder Bus Service

NOTES

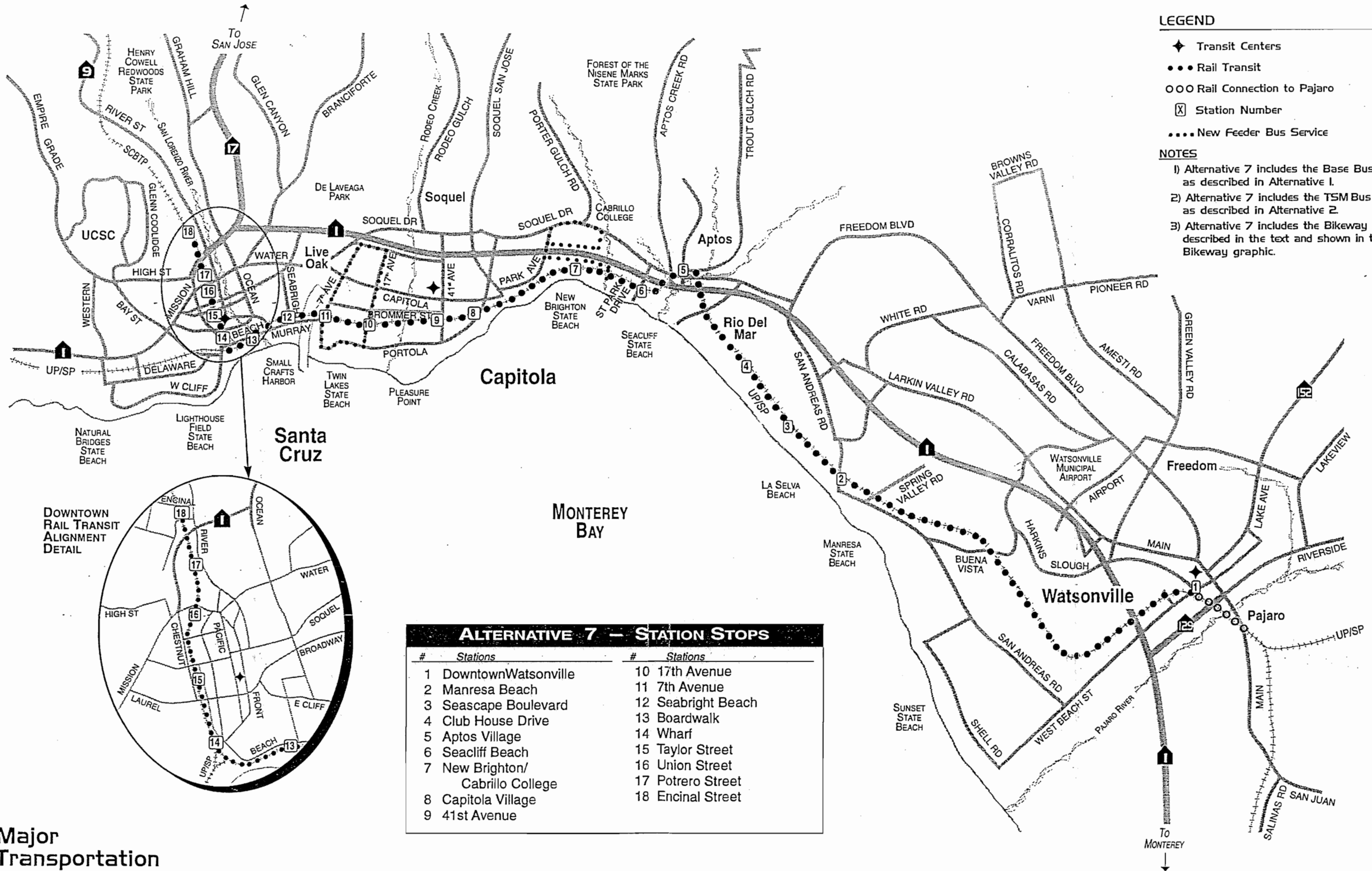
- 1) Alternative 5 includes the Base Bus Routes as described in Alternative 1.
- 2) Alternative 5 includes the TSM Bus Routes as described in Alternative 2.
- 3) Alternative 5 includes the Bikeway as described in the text and shown in the Bikeway graphic.
- 4) Alternative 5 includes the Pedestrian Overcrossing as described in Alternative 4.

| ALTERNATIVE 5 - STATION STOPS | | | |
|-------------------------------|-----------------------------------|----|-----------------------|
| # | Stations | # | Stations |
| 1 | Watsonville Transit Center | 11 | 7th Avenue |
| 2 | Manresa Beach | 12 | Seabright Beach |
| 3 | Seascape Boulevard | 13 | Boardwalk |
| 4 | Club House Drive | 14 | Wharf |
| 5 | Aptos Village | 15 | Metro Center |
| 6 | Seacliff Beach | 16 | Cooper Street |
| 7 | New Brighton/ Cabrillo College | 17 | Josephine Street |
| 8 | Capitola Village | 18 | Encinal Street |
| 9 | 41st Avenue | 19 | Bay Street/California |
| 10 | 17th Avenue | 20 | Almar Avenue |
| | | 21 | Natural Bridges |



| ALTERNATIVE 6 - STATION STOPS | | | |
|-------------------------------|----------------------------|----|-----------------|
| # | Stations | # | Stations |
| 1 | Watsonville Transit Center | 10 | Almar Avenue |
| 2 | Capitola Village | 11 | Natural Bridges |
| 3 | 41st Avenue | | |
| 4 | 17th Avenue | | |
| 5 | 7th Avenue | | |
| 6 | Seabright Beach | | |
| 7 | Boardwalk | | |
| 8 | Wharf | | |
| 9 | Bay Street/California | | |

NOTE:
From Park Avenue to the Watsonville Transit Center Station, Buses on the Busway use Highway 1.



