California High-Speed Rail Authority

Palmdale to Burbank Project Section

PEPD RECORD SET REV02

Tunnels Plans

April 2021

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being or have been carried out by the State of California pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated July 23, 2019, and executed by the Federal Railroad Administration and the State of California.
NOTE:
PRELIMINARY DRAFT/SUBJECT TO CHANGE

SOURCE:
FAULTS - USGS QUATERNARY FAULT AND FOLD DATABASE AND CGS GEOLOGIC MAP DATABASES FAULT SCREENING REPORT - PALMDALE TO BURBANK SEGMENT, SEISMIC SPECIALIST TEAM - FAULT DISPLACEMENT, DRAFT, MAY 2017
<table>
<thead>
<tr>
<th>ALIGNMENT</th>
<th>TUNNEL</th>
<th>TUNNEL CONFIGURATION</th>
<th>LENGTH MILES</th>
<th>PORTAL/DISTANCE</th>
<th>TYPE</th>
<th>PORTAL TYPE</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tunnel 1</td>
<td>Twin branch, single track</td>
<td>1.63</td>
<td>P1</td>
<td>635+19.62</td>
<td>twin track portal</td>
<td>Existing mine portal, Alice cavern</td>
</tr>
<tr>
<td></td>
<td>Tunnel 2</td>
<td>Twin branch, single track</td>
<td>2.16</td>
<td>P2</td>
<td>729+16.18</td>
<td>twin track portal</td>
<td>Alice cavern</td>
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<tr>
<td></td>
<td>Tunnel 3</td>
<td>Twin branch, single track</td>
<td>1.90</td>
<td>P3</td>
<td>847+66.39</td>
<td>twin track portal</td>
<td>Alice cavern</td>
</tr>
<tr>
<td></td>
<td>Tunnel 4</td>
<td>Twin branch, single track</td>
<td>1.63</td>
<td>P4</td>
<td>1045+36.93</td>
<td>twin track portal</td>
<td>Alice cavern</td>
</tr>
<tr>
<td></td>
<td>Tunnel 5</td>
<td>Twin branch, single track</td>
<td>1.35</td>
<td>P5</td>
<td>1237+18.16</td>
<td>twin track portal</td>
<td>Existing mine portal, Alice cavern</td>
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<tr>
<td></td>
<td>Tunnel 6</td>
<td>Twin branch, single track</td>
<td>1.63</td>
<td>P6</td>
<td>1774+45.00</td>
<td>twin track portal</td>
<td>Existing mine portal, Alice cavern</td>
</tr>
<tr>
<td></td>
<td>Tunnel 7</td>
<td>Twin branch, single track</td>
<td>1.63</td>
<td>P7</td>
<td>1774+45.00</td>
<td>twin track portal</td>
<td>Existing mine portal, Alice cavern</td>
</tr>
<tr>
<td></td>
<td>Tunnel 8</td>
<td>Twin branch, single track</td>
<td>1.63</td>
<td>P8</td>
<td>1774+45.00</td>
<td>twin track portal</td>
<td>Existing mine portal, Alice cavern</td>
</tr>
<tr>
<td></td>
<td>Tunnel 9</td>
<td>Twin branch, single track</td>
<td>1.63</td>
<td>P9</td>
<td>1774+45.00</td>
<td>twin track portal</td>
<td>Existing mine portal, Alice cavern</td>
</tr>
<tr>
<td></td>
<td>Tunnel 10</td>
<td>Twin branch, single track</td>
<td>1.63</td>
<td>P10</td>
<td>1774+45.00</td>
<td>twin track portal</td>
<td>Existing mine portal, Alice cavern</td>
</tr>
<tr>
<td></td>
<td>Tunnel 11</td>
<td>Twin branch, single track</td>
<td>1.63</td>
<td>P11</td>
<td>1774+45.00</td>
<td>twin track portal</td>
<td>Existing mine portal, Alice cavern</td>
</tr>
</tbody>
</table>

**NOTES:**
- All tunnels are located in the Aliso Canyon area.
- Tunnel 1 is the mountain portal at Aliso Canyon.
- Tunnel 2 is the mountain portal at San Gabriel fault zone.
- Tunnel 3 is the mountain portal at Verdugo fault zone.
- Tunnel 4 is the mountain portal at Sierra Madre fault zone.
- Tunnel 5 is the mountain portal at San Andreas fault zone.
- Tunnel 6 is the mountain portal at Sierra Madre fault zone.
- Tunnel 7 is the mountain portal at San Andreas fault zone.
- Tunnel 8 is the mountain portal at Sierra Madre fault zone.
- Tunnel 9 is the mountain portal at Sierra Madre fault zone.
- Tunnel 10 is the mountain portal at Sierra Madre fault zone.
- Tunnel 11 is the mountain portal at Sierra Madre fault zone.

**Geotechnical Risks:**
- **Tunnel 1:** Potential slope instability of bedrock during earthquakes.
- **Tunnel 2:** Potential slope instability of bedrock during earthquakes.
- **Tunnel 3:** Potential slope instability of bedrock during earthquakes.
- **Tunnel 4:** Potential slope instability of bedrock during earthquakes.
- **Tunnel 5:** Potential slope instability of bedrock during earthquakes.
- **Tunnel 6:** Potential slope instability of bedrock during earthquakes.
- **Tunnel 7:** Potential slope instability of bedrock during earthquakes.
- **Tunnel 8:** Potential slope instability of bedrock during earthquakes.
- **Tunnel 9:** Potential slope instability of bedrock during earthquakes.
- **Tunnel 10:** Potential slope instability of bedrock during earthquakes.
- **Tunnel 11:** Potential slope instability of bedrock during earthquakes.

**Construction Method:**
- Mixed: Mixed methods or other solutions used for construction.

**Site Conditions:**
- Wetlands, slopes, and other obstacles mixed face condition.
- Limited access or other solutions used for construction.

**Numbering of Tunnels:**
- All tunnels are numbered from the operational point of view, not from the construction method.
CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"
HIGH SPEED RAIL TUNNEL PLANS
KEY MAP 1 OF 2

DESIGNED BY
E. VELASCO
D.P. DOMINGUEZ

DRAWN BY
N. SAH
A. DELARIO

CHECKED BY
A. RE

IN CHARGE
N. A. R.

REQ. NO.
80000001

DATE
04/30/2021

REV.
1

DESCRIPTION
REVISION HISTORY: 04/30/2021

PEPD RECORD SET
KEY 01

NOT FOR CONSTRUCTION

HIGH-SPEED RAIL AUTHORITY
CALIFORNIA

SAN BERNARDINO

BRIDGE

VICINITY MAP
NOTE:

1. PERMANENT PORTAL P2 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED
   - ADDED RESERVE OF SPACE FOR WATER STORAGE/SUPPLY
   - ADDED DETENTION POND (LOW POINT)

2. TRAIN SURFACE EVACUATION AND FIRE CONTROL ZONE (1350' LONG) IS SHARED BETWEEN PORTAL 2 AND PORTAL 3, PARTIALLY LOCATED OVER VIADUCT.
TUNNEL 02
PORTAL P3

NOTE:
1. PERMANENT PORTAL P3 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - DOES NOT INCLUDE SPACE FOR WATER STORAGE/SUPPLY.
   - DOES NOT INCLUDE SPACE FOR DETENTION POND (THIS PORTAL IS A HIGHEST POINT).

2. TRAIN SURFACE EVACUATION AND FIRE CONTROL ZONE IS SPARED BETWEEN PORTAL 2 AND PORTAL 3, PARTIALLY LOCATED OVER VIADUCT.

NOTE:
1. PERMANENT PORTAL P3 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - DOES NOT INCLUDE SPACE FOR WATER STORAGE/SUPPLY.
   - DOES NOT INCLUDE SPACE FOR DETENTION POND (THIS PORTAL IS A HIGHEST POINT).

2. TRAIN SURFACE EVACUATION AND FIRE CONTROL ZONE IS SPARED BETWEEN PORTAL 2 AND PORTAL 3, PARTIALLY LOCATED OVER VIADUCT.

NOTE:
1. PERMANENT PORTAL P3 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - DOES NOT INCLUDE SPACE FOR WATER STORAGE/SUPPLY.
   - DOES NOT INCLUDE SPACE FOR DETENTION POND (THIS PORTAL IS A HIGHEST POINT).

