

Appendix B.  
Plan & Profile Drawings



This summary presents guidance for geometric design as it pertains to horizontal and vertical alignment elements as well as track layouts at Caltrain Stations. There are guidelines and values for three types of design criteria: Desirable, Minimum and Exceptional as described in the Technical Memorandum: *Alignment Design Standards for High Speed Train Operation* by the California High Speed Rail Authority.

The current design, as of March 2010, is based on the Desirable Criteria values.

#### Minimum Lengths of Alignment Segments

To maintain a smooth, ride quality throughout the corridor, there is a minimum length (based on time criteria) for any alignment element for HST service; such as tangents, curves and spirals. This means that the train set must traverse each of these elements for a minimum run time length – established to be 2.4 seconds of run time for the applicable design speed. At 125 mph, this length is equal to 458 feet.

For Caltrain service, the minimum lengths for various elements use a different design criteria. For an operating configuration for a 79 mph design speed, the minimum tangent length is equal to 237 feet ( $L = 3V$ ). The minimum curve length is 100 feet. The minimum radius, based on speed (79 mph) and superelevation (5 inches), is equal 5,100 feet.

#### HST Minimum Horizontal Curve Radii

Based on 125 mph design speed:

- R = 10,500 feet (Desirable)
- R = 7,000 feet (Minimum)
- R = 5,700 feet (Exceptional)

Based on 100 mph design speed:

- R = 6,700 feet (Desirable)
- R = 4,500 feet (Minimum)
- R = 3,700 feet (Exceptional)

#### HST Superelevation

Desirable values for design speeds  $\leq$  125 MPH:

- Superelevation plus Unbalanced Superelevation: 6 inches
- Applied Superelevation: 4 inches
- Unbalanced Superelevation: 2 inches

Minimum values for design speeds  $\leq$  125 MPH:

- Superelevation plus Unbalanced Superelevation: 9 inches
- Applied Superelevation: 6 inches
- Unbalanced Superelevation: 3 inches

Exceptional values for design speeds  $\leq$  125 MPH:

- Superelevation plus Unbalanced Superelevation: 11 inches
- Applied Superelevation: 7 inches
- Unbalanced Superelevation: 4 inches

#### Vertical Alignment Grades

- Maximum grade for HST service: 1.25% (Desirable), 2.5% (Maximum), and 3.5% (Exceptional).
- Maximum grade for Caltrain (shared used) tracks with diesel powered freight trains: 1.0%.
- Minimum grade, when a separate drainage system is not available, in trench or tunnel sections: 0.25%.
- At stations, 0.0% (Desirable), 0.25% (Exceptional).

#### HST Minimum Vertical Curve Length

- The length of curve is a function of the difference in gradients and speed.
  - Based on a difference in gradient of 2% and 125 mph design speed:
    - 1,200 feet
  - Based on a difference in gradient of 1.5% and 125 mph design speed:
    - 900 feet
  - Based on a difference in gradient of 1.5% and 100 mph design speed:
    - 600 feet

#### Bored Tunnels

- Minimum cover at a bored tunnel portal: One tunnel diameter (for a two-track tunnel = 45 feet).
- Minimum cover for a bored tunnel: One and a half diameters (for a two-track tunnel = 68 feet).

#### Intermediate Caltrain Station Track Layout

- Station Platform Length: 800 feet (Minimum) (able to accommodate an 8-car train set).
- Center Platform Width: 32 feet (Preferred), 26 feet (Minimum)
- Outboard Platform Width: 20 feet (Preferred), 16 feet (Minimum)
- Distance from edge of platform to where the transition out of the station can begin: 100 feet.
- Minimum transition distance from track spacings at a station to track spacings in non-station areas at 125 mph (HST service): 3,080 feet

#### Intermediate HST Station Track Layout

- Station Platform Length: 1,380 feet
- Outboard Platform Width: 20 feet
- Distance from center of platform to point of turnout for station tracks: 3,000 feet.

# Subsection #1-1

Length: 4.8 miles Land Use: Urban

## North of Common Street to South Portal Tunnel No. 4 (MP. 1.03 to MP. 5.77)

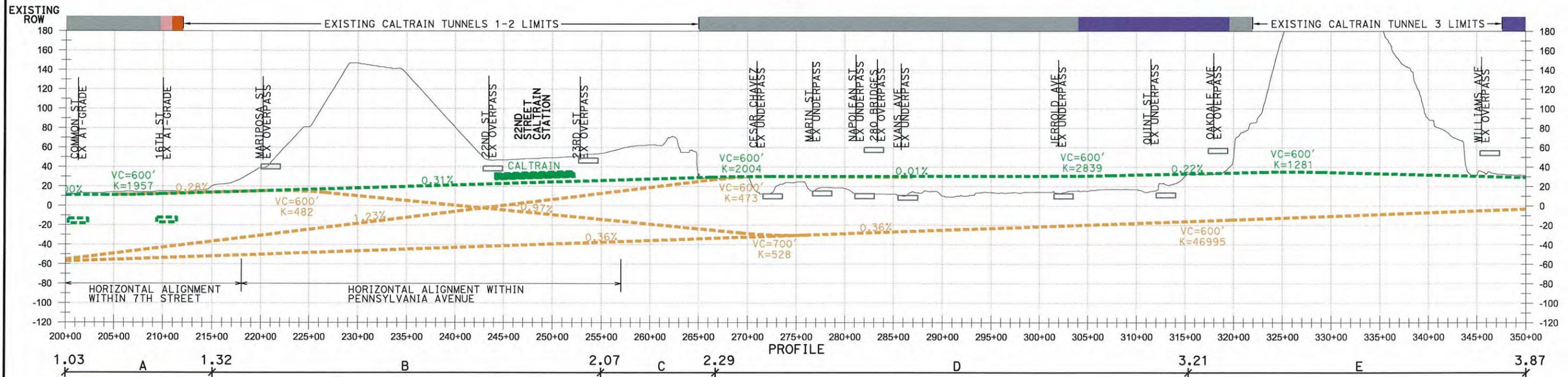
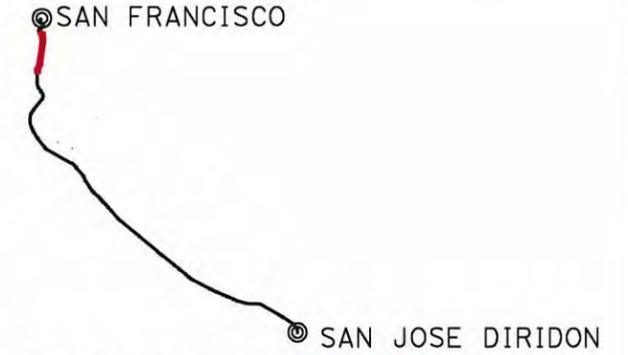
This subsection is located within the City and County of San Francisco. Except for two crossings near Mission Bay, all other street crossings in this subsection are grade separated. The existing Caltrain alignment passes through a series of hills and valleys necessitating 4 tunnels and several embankment and trench segments. The I-280 freeway structure above the tracks and its supporting columns are constraints in the northern portion of the subsection.

EXISTING (APPROX)	
	ROW WIDTH ≥ 100'
	ROW WIDTH 90' - 99'
	ROW WIDTH 80' - 89'
	ROW WIDTH 70' - 79'
	ROW WIDTH 60' - 69'
	ROW WIDTH < 60'

ROADWAY DESIGN OPTION

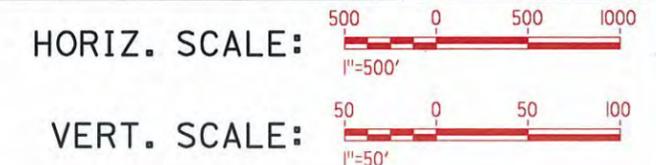
	STATION	ELEVATED (AERIAL/BERM)
	STATION	EXISTING CALTRAIN GRADE
	STATION	BELOW GRADE (TRENCH/TUNNEL)
		BELOW GRADE (DEEP TUNNEL) (HST ONLY)

NOTES:  
 1. CENTERLINE SHOWN IS PROPOSED MT2.  
 2. PROFILES SHOWN ARE TOR.



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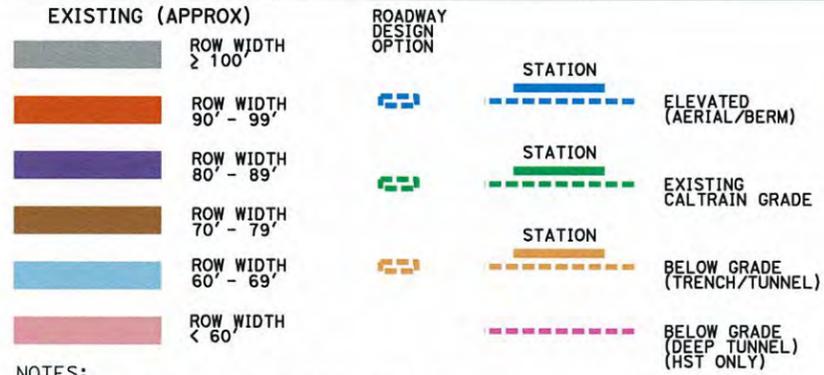


# Subsection #1-2

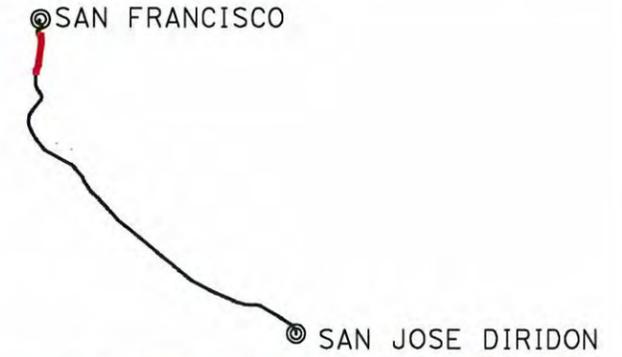
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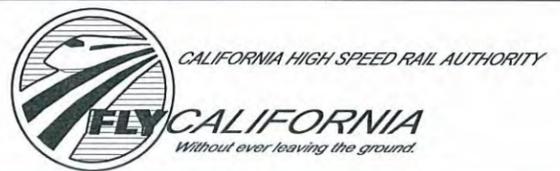
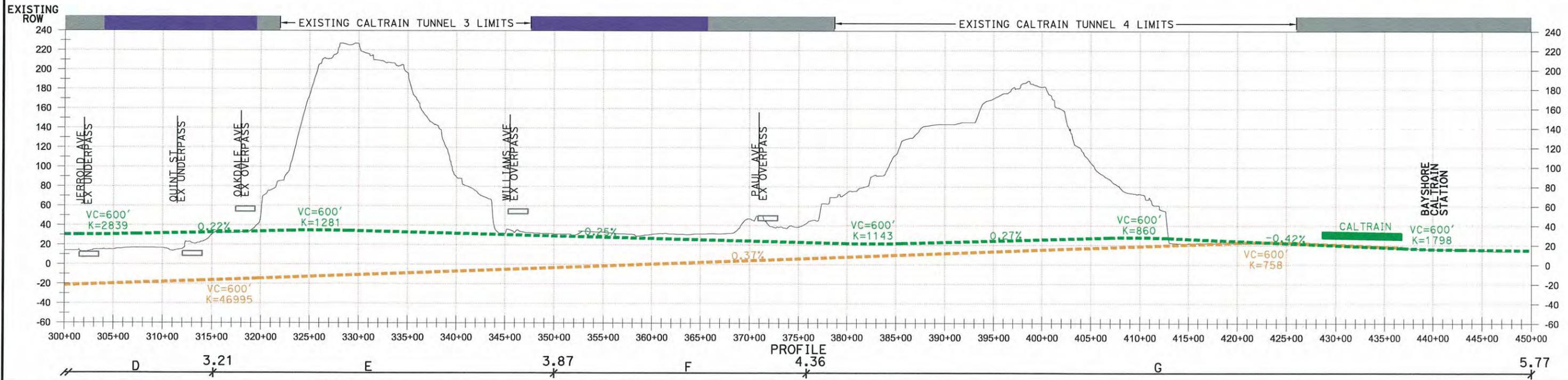
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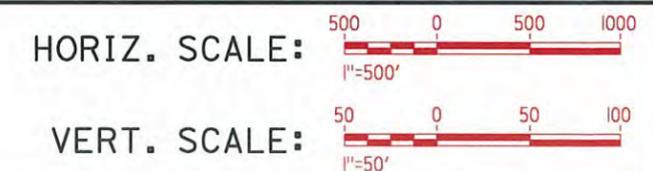
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# Subsection #2-1

Length: 8.6 miles Land Use: Urban

## South Portal Tunnel No. 4 to South of Millbrae Avenue (MP. 5.77 to MP. 14.38)

This subsection is located in the Cities of Brisbane, South San Francisco, San Bruno and Millbrae. The existing Caltrain alignment is at-grade in this subsection and many crossings are grade separated. The northern portion of this subsection is completely grade separated and includes an existing 4-track segment in Brisbane. In the southern portion of the subsection, BART runs underneath and alongside the Caltrain tracks.

