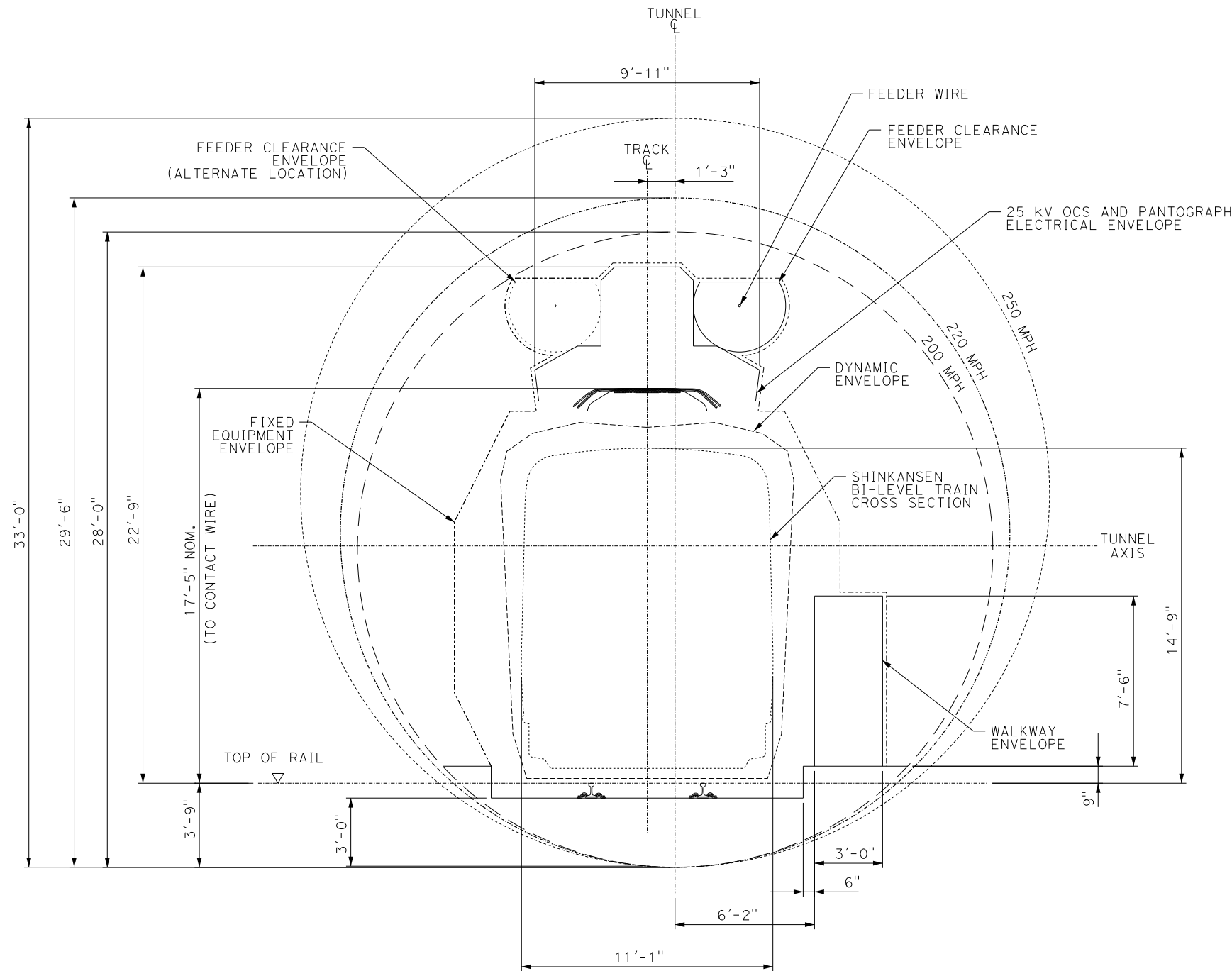


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CROSS-SECTIONS FOR TUNNEL LENGTH OF 0.6 MILES TO 2.2 MILES

NOTES:

1. FREE TUNNEL CROSS-SECTIONAL AREAS COMPLY WITH REQUIREMENTS OF EUROPEAN TECHNICAL SPECIFICATIONS FOR INTEROPERABILITY FOR HIGH SPEED TRAINS, 2008 INFRASTRUCTURE SECTION, CLAUSE 4.2.16.1.
2. FREE TUNNEL CROSS-SECTIONAL AREAS HAVE BEEN CALCULATED IN ACCORDANCE WITH MEDICAL HEALTH CRITERIA CURVES UIC GUIDELINE 779-11 R "DETERMINATION OF RAILWAY TUNNEL CROSS SECTIONAL AREAS ON THE BASIS OF AERODYNAMIC CONSIDERATIONS", APPENDIX F, FIGURE 4.
3. FREE TUNNEL CROSS-SECTIONAL AREAS HAVE NOT BEEN CALCULATED TO MINIMIZE AERODYNAMIC RESISTANCE OR MINIMIZE HEAT BUILD UP IN TUNNELS.
4. FOR PANTOGRAPH DETAILS, REFER TO TM 3.2.3 PANTOGRAPH CLEARANCE ENVELOPE.
5. FOR DYNAMIC ENVELOPE DETAILS, REFER TO TM 1.1.10 STRUCTURE GAUGES.

TABLE 1

MINIMUM FREE TUNNEL CROSS-SECTIONAL AREAS TO COMPLY WITH MEDICAL HEALTH CRITERIA

MINIMUM FREE TUNNEL C/S AREA (SF)	TUNNEL LENGTH (MILES)						
	< 0.6	0.6 TO 2.2	>2.2 TO 3.1	>3.1 TO 4.7	>4.7 TO 6.2	> 6.2	
DESIGN SPEED (MPH)	250	740	795	740	700	640	595
	220	595	615	585	555	<555	<555
	200 OR LESS	550	550	550	<550	<550	<550

ASSUMPTIONS FOR TABLE 1:

1. TRAIN LENGTH OF 1312 FEET
2. SINGLE TRAIN OPERATION
3. EXCELLENTLY SEALED TRAIN (SHINKANSEN OR ICE 3)
4. FIXED EQUIPMENT ALLOWANCE OF 20 SF
5. 6" ALLOWANCE ON DIAMETER FOR CONSTRUCTION TOLERANCE
6. AREAS ROUNDED UP TO NEAREST 5 SF

TABLE 2

BORED TUNNEL INTERNAL DIAMETERS EQUIVALENT TO MINIMUM FREE TUNNEL CROSS-SECTIONAL AREAS

BORED TUNNEL INTERNAL DIAMETER (FT)	TUNNEL LENGTH (MILES)						
	< 0.6	0.6 TO 2.2	>2.2 TO 3.1	>3.1 TO 4.7	>4.7 TO 6.2	> 6.2	
DESIGN SPEED (MPH)	250	32	33	31.5	31	30	28.5
	220	28.5	29.5	28.5	28	<28	<28
	200 OR LESS	28	28	28	<28	<28	<28

ASSUMPTIONS FOR TABLE 2:

1. DIAMETERS ROUNDED UP TO NEAREST 6 INCHES

LEGENDS:

- MINIMUM FREE TUNNEL CROSS-SECTIONAL AREA REQUIRED (250 MPH): 795 SF
- MINIMUM FREE TUNNEL CROSS-SECTIONAL AREA REQUIRED (220 MPH): 615 SF
- MINIMUM FREE TUNNEL CROSS-SECTIONAL AREA REQUIRED (200 MPH): 550 SF
- TRAIN CROSS-SECTIONAL AREA: 150 SF