2. TRAIN SURFACE EVACUATION AND FIRE CONTROL ZONE IS SPARED BETWEEN PORTAL 2 AND PORTAL 3, PARTIALLY LOCATED OVER VIADUCT.
NOTE:
1. PERMANENT PORTAL P4 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - PORTAL P4 INCLUDES BOTH SPACE FOR DETENTION POND (LOW POINT), AND FOR WATER STORAGE SUPPLY.
   - HELIPAD NOT INCLUDED.
2. TRAIN SURFACE EVACUATION AND FIRE CONTROL ZONE IS SHARED BETWEEN PORTAL 4 AND PORTAL 5.
3. LATER CONSIDERATION CAN BE GIVEN TO MOVE THE TSEFCZ AWAY FROM THE FAULT ZONE. (TBD)

NOTE:
1. PERMANENT PORTAL P4 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - PORTAL P4 INCLUDES BOTH SPACE FOR DETENTION POND (LOW POINT), AND FOR WATER STORAGE SUPPLY.
   - HELIPAD NOT INCLUDED.
2. TRAIN SURFACE EVACUATION AND FIRE CONTROL ZONE IS SHARED BETWEEN PORTAL 4 AND PORTAL 5.
3. LATER CONSIDERATION CAN BE GIVEN TO MOVE THE TSEFCZ AWAY FROM THE FAULT ZONE. (TBD)
NOTE:
1. PERMANENT PORTAL P5 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - ADDED RESERVE OF SPACE FOR WATER STORAGE/ SUPPLY.
   - DETENTION POND NOT INCLUDED (HIGH POINT).
   - TSFCZ SHARED AND LOCATED NEXT TO PORTAL P4.

2. PERMANENT PORTAL P6 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN "TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - DETENTION POND INCLUDED (LOW POINT).
   - TSFCZ SHARED AND LOCATED NEXT TO PORTAL P7.
   - WATER SUPPLY/ STORAGE ADDED.
PLAN
STA 1118+00.00 TO STA 1168+00.00

CONTRACT NO. HSR14-42
DRAWING NO. TN-D4016-S14
SCALE AS SHOWN
SHEET NO.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"
PLAN
STA 1118+00.00 TO STA 1168+00.00

DESIGNED BY
E. VELASCO
DRAWN BY
F. DOMINGUEZ
CHECKED BY
W. GUO
CHARGE
A. REYLANO

DATE
04/30/2021

REV DATE BY CHK APP DESCRIPTION
PEPD RECORD SET
REVISION

NOT FOR CONSTRUCTION

100 YEAR FLOOD ZONE
100 YEAR FLOOD ZONE

CONSTRUCTION POWER SUPPLY LINE
TEMPORARY CONSTRUCTION STAGING AREA (ETF ALONG)

200' WIDE ACCESS ROAD AND UTILITIES EASEMENT

1,500' MIN. TRAIN SURFACE EVACUATION AND FIRE CONTROL ZONE (VIA VIADUCT)

02/15/2021

Nota: This document contains information about the California High-Speed Rail Project. The image shows a plan for the alignment "Refined SR14" between STA 1118+00.00 and STA 1168+00.00, including details such as access roads, utilities, and construction zones. The document is not for construction and is marked accordingly.
NOTE:
1. PERMANENT PORTAL P7 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - DETENTION POND NOT INCLUDED.
   - ADDED RESERVE OF SPACE FOR WATER STORAGE/SUPPLY.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"

PLAN
STA 1168+00.00 TO STA 1218+00.00

DESIGNED BY
E. VELASCO

DRAWN BY
F.J. DOMINGUEZ

CHECKED BY
W. GUO

DATE
04/30/2021

CONSTRUCTION NOT FOR

CALIFORNIA HIGH-SPEED RAIL AUTHORITY

SENER

MARKER
"-"
NOTE:
1. PERMANENT PORTAL P8 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - ADDED DETENTION POND (LOW POINT).
   - ADDED WATER STORAGE / SUPPLY.

2. LATER CONSIDERATION TO BE GIVEN TO MOVE THE TSEFZ AWAY FROM THE FAULT ZONE (TBD).

NOTE:
1. PERMANENT PORTAL P8 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - ADDED DETENTION POND (LOW POINT).
   - ADDED WATER STORAGE / SUPPLY.

2. LATER CONSIDERATION TO BE GIVEN TO MOVE THE TSEFZ AWAY FROM THE FAULT ZONE (TBD).

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"
PLAN
STA 1218+00.00 TO STA 1268+00.00

NOTE:
1. PERMANENT PORTAL P8 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - ADDED DETENTION POND (LOW POINT).
   - ADDED WATER STORAGE / SUPPLY.

2. LATER CONSIDERATION TO BE GIVEN TO MOVE THE TSEFZ AWAY FROM THE FAULT ZONE (TBD).

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"
PLAN
STA 1218+00.00 TO STA 1268+00.00

NOTE:
1. PERMANENT PORTAL P8 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - ADDED DETENTION POND (LOW POINT).
   - ADDED WATER STORAGE / SUPPLY.

2. LATER CONSIDERATION TO BE GIVEN TO MOVE THE TSEFZ AWAY FROM THE FAULT ZONE (TBD).

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"
PLAN
STA 1218+00.00 TO STA 1268+00.00

NOTE:
1. PERMANENT PORTAL P8 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - ADDED DETENTION POND (LOW POINT).
   - ADDED WATER STORAGE / SUPPLY.

2. LATER CONSIDERATION TO BE GIVEN TO MOVE THE TSEFZ AWAY FROM THE FAULT ZONE (TBD).

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"
PLAN
STA 1218+00.00 TO STA 1268+00.00

NOTE:
1. PERMANENT PORTAL P8 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - ADDED DETENTION POND (LOW POINT).
   - ADDED WATER STORAGE / SUPPLY.

2. LATER CONSIDERATION TO BE GIVEN TO MOVE THE TSEFZ AWAY FROM THE FAULT ZONE (TBD).

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"
PLAN
STA 1218+00.00 TO STA 1268+00.00

NOTE:
1. PERMANENT PORTAL P8 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - ADDED DETENTION POND (LOW POINT).
   - ADDED WATER STORAGE / SUPPLY.

2. LATER CONSIDERATION TO BE GIVEN TO MOVE THE TSEFZ AWAY FROM THE FAULT ZONE (TBD).

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"
PLAN
STA 1218+00.00 TO STA 1268+00.00

NOTE:
1. PERMANENT PORTAL P8 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED.
   - ADDED DETENTION POND (LOW POINT).
   - ADDED WATER STORAGE / SUPPLY.

2. LATER CONSIDERATION TO BE GIVEN TO MOVE THE TSEFZ AWAY FROM THE FAULT ZONE (TBD).
NOTE:
1. THE ALIGNMENT CUTS DEEP 150 FT INTO THE LANG MINUTE MAN MISSILE SITE, WHICH IS A HARDENED STEEL REINFORCED CONCRETE BUNKER INSTALLATION THAT WILL HAVE TO BE DEMOLISHED.

2. PERMANENT PORTAL P9 FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TABLE 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELI PAD NOT INCLUDED.
   - NO DETENTION POND (HIGH POINT).
   - ADDED WATER STORAGE/SUPPLY.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"
PLAN
STA 1318+00.00 TO STA 1368+00.00
TUNNEL 05

100 YEAR FLOOD ZONE

ANGLE'S NATIONAL FOREST BOUNDARY

FAULT APPROX. LOCATED

CROSS-PASSAGE (TYP)

UNDERGROUND TECHNICAL ROOM (TYP)

REFINED SR14 TUNNEL 05

E CHR SB ALIGNMENT "REFINED SR14"

PLAN

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"

PLAN
STA 1468+00.00 TO STA 1518+00.00

DESIGNED BY
E. VELASCO

DRAWN BY
T. Z. DOMINGUEZ

CHECKED BY
W. GUO

IN CHARGE
A. R. A. LANO

DATE
04/30/2021

NOT FOR CONSTRUCTION

PPE AND RECORD SET
REV 00

High-Speed Rail Authority
2017

AS SHOWN

SCALE
AS SHOWN
DRAWING NO.
TN-D4023-S14
CONTRACT NO.
HSR14-42

STA 1468+00.00 TO STA 1518+00.00

0 200 400 600

Plan

200 0 400

f=1000'
SAN GABRIEL FAULT ZONE (PHFZ) APPROX. LOCATION FROM STA 1546+00 TO STA 1610+00 FAULT CHAMBER

TUNNEL 05

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"