EXISTING (APPROX)	
	ROW WIDTH ≥ 100'
	ROW WIDTH 90' - 99'
	ROW WIDTH 80' - 89'
	ROW WIDTH 70' - 79'
	ROW WIDTH 60' - 69'
	ROW WIDTH < 60'

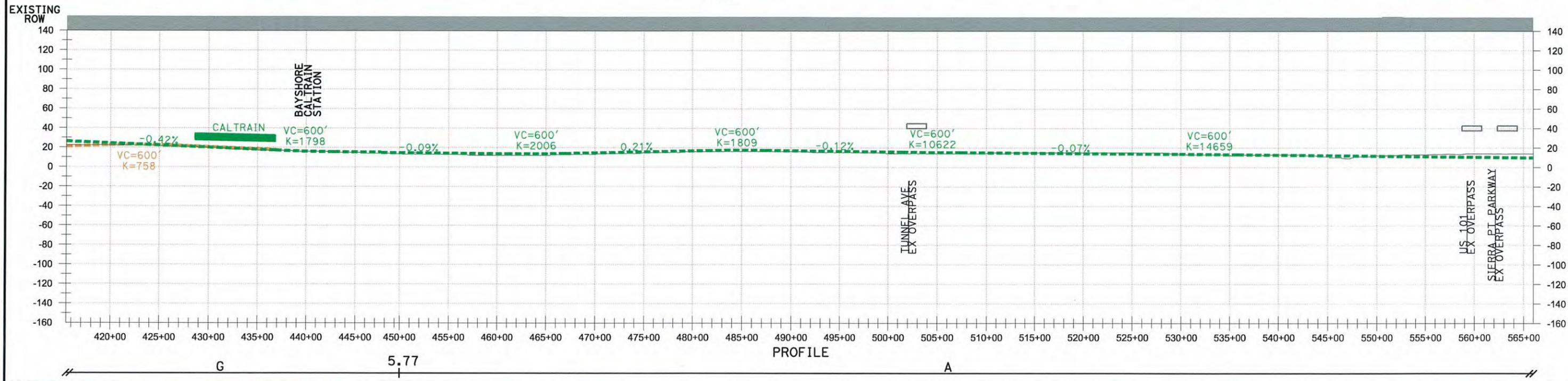
ROADWAY DESIGN OPTION

	STATION	ELEVATED (AERIAL/BERM)
	STATION	EXISTING CALTRAIN GRADE
	STATION	BELOW GRADE (TRENCH/TUNNEL)
		BELOW GRADE (DEEP TUNNEL) (HST ONLY)

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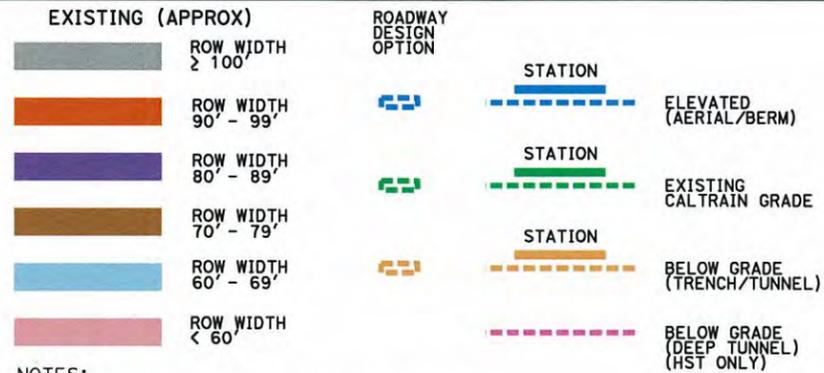


# Subsection #2-2

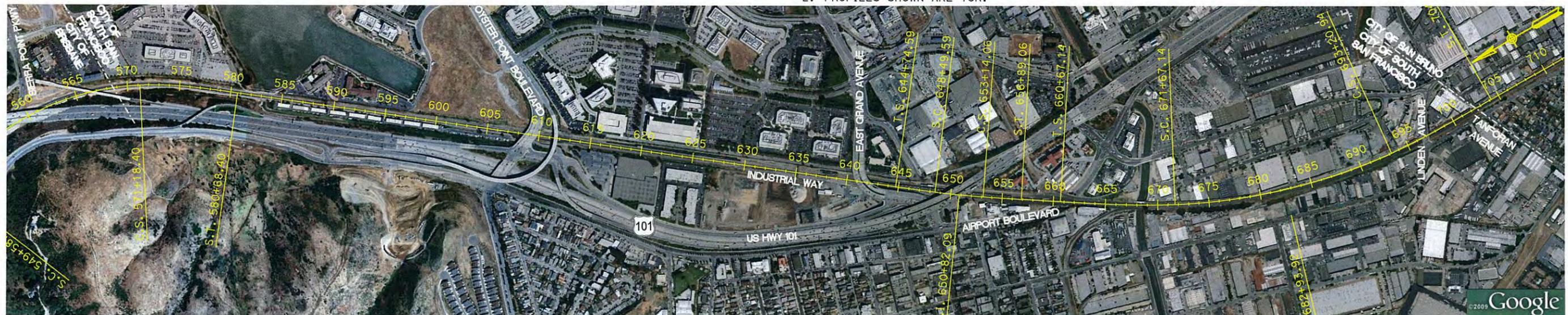
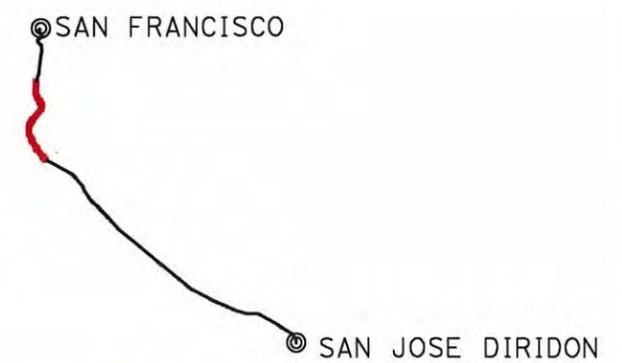
Length: 8.6 miles Land Use: Urban

## South Portal Tunnel No. 4 to South of Millbrae Avenue (MP. 5.77 to MP. 14.38)

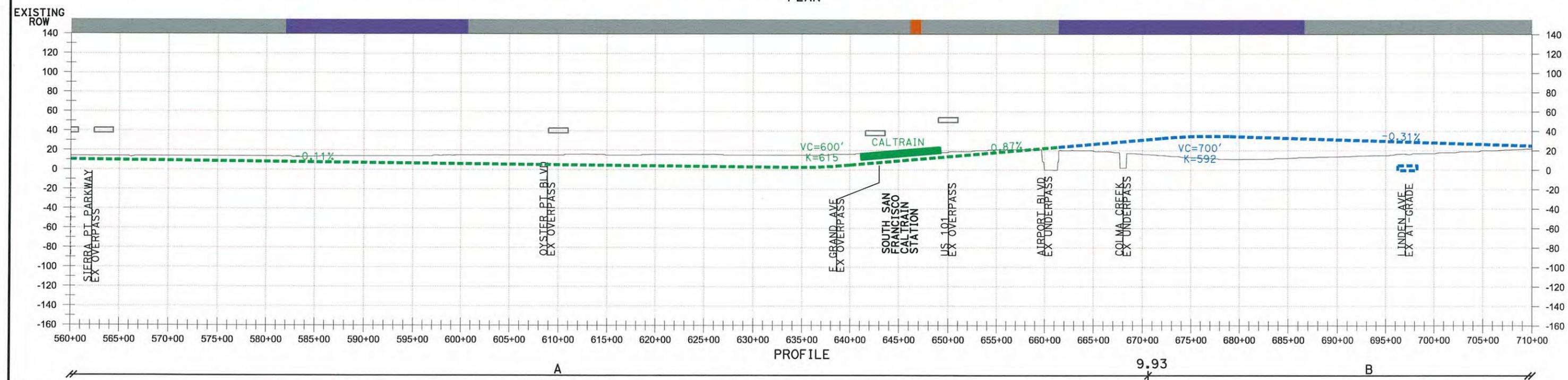
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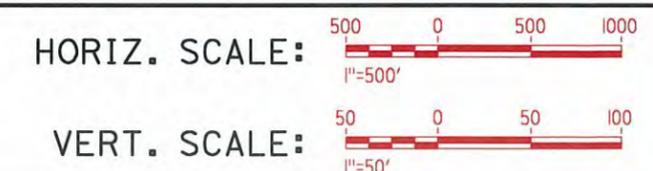
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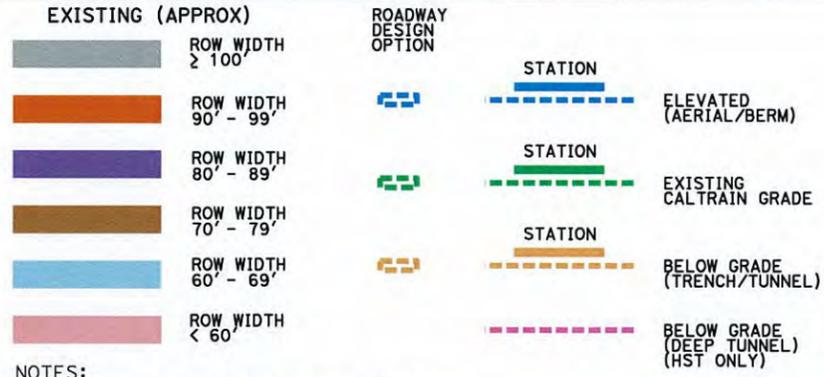


# Subsection #2-3

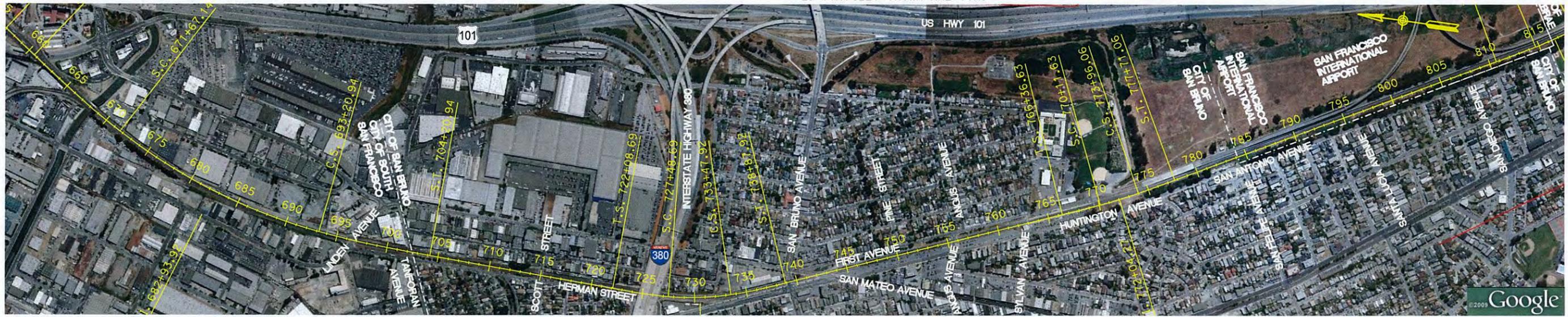
Length: 8.6 miles Land Use: Urban

## South Portal Tunnel No. 4 to South of Millbrae Avenue (MP. 5.77 to MP. 14.38)

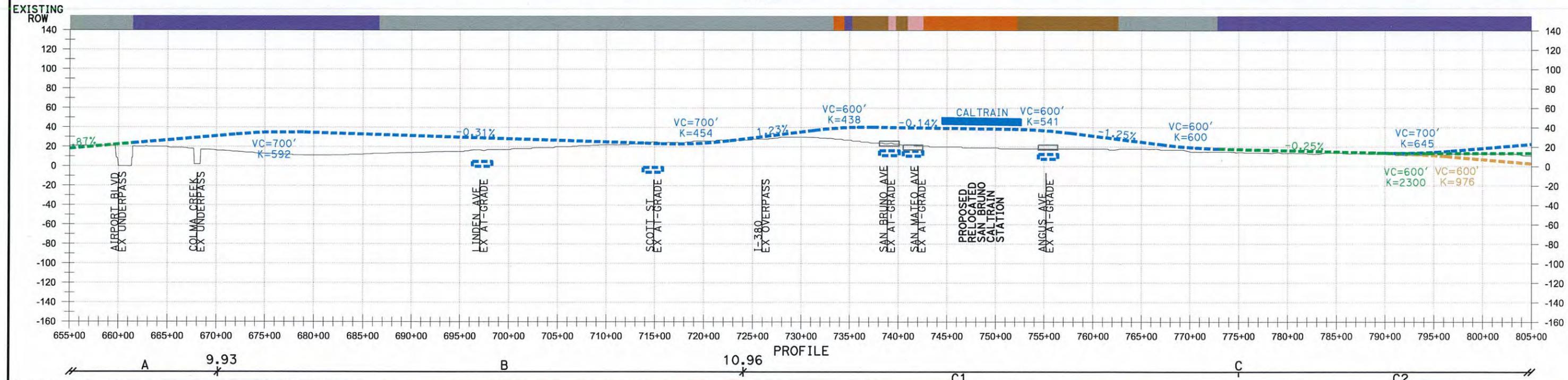
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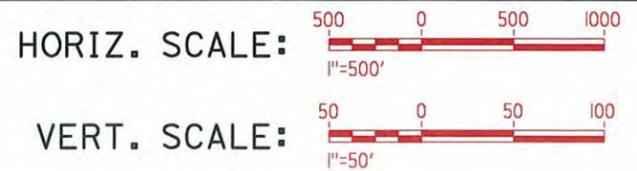
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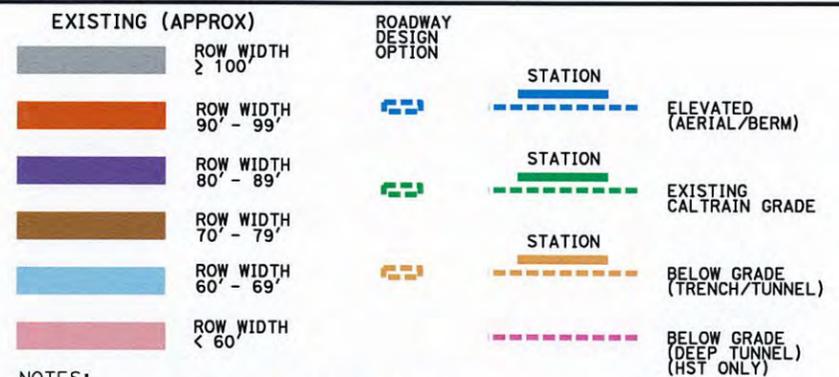