LEGEND

- ◆ Transit Centers
- Rail Transit
- ○ ○ Rail Connection to Pajaro
- ☒ Station Number
- New Feeder Bus Service

NOTES

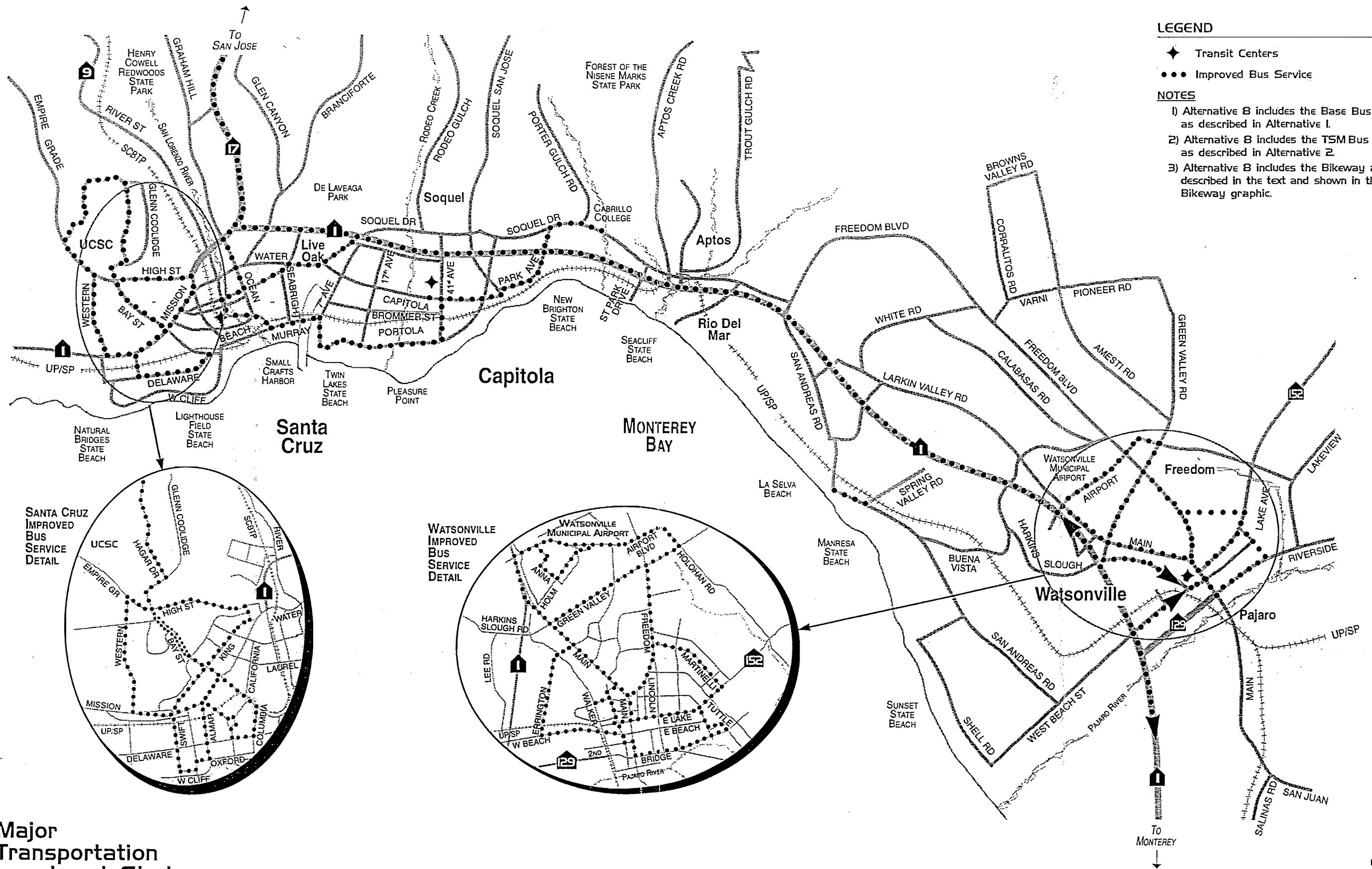
- 1) Alternative 7 includes the Base Bus Routes as described in Alternative 1.
- 2) Alternative 7 includes the TSM Bus Routes as described in Alternative 2.
- 3) Alternative 7 includes the Bikeway as described in the text and shown in the Bikeway graphic.

| ALTERNATIVE 7 - STATION STOPS | | | |
|-------------------------------|-----------------------------------|----|-----------------|
| # | Stations | # | Stations |
| 1 | Downtown Watsonville | 10 | 17th Avenue |
| 2 | Manresa Beach | 11 | 7th Avenue |
| 3 | Seascape Boulevard | 12 | Seabright Beach |
| 4 | Club House Drive | 13 | Boardwalk |
| 5 | Aptos Village | 14 | Wharf |
| 6 | Seacliff Beach | 15 | Taylor Street |
| 7 | New Brighton/ Cabrillo College | 16 | Union Street |
| 8 | Capitola Village | 17 | Potrero Street |
| 9 | 41st Avenue | 18 | Encinal Street |



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Figure B-9

APPENDIX C

PARK-AND-RIDE AND WALK-AND-RIDE FACILITY LOCATIONS

APPENDIX C

Park-and-Ride and Walk-and-Ride Facility Locations

Provided below are four tables listing the proposed location of Park-and-Ride (PNR) and Walk-and-Ride (WNR) lots for the three rail alternatives (Alternatives 4, 5, and 7), and the Busway Alternative (Alternative 6).