REV	DATE	BY	CHK	APP	DESCRIPTION

DESIGNED BY
J. THOMPSON
DRAWN BY
P. DO
CHECKED BY
J. CHIRCO
IN CHARGE
J. CHIRCO
DATE
07-30-09

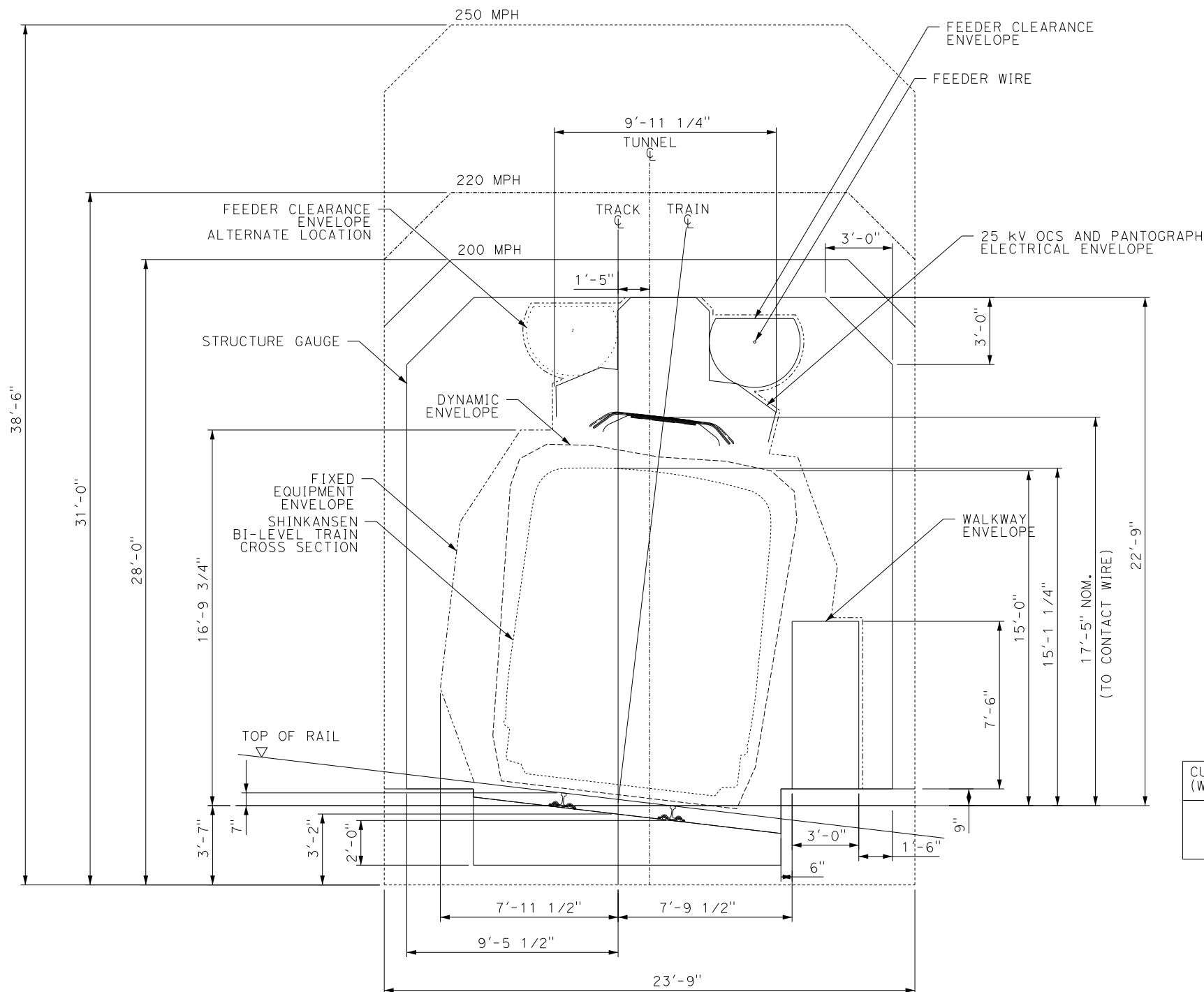


CALIFORNIA HIGH-SPEED TRAIN PROJECT

BASIC TUNNEL CONFIGURATION
SINGLE TRACK, TBM BORED TUNNEL

CONTRACT NO.
13259
DRAWING NO.
TM 2.4.2-A
SCALE
AS SHOWN
SHEET NO.