PLAN
STA 1568+00 TO STA 1618+00

DESIGNED BY
E. VELASCO

DRAWN BY
J. DOMINGUEZ

CHECKED BY
W. GUO
NOTE:
1. LOCATION OF CAVERN SHOULD BE OUTSIDE FAULT ZONE, IN SOUND ROCK. VERIFICATION BOREHOLES NEEDED TO CONFIRM LOCATION.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"

PLAN
STA 1618+00.00 TO STA 1668+00.00

NOTE:
1. LOCATION OF CAVERN SHOULD BE OUTSIDE FAULT ZONE, IN SOUND ROCK. VERIFICATION BOREHOLES NEEDED TO CONFIRM LOCATION.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"

PLAN
STA 1618+00.00 TO STA 1668+00.00

NOTE:
1. LOCATION OF CAVERN SHOULD BE OUTSIDE FAULT ZONE, IN SOUND ROCK. VERIFICATION BOREHOLES NEEDED TO CONFIRM LOCATION.
PLAN
STA 1668+00.00 TO STA 1718+00.00

CONTRACT NO. HSR14-42
DRAWING NO. TN-D4027-S14
SCALE AS SHOWN
SHEET NO. TUNNEL 05
TUNNEL 05

NOTE:

1. Depicted adits are potential locations selected because of available surface space for construction staging area, and optimal slope and length of the descending gallery.

2. Adit #1 and Adit #2 are options to choose from.

3. Location of cavern should be outside fault zone, in sound rock. Verification boreholes needed to confirm location.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"

PLAN
STA 1718+00.00 TO STA 1768+00.00

DESIGNED BY
E. VELASCO

DRAWN BY
F. J. DOMINGUEZ

CHECKED BY
W. GUO

DATE
04/30/2021

NOT FOR CONSTRUCTION

DEPICTED ADITS ARE POTENTIAL LOCATIONS SELECTED BECAUSE OF AVAILABLE SURFACE SPACE FOR CONSTRUCTION STAGING AREA, AND OPTIMAL SLOPE AND LENGTH OF THE DESCENDING GALLERY.

ADIT #1 AND ADIT #2 ARE OPTIONS TO CHOOSE FROM.

LOCATION OF CAVERN SHOULD BE OUTSIDE FAULT ZONE, IN SOUND ROCK. VERIFICATION BOREHOLES NEEDED TO CONFIRM LOCATION.
TUNNEL 05

SIERRA MARKE, SOUTHERN LOCATION, SOURCE OF 1971 EARTHQUAKE
SAN FERMIN FAULT SPLAY TYP
ARFACE, LOCATED FROM STA 1832+00 TO STA 1872+00
FAULT CHAMBER

RUSSELL MOE EXPERIMENTAL LANDFILL

A 100 YEAR FLOOD ZONE

PLANT

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"

PLAN
STA 1818+00.00 TO STA 1868+00.00
TUNNEL 05
INTERMEDIATE WINDOW IW1

HIGHWAY STRUCTURE AND FOUNDATIONS AMENDED W/ AS-BUILT DRAWINGS WITHOUT DETECTED INTERFERENCE

TRACTION POWER SUPPLY STATION (SURFACE)
TEMPORARY CONSTRUCTION STAGING AREA (1.6 ACRES)

UNDERGROUND TECHNICAL ROOM (TYP)

HIGHWAY-STRUCTURE STAGING AREA (1.5 ACRES)

TRACTION POWER FEEDING LINE
TEMPORARY CONSTRUCTION STAGING AREA (1.4 ACRES)

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"

PLAN
STA 1868+00.00 TO STA 1918+00.00
TUNNEL 05
PORTAL P10

NOTE:
1. PERMANENT PORTAL P10 FOOTPRINT INCLUDES SPACE FOR FACILITIES DEPICTED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
- HELIPAD NOT INCLUDED

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"

PLAN
STA 1968+00.00 TO STA 2018+00.00

DESIGNED BY
E.VELASCO

DRAWN BY
P.Z.DOMINGUEZ

CHECKED BY
W.GUO

CHARGE
LDO

DATE
04/30/2021

CALIFORNIA HIGH-SPEED RAIL AUTHORITY

NOTE:
1. PERMANENT PORTAL P10 FOOTPRINT INCLUDES SPACE FOR FACILITIES DEPICTED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
- HELIPAD NOT INCLUDED
NOTE:
Fault Zones Limits Approximate Only.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"
TUNNEL PROFILE
SOUTH-bound TUNNEL
STA 368+00.00 TO STA 468+00.00

REV DATE BY CHK APP DESCRIPTION
04/30/2021 04/30/2021
3400 3400
3300 3300
3200 3200
3100 3100
3000 3000
2900 2900
2800 2800
2700 2700
2600 2600
2500 2500
2400 2400
2300 2300
2200 2200
2100 2100
2000 2000
1900 1900
1800 1800
1700 1700
1600 1600
1500 1500
1400 1400
1300 1300
1200 1200
1100 1100
1000 1000
900 900
800 800
700 700
600 600
500 500
400 400
300 300
200 200
100 100
0 0
NOTE:
SHEET ZONES (UNITS APPROXIMATE ONLY)
NOTE: Full Zones Units APPROXIMATE Only

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14" TUNNEL PROFILE
SOUTH ROUND TUNNEL
STA 668+00.00 TO STA 768+00.00

TBM BORED TUNNEL PROFILES

HORIZ = 200'
CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"
TUNNEL PROFILE
SOUTH BOUND TUNNEL
STA 1618400.00 TO STA 1668400.00

NOTE:
Real zones units approximate only

SCALE
AS SHOWN
NOTE:
F A C T Z O N E S ( U N I T S A P P R O X I M A T E O N L Y

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"
TUNNEL PROFILE
SOUTH BOUND TUNNEL
STA 2224+76.26 TO 2254+47.54
NOTE:

1. EXAMPLE OF ROCK CUT SLOPE REINFORCEMENT AT PORTAL MOUTH
   - 2 IN. OF SHOTCRETE WITH STEEL FIBERS (50 KG/M³)
   - REINFORCED WELD MESH 6X6 - 8.40 X 8.40
   - SOFT LONG EMBANKMENT GROUTED DOVELS ON 4' BY 4' PATTERN
   - WEEP AS DIRECTED

2. GEOTECHNICAL RISKS AND CONSTRUCTABILITY ISSUES
   SEE DRAWING TN-B0006

3. THE DRAWING SHOWS THE TEMPORARY PORTAL CUT PLAN AND LONG SECTION FOR CONSTRUCTION AT THE PORTAL MOUTH ALONG WITH TEMPORARY SUPPORT FOR THE PORTAL CUT SLOPE, AND THE FINISHED FILL.

4. THE DRAWING DOES NOT SHOW THE OVERALL GRADING (2%/1V)

EXCAVATION VOLUME: 5,838 CY
FILL VOLUME: 3,020 CY
CUT SLOPE SURFACE: 18,584 SQFT
NOTE:
1. EXAMPLE OF ROCK CUT SLOPE REINFORCEMENT AT PORTAL MOUTH
   - 2 IN. OF SHOTCRETE WITH STEEL FIBERS (50 KG/ M³)
   - REINFORCED WIRE MESH 6X6 - 80.0 X W10.0
   - SOFT 1/2 LONG EMBEDDING STONE ON 1/4'-BY-1'-PATTERN
   - WEEP AS DIRECTED
2. GEOTECHNICAL RISKS AND CONSTRUCTABILITY ISSUES
   SEE DRAWING TN-B006
3. THE DRAWING SHOWS THE TEMPORARY PORTAL CUT PLAN
   AND LONG SECTION FOR CONSTRUCTION AT THE PORTAL MOUTH
   ALONG WITH TEMPORARY SUPPORT FOR THE PORTAL CUT SLOPE
   AND THE FINISHED FILL.
4. THE DRAWING DOES NOT SHOW THE OVERALL GRADING (200:1)
   OF THE WIDER PORTAL AREA, THE EXTENT OF WHICH IS SHOWN
   ON THE GENERAL PLAN (SEE LIMITS OF EXCAVATION-CUT).

EXCAVATION VOLUME: 51,717 CY
FILL VOLUME: 31,892 CY
CUT SLOPE SURFACE: 44,007 SQFT
1. Example of rock cut slope reinforcement at portal mouth:
   - 2 in of shotcrete with steel fibers (50 kg/m³)
   - Welded wire mesh 6′ x 6′ x 6′
   - 2′ x 2′ long element grouted domes on 4′ by 4′ pattern
   - Weep as directed

2. Geotechnical risks and constructability issues:
   See drawing TN-B0006

3. The drawing shows the temporary portal cut plan and long section for construction at the portal mouth along with temporary support for the portal cut slope and the finished fill.