TABLE 1

**RAIL STATION AND BUS SERVICE IMPROVEMENTS
ALTERNATIVE 4: RAIL SERVICE FROM WATSONVILLE
TRANSIT CENTER TO UCSC VIA HARVEY WEST**

| | Rail Station Name | Street Location (Railroad tracks at . . .) | Park-and- Ride (PNR) or Walk- and Ride (WNR) | Bus Routes Serving Station |
|-----|----------------------------|---|---|--|
| 1. | Watsonville Transit Center | West Beach and Rodriguez Streets | PNR | 69W, 71, 72, 73, 75, 79, 91, A |
| 2. | Manresa Beach | South of San Andreas Road | WNR | 54 |
| 3. | Club House Drive | Club House Drive | WNR | 54 |
| 4. | Aptos Village | Soquel Drive and Trout Gulch Road | PNR | 71 |
| 5. | Seacliff Beach | State Park Drive | PNR | 54, 69W, 70, 17E |
| 6. | New Brighton | New Brighton Road | PNR | |
| 7. | Capitola Village | Monterey Avenue | PNR | 52, 54 |
| 8. | 41st Avenue | 41st Avenue | PNR | 51, 52, 65, 67, E |
| 9. | 17th Avenue | 17th Avenue | WNR | 65, 66, E Live Oak Shuttle |
| 10. | 7th Avenue | 7th Avenue | PNR | 6, 67, E Live Oak Shuttle |
| 11. | Seabright Beach | Railroad tracks at | WNR | 6, 67, E |
| 12. | Boardwalk | Leibrandt Avenue | WNR | C |
| 13. | Davenport Junction | West end of the Boardwalk | WNR | 1B, 3A, C |
| 14. | Taylor Street | Taylor Street | WNR | 1L, 2, 3B, 5, 12, 30, 35, 40, 41, 91, A, E |
| 15. | Union Street | Union Street | WNR | 1H |
| 16. | Potrero Street | Potrero Street (North) | PNR | C |
| 17. | Harvey West | Harvey West Boulevard and Sylvania Avenue | WNR | C |
| 18. | Glen Coolidge Drive | Glen Coolidge Drive and Hagar Drive | WNR | 1B, 1H, 1W, 1L, A, B, D, E |
| 19. | UCSC Bookstore | Hagar Drive South of Steinhart. | WNR | 1B, 1H, 1W, 1L, A, B, D, E |

TABLE 2

**RAIL STATION AND BUS SERVICE IMPROVEMENTS
ALTERNATIVE 5: RAIL SERVICE FROM WATSONVILLE
TRANSIT CENTER TO HARVEY WEST AND NATURAL BRIDGES**

| | Rail Station Name | Street Location (Railroad tracks at . . .) | Park-and-Ride (PNR) or Walk-and-Ride (WNR) | Bus Routes Serving Station |
|-----|----------------------------|---|---|--|
| 1. | Watsonville Transit Center | West Beach and Rodriguez Streets | PNR | 69W, 71, 72, 73, 75, 79, 91, A |
| 2. | Manresa Beach | South of San Andreas Road | WNR | 54 |
| 3. | Club House Drive | Club House Drive | WNR | 54 |
| 4. | Aptos Village | Soquel Drive and Trout Gulch Road | PNR | 71 |
| 5. | Seacliff Beach | State Park Drive | PNR | 54, 69W, 70, 17E |
| 6. | New Brighton | New Brighton Road | PNR | |
| 7. | Capitola Village | Monterey Avenue | PNR | 52, 54 |
| 8. | 41st Avenue | 41st Avenue | PNR | 51, 52, 65, 67, E |
| 9. | 17th Avenue | 17th Avenue | WNR | 65, 66, E Live Oak Shuttle |
| 10. | 7th Avenue | 7th Avenue | PNR | 6, 67, E Live Oak Shuttle |
| 11. | Seabright Beach | Seabright Avenue | WNR | 6, 67, E |
| 12. | Boardwalk | Leibrandt Avenue | WNR | C |
| 13. | Davenport Junction | West end of the Boardwalk | WNR | 1B, 3A, C |
| 14. | Metro Center | Pacific Avenue and Elm Street | WNR | 1B, 1H, 1W, 1L, 2, 3A, 3B, 4, 5, 6, 7, 8, 30, 35, 40, 41, 65, 66, 67, 69, 69W, 70, 71, 91, A, C, E |
| 15. | Cooper Street | Cooper and Front Streets | WNR | 1H, 4, 5, 8, 30, 35, 65, 66, 70, 71, A, C |
| 16. | Josephine Street | Josephine and River Streets | WNR | C |
| 17. | Encinal Street | Encinal Street | WNR | C |
| 18. | Bay/California | Bay and California Streets | WNR | 1B, 3A, D |
| 19. | Almar Avenue | Almar Avenue | WNR | 2, 3A, 3B |
| 20. | Natural Bridges | Natural Bridges | PNR | 2, 40, D |