# Subsection #2-4

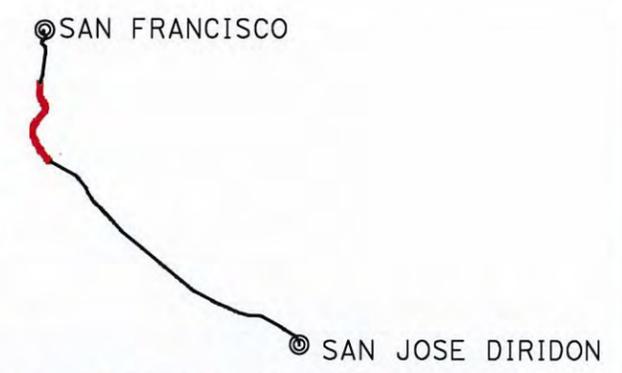
Length: 8.6 miles Land Use: Urban

## South Portal Tunnel No. 4 to South of Millbrae Avenue (MP. 5.77 to MP. 14.38)

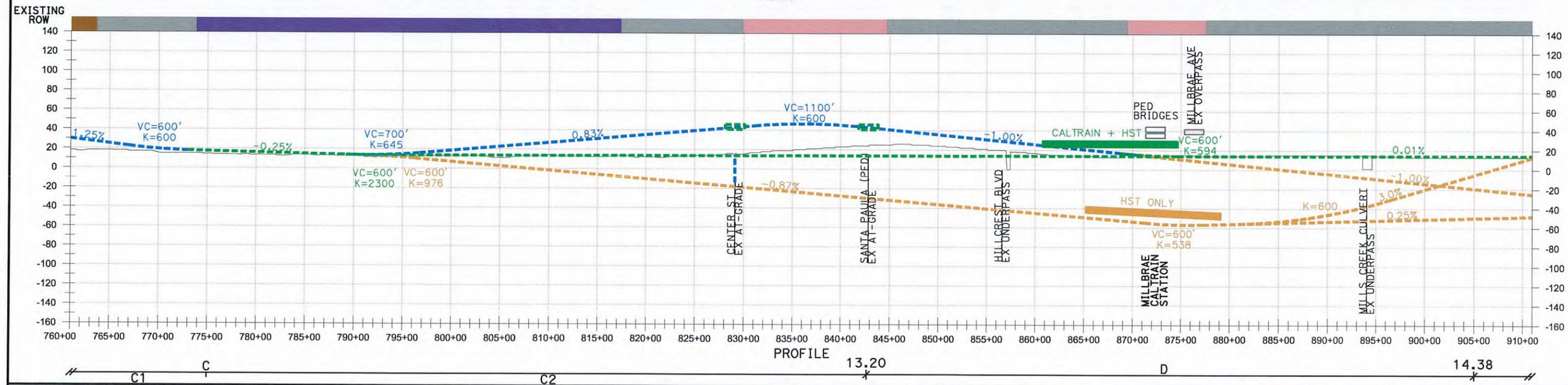
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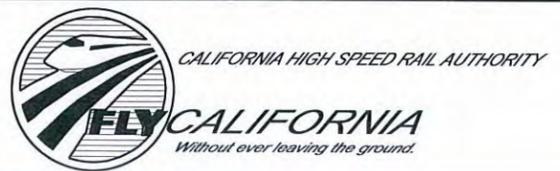
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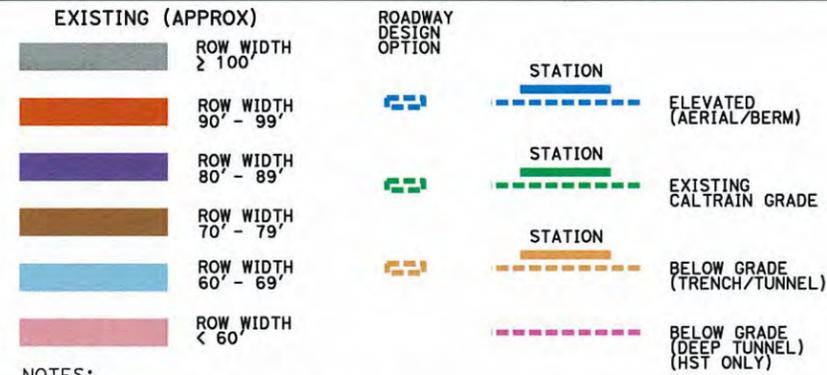


# Subsection #3-1

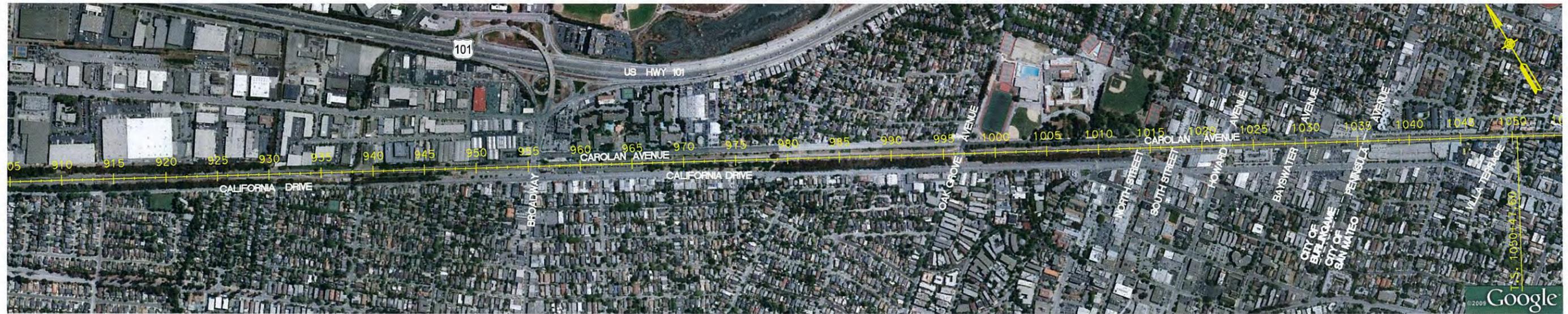
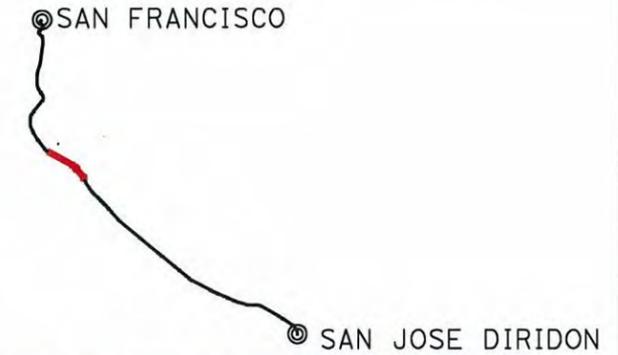
Length: 4.9 miles Land Use: Urban

## South of Millbrae Avenue to North of Highway 92 (MP. 14.38 to MP. 19.29)

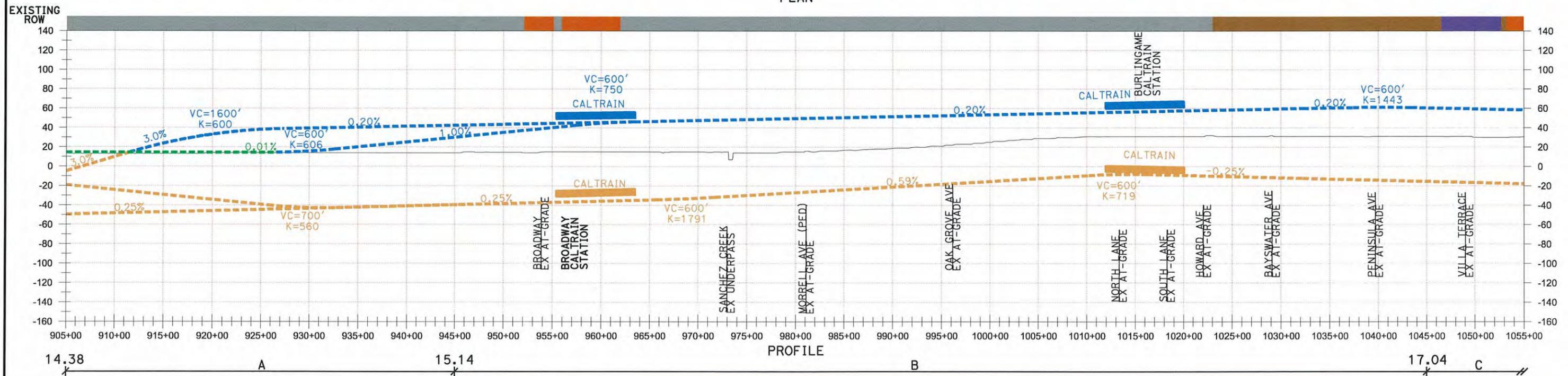
This subsection is located in the Cities of Burlingame and San Mateo. In this subsection, the Caltrain tracks are primarily at-grade as are most of the crossings; those that are grade-separated have sub-standard clearances. This subsection includes a tight area through downtown San Mateo where a number of closely spaced at-grade crossings are an integral part of the street grid.



NOTES:  
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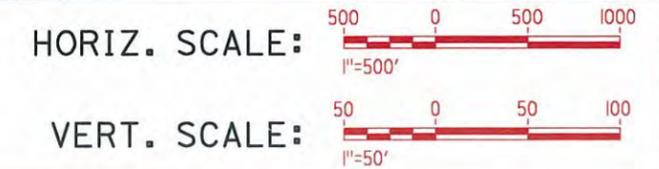


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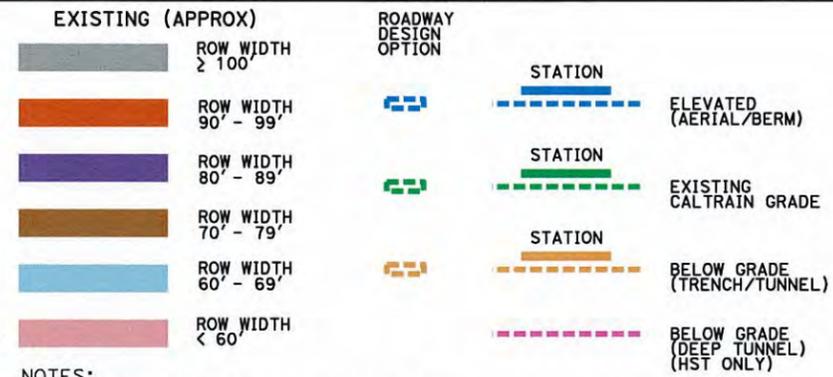