4. The drawing does not show the overall grading (2H:1V) of the wider portal area, the extent of which is shown on the general plan (see limits of excavation-cut).

Excavation Volume: 124,484 CY
Fill Volume: 38,550 CY
Cut Slope Surface: 7,326 SQF

Profile

Longitudinal Profile
SB Tunnel

Portals 3

Temporary Construction Staging Area (10 acres)

NOTE:

- Example of rock cut slope reinforcement at portal mouth
- Geotechnical risks and constructability issues
- The drawing shows the temporary portal cut plan and long section for construction at the portal mouth along with temporary support for the portal cut slope and the finished fill.
- The drawing does not show the overall grading (2H:1V) of the wider portal area, the extent of which is shown on the general plan (see limits of excavation-cut).
1. Example of Rock Cut Slope Reinforcement at Portal Mouth
   - 2 in. of Shotcrete with Steel Fibers (50 kg/m^3)
   - Welded Wire Mesh 6 X 6 - 40-lb Weld
   - Soft Long Steel Grouted dowels on 4' by 4' pattern
   - Wipe as directed

2. Geotechnical Risks and Constructability Issues
   See Drawing TN-D7004-S14

3. The drawing shows the temporary Portal Cut Plan and Long Section for construction at the Portal Mouth along with temporary support for the Portal Cut Slope and the finished fill.

4. The drawing does not show the overall grading (2H:1V) of the wider Portal Area, the extent of which is shown on the General Plan (see Limits of Excavation-Cut).

EXCAVATION VOLUME: 79,290 CY
FILL VOLUME: 38,548 CY
CUT SLOPE SURFACE: 7,324 SQFT

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"

PORTAL 4
PLAN AND PROFILE FOR CONSTRUCTION

SRA14-42
NOT AS SHOWN
EXHIBIT 15
9/18/2013
4/30/2021

NOTES
NOTE:

1. EXAMPLE OF ROCK CUT SLOPE REINFORCEMENT AT PORTAL MOUTH
   - 2 IN. OF SHOTCRETE WITH STEEL FIBERS (50 KG/ M^3)
   - WELDED WIRE MESH 6X6 - 4' X 8' X 10' INC
   - SOFT LONG SLOPE GRADED DOVETS ON 4' BY 4' PATTERN
   - WEEP AS DIRECTED

2. GEOTECHNICAL RISKS AND CONSTRUCTABILITY ISSUES
   SEE DRAWING TN-BOOK6

3. THE DRAWING SHOWS THE TEMPORARY PORTAL CUT PLAN
   AND LONG SECTION FOR CONSTRUCTION AT THE PORTAL
   MOUTH ALONG WITH TEMPORARY SUPPORT FOR THE PORTAL
   CUT SLOPE, AND THE FINISHED FILL.

4. THE DRAWING DOES NOT SHOW THE OVERALL GRADING (2H:1V)
   OF THE WIDER PORTAL AREA, THE EXTENT OF WHICH IS SHOWN
   ON THE GENERAL PLAN (SEE LIMITS OF EXCAVATION-CUT).

EXCAVATION VOLUME 175,996 CY
FILL VOLUME 38,549 CY
CUT SLOPE SURFACE 47,329 SOFT

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"
PORTAL 5
PLAN AND PROFILE FOR CONSTRUCTION

HIGH-SPEED RAIL AUTHORITY
CALIFORNIA

4. NOTE:

---

NOTE ON THE MAP:

- E CHSR NB ALIGNMENT "REFINED SR14"
- E CHSR SB ALIGNMENT "REFINED SR14"

---

PLAN:

- LONGITUDINAL PROFILE SB TUNNEL
- 3V1/2H REINFORCED CUT SLOPE
- BACK FILLED TO FINISHED SURFACE
- ARTIFICIAL TUNNEL HOO 0' 45"
NOTE:

1. EXAMPLE OF ROCK CUT SLOPE REINFORCEMENT AT PORTAL MOUTH
   - 2 IN OF SHOTCRETE WITH STEEL FIBERS [50 KG/M³]
   - weaved wire mesh 6x6 - 94.0 X 94.0
   - SOFT LONG ELEMT GRouted Concrete on 4' BY 4' Pattern
   - WEEP AS DIRECTED

2. GEOTECHNICAL RISKS AND CONSTRUCTABILITY ISSUES
   SEE DRAWING TH-BOOK 4

3. THE DRAWING SHOWS THE TEMPORARY PORTAL CUT PLAN
   AND LONG SECTION FOR CONSTRUCTION AT THE PORTAL
   MOUTH ALONG WITH TEMPORARY SUPPORT FOR THE PORTAL
   CUT SLOPE, AND THE FINISHED FILL.

4. THE DRAWING DOES NOT SHOW THE OVERALL GRADING (2H:1V)
   OF THE WIDER PORTAL AREA, THE EXTENT OF WHICH IS SHOWN
   ON THE GENERAL PLAN [SEE LIMITS OF EXCAVATION-CUT].

<table>
<thead>
<tr>
<th>EXCAVATION VOLUME</th>
<th>87,833 CY</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILL VOLUME</td>
<td>37,381 CY</td>
</tr>
<tr>
<td>CUT SLOPE SURFACE</td>
<td>47,040 SQFT</td>
</tr>
</tbody>
</table>

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"

PLAN AND PROFILE FOR CONSTRUCTION
1. Example of rock cut slope reinforcement at portal mouth:
   - 2 in. of shotcrete with steel fibers (50 kg/m³)
   - Welded wire mesh 6 in. by 6 in. x 10 ft.
   - Soft long element grouted dowels on 4' by 4' pattern
   - Weep as directed

2. Geotechnical risks and constructibility issues see drawing TR-0006

3. The drawing shows the temporary portal cut plan and long section for construction at the portal mouth along with temporary support for the portal cut slope and the finished fill.

4. The drawing does not show the overall grading (2H:1V) of the wider portal area, the extent of which is shown on the general plan (see limits of excavation-cut).

<table>
<thead>
<tr>
<th>Excavation Volume</th>
<th>61,958 CY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fill Volume</td>
<td>24,269 CY</td>
</tr>
<tr>
<td>Cut Slope Surface</td>
<td>37,603 SFt</td>
</tr>
</tbody>
</table>
NOTE:
1. EXAMPLE OF ROCK SLOPE REINFORCEMENT AT PORTAL MOUTH
   - 2 IN. OF SHOTCRETE WITH STEEL FIBERS (50 KG/M³)
   - REINFORCED WIRE MESH 6 X 6 - 0.04 X 0.04
   - SOFT LONG ENSLEM GROUTED DOWELS ON 4' BY 4' PATTERN
   - WEEP AS DIRECTED
2. GEOTECHNICAL RISKS AND CONSTRUCTABILITY ISSUES
   SEE DRAWING TN-BOOK0
3. THE DRAWING SHOWS THE TEMPORARY PORTAL CUT PLAN
   AND LONG SECTION FOR CONSTRUCTION AT THE PORTAL
   MOUTH ALONG WITH TEMPORARY SUPPORT FOR THE PORTAL
   CUT SLOPE, AND THE FINISHED FILL.
4. THE DRAWING DOES NOT SHOW THE OVERALL GRADING (PHI/V)
   OF THE NEEER PORTAL AREA. THE EXTENT OF WHICH IS SHOWN
   ON THE GENERAL PLAN (SEE LIMITS OF EXCAVATION-CUT).

| EXCAVATION VOLUME | 123,190 CY  |
| FILL VOLUME       | 38,589 CY   |
| CUT SLOPE SURFACE | 7,581 SF    |

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "REFINED SR14"