TABLE 3
BUS STATIONS AND SERVICE IMPROVEMENTS
ALTERNATIVE 6: BUSWAY

| | Bus Station Name | Street Location (Railroad tracks at . . .) | Park-and-Ride (PNR) or Walk-and-Ride (WNR) | Bus Routes Serving Station |
|-----|----------------------------|---|---|---------------------------------------|
| 1. | Watsonville Transit Center | West Beach and Rodriguez Streets | PNR | 69W, 71, 72, 73, 75, 79, 91, A |
| 2. | Seacliff Beach | State Park Drive | PNR | 54, 69W, 70, 17E |
| 3. | New Brighton | New Brighton Road | PNR | Cabrillo College Shuttle |
| 4. | Capitola Village | Monterey Avenue | PNR | 52, 54 |
| 5. | 41st Avenue | 41st Avenue | PNR | 51, 52, 65, 67, E |
| 6. | 17th Avenue | 17th Avenue | WNR | 65, 66, E Live Oak Shuttle |
| 7. | 7th Avenue | 7th Avenue | PNR | 6, 67, E Live Oak Shuttle |
| 8. | Seabright Beach | Seabright Avenue | WNR | 6, 67, E Live Oak Shuttle |
| 9. | Boardwalk | Leibrandt Avenue | WNR | C |
| 10. | Davenport Junction | West end of the Boardwalk | WNR | 1B, 3A, C* |
| 11. | Bay/California | Bay and California Streets | WNR | 1B, 3A, D* |
| 12. | Almar Avenue | Almar Avenue | WNR | 2, 3A, 3B* |
| 13. | Natural Bridges | Natural Bridges | PNR | 2, 40, D |

Note: * indicates that during the perk period, Routes 3A and 3B are diverted to the busway.

TABLE 4

**RAIL STATION AND BUS SERVICE IMPROVEMENTS
ALTERNATIVE 7: RAIL SERVICE
FROM DOWNTOWN WATSONVILLE TO HARVEY WEST**

| | Rail Station Name | Street Location (Railroad tracks at . . .) | Park-and- Ride (PNR) or Walk- and-Ride (WNR) | Bus Routes Serving Station |
|-----|--------------------------|---|---|---|
| 1. | Walker Street | Walker Street | PNR | 69W, 71, 72, 73, 75, 79, 91, A |
| 2. | Manresa Beach | South of San Andreas Road | WNR | 54 |
| 3. | Club House Drive | Club House Drive | WNR | 54 |
| 4. | Aptos Village | Soquel Drive and Trout Gulch Road | PNR | 71 |
| 5. | Seacliff Beach | State Park Drive | PNR | 54, 69W, 70, 17E |
| 6. | New Brighton | New Brighton Road | PNR | Cabrillo College Shuttle |
| 7. | Capitola Village | Monterey Avenue | PNR | 52, 54 |
| 8. | 41st Avenue | 41st Avenue | PNR | 51, 52, 65, 67, E |
| 9. | 17th Avenue | 17th Avenue | WNR | 65, 66, E Live Oak Shuttle |
| 10. | 7th Avenue | 7th Avenue | PNR | 6, 67, E Live Oak Shuttle |
| 11. | Seabright Beach | Seabright Avenue | WNR | 6, 67, E Live Oak Shuttle |
| 12. | Boardwalk | Leibrandt Avenue | WNR | C |
| 13. | Davenport Junction | West end of the Boardwalk | WNR | 1B, 3A, C |
| 14. | Taylor Street | Taylor Street | WNR | 1L, 2, 3B, 5, 12, 30, 35, 40, 41, 91, A, E |
| 15. | Union Street | Union Street | WNR | 1H |
| 16. | Potrero Street | Potrero Street | PNR | C |
| 17. | Encinal Street | Encinal Street | WNR | C |
| | | | | |

APPENDIX D

**FTA COST-EFFECTIVENESS
WORKSHEETS**

APPENDIX D

Federal Transit Administration Performance Criteria

In September 1997, the Federal Transit Administration (FTA) issued technical guidance for evaluating projects eligible for Section 5309 New Starts funding. This guidance is designed to assist local agencies in submitting information and documentation of the New Starts criteria for proposed transit investments to FTA.¹

BACKGROUND

In December 1996, FTA issued a Federal Register notice describing the revised New Starts justification criteria to be used to evaluate candidate projects for discretionary New Starts funding under Section 5309. These criteria, which replaced those in effect since 1984, are to be applied in the annual ratings of proposed New Starts projects as reported to Congress, and to make the statutory approval to initiate preliminary engineering and project development.

The revised Section 5309 New Starts criteria is to assess a comprehensive set of quantitative and qualitative measures including:

- Mobility Improvements
- Environmental Benefits
- Operating Efficiencies
- Cost Effectiveness
- Transit Supporting Existing Land Use and Future Patterns
- Local Financial Commitment

The purpose of the criteria is to provide FTA with a consistent framework for evaluating major transit investments for Federal discretionary funding under the Section 5309 New Starts program. Such a framework is needed to help ensure that available discretionary resources are directed to candidate projects that offer the greatest return on the Federal investment.