# Subsection #3-2

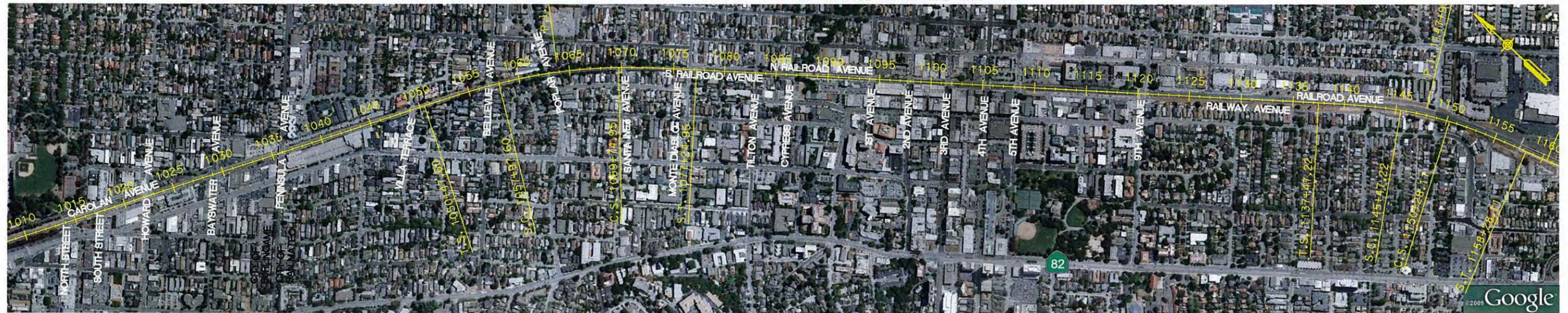
Length: 4.9 miles Land Use: Urban

## South of Millbrae Avenue to North of Highway 92 (MP. 14.38 to MP. 19.29)

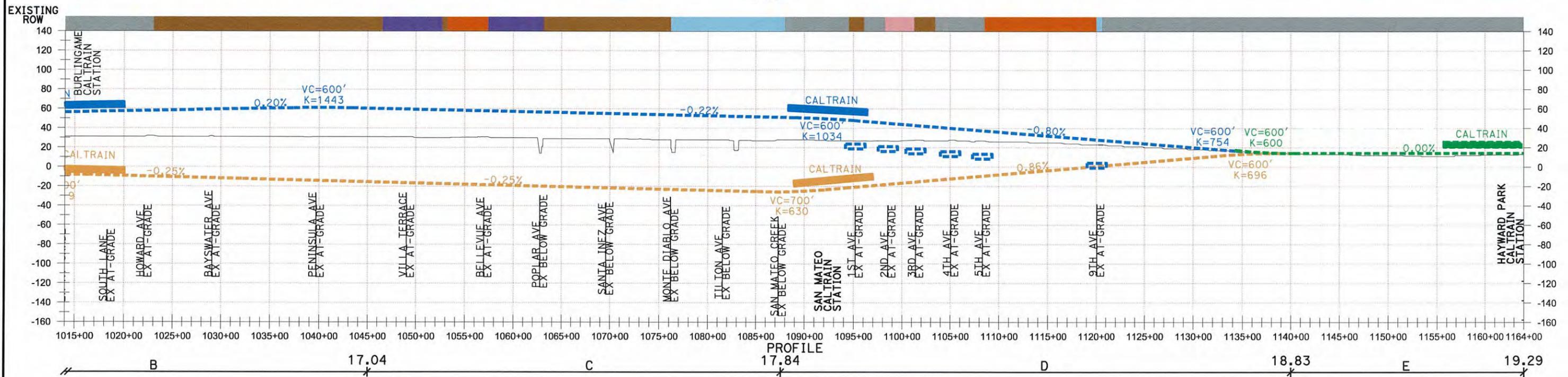
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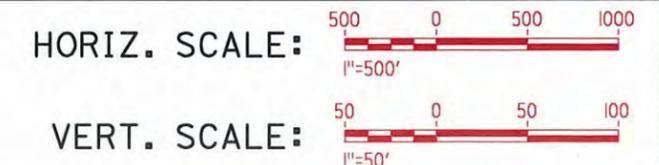


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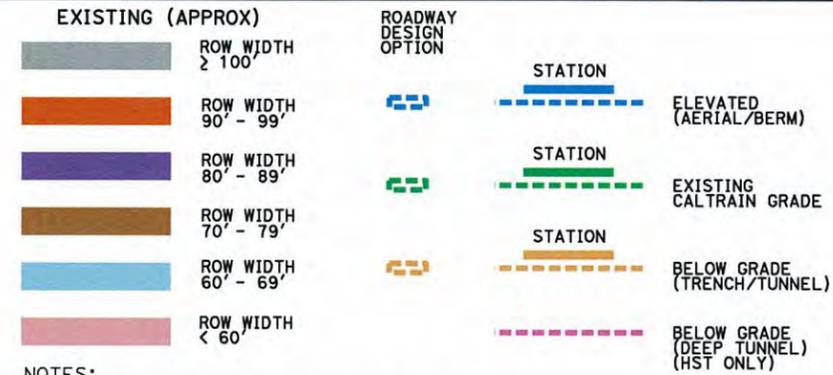


# Subsection #4-1

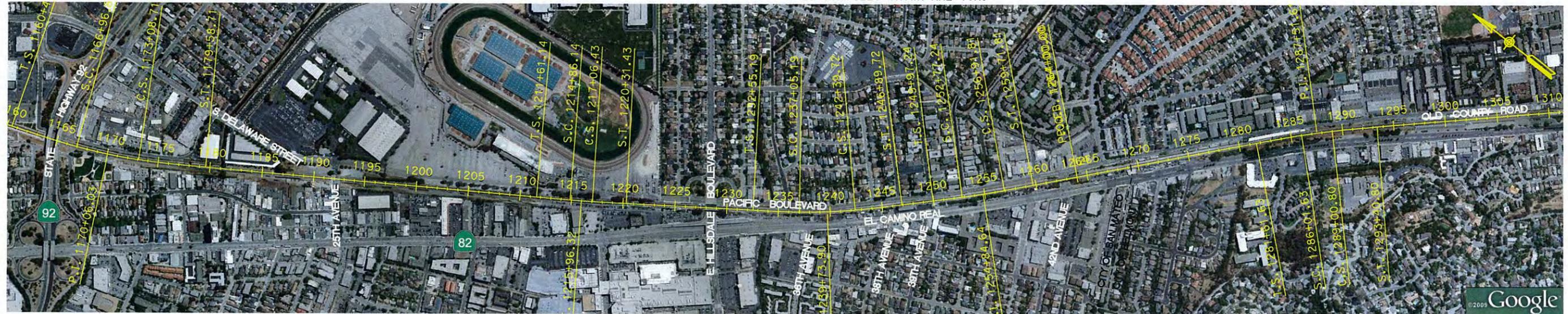
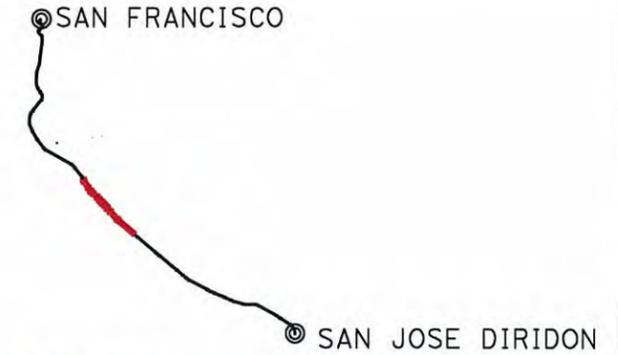
Length: 7.6 miles Land Use: Urban

## North of Highway 92 to North of 5th Avenue (MP. 19.29 to MP. 26.88)

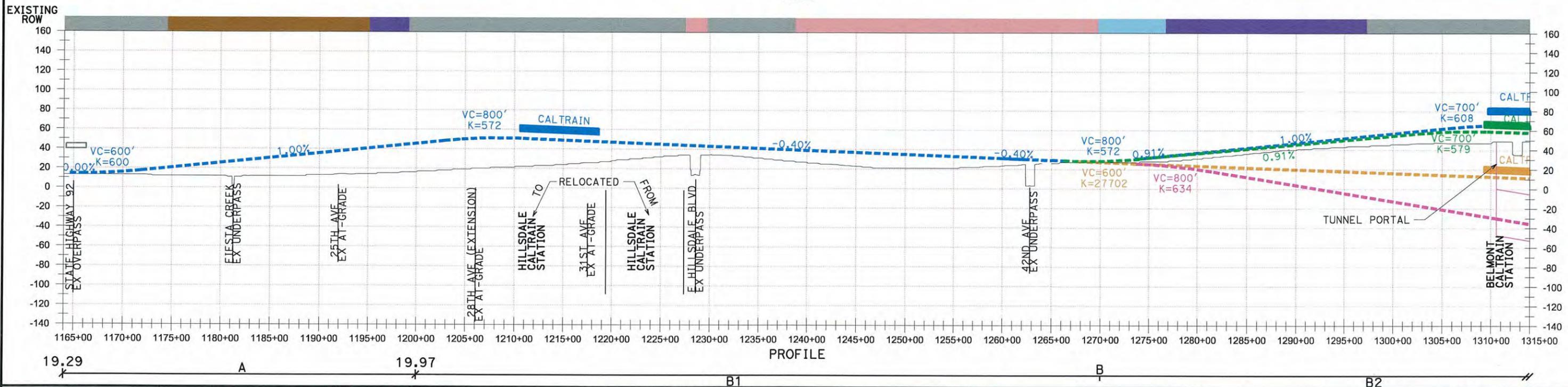
This subsection is located in the Cities of San Mateo, Belmont, San Carlos and Redwood City. For most of the northern portion of this subsection, the existing Caltrain tracks are on a recently constructed embankment that passes over the cross streets. In the southern portion of this subsection the at-grade Caltrain tracks pass through a number of at-grade crossings in downtown Redwood City. There is an existing 4 track segment at the southern end of this subsection.



NOTES:  
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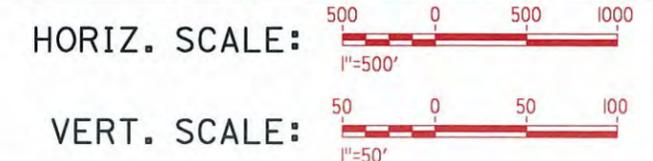
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# Subsection #4-2

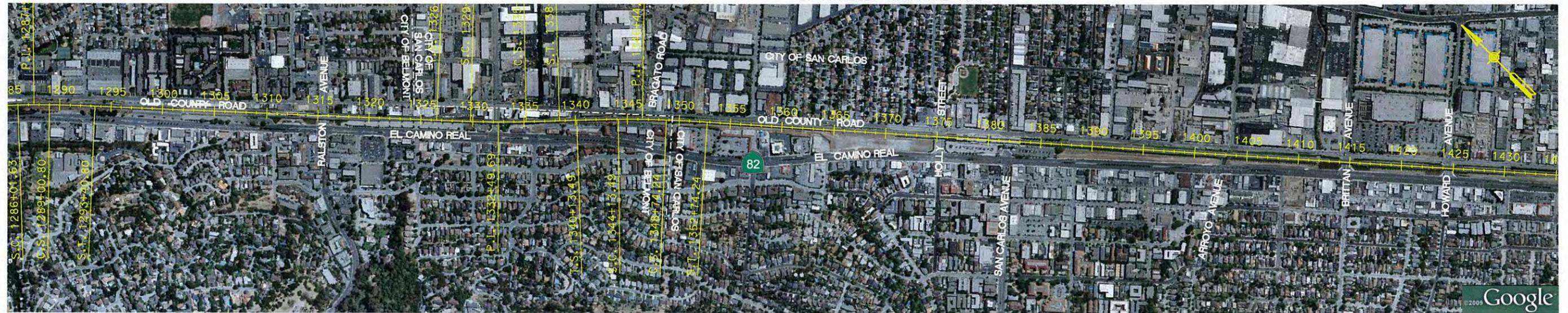
Length: 7.6 miles Land Use: Urban

## North of Highway 92 to North of 5th Avenue (MP. 19.29 to MP. 26.88)

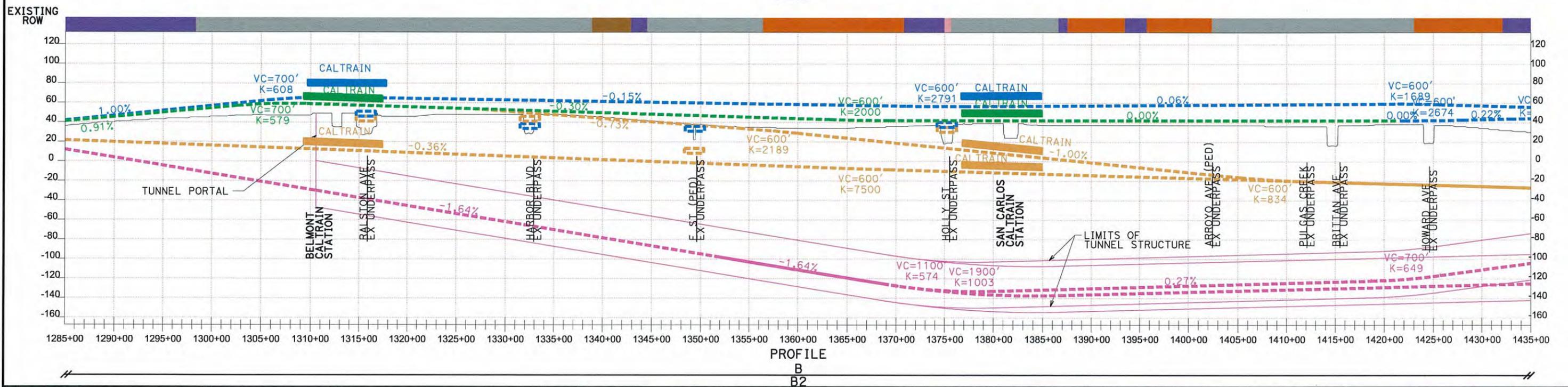
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NOTES:  
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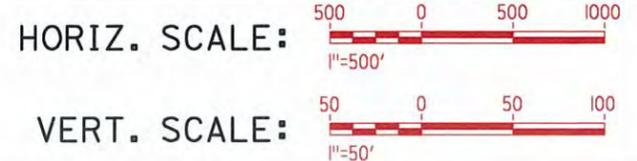
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# Subsection #4-3