PORTAL B
PLAN AND PROFILE FOR CONSTRUCTION
NOTE 1:
1. EXAMPLE OF ROCK CUT SLOPE REINFORCEMENT AT PORTAL MOUTH
   - 2 IN OF CRUSHED ROCK WITH STEEL-FIRED 150 KG/MT
   - REINFORCED MESH EAG - W4.0 X W4.0
   - SOFT LONG CEMENT EXCAVATED SLOPES ON 4' BY 4' PATTERN
   - REEP AS DIRECTED
2. GEOTECHNICAL RISKS AND CONSTRUCTABILITY ISSUES
   SEE DRAWING TN-B0006
3. THE DRAWING SHOWS THE TEMPORARY PORTAL CUT PLAN
   AND LONG SECTION FOR CONSTRUCTION AT THE PORTAL
   MOUTH ALONG WITH TEMPORARY SUPPORT FOR THE PORTAL
   CUT SLOPE, AND THE FINISHED FILLED.
4. THE DRAWING DOES NOT SHOW THE OVERALL GRADE (2H/1V)
   OF THE WIDER PORTAL AREA, THE EXTENT OF WHICH IS SHOWN
   ON THE GENERAL PLAN (SEE LIMITS OF EXCAVATION-CUT).
NOTE:
1. PERMANENT FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6, WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED
   - SPACE RESERVED FOR WATER STORAGE/SUPPLY
   - DETENTION POND NOT INCLUDED. PORTAL P1 IS HIGH POINT.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"

PLAN
STA 618+00.00 TO STA 668+00.00

PERMANENT FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6, WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED
   - SPACE RESERVED FOR WATER STORAGE/SUPPLY
   - DETENTION POND NOT INCLUDED. PORTAL P1 IS HIGH POINT.
PLAN
STA 668+00.00 TO STA 718+00.00

CONTRACT NO. HSR14-42
DRAWING NO. TN-D4003-E1
SCALE AS SHOWN

DESIGNED BY E.VELASCO
DRAWN BY F.J. DOMINGUEZ
CHECKED BY W.GUO

0 DATE REV DATE BY CHK APP DESCRIPTION
PEPD RECORD SET REY 08 NO DATE CONSTRUCTION

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"

PLAN
STA 668+00.00 TO STA 718+00.00

CROSS-PASSAGE (TYP)
C CHSR NB ALIGNMENT "E1"
C CHSR SB ALIGNMENT "E1"

TUNNEL 01

NOT FOR CONSTRUCTION
NOTE:

1. TEMPORARY CONSTRUCTION STAGING AREAS (38 AND 6.5 ACRES) TO BE SHARED BETWEEN PORTALS.

2. TRAIN SURFACE EVACUATION AND FIRE CONTROL ZONE SHARED BETWEEN PORTALS.

3. PERMANENT FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6 WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED
   - PORTAL P2 INCLUDES SPACE FOR BOTH DETENTION POND (LOW POINT) AND WATER STORAGE / WATER SUPPLY
   - PORTAL P3 INCLUDES SPACE FOR WATER STORAGE / WATER SUPPLY

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"

PLAN
STA 718+00.00 TO STA 768+00.00

REvised DATE by CHK APP DESCRIPTION
04/30/2021

DESIGNED BY
E. VELASCO
D. DOMINGUEZ

DRAWN BY
A. RE Y X

CHECKED BY
W. GUO

AS SHOWN

CALIFORNIA HIGH-SPEED RAIL AUTHORITY
TUNNEL 02

PLAN

STA 768+00.00 TO STA 818+00.00

CONTRACT NO. HSR14-42

DRAWING NO. TN-D4005-E1

SCALE AS SHOWN

SHEET NO.

TUNNEL 02

CROSS-PASSAGE (TYP)

C CHSR ALIGNMENT "E1"

C OSPA SB ALIGNMENT "E1"

UNDERGROUND TECHNICAL ROOM (TYP)

MOSSY FAULT (APPROX LOCATED)

TUNNEL 02

PLAN

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"

PLAN

STA 768+00.00 TO STA 818+00.00

DESIGNED BY

E. VELASCO

DRAWN BY

F. J. DOMINGUEZ

CHECKED BY

W. GUO

CHARGE

A. R. LANO

REVISION

REV 02

PEPD RECORD SET

REV DATE BY CHK APP DESCRIPTION
04/30/2021

NOT FOR CONSTRUCTION

GREAT EVIDENCE OF DRAWING, ENSURE CONSTRUCTION IS ACCURATE AND UP TO DATE

CALIFORNIA HIGH-SPEED RAIL AUTHORITY
PLAN
STA 818+00.00 TO STA 868+00.00
CONTRACT NO. HSR14-42
DRAWING NO. TN-D4006-E1
SCALE AS SHOWN

TUNNEL 02

PLAN FOR TEMPORARY CONSTRUCTION STAGING AREA (20 ACRE) INTERMEDIATE WINDOW 1 CONSTRUCTION PURPOSES ONLY. TBM LAUNCH SOUTHWARDS AND MINED TUNNELS NORTHWARDS (TEMPORARY)

POWER SUPPLY LINE AND EASEMENT (FOR CONSTRUCTION)

FAULT APPROX. LOCATED

DESIGNED BY D. VELASCO
DRAWN BY E. DOMINGUEZ
CHECKED BY W. GUO

REVIEW DATE BY CHK APP DESCRIPTION 04/30/2021

NOT FOR CONSTRUCTION

CALIFORNIA HIGH-SPEED RAIL PROJECT PALMDALE TO BURBANK
ALIGNMENT "E1"
PLAN
STA 818+00.00 TO STA 868+00.00

CALIFORNIA HIGH-SPEED RAIL AUTHORITY

SENER CALIFORNIA HIGH-SPEED RAIL AUTHORITY
TUNNEL 02

PLAN

STA 1218+00.00 TO STA 1268+00.00

CONTRACT NO. HSR14-42
DRAWING NO. TN-D4014-E1
SCALE AS SHOWN

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"

PLAN
STA 1218+00.00 TO STA 1268+00.00
TUNNEL 02

PLAN

STA 1268+00.00 TO STA 1318+00.00

CONTRACT NO.
HSR14-42

DRAWING NO.
TN-D4015-E1

SCALE
AS SHOWN

SHEET NO.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"

PLAN
STA 1268+00.00 TO STA 1318+00.00

CALIFORNIA HIGH-SPEED RAIL AUTHORITY
CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"

PLAN
STA 1318+00.00 TO STA 1368+00.00

DESIGNED BY
E. VELASCO

DRAWN BY
F. J. DOMINGUEZ

CHECKED BY
REY 02

IN CHARGE
W. GUO

CONTRACT NO.
HSR14-42

DRAWING NO.
TN-D4016-E1

SCALE
AS SHOWN

SHEET NO.

PLAN

TUNNEL 02

CROSS-PASSAGE (TYP)

CHAIR NB ALIGNMENT "E1"

CHAIR SB ALIGNMENT "E1"

LI TUNNEL 02

UNDERGROUND TECHNICAL ROOM (TYP)

ONETREE FAULT APPROX. LOCATED

MATCH LINE (TN-S05015-E1)
NOTE:
1. Two potential adits are shown connecting at the same point to the main tunnels.
2. The connection point (cavern) between the adit and main tunnels should be outside the fault zone. A borehole will be needed for verification.

TUNNEL 02

PLAN

SAN GABRIEL FAULT ZONE (WILL BE) APPROX.
LOCATION FROM STA 1468+00 TO STA 1518+00
ADIT 2A
POWER SUPPLY LINE AND PILE 4 X 4" FOR CONSTRUCTION
ALTERNATIVE ADIT CONSTRUCTION STAGING AREA (35 ACRES)
ACCESS ROAD TO CONSTRUCTION SITE (WATER WRT) AND WATER SUPPLY EASEMENT
GROUND ROOM (TYPE)
CROSS-PASSAGE (TYPE)
2 CHDR RP ALIGNMENT T1
4 CHDR SB ALIGNMENT T1
LENGTH 4000 FT SLOPE N-NW
ADIT AT SAN GABRIEL FAULT ZONE, CAVEN FOR CONNECTION WITH MAIN TUNNELS

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"

PLAN

STA 1468+00.00 TO STA 1518+00.00
TUNNEL 02

SAN GABRIEL FAULT ZONE (PHF Z) APPROX. LOCATION FROM STA 1500+00 TO STA 1552+00

PLAN

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"
PLAN
STA 1518+00.00 TO STA 1568+00.00

SCALE AS SHOWN

DESIGNED BY
E. VELASCO

DRAWN BY
R. D. DOMINGUEZ

CHECKED BY
W. GUO

IN CHARGE
A. RE ALANO

DATE
04/30/2021

REVISION NO.
REV 02
TEMPORARY CONSTRUCTION STAGING AREA (1.6 ACRES)

TEMPORARY CONSTRUCTION STAGING AREA (1.6 ACRES)

INTERMEDIATE WINDOW 2.
FOR CONSTRUCTION PURPOSES ONLY (TEMPORARY)