APPLICATION OF CRITERIA

The remainder of this section describes the results of applying the FTA criteria in evaluating the Busway alternative (Alternative 6) included as part of the locally preferred investment strategy recommended for the Watsonville Junction-Santa Cruz-University of Santa Cruz (UCSC) Corridor. FTA worksheets documenting the results of this analysis are included at the end of this section.

Value of Travel Time Savings

¹ This discussion is contained in *Technical Guidance on Section 5309 New Starts Criteria*, September 1997, published by the Office of Planning, Federal Transit Administration.

Travel time savings to transit riders are measured using the dollar value of travel time for time spent in in-vehicle and out-of-vehicle. Travel time savings for motorists and commercial vehicles are measured solely using in-vehicle travel time. The FTA estimates that an hour of out-of-vehicle travel time is valued at \$17.00 and an hour of in-vehicle travel time at \$8.90. Auto/commercial travel time is valued at \$9.50 per hour.

The Busway alternative would result in savings of 200,000 hours of out-of-vehicle travel time. The Busway would, however, add 100,000 hours of in-vehicle travel time for transit riders. This would result in \$3.1 million net savings for transit users, compared to Baseline conditions. Motorists would realize \$279.5 million in total travel time savings, compared to Baseline conditions. The Busway alternative would result in \$1.6 million in total annual travel time savings to transit riders, compared to the TSM alternative. Motorists would gain \$50 million in travel time savings, compared to TSM.

Change in Criteria Pollutant and Precursor Emissions

Criteria pollutants include carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NO_x) and fine particulate (PM₁₀). NO_x and HC also contribute to the formation of ozone (O₃) in the lower atmosphere. Ground-level ozone can irritate the eyes, constrict the airways and aggravate existing respiratory conditions. Ozone can also damage vegetation, rubber and fabrics.

The Busway alternative would lower the number of annual vehicle miles traveled (VMT) by passenger vehicles and light-duty trucks, compared to Baseline conditions and the TSM alternative. Heavy duty truck traffic would not be affected by the proposed alternative. A reduction in VMT reduces the amount of criteria pollutants and ozone precursors produced by the transportation system.

Compared to Baseline conditions, the Busway alternative would reduce the amount of annual production of criteria pollutants and ozone precursors. Hydrocarbons would be reduced by nearly 9 million tons per year. The busway would produce 161 million tons less of CO and 12 million tons less of NO_x than under Baseline conditions. PM₁₀ would, however, increase by 640,000 tons annually.

Annually, the Busway would produce more criteria pollutants and ozone precursors that would the TSM alternative. The Busway would produce nearly a million tons more HC, nearly 3 million tons more CO, 350,000 tons NO_x and nearly 725,00 tons more PM₁₀ than the TSM alternative.

Greenhouse Gas Emissions

Greenhouse gas emissions, for the purpose of this study, consist exclusively of carbon dioxide CO₂. Greenhouse gases are viewed as having the potential to contribute to global climate change and warming.

The Busway alternative would reduce CO₂ by about 12 billion tons annually compared to Baseline conditions. The Busway alternative would, however, increase CO₂ production by about 1.5 billion tons, compared to the TSM alternative.

Energy Consumption

The Busway alternative would lower the number of annual VMT by passenger vehicles, light-duty trucks and heavy duty trucks, compared to Baseline conditions and the TSM alternative, resulting in lower gasoline and diesel fuel use and lower energy use. The Busway alternative would increase diesel fuel use associated with operating the new transit service, compared to Baseline and TSM. The Busway alternative would consume about 162 billion fewer British Thermal Units (BTUs) than under Baseline conditions but about 19 billion more BTUs than the TSM alternative.

Incremental Cost per Incremental Passenger

The Busway alternative would attract 6.2 million passengers per year, 600,000 more than under Baseline conditions but 150,000 less than the TSM alternative. The proposed New Start would have annual capital and operating costs of \$41.6 million greater than Baseline conditions and \$11.1 million greater than the TSM alternative.

The Busway alternative would have an incremental cost per incremental passenger (i.e., cost per new rider) of \$59.64 compared to the Baseline and \$72.98 when compared with the TSM alternative.

Operating Cost per Passenger Mile

The Busway alternative would cost \$0.26 per passenger mile to operate compared to \$0.11 for Baseline and \$0.22 for the TSM alternative.

Annualization of Capital Costs

The Busway would incur annual capital costs of about \$9.1 million. Pavement, parking lots and grade crossing would be the single largest cost category accounting for \$4 million annually or 44 percent of annual costs. Buses and right-of-way preparation would each account for about \$2 million annually over the useful life of the project.