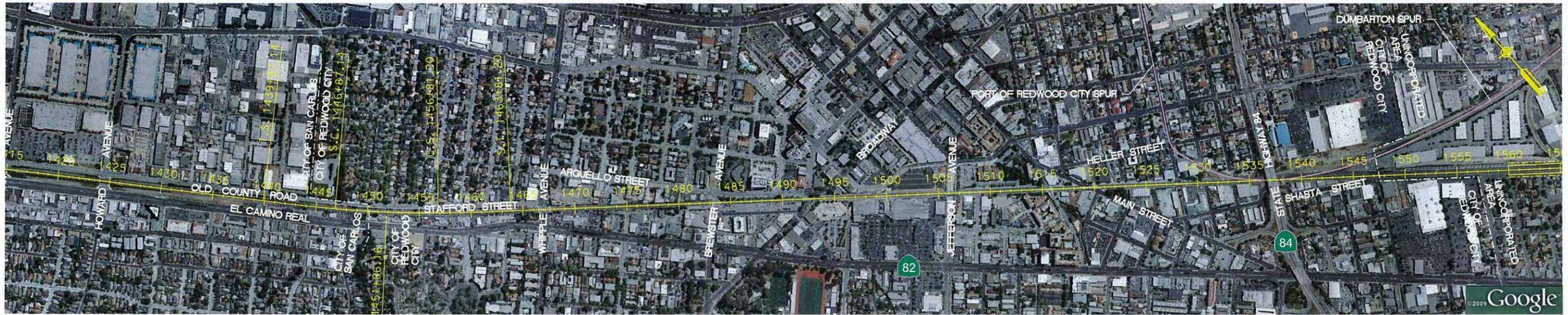
Length: 7.6 miles Land Use: Urban

## North of Highway 92 to North of 5th Avenue (MP. 19.29 to MP. 26.88)

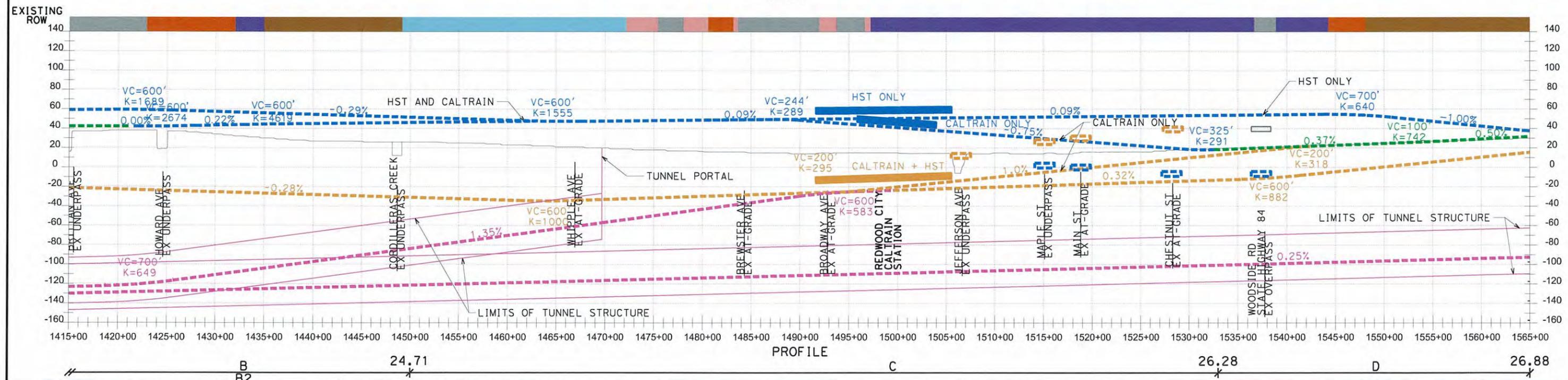
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EXISTING (APPROX)		ROADWAY DESIGN OPTION	
	ROW WIDTH ≥ 100'		STATION
	ROW WIDTH 90' - 99'		STATION
	ROW WIDTH 80' - 89'		STATION
	ROW WIDTH 70' - 79'		STATION
	ROW WIDTH 60' - 69'		ELEVATED (AERIAL/BERM)
	ROW WIDTH < 60'		EXISTING CALTRAIN GRADE
			BELOW GRADE (TRENCH/TUNNEL)
			BELOW GRADE (DEEP TUNNEL) (HST ONLY)

NOTES:  
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 2. PROFILES SHOWN ARE TOR.



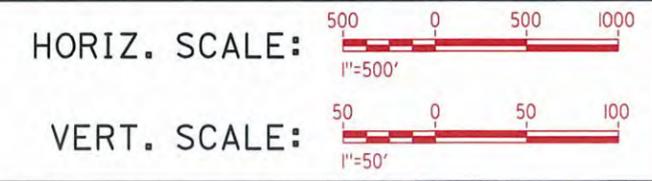
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# Subsection #5-1

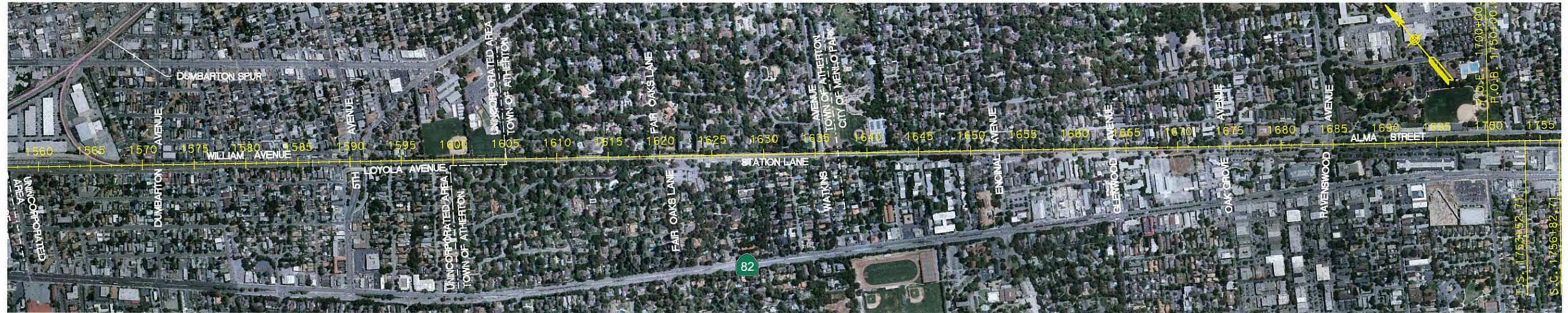
Length: 2.8 miles Land Use: Urban

## North of 5th Avenue to North of SCL/SM County Line (MP. 26.88 to MP. 29.72)

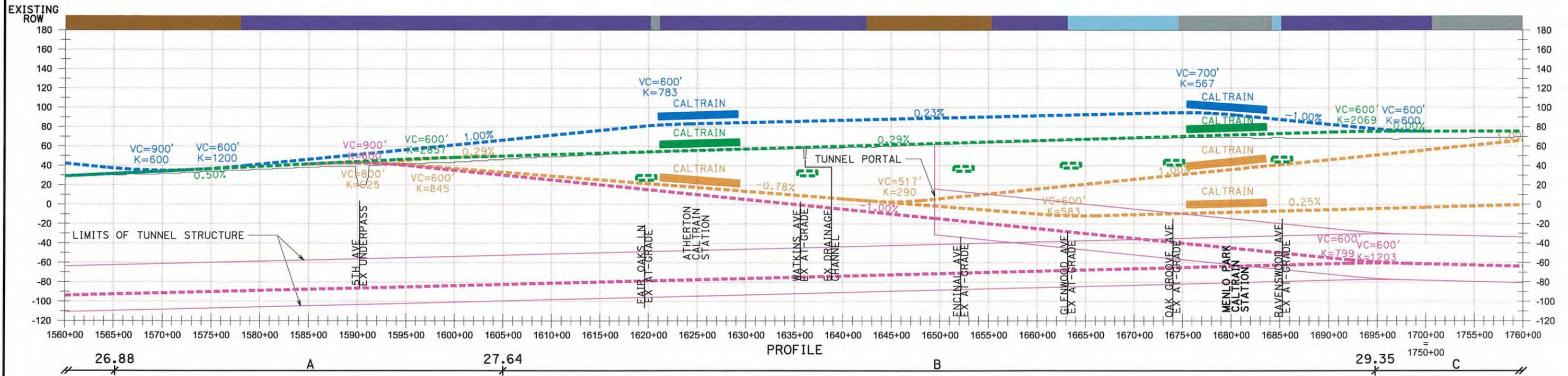
This subsection is located in the Cities of Atherton and Menlo Park, with a small portion in unincorporated San Mateo County. The Caltrain tracks are at-grade, and with one exception, all street crossings are at-grade. Generally, the streets that cross the tracks are two-lane collectors serving residential areas. In most cases, these streets are integral parts of the local street network.



NOTES:  
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# Subsection #6-1

Length: 3.9 miles Land Use: Urban

## North of SCL/SM County Line to North of Adobe Creek (MP. 29.72 to MP. 33.61)

This subsection is located in the City of Palo Alto. The Caltrain tracks are at-grade and all of the streets that are grade separated pass under the tracks. Several at-grade crossings occur between the grade separations. Alma Street runs alongside the Caltrain tracks for the entire length of this subsection.

### EXISTING (APPROX)

	ROW WIDTH ≥ 100'
	ROW WIDTH 90' - 99'
	ROW WIDTH 80' - 89'
	ROW WIDTH 70' - 79'
	ROW WIDTH 60' - 69'
	ROW WIDTH < 60'

### ROADWAY DESIGN OPTION

	STATION	ELEVATED (AERIAL/BERM)
	STATION	EXISTING CALTRAIN GRADE
	STATION	BELOW GRADE (TRENCH/TUNNEL)
		BELOW GRADE (DEEP TUNNEL) (HST ONLY)

### NOTES:

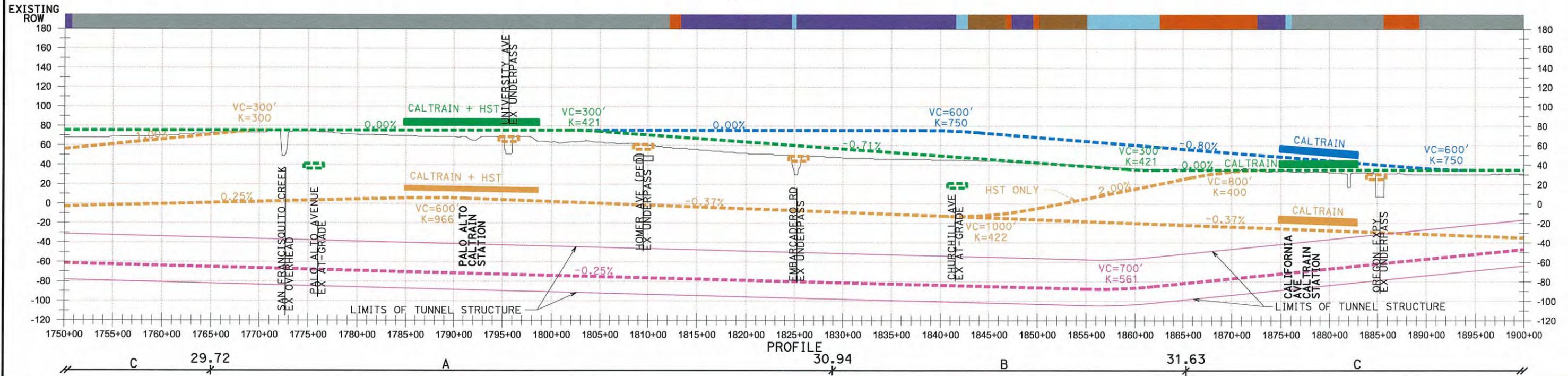
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HORIZ. SCALE:



VERT. SCALE:

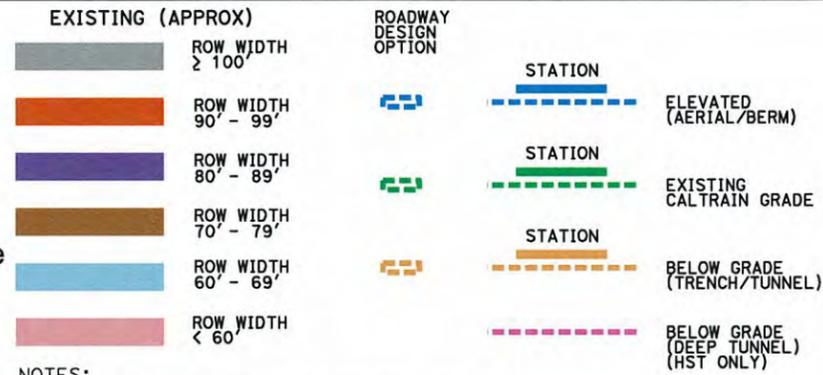


# Subsection #6-2

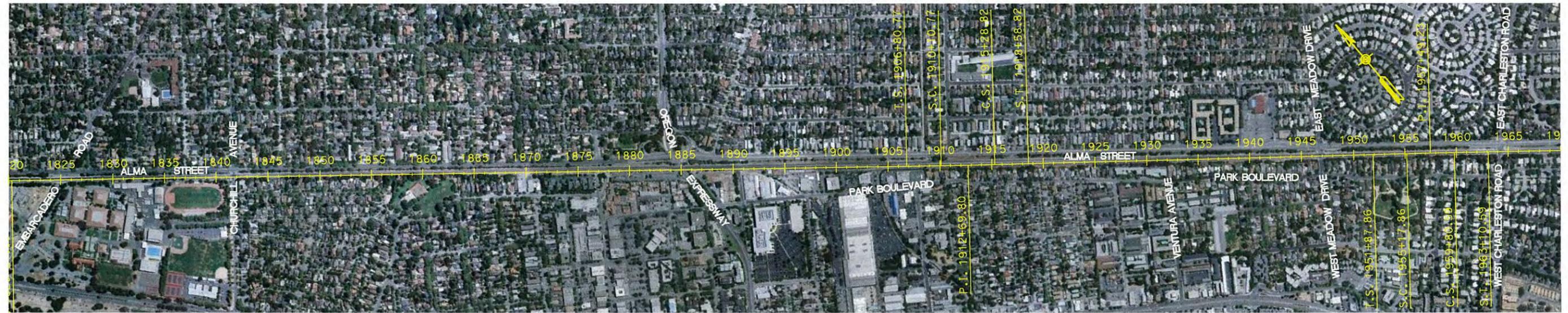
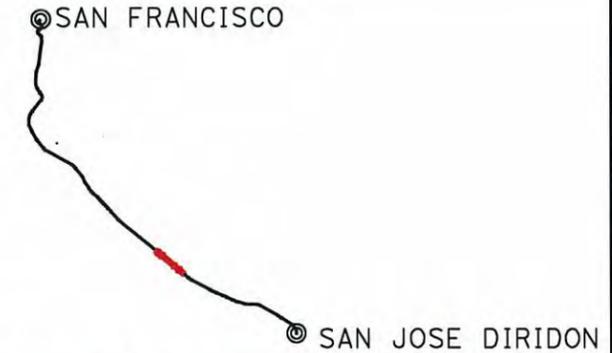
Length: 3.9 miles Land Use: Urban

## North of SCL/SM County Line to North of Adobe Creek (MP. 29.72 to MP. 33.61)

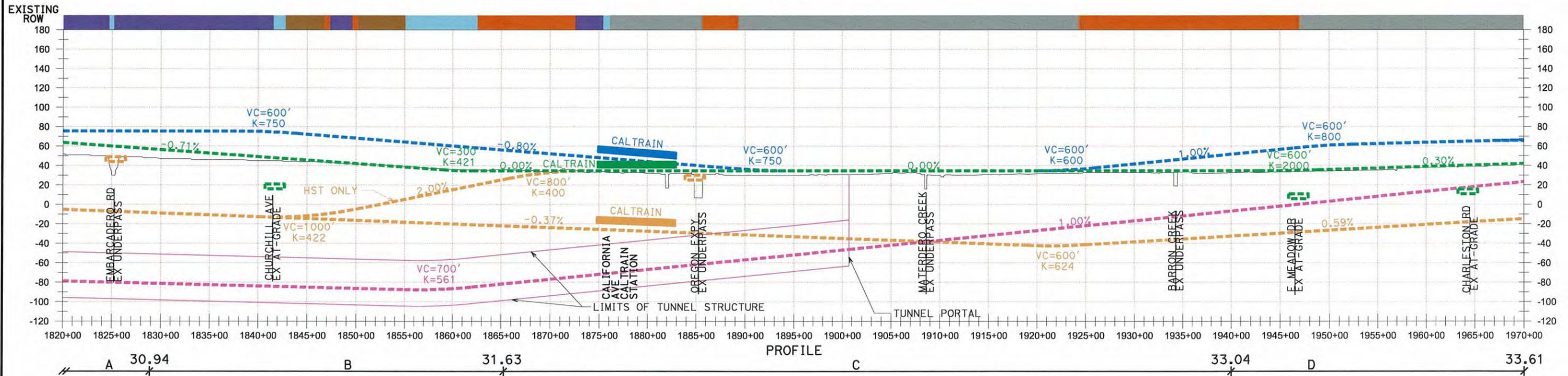
This subsection is located in the City of Palo Alto. The Caltrain tracks are at-grade and all of the streets that are grade separated pass under the tracks. Several at-grade crossings occur between the grade separations. Alma Street runs alongside the Caltrain tracks for the entire length of this subsection.



NOTES:  
 1. CENTERLINE SHOWN IS PROPOSED MT2.  
 2. PROFILES SHOWN ARE TOR.



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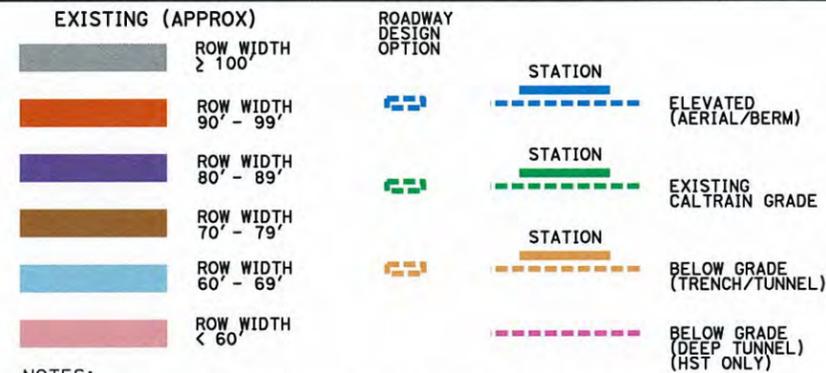
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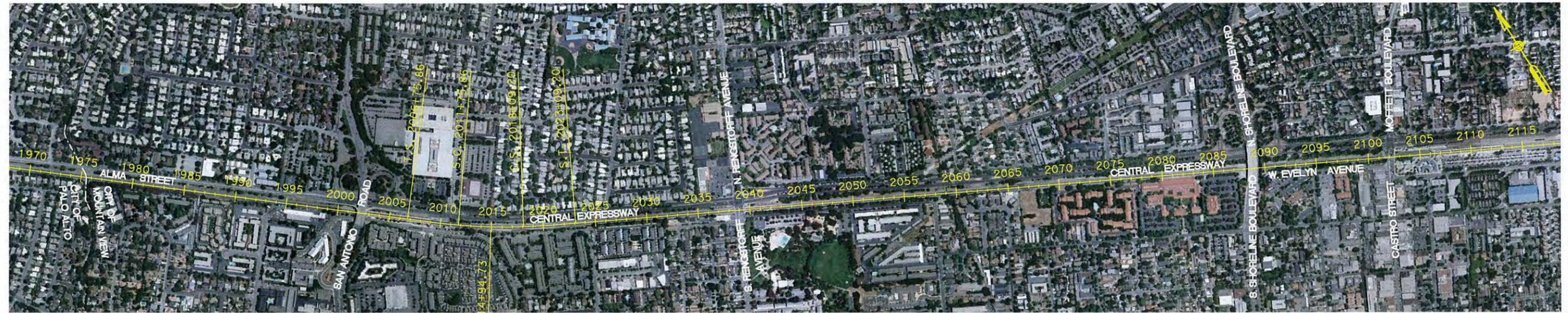
# Subsection #7-1

Length: 5.7 miles Land Use: Urban

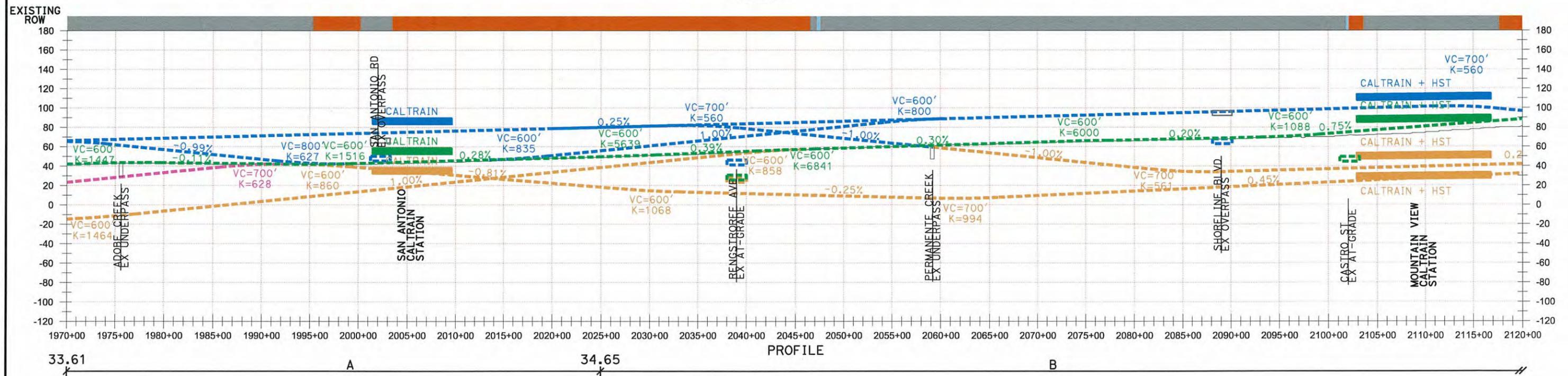
**North of Adobe Creek to North of Fair Oaks Avenue (MP. 33.61 to MP. 39.29)**  
 This subsection is located in the Cities of Mountain View and Sunnyvale. The Caltrain tracks are at-grade and all grade separated crossings pass over the tracks. Several at-grade crossings occur between the grade separations. Central Expressway and Evelyn Avenue run alongside the Caltrain tracks for a large portion of this subsection.



NOTES:  
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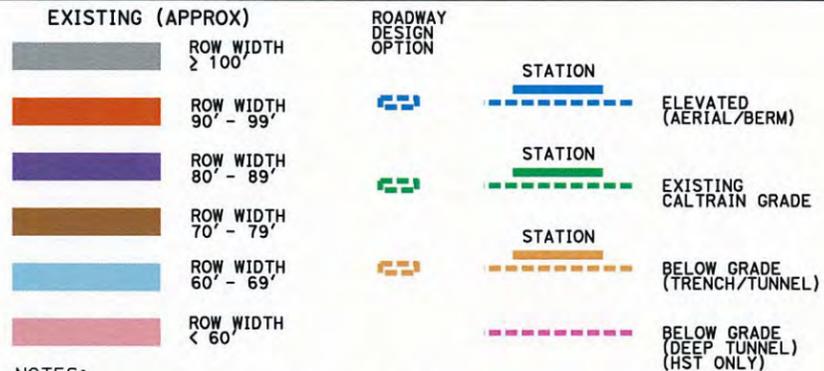