TEMPORARY CONSTRUCTION STAGING AREA (1.6 ACRES)

HIGHWAY STRUCTURE AND FOUNDATIONS ANALYZED WITH AS-BUILT DRAWINGS WITHOUT INTERFERENCE DETECTED

DESIGNED BY
E. VELASCO

DRAWN BY
F. J. DOMINGUEZ

CHECKED BY
W. GUO

IN CHARGE
A. RE LAMO

NOT FOR CONSTRUCTION

DATE
04/30/2021

SCALE
AS SHOWN

SHEET NO.
1

CONTRACT NO.
HSR14-42

APPLICATION NO.
TN-D4025-E1

AS SHOWN

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"

PLAN
STA 1768+00.00 TO STA 1818+00.00

CROSS-PASSAGE (TYPE)
E CHSR NS ALIGNMENT E1
E CHSR SB ALIGNMENT E1

CROSS-PASSAGE (TYPE)
E CHSR NS ALIGNMENT E1
E CHSR SB ALIGNMENT E1

DEGREE
90

DRAWN
A. RE LAMO

04/30/2021
NOTE:
1. Permanent portal P4 footprint include space for facilities depicted in TM 2.4.6. with the following exceptions:
   - Helipad not included
CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"

PLAN
STA 2018+00.00 TO STA 2068+00.00

TUNNEL 03

INTERSTATE 5

PLAN

1"=200'

200
400

SCALE AS SHOWN

SHEET NO.

CONTRACT NO.

HSR14-42

DRAWING NO.

TN-D4030-E1

AS SHOWN

REVISION

REV 02

DATE

04/30/2021

DATE

DESCRIPT

E. VELASCO

F. DOMINGUEZ

E. VELASCO

F. DOMINGUEZ

CALIFORNIA HIGH-SPEED RAIL AUTHORITY

NOT FOR CONSTRUCTION

EMERGENCY EGRESS (TYP.)

CUT AND COVER, SINGLE-CELL

100 YEAR FLOOD ZONE

SEM SINGLE TUNNEL, DOUBLE TRACK

SAN FERNANDO ROAD

OPEN TRENCH

"E 1"

CHSR NR ALIGNMENT TYP

CHSR SB ALIGNMENT TYP

SCOPA TRACK

MOUNTING STS

PLAN

° 0

"E 1"

CHSR NR ALIGNMENT TYP

CHSR SB ALIGNMENT TYP

SCOPA TRACK

MOUNTING STS

PLAN

° 0

"E 1"

CHSR NR ALIGNMENT TYP

CHSR SB ALIGNMENT TYP

SCOPA TRACK

MOUNTING STS

PLAN

° 0

"E 1"

CHSR NR ALIGNMENT TYP

CHSR SB ALIGNMENT TYP

SCOPA TRACK

MOUNTING STS

PLAN

° 0

"E 1"

CHSR NR ALIGNMENT TYP

CHSR SB ALIGNMENT TYP

SCOPA TRACK

MOUNTING STS

PLAN

° 0

"E 1"

CHSR NR ALIGNMENT TYP

CHSR SB ALIGNMENT TYP

SCOPA TRACK

MOUNTING STS

PLAN

° 0

"E 1"

CHSR NR ALIGNMENT TYP

CHSR SB ALIGNMENT TYP

SCOPA TRACK

MOUNTING STS

PLAN

° 0

"E 1"

CHSR NR ALIGNMENT TYP

CHSR SB ALIGNMENT TYP

SCOPA TRACK

MOUNTING STS

PLAN

° 0

"E 1"

CHSR NR ALIGNMENT TYP

CHSR SB ALIGNMENT TYP

SCOPA TRACK

MOUNTING STS
TUNNEL 03

VERDUGO FAULT ZONE (PHFZ) APPROX. LOCATION FROM STA 1921+00 TO STA 2080+00

SAN FERNANDO ROAD

EMERGENCY EGRESS (TYP.)

SAN FERNANDO BLVD

EMERGENCY EGRESS (TYP.)

SAN FERNANDO ROAD

SAN FERNANDO AIRPORT

TUNNEL 03 - DOUBLE TRACK

VERDUGO FAULT STRAND APPROX.

EMERGENCY EGRESS (TYP.)

NEW SINGLE TUNNEL, DOUBLE TRACK

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"

PLAN

STA 2068+00.00 TO STA 2117+34.00

DESIGNATED BY
E. VELASCO

DRAWN BY
P. J. DOMINGUEZ

CHECKED BY
W. GUO

IN CHARGE
A. RE MENDOZA

DATE
04/30/2021

SCALE
AS SHOWN

CONTRACT NO.
HSR14-42

DRAWING NO.
TN-D4031-E1

SHEET NO.
TUNNEL 03
NOTE:
Field NOTES Limits APPROXIMATE only

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT 'E1'
TUNNEL PROFILE
SOUTH Bound TUNNEL
STA 768+00.00 TO STA 818+00.00

CONTRACT NO. TN-Y1004-E1
NOT FOR CONSTRUCTION

REV DATE BY CHK APP DESCRIPTION

3600 3600
2700
2800
2900
3000 3000
3100
3200
3300
3400
3500
3600
3700
3800
3900
200 0 400
200 0 400
200 0 400
200 0 400

HIGH-SPEED RAIL AUTHORITY
CONSTRUCTION
~
NOT FOR
~
~
~
~
~
~
~
~
~
~
~
NOTE:
Field zones limits approximate only.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT 'E1'
TUNNEL PROFILE
SOUTH Bound TUNNEL
STA 918+00.00 TO STA 968+00.00

DATE DRAWN BY
FJ. DOMINGUEZ

CONTRACT NO. HSR16-02
DRAWNO. TN-Y1007-E1
A S SHOWN
P.P. RECORD SET REV 00
3/24/2021

1 TUNNEL 22' New TBM bored TUNNELS DB 3D
"E1" Track profile
_PROFILE

NOTE:
Fault Zones limits approximate only

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT 'E1'
TUNNEL PROFILE
SOUTHBOUND TUNNEL
STA 968+00.00 TO STA 1018+00.00

GEOCORP
34/30/2021

DRAWN BY: W. GUO
 CHECKED BY: PEPP RECORD SET
 CONTRACT NO.: HSR14-42
 SHEET NO.: TN-11008-E1

NOT FOR CONSTRUCTION
NOTE:
Fault zones limits approximate only.
Fault Zones Limits Approximate Only

NOTE:
Fault Zones Limits Approximate Only
NOTE:

1. EXAMPLE OF ROCK CUT SLOPE REINFORCEMENT AT PORTAL MOUTH:
   - 2 in. of shotcrete with steel fibers (80 lbs/ cubic yard)
   - Rebar with 14-gauge mesh 6x6. 94 lbs. x 1000 lbs.
   - 20 ft long cement grouted dowels on 4' by 4' pattern
   - Weep as directed

2. GEOTECHNICAL RISKS AND CONSTRUCTABILITY ISSUES
   See Drawing TN-B0006

3. THE DRAWING SHOWS THE TEMPORARY PORTAL CUT PLAN
   AND LONG SECTION FOR CONSTRUCTION AT THE PORTAL
   MOUTH ALONG WITH TEMPORARY SUPPORT FOR THE PORTAL
   CUT SLOPE, AND THE FINISHED FILL.

4. THE DRAWING DOES NOT SHOW THE OVERALL GRADING (2H:1V)
   OF THE WIDER PORTAL AREA, THE EXTENT OF WHICH IS SHOWN
   ON THE GENERAL PLAN (SEE LIMITS OF EXCAVATION-CUT).

EXCAVATION VOLUME 71,369 CY
FILL VOLUME 38,134 CY
CUT SLOPE SURFACE 48,894 SQ FT

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"
PORTAL 1
PLAN AND PROFILE FOR CONSTRUCTION
1. Example of rock cut slope reinforcement at portal mouth:
   - 2 in. of shotcrete with steel fibers (80 lbs/cubic yard)
   - Welded wire mesh 6x6 8x4 x WJG
   - Soft long cement grouted dowels on 4' by 4' pattern
   - Weep as directed

2. Geotechnical risks and constructability issues:
   See drawing TN-BO006

3. The drawing shows the temporary portal cut plan and long section for construction at the portal mouth along with temporary support for the portal cut slope and the finished fill.

4. The drawing does not show the overall grading (2H:1V) of the wider portal area. The extent of which is shown on the general plan (see limits of excavation-cut).