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CROSS-SECTIONS FOR TUNNEL LENGTH OF 0.6 MILES TO 2.2 MILES

NOTES:

1. FREE TUNNEL CROSS-SECTIONAL AREAS COMPLY WITH REQUIREMENTS OF EUROPEAN TECHNICAL SPECIFICATIONS FOR INTEROPERABILITY FOR HIGH SPEED TRAINS, 2008 INFRASTRUCTURE SECTION, CLAUSE 4.2.16.1.
2. FREE TUNNEL CROSS-SECTIONAL AREAS HAVE BEEN CALCULATED IN ACCORDANCE WITH MEDICAL HEALTH CRITERIA CURVES UIC GUIDELINE 779-11 R "DETERMINATION OF RAILWAY TUNNEL CROSS SECTIONAL AREAS ON THE BASIS OF AERODYNAMIC CONSIDERATIONS", APPENDIX F, FIGURE 4.
3. FREE TUNNEL CROSS-SECTIONAL AREAS HAVE NOT BEEN CALCULATED TO MINIMIZE AERODYNAMIC RESISTANCE OR MINIMIZE HEAT BUILD UP IN TUNNELS.
4. FOR PANTOGRAPH DETAILS, REFER TO TM 3.2.3 PANTOGRAPH CLEARANCE ENVELOPE.
5. FOR DYNAMIC ENVELOPE DETAILS, REFER TO TM 1.1.10 STRUCTURE GAUGES.

TABLE 1

MINIMUM FREE TUNNEL CROSS-SECTIONAL AREAS TO COMPLY WITH MEDICAL HEALTH CRITERIA

MINIMUM FREE TUNNEL C/S AREA (SF)	TUNNEL LENGTH (MILES)						
	< 0.6	0.6 TO 2.2	>2.2 TO 3.1	>3.1 TO 4.7	>4.7 TO 6.2	> 6.2	
DESIGN SPEED (MPH)	250	755	810	755	715	655	610
	220	610	630	600	570	<570	<570
	200 OR LESS	560	560	560	<560	<560	<560

ASSUMPTIONS FOR TABLE 1:

1. TRAIN LENGTH OF 1312 FEET
2. SINGLE TRAIN OPERATION
3. EXCELLENTLY SEALED TRAIN (SHINKANSEN OR ICE 3)
4. FIXED EQUIPMENT ALLOWANCE OF 20 SF
5. 6" ALLOWANCE ON EACH VERTICAL WALL AND 4" ALLOWANCE ON SOFFIT FOR CONSTRUCTION TOLERANCE
6. AREAS ROUNDED UP TO NEAREST 5 SF

TABLE 2

CUT AND COVER TUNNEL INTERNAL HEIGHTS EQUIVALENT TO MINIMUM FREE TUNNEL CROSS-SECTIONAL AREAS

CUT-AND-COVER TUNNEL INTERNAL HEIGHT (FT) (WIDTH FIXED AT 23.75 FT)	TUNNEL LENGTH (MILES)						
	< 0.6	0.6 TO 2.2	>2.2 TO 3.1	>3.1 TO 4.7	>4.7 TO 6.2	> 6.2	
DESIGN SPEED (MPH)	250	36	38.5	36	34.5	32	30
	220	30	31	29.5	28.5	<28.5	<28.5
	200 OR LESS	28	28	28	<28	<28	<28

ASSUMPTIONS FOR TABLE 2:

1. HEIGHTS ROUNDED UP TO NEAREST 6 INCHES

LEGENDS:

- MINIMUM FREE TUNNEL CROSS-SECTIONAL AREA (250 MPH): 810 SF
- MINIMUM FREE TUNNEL CROSS-SECTIONAL AREA (220 MPH): 630 SF
- MINIMUM FREE TUNNEL CROSS-SECTIONAL AREA (200 MPH): 560 SF



REV	DATE	BY	CHK	APP	DESCRIPTION

DESIGNED BY
J. THOMPSON
DRAWN BY
P. DO
CHECKED BY
J. CHIRCO
IN CHARGE
J. CHIRCO
DATE
07-30-09



CALIFORNIA HIGH-SPEED TRAIN PROJECT

BASIC TUNNEL CONFIGURATION
CUT-AND-COVER TUNNEL
SINGLE AND DOUBLE TRACK

CONTRACT NO.
13259
DRAWING NO.
TM 2.4.2-B
SCALE
AS SHOWN
SHEET NO.