# Subsection #7-2

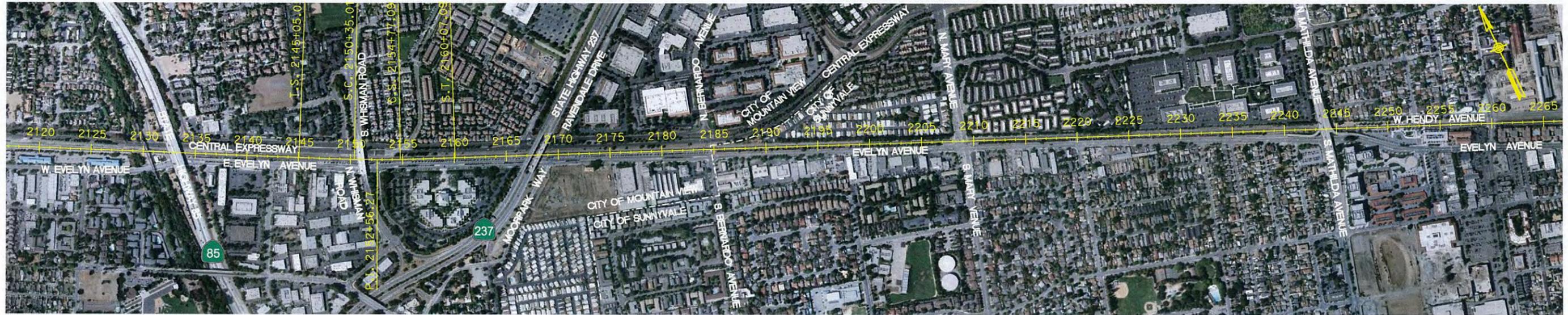
Length: 5.7 miles Land Use: Urban

## North of Adobe Creek to North of Fair Oaks Avenue (MP. 33.61 to MP. 39.29)

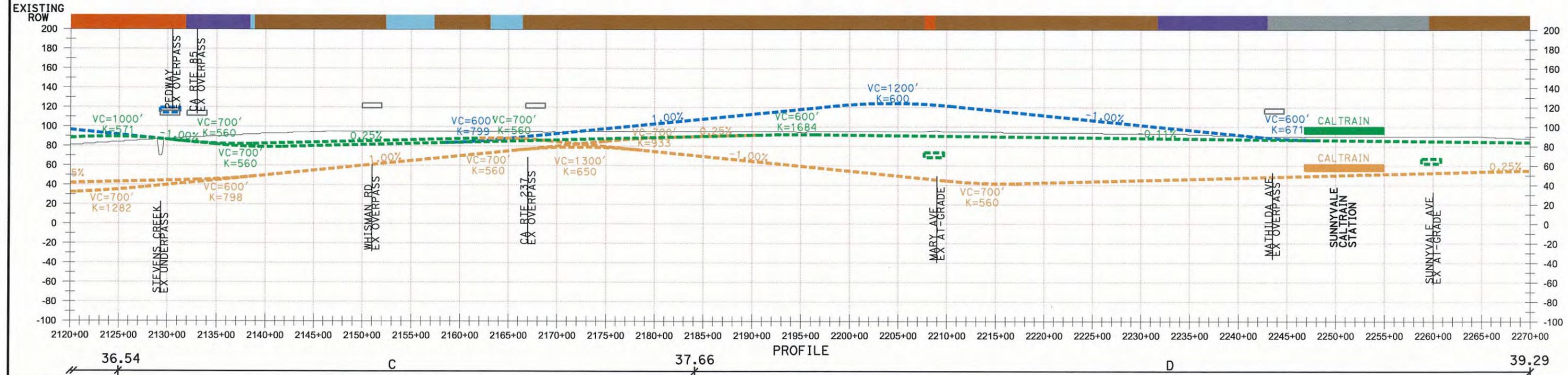
This subsection is located in the Cities of Mountain View and Sunnyvale. The Caltrain tracks are at-grade and all grade separated crossings pass over the tracks. Several at-grade crossings occur between the grade separations. Central Expressway and Evelyn Avenue run alongside the Caltrain tracks for a large portion of this subsection.



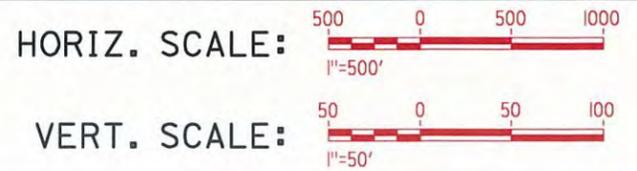
NOTES:  
 1. CENTERLINE SHOWN IS PROPOSED MT2.  
 2. PROFILES SHOWN ARE TOR.



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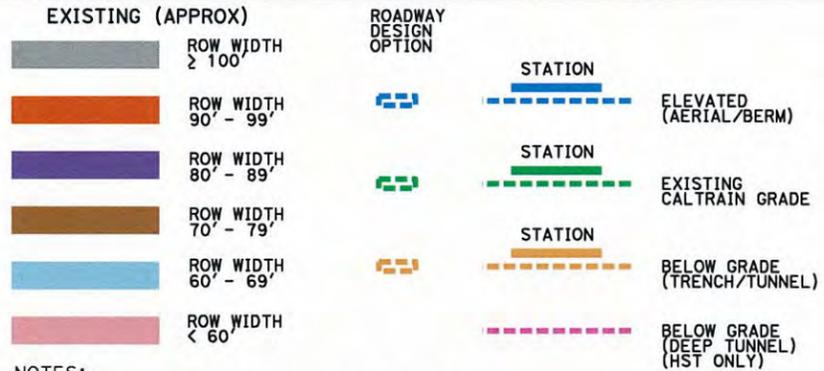
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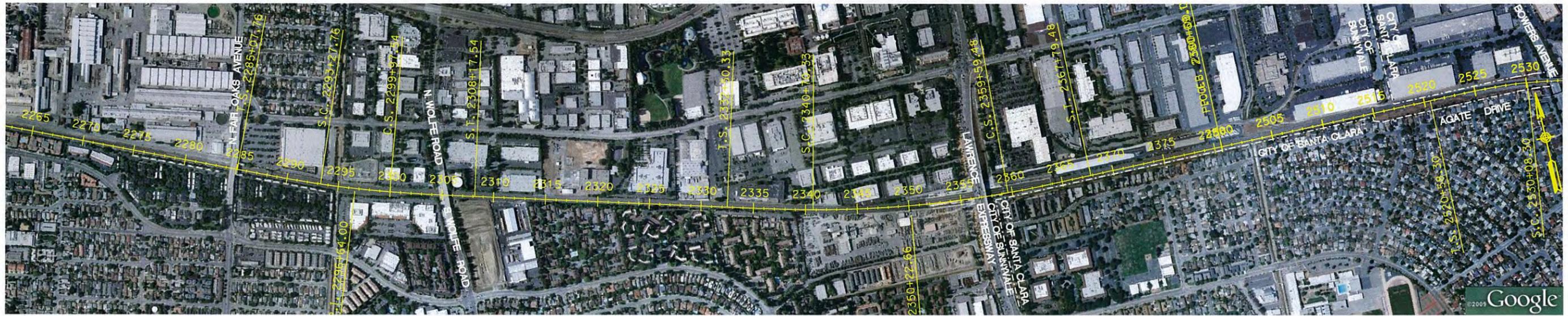
# Subsection #8-1

Length: 4.7 miles Land Use: Urban

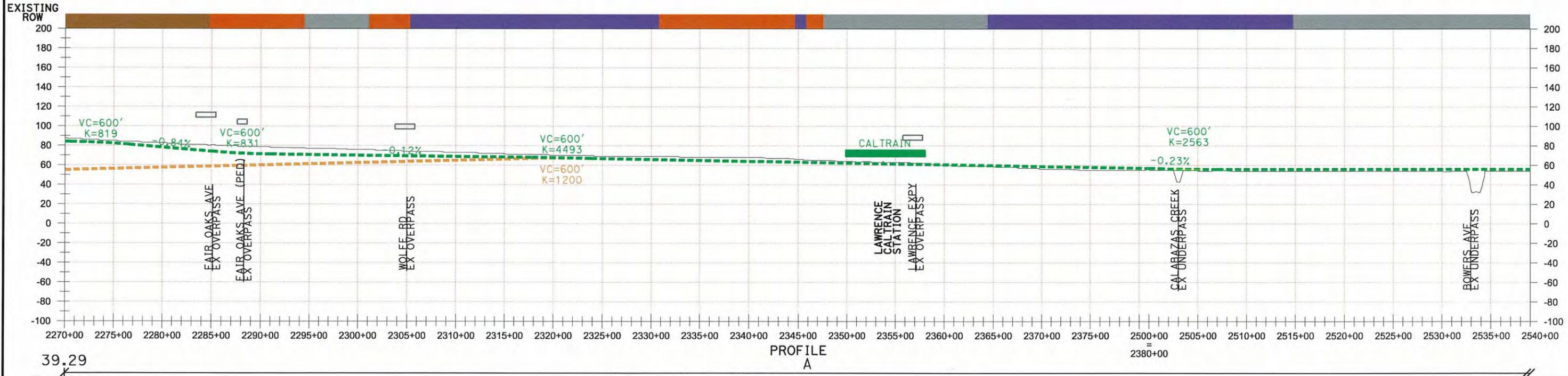
**North of Fair Oaks Avenue to South of De La Cruz Boulevard (MP. 39.29 to MP. 44.04)**  
 This subsection is located in the Cities of Sunnyvale and Santa Clara. The Caltrain tracks are at-grade and all crossings are grade separated. Most of the crossings pass over the tracks. This subsection includes an existing 4-track segment near Lawrence Expressway.



NOTES:  
 1. CENTERLINE SHOWN IS PROPOSED MT2.  
 2. PROFILES SHOWN ARE TOR.



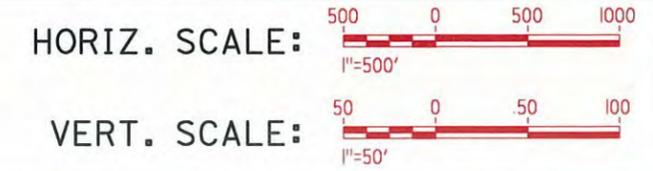
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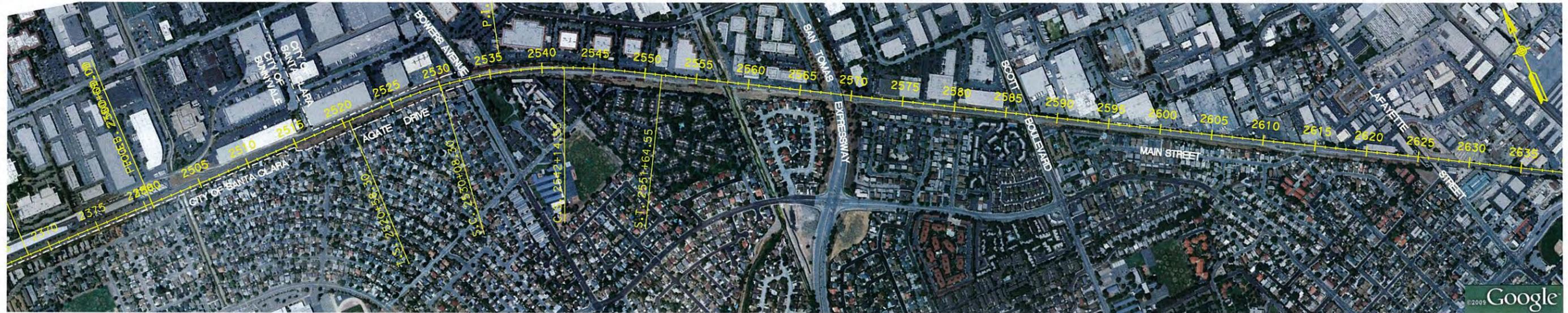
# Subsection #8-2

Length: 4.7 miles Land Use: Urban

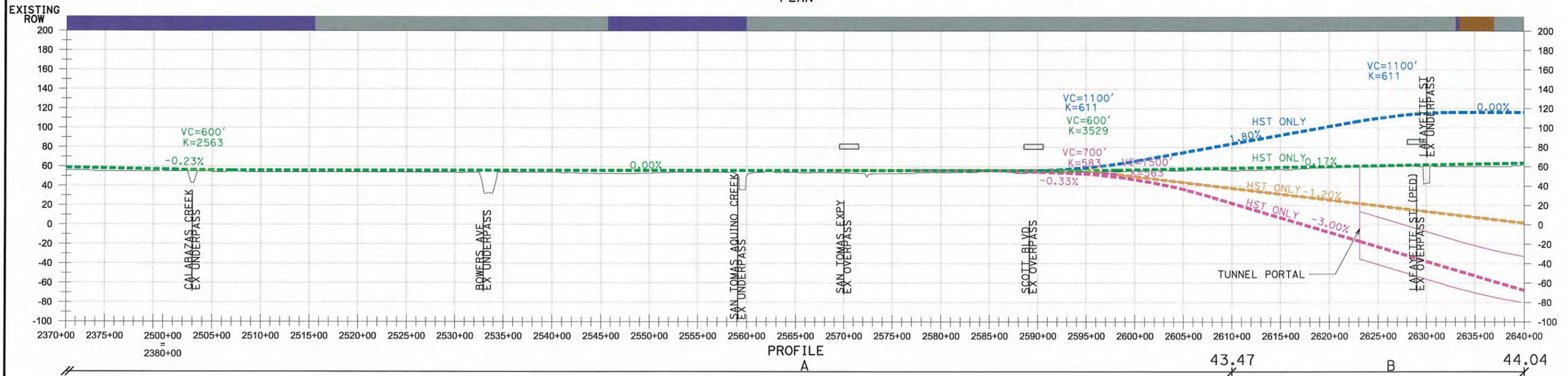
**North of Fair Oaks Avenue to South of De La Cruz Boulevard (MP. 39.29 to MP. 44.04)**  
 This subsection is located in the Cities of Sunnyvale and Santa Clara. The Caltrain tracks are at-grade and all crossings are grade separated. Most of the crossings pass over the tracks. This subsection includes an existing 4-track segment near Lawrence Expressway.