<table>
<thead>
<tr>
<th>EXCAVATION VOLUME</th>
<th>FILL VOLUME</th>
<th>CUT SLOPE SURFACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>15,372 CY</td>
<td>4,678 CY</td>
<td>24,497 SF</td>
</tr>
</tbody>
</table>

Example of rock cut slope reinforcement at portal mouth:
- 2 in. of shotcrete with steel fibers (80 lbs/cubic yard)
- Welded wire mesh 6x6 8x4 x WJG
- Soft long cement grouted dowels on 4' by 4' pattern
- Weep as directed

Califonia High-Speed Rail Project
Palmdale to Burbank
Alignment "E1"

Portal 2
Plan and Profile for Construction

Declared by: E. Velasco
Prep Record Rev 02
Plotted by: W. David
Drafted by: M. Sandoval
Not for Construction
24/30/2021
1. EXAMPLE OF ROCK CUT SLOPE REINFORCEMENT AT PORTAL MOUTH:
   - 2 IN OF SHOTCRETE WITH STEEL FIBERS (85 LBS/CUBIC YARD)
   - REBIMED WIRE MESH 6" X 6" X W.W.O.
   - SOFT LONG EMBLEM GRANTED DOWELS ON 4' BY 4' PATTERN
   - WEEL AS DIRECTED
2. GEOTECHNICAL RISKS AND CONSTRUCTABILITY ISSUES SEE DRAWING TN-B006A
3. THE DRAWING SHOWS THE TEMPORARY PORTAL CUT PLAN AND LONG SECTIONS FOR CONSTRUCTION AT THE PORTAL MOUTH ALONG WITH TEMPORARY SUPPORT FOR THE PORTAL CUT SLOPE AND THE FINISHED FILL.

EXCAVATION VOLUME: 227,894 CY
FILL VOLUME: 38,132 CY
CUT SLOPE SURFACE: 46,894 SQF

PLAN AND PROFILE FOR CONSTRUCTION

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E1"

PORTAL 3

PLANNING AND PROFILE FOR CONSTRUCTION

HIGH-SPEED RAIL AUTHORITY
CALIFORNIA HIGH-SPEED RAIL PROJECT

ARTIFICIAL TUNNEL MODE ANGLE 45°
BACK FILL TO FINISHED SURFACE

TUNNEL HEADWALL

VERT 1:50
HORIZ 1:50
NOTE:
1. ADIT #1 and ADIT #2 are options to choose from.
2. Location of cavern should be outside fault zone, in sound rock. Verification borings needed to confirm location.
TUNNEL 01 PORTAL P1

NOTE:
1. PERMANENT FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 24-16, WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED
   - SPACE RESERVED FOR WATER STORAGE/SUPPLY
   - DETENTION Ponds NOT INCLUDED; PORTAL P1 IS HIGH POINT.
1. Temporary construction staging areas (38 and 6.5 acres) to be shared between portals.
2. Train surface evacuation and fire control zone shared between portals.
3. Permanent footprint includes space for facilities described in 3.2.4.6 with the following exceptions:
   - Helipad not included
   - Portal P3 includes space for both detention pond (low point), and water storage/water supply
   - Portal P1 includes space for water storage/water supply
NOTE:
1. REFER TO TN-D5002-E2 FOR PLAN VIEW OF POTENTIAL ADITS AT SAN GABRIEL FAULT ZONE.
NOTE:
1. TRAIN SURFACE EVACUATION AND FIRE CONTROL ZONE SHARED BETWEEN PORTALS 4 AND 5, PARTIALLY LOCATED OVER VIADUCT.
2. PERMANENT PORTAL FOOTPRINT INCLUDES SPACE FOR FACILITIES DESCRIBED IN TM 2.4.6, WITH THE FOLLOWING EXCEPTIONS:
   - HELIPAD NOT INCLUDED
   - INCLUDES SPACE FOR FIRE FIGHTING WATER STORAGE/ SUPPLY
   - DOES NOT INCLUDE DETENTION POND. PORTAL P5 IS HIGH POINT.
TUNNEL 03

NOTE:
1. New Tunnels Transition
   bifurcation from
   STA. 1810+40 to STA. 1820+40
   approx. minimum pillar width
   between twin tunnels 13.2 ft.
   (= Track axes distance 38.5 ft.)
TRANSITION FROM TUNNELS TUNNEL 03

NOTE:
1. SEM CAVERN FROM STA. 1820+40 TO STA. 1843+79
   (+ TRACK AXES DISTANCE FROM 38.5 TO 16.5 FT.)
CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT 'E2' TUNNEL PROFILE
SOUTH BOUND TUNNEL
STA 768+00.00 TO STA 818+00.00

PROFILE

NOTE:
FAULZ ZONES LIMITS APPROXIMATE ONLY

SCALE

200 50 100

W.E. 1:100

NOT FOR CONSTRUCTION

SOUTH BOUND TUNNEL

CALIFORNIA HIGH-SPEED RAIL AUTHORITY
NOTE:
SHEET ZONES LIMITS APPROXIMATE ONLY

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E2"
SOUTHBOUND TUNNEL
STA 1268+00.00 TO STA 1318+00.00

DRAWN BY
FJ. DOMINGUEZ

PEPD RECORD SET
SF STAMPED
REV 00
NUT FOR CONSTRUCTION

34/30/2021
NO. 1 TUNNEL (E-1-101-E)
TEMP TWIN BORED TUNNELS LTD.
MUS AT SAN GABRIEL
FAULT ZONE
CONSTRUCTION
WITH TEMP TUNNELS
STA 1364+00.00

PROFILE

NOTE:
FAULT ZONES LIMITS APPROXIMATE ONLY

SCALE

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E2"
TUNNEL PROFILE
SOUTH BOUND TUNNEL
STA 1318+00.00 TO STA 1368+00.00
NOTE:
Fault Zones Limits Approximate Only
NOTE:

EARTZ LIMITS APPROXIMATE ONLY
NOTE 1:
1. EXAMPLE OF ROCK CUT SLOPE REINFORCEMENT AT PORTAL MOUTH
   - 2" IN OF SHOTCRETE WITH STEEL FIBERS (85 LBS/CUBIC YARD)
   - REINFORCED WIRE MESH 8X8 - 24" X 24" X 6" LAMES
   - SOFT LONG EMBANKMENT GRATED DOWELS ON 4' BY 4' PATTERN
   - WEAP AS DIRECTED
2. GEOTECHNICAL RISKS AND CONSTRUCTABILITY ISSUES
   SEE DRAWING TN-BOOK06
3. THE DRAWING SHOWS THE TEMPORARY PORTAL CUT PLAN
   AND LONG SECTION FOR CONSTRUCTION AT THE PORTAL
   MOUTH ALONG WITH TEMPORARY SUPPORT FOR THE PORTAL
   CUT SLOPE, AND THE FINISHED FILL.
4. THE DRAWING DOES NOT SHOW THE OVERALL GRADING (2%:1V)
   OF THE WIDER PORTAL AREA, THE EXTENT OF WHICH IS SHOWN
   ON THE GENERAL PLAN (SEE LIMITS OF EXCAVATION-CUT).

EXCAVATION VOLUME 71,369 CY
FILL VOLUME 38,134 CY
CUT SLOPE SURFACE 46,894 SQFT
NOTE:

1. EXAMPLE OF ROCK CUT SLOPE REINFORCEMENT AT PORTAL MOUTH
   - 2 IN SOFT TIES WITH STEEL WIRE (112 LBS/100 YARDS)
   - HELD IN PLACE WITH STEEL STAKES 4 X 4 X 0.3125
   - SOFT LONG SHORT RODS ON 4' BY 4' PATTERN
   - WEEP AS DIRECTED

2. GEOLOGICAL RISKS AND CONSTRUCTABILITY ISSUES
   SEE DRAWING TN-9060A

3. THE DRAWING SHOWS THE TEMPORARY PORTAL CUT PLAN
   AND LONG SECTION FOR CONSTRUCTION AT THE PORTAL
   MOUTH ALONG WITH TEMPORARY SUPPORT FOR THE PORTAL
   CUT SLOPE, AND THE FINISHED FILL.

4. THE DRAWING DOES NOT SHOW THE OVERALL GRADING (1:2H:1V)
   OF THE NEAR PORTAL AREA, THE EXTENT OF WHICH IS SHOWN
   ON THE GENERAL PLAN (SEE LIMITS OF EXCAVATION-OCT).

EXCAVATION VOLUME: 15,372 CY
FILL VOLUME: 4,678 CY
CUT SLOPE SURFACE: 24,497 SQF
NOTE:
1. EXAMPLE OF ROCK CUT SLOPE REINFORCEMENT AT PORTAL MOUTH
   - 2 IN. OF SHOTCRETE WITH STEEL FIBERS [65 LBS/CFYARD]
   - REINFORCED WIRE MESH 6X6 - 94.0 X 5.0
   - SOFT LONG ELENT GRANITE DOLLIES ON 4' BY 4' PATTERN
   - WEEP AS DIRECTED
2. GEOTECHNICAL RISKS AND CONSTRUCTABILITY ISSUES
   SEE DRAWING TN-6009A
3. THE DRAWING SHOWS THE TEMPORARY PORTAL CUT PLAN
   AND LONG SECTION FOR CONSTRUCTION AT THE PORTAL MOUTH ALONG WITH TEMPORARY SUPPORT FOR THE PORTAL CUT SLOPE, AND THE FINISHED FILL.
4. THE DRAWING DOES NOT SHOW THE OVERALL GRADING (HORIZ)
   OF THE NEEED PORTAL AREA, THE EXTENT OF WHICH IS SHOWN
   ON THE GENERAL PLAN (SEE LIMITS OF EXCAVATION-CUT).

| EXCAVATION VOLUME | 227,894 CY |
| FILL VOLUME       | 38,132 CY  |
| CUT SLOPE SURFACE | 48,894 SQF |

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E2"
PORTAL 3
PLAN AND PROFILE FOR CONSTRUCTION
NOTE 1:
1. EXAMPLE OF ROCK CUT SLOPE REINFORCEMENT AT PORTAL MOUTH
   - 2 IN OF SHOTCRETE WITH STEEL FIBERS (50 KG/ M)
   - WELDED WIRE MESH 6 X 6 - 0.40 X WDL
   - 2-1/2 LONG Element GRouted dowels ON 4' BY 4' PATTERN
   - WEEP AS DIRECTED
2. GEOTECHNICAL RISKS AND CONSTRUCTABILITY ISSUES
   SEE DRAWING TN-B0006
3. THE DRAWING SHOWS THE TEMPORARY PORTAL CUT PLAN
   AND LONG SECTION FOR CONSTRUCTION AT THE PORTAL MOUTH ALONG WITH TEMPORARY SUPPORT FOR THE PORTAL CUT SLOPE, AND THE FINISHED FILL.
4. THE DRAWING DOES NOT SHOW THE OVERALL GRADING (PH11V)
   OF THE NEEDED PORTAL AREA, THE EXTENT OF WHICH IS SHOWN
   ON THE GENERAL PLAN (SEE LIMITS OF EXCAVATION/CUT).

EXCAVATION VOLUME 107,196 CY
FILL VOLUME 35,886 CY
CUT SLOPE SURFACE 4,337 SQFT

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT "E2"
PORTAL 4
PLAN AND PROFILE FOR CONSTRUCTION
NOTE:

1. EXAMPLE OF ROCK CUT SLOPE REINFORCEMENT AT PORTAL MOUTH
   - 2 IN OF SHOTCRETE WITH STEEL FIBERS (50 KG/ M³)
   - REINFORCED WITH 6@6 X 1/4" WIRES
   - SOFT LIME CEMENT GROUTED CEMENT ON 4" X 4" PATTERN
   - WEEP AS DIRECTED

2. GEOTECHNICAL RISKS AND CONSTRUCTABILITY ISSUES
   - SEE DRAWING TN-SKID3

3. THE DRAWING SHOWS THE TYPICAL PORTAL CUT PLAN
   - AND CROSS SECTION FOR CONSTRUCTION AT THE PORTAL MOUTH
   - ALONG WITH TEMPORARY SUPPORT FOR THE PORTAL CUT SLOPE
   - AND THE FINISHED FILL.

4. THE DRAWING DOES NOT SHOW THE OVERALL GRADING (PH15V)
   - OF THE NEAR PORTAL AREA, THE EXTENT OF WHICH IS SHOWN
   - ON THE GENERAL PLAN (SEE LIMITS OF EXCAVATION-CUT).

| EXCAVATION VOLUME | 15,161 CY |
| FILL VOLUME       | 38,950 CY |
| CUT SLOPE SURFACE | #7,326 SQF |
NOTES:
1. DIMENSIONS AS PER TM 2.4.6.
2. TUNNEL INNER DIAMETER TO BE CONSIDERED IS 28 FT AS PER NOTICE TO DESIGNERS NO. 10.

PORTAL BUILDING EITHER CONTAINING TUNNEL VENTILATION FACILITIES OF 7500 sqft x 3 FLOORS OR ENLARGED PORTAL BUILDING CONTAINING TUNNEL VENTILATION AND MAINTENANCE FACILITIES WITH APPROXIMATELY 40,000 sqft ON 3 FLOORS (ALTERNATIVE TO SEPARATE SITE AREA).

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
TYPICAL TUNNEL PORTAL FACILITIES AT GRADE
TWIN TUNNEL CONFIGURATION
ELEVATION
NOTES:
1. ADDITIONAL PROVISION OF SPACE OF 150% HAS BEEN ADDED IN PLANT DRAWINGS TO STAGGER PORTAL ENTRANCES TO PREVENT SMOKE RE-CIRCULATION IN TUNNEL, CLIMATE CONDITIONS.
2. FREE AREA (A)=150% OF FREE AREA (B).
3. VENTILATION AND AERODYNAMICS TBD.
4. DIMENSIONS AS PER TM 2.4.6.

VENTILATION AND MAINTENANCE FACILITIES CONTAINED
WITHIN A SINGLE PORTAL BUILDING:
APPROXIMATELY 40,000 SQ. FT, ON 3 FLOORS

120'
7500 SQ. FT, X 2 FLOORS

PORTAL VENTILATION BUILDING

ROCKFALL AND DEBRIS CONTAINMENT AREA

35'

UPPER FLOOR LEVEL BUILDING ACCESS

65'

TWO APPROX 100 SQ. FT. EACH APERTURES TO OPEN AIR FOR PRESSURE RELIEF
(PERMANENTLY OPENED)

150' TRUMPET HOOD FOR NOISE MITIGATION
(NOTE 1)

BORED OR MINED OR BORED TUNNEL

SECTION
SCALE 1"=15'

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
TYPICAL TUNNEL PORTAL FACILITIES AT GRADE
TWIN TUNNEL CONFIGURATION
LONG SECTION
COMPOSITE VEHICLE
STATIC AND DYNAMIC ENVELOPE
TANGENT TRACK

NOTES OF ASSUMPTIONS:
1. REFER TO TM 1.1.10 FOR ASSUMPTIONS ON GAUGES.
2. HIGH-SPEED EQUIPMENT ONLY.

COMPOSITE STATIC ENVELOPE

COMPOSITE DYNAMIC ENVELOPE

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK

CONTRACT NO. HSR14-42
DRAWING NO. TN-C0004
SHEET NO. C

SCALE AS SHOWN

DATE 04/30/2021

REV DATE BY CHK APP DESCRIPTION

NOT FOR CONSTRUCTION
COMPOSITE VEHICLE
STATIC AND DYNAMIC ENVELOPE
SUPERELEVATED TRACK

NOTES OF ASSUMPTIONS:
1. REFER TO TM 1.1.10 FOR ASSUMPTIONS ON GAUGES.
2. HIGH-SPEED EQUIPMENT ONLY.

---

COMPOSITE STATIC ENVELOPE

---

COMPOSITE DYNAMIC ENVELOPE

---

COMPOSITE STATIC ENVELOPE, EXCEPT TS! CC AT TOP

---

TOP OF TS! CC STATIC ENVELOPE

---

COMPOSITE DYNAMIC ENVELOPE

---

TOP OF TS! CC DYNAMIC ENVELOPE

---

COMPOSITE DYNAMIC ENVELOPE

---

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK

---

CALIFORNIA HIGH-SPEED RAIL AUTHORITY
2024

---

REVISION DATE 04/30/2021

---

DRAWN BY F. J. DOMINGUEZ
CHECKED BY W. GUO

---

DATE 04/30/2021

---

CC CLEARANCE (TYP)
NOTES OF ASSUMPTIONS:
1. NO ALLOWANCE FOR AERODYNAMICS.
2. EXCLUDES CONSTRUCTION TOLERANCE.