Mobility Improvements: Value of Travel Time Savings

| | Step 1 | | | Step 2 | | Step 3 | | | | Step 4 | | | Step 5 | | | |
|--|------------------|------------------|--|------------------------|-------------------|---|-------------------|------------------------|--|---------------|--------------------------------|---|---------------|---|---|--|
| | No-Build | TSM | New Start | Change | | Time Savings for New Riders | | Total Daily Change | | Annual Factor | Total Annual Change (millions) | | Dollar Values | Total Annual Travel Time Savings (\$millions) | | |
| | | | | New Start vs. No-Build | New Start vs. TSM | New Start vs. No-Build | New Start vs. TSM | New Start vs. No-Build | New Start vs. TSM | | New Start vs. No-Build | New Start vs. TSM | | New Start vs. No-Build | New Start vs. TSM | |
| Daily Trips | | | | | | | | | | | | | | | | |
| - Transit | 22,400 | 25,400 | 24,800 | 2,400 | -600 | | | | | 252 | 0.6 | -0.2 | | | | |
| - Auto | 875,500 | 876,100 | 875,500 | 0 | -600 | | | | | 252 | 0.0 | -0.2 | | | | |
| - Commercial | 17,000 | 17,000 | 17,000 | 0 | 0 | | | | | 252 | 0.0 | 0.0 | | | | |
| Total Daily Trips | 914,900 | 918,500 | 917,300 | 2,400 | -1,200 | | | | | 252 | 0.6 | -0.3 | | | | |
| Daily Travel Time (hrs.) | | | | | | | | | | | | | | | | |
| - Out-of-Vehicle | 15,871 | 15,172 | 14,965 | -906 | -207 | -43.84 | 2.50 | -950 | -204 | 252 | -0.2 | -0.1 | \$17.00 | \$ 4.1 | \$ 0.9 | |
| - In-Vehicle -- Transit | 9,668 | 10,433 | 10,104 | 437 | -329 | 21.13 | 3.98 | 458 | -325 | 252 | 0.1 | -0.1 | \$ 8.90 | \$ (1.0) | \$ 0.7 | |
| - In-Vehicle -- Auto/Commercial | 1,702,086 | 1,606,269 | 1,585,373 | -116,713 | -20,896 | 0 | 0 | -116,713 | -20,896 | 252 | -29.4 | -5.3 | \$ 9.50 | \$ 279.4 | \$ 50.0 | |
| Total Daily Travel Time | 1,727,625 | 1,631,874 | 1,610,442 | -117,183 | -21,432 | -23 | 6.48 | -117,205 | -21,426 | 252 | -29.5 | -5.4 | | \$ 282.5 | \$ 51.6 | |
| Source: Regional travel demand model | | | Calculation: Subtract (1) New Start from No-Build; (2) New Start from TSM. | | | Calculation: Travel time savings to new riders = (change in travel time per rider) * (change in riders) * 0.5 | | | Calculation: Total Daily Change in Travel Time = Change + Change in Travel Time for New Riders | | | Calculation: Total annual change = Total daily change * Annual Factor | | | Calculation: Total annual travel time savings (\$) = Total annual travel time change * Value of travel time | |
| Note Auto includes light-duty commercial vehicles. | | | | | | | | | | | | | | | | |

Sample Calculations and Reporting
Mobility Improvements: Low Income Households Served

| Census Tract | Number of Total Households | Number of Low-Income Households | Fraction of Tract within 1/4 mi. of New Start Boarding Points | Number of Total HH's within 1/4 Mile of Boarding Points | Number of Low-Inc. HH's within 1/4 Mile of Boarding Points |
|---|--|---|--|--|--|
| For Each Station on Proposed Busway Facility | | | | | |
| Station 1 – Watsonville Transit Center | 4,892 | 1,669 | n/a | 370 | 159 |
| Station 2 – SeaCliff | 2,810 | 616 | n/a | 696 | 199 |
| Station 3 – New Brighton/Cabrillo | 3,545 | 746 | n/a | 30 | 6 |
| Station 4 – Capitola Village | 5,638 | 1,608 | n/a | 576 | 137 |
| Station 5 – 41st Avenue | 7,441 | 2,309 | n/a | 583 | 183 |
| Station 6 – 17th Avenue | 7,914 | 2,260 | n/a | 376 | 112 |
| Station 7 – 7th Avenue | 7,205 | 2,402 | n/a | 521 | 145 |
| Station 8 – Seabright Beach | 6,758 | 2,756 | n/a | 932 | 391 |
| Station 9 – Boardwalk | 6,496 | 2,771 | n/a | 428 | 220 |
| Station 10 – Wharf/Davenport Junction | 6,997 | 2,877 | n/a | 281 | 152 |
| Station 11 – Bay/California | 7,081 | 2,315 | n/a | 478 | 170 |
| Station 12 – Almar Avenue | 6,482 | 1,664 | n/a | 329 | 82 |
| Station 13 – Natural Bridges | 2,982 | 668 | n/a | 160 | 41 |
| Subtotal | 76,241 | 24,661 | | 5,760 | 1,997 |
| Total for All Boarding Points | 76,241 | 24,661 | | 5,760 | 1,997 |
| Note: See List of Stations for Busway Alternative | Source: U.S. Census Data: Total Households 1990 Data | Source: U.S. Census Data: Households with "income below \$19,000" | Source: Calculated using GIS and 1990 Census Tract Information | Calculation: Parsons Brinckerhoff GIS Services | Calculation: Parsons Brinckerhoff GIS Services |

Environmental Benefits: Change in Criteria Pollutant and Precursor Emissions

| Vehicle Class | Regional VMT/year (millions) | | | Emission Factor (g/mi) | | | | Annual Emissions (tons) | | | | | | |
|--|------------------------------|-------|-----------|------------------------|-------|------|------|-------------------------|--------|-----|----|-----|--------|-----|
| | No-Build | TSM | New Start | HC | CO | NOx | PM | No-Build | | | | TSM | | |
| | | | | | | | | HC | CO | NOx | PM | HC | CO | NOx |
| Passenger Veh. (LDV/LDT) | 1,970 | 1,940 | 1,939 | 0.32 | 5.07 | 0.39 | 0.02 | 699 | 10,986 | 840 | 43 | 688 | 10,816 | 827 |
| Heavy-Duty Vehicle | 67 | 67 | 67 | 1.97 | 11.20 | 1.05 | 1.20 | 144 | 822 | 77 | 88 | 144 | 822 | 77 |
| Bus/Diesel | | | | | | | | | | | | | | |
| Bus/CNG | 3 | 3 | 4 | 1.97 | 11.20 | 1.05 | 1.20 | 6 | 34 | 3 | 4 | 7 | 39 | 4 |
| Bus/LPG | - | - | - | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bus/M85 or E85 | - | - | - | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Commuter Rail/ Diesel | - | - | - | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | | | | | | | | | | | | | | |
| <p>Note: Private vehicle classes should be consistent with regional travel model -- examples are shown here.</p> <p>Source: - Private vehicles from regional travel demand model - Bus and rail from system operating plans</p> <p>Source: - Private vehicles from MOBILE or EMFAC emission factor model - Diesel bus from MOBILE HDDV emission factor - Alt. fuel buses from diesel EF's and conversion factors given in text - Rail: See supplemental worksheet</p> <p>Note: Santa Cruz County emission factors include a weighted average of stationary emissions (e.g. cold start, hot soak).</p> <p>Calculation: Annual Emissions = VMT * 1,000,000 * Emission Factor / 909,000 g/ton</p> <p>Santa Cruz Annualization Factor: 252</p> <p>Emission factors derived from CEQA Air Quality Guidelines, prepared by MBUAPCD, 10/1995</p> | | | | | | | | | | | | | | |

Environmental Benefits: Change in Criteria Pollutant and Precursor Emissions

| | | | | | Change in Emissions (tons per year) | | | | | | | |
|-----------|-----|--------|-----|----|--|------|-----|----|---|----|-----|----|
| New Start | | | | | New Start vs. No-Build | | | | New Start vs. TSM | | | |
| PM | HC | CO | NOx | PM | HC | CO | NOx | PM | HC | CO | NOx | PM |
| 43 | 688 | 10,813 | 828 | 43 | -11 | -174 | -13 | -1 | 0 | -4 | 0 | 0 |
| 88 | 144 | 822 | 77 | 88 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | |
| 4 | 8 | 48 | 4 | 5 | 2 | 12 | 1 | 1 | 1 | 7 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | -9 | -181 | -12 | 1 | 1 | 3 | 0 | 1 |
| | | | | | Calculation: Change in Emissions = New Start Emissions - No-Build Emissions | | | | Calculation: Change in Emissions = New Start Emissions - TSM Emissions | | | |

Environmental Benefits: Change in Greenhouse Gas Emissions

| Fuel Type | Change in BTU/year | | CO2 consumption (tons CO2/million BTU) | Change in CO2 Emissions/year | |
|---|------------------------|--|---|---|-------------------|
| | New Start vs. No-Build | New Start vs. TSM | | New Start vs. No-Build | New Start vs. TSM |
| Gasoline | -194,298 | -4,398 | 0.0765 | -14,864 | -336 |
| Diesel | 0 | 0 | 0.0788 | 0 | 0 |
| CNG | 41,884 | 23,306 | 0.0585 | 2,450 | 1,363 |
| LPG | 0 | 0 | 0.0678 | 0 | 0 |
| M85/E85 | 0 | 0 | 0.0765 | 0 | 0 |
| Electricity | 0 | 0 | 0.0665 | 0 | 0 |
| Total | | | | -12,414 | 1,027 |
| <p><u>Source:</u> Section 4.6, Calculation of Change in BTU Consumption</p> | | <p><u>Source:</u> Calculations by Cambridge Systematics, Inc. based on Energy Information Administration (1996) and Delucchi (1996).</p> | | <p><u>Calculation:</u> Change in CO2/year = Change in BTU/year * Tons CO2/million BTU / 1,000,000</p> | |

Environmental Benefits: Change In Regional Energy Consumption

| Veh. Class | Regional VMT/year | | | Change in VMT/year | | Energy Consumption (BTU/veh-mi) | Change in BTU/year | |
|---|-------------------|-------|-----------|------------------------|-------------------|---------------------------------|------------------------|-------------------|
| | No-Build | TSM | New Start | New Start vs. No-Build | New Start vs. TSM | | New Start vs. No-Build | New Start vs. TSM |
| Passenger Veh. (LDV/LDT) | 1,970 | 1,940 | 1,939 | -31 | -1 | 6,233 | -194,298 | -4,398 |
| Heavy-Duty Vehicle | 67 | 67 | 67 | 0 | 0 | 22,046 | 0 | 0 |
| Bus/Diesel | | | | | | 41,655 | 0 | 0 |
| Bus/CNG | 3 | 3 | 4 | 1 | 1 | 41,655 | 41,884 | 23,306 |
| Bus/LPG | 0 | 0 | 0 | 0 | 0 | 41,655 | 0 | 0 |
| Bus/M85 or E85 | 0 | 0 | 0 | 0 | 0 | 41,655 | 0 | 0 |
| Bus/Electric | 0 | 0 | 0 | 0 | 0 | 41,655 | 0 | 0 |
| Light or Heavy Rail/Electric | 0 | 0 | 0 | 0 | 0 | 77,739 | 0 | 0 |
| Commuter Rail/Diesel | 0 | 0 | 0 | 0 | 0 | 100,000 | 0 | 0 |
| Commuter Rail/Electric | 0 | 0 | 0 | 0 | 0 | 100,000 | 0 | 0 |
| Total | | | | | | | -152,413 | 18,908 |
| <p>Note: For dual-mode buses, allocate total VMT by percentage used for each fuel type (i.e. 50% diesel/ 50% electric)</p> <p>Source: - Passenger and HDV from Regional Travel Demand Model - Bus and rail from system operating plans</p> <p>Calculation: - New Start vs. No-Build = New Start VMT/year - No-Build VMT/year - New Start vs. TSM = New Start VMT/year - TSM VMT/year</p> <p>Source: Transportation Energy Data Book Edition 16 (Bus factors assumed same for alternative fuels as for diesel)</p> <p>Note: Transit agencies may provide their own estimates for transit vehicle BTU/mi factors. If so, documentation should be provided.</p> <p>Calculation: Change in BTU/year = Change in VMT/year * BTU/veh-mi</p> | | | | | | | | |

Operating Efficiencies: Operating Cost per Passenger Mile

| Factor | Alternative | | | Comparison | | Source/Calculation |
|-------------------------------|-----------------|-----------------|-----------------|------------------------|-------------------|--|
| | No-Build | TSM | New Start | New Start vs. No-Build | New Start vs. TSM | |
| System Annual Operating Cost | \$ 22,200,000.0 | \$ 50,900,000.0 | \$ 54,700,000.0 | | | Source: Transit system operating costs, current and projected |
| System Annual Passenger-Miles | 210,878,640 | 234,601,668 | 207,632,124 | | | Source: Forecast system passenger-miles from regional travel model or other ridership projection model |
| Cost per Passenger-Mile | \$ 0.11 | \$ 0.22 | \$ 0.26 | \$ 0.16 | \$ 0.05 | Calculation: Annual Operating Cost / Annual Passenger-Miles (Line 1/ Line 2) |

Annualization of Capital Costs – Supplemental Worksheet

| Alternative: | | New Start | | |
|--|---|--|---|--|
| Item | Useful Life (Years) | Annualization Factor | Total Cost | Annualized Cost |
| Right-of-way | 100 | 0.070 | \$ 500,000.0 | \$ 35,000.00 |
| Right-of-way preparation (major grading, etc.) | 100 | 0.070 | \$ 28,600,000.0 | \$ 2,002,000.00 |
| Structures | 30 | 0.081 | \$ 2,100,000.0 | \$ 170,100.00 |
| Trackwork | 30 | 0.081 | \$ 7,900,000.0 | \$ 639,900.00 |
| Signals, electrification | 30 | 0.081 | \$ 1,500,000.0 | \$ 121,500.00 |
| Pavement, parking lots, grade crossings | 20 | 0.094 | \$ 43,200,000.0 | \$ 4,060,800.00 |
| Rail vehicles | 25 | 0.086 | \$ - | \$ - |
| Buses | 12 | 0.126 | \$ 16,500,000.0 | \$ 2,079,000.00 |
| Contingencies | item-specific | [REDACTED] | | |
| Engineering, construction management | allocate proportionally among other items | | | |
| Total | | | | \$ 9,108,300.00 |
| | | <u>Source:</u> Based on 7 percent discount rate and assumed useful life of item | <u>Source:</u> New Start or TSM capital cost estimates | <u>Calculation:</u> Annual Cost = Total Cost * Annualization Factor |

Cost-Effectiveness: Incremental Cost per Incremental Passenger

| Line | Factor | Alternative | | | Comparison | | Source/Calculation |
|------|---|----------------|----------------|----------------|------------------------|-------------------|---|
| | | No-Build | TSM | New Start | New Start vs. No-Build | New Start vs. TSM | |
| 1 | Annualized Capital Cost (current year dollars) | \$5,600,000.0 | \$7,400,000.0 | \$14,700,000.0 | | | Source: New Start or TSM capital cost estimate; annualized based on factors in Appendix G. Include documentation as shown on attached worksheet (Figure 4.16(a)). |
| 2 | Total Systemwide Annual Operating and Maintenance Cost (current year dollars) | \$22,200,000.0 | \$50,900,000.0 | \$54,700,000.0 | | | Source: Systemwide operating and maintenance cost estimates for no-build, TSM, and New Start alternatives (attach documentation). |
| 3 | Total Annualized Cost in Forecast Year (current year dollars) | \$27,800,000.0 | \$58,300,000.0 | \$69,400,000.0 | | | Calculation: Total Cost = Annualized Capital Cost + Annual Operating Cost (Line 1 + Line 2) |
| 4 | Total Annual Ridership (forecast year) | 5,644,800 | 6,400,800 | 6,249,600 | | | Source: Regional travel demand model (attach documentation of factors to annualize daily ridership, if applicable) |
| 5 | Incremental Annualized Cost | | | | \$41,600,000.0 | \$11,100,000.0 | Calculation: Subtract Total Annualized Costs (Line 3) for: - No-Build from New Start alternative - No-Build from TSM alternative |
| 6 | Incremental Annual Ridership | | | | 604,800 | -151,200 | Calculation: Subtract Total Annual Ridership (Line 4) for: - No-Build from New Start alternative - No-Build from TSM alternative |
| 7 | Cost-Effectiveness (Incremental Cost per New Rider) | | | | \$ 68.78 | \$ (73.41) | Calculation: Divide Incremental Annual Cost (Line 5) by Incremental Annual Ridership (Line 6) for: -New Start vs. No-Build alternative -New Start vs. TSM alternative |