**NOTES:**  
 1. CENTERLINE SHOWN IS PROPOSED MT2.  
 2. PROFILES SHOWN ARE TOR.



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# Subsection #9 (a)-1

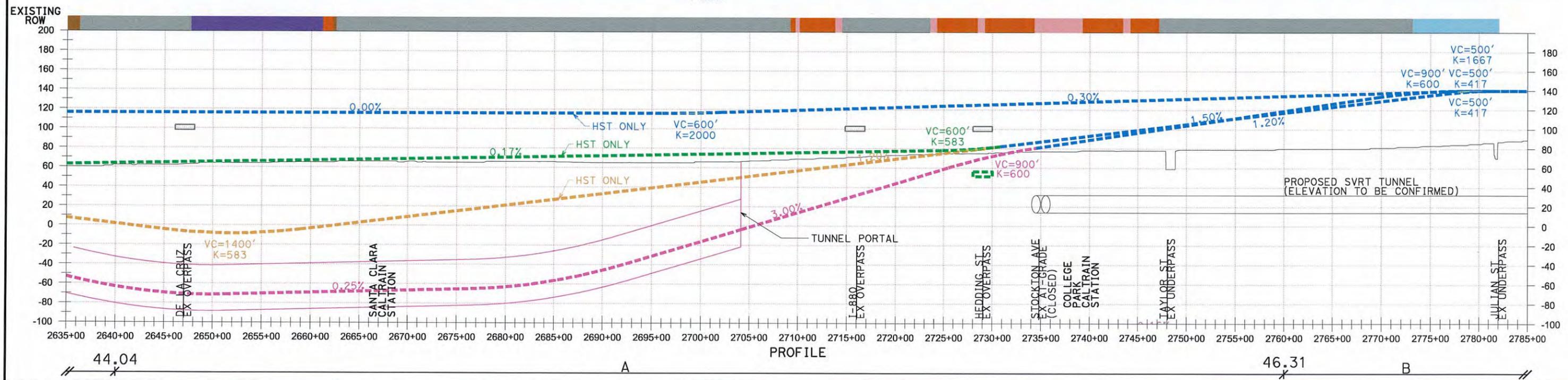
Length: 3.5 miles Land Use: Urban

## North of De La Cruz Boulevard to San Jose Diridon Station (MP. 44.04 to MP. 47.54)

This subsection is located in the Cities of San Jose and Santa Clara. The Caltrain tracks are at-grade and all crossings are grade separated. Besides Caltrain, this subsection is also used by ACE, Capitol Corridor and Amtrak long distance passenger trains and UPRR through freight trains. The future BART extension will also run alongside this subsection, primarily in a tunnel.

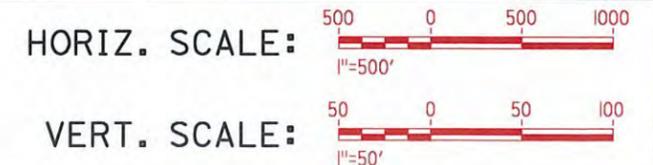


NOTES:  
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 2. PROFILES SHOWN ARE TOR.



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# Subsection #9 (a)-2

Length: 3.5 miles Land Use: Urban

## North of De La Cruz Boulevard to San Jose Diridon Station (MP. 44.04 to MP. 47.54)

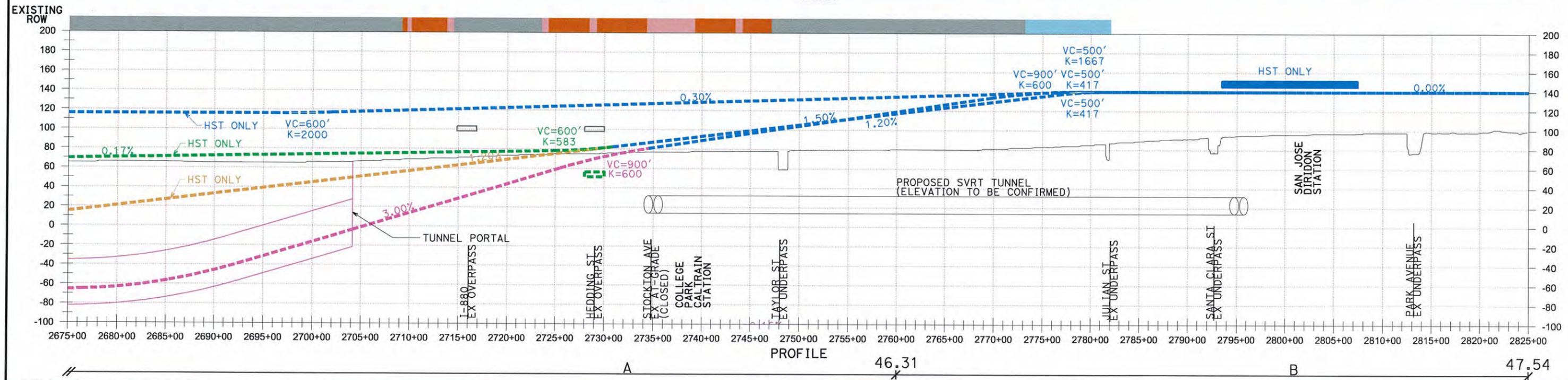
This subsection is located in the Cities of San Jose and Santa Clara. The Caltrain tracks are at-grade and all crossings are grade separated. Besides Caltrain, this subsection is also used by ACE, Capitol Corridor and Amtrak long distance passenger trains and UPRR through freight trains. The future BART extension will also run alongside this subsection, primarily in a tunnel.

EXISTING (APPROX)	
	ROW WIDTH ≥ 100'
	ROW WIDTH 90' - 99'
	ROW WIDTH 80' - 89'
	ROW WIDTH 70' - 79'
	ROW WIDTH 60' - 69'
	ROW WIDTH < 60'

ROADWAY DESIGN OPTION

	STATION	ELEVATED (AERIAL/BERM)
	STATION	EXISTING CALTRAIN GRADE
	STATION	BELOW GRADE (TRENCH/TUNNEL)
		BELOW GRADE (DEEP TUNNEL) (HST ONLY)

- NOTES:
- CENTERLINE SHOWN IS PROPOSED MT2.
  - PROFILES SHOWN ARE TOR.



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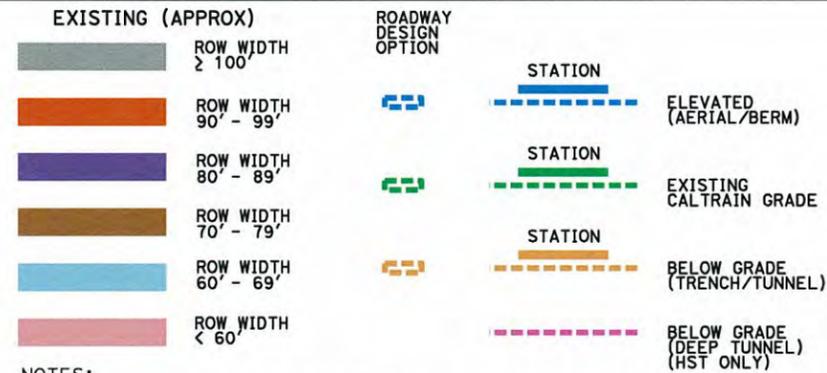


# Subsection #9 (b) -1

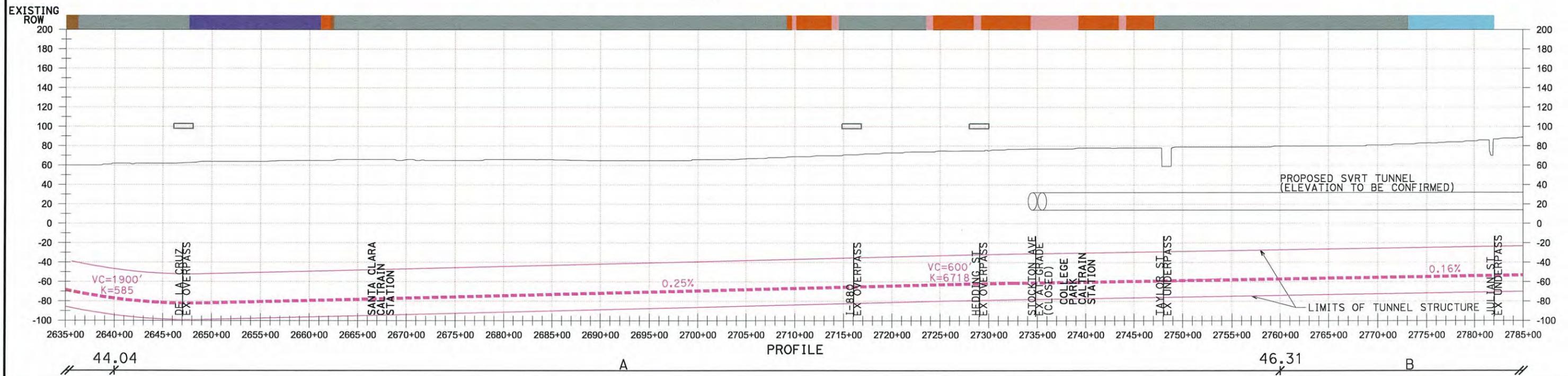
Length: 3.1 miles Land Use: Urban

## North of De La Cruz Boulevard to San Jose Diridon Station (MP. 44.04 to MP. 47.07)

This subsection is located in the Cities of San Jose and Santa Clara. The Caltrain tracks are at-grade and all crossings are grade separated. Besides Caltrain, this subsection is also used by ACE, Capitol Corridor and Amtrak long distance passenger trains and UPRR through freight trains. The future BART extension will also run alongside this subsection, primarily in a tunnel.



NOTES:  
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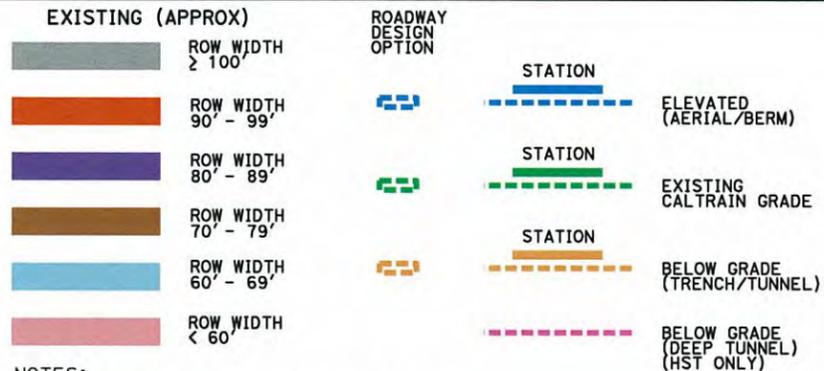


# Subsection #9 (b) - 2

Length: 3.1 miles Land Use: Urban

## North of De La Cruz Boulevard to San Jose Diridon Station (MP. 44.04 to MP. 47.07)

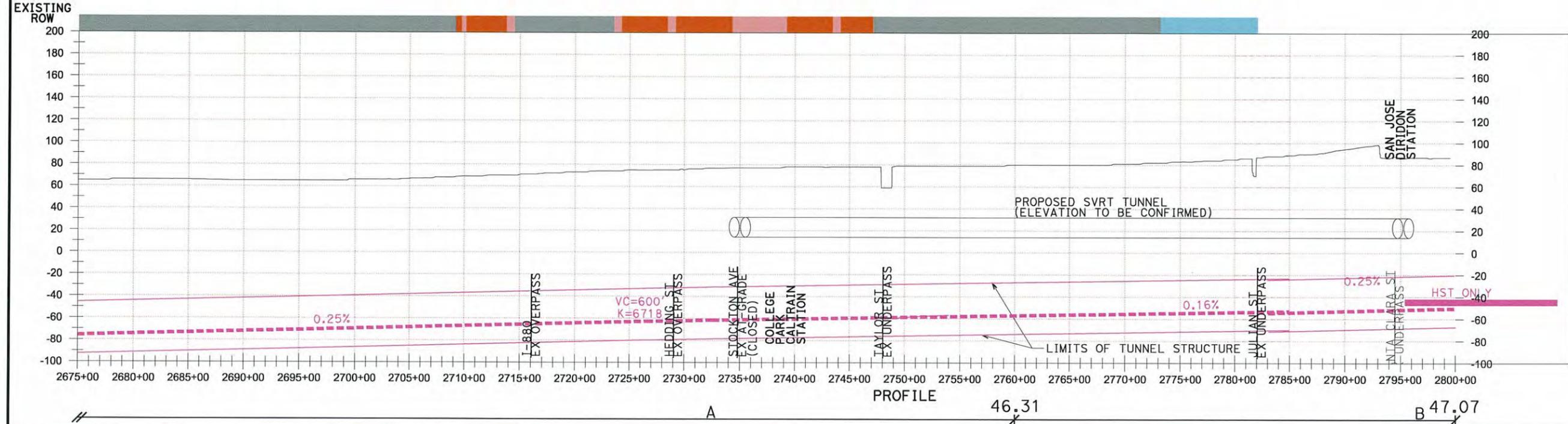
This subsection is located in the Cities of San Jose and Santa Clara. The Caltrain tracks are at-grade and all crossings are grade separated. Besides Caltrain, this subsection is also used by ACE, Capitol Corridor and Amtrak long distance passenger trains and UPRR through freight trains. The future BART extension will also run alongside this subsection, primarily in a tunnel.



NOTES:  
 1. CENTERLINE SHOWN IS PROPOSED MT2.  
 2. PROFILES SHOWN ARE TOR.



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PROFILE 46.31 47.07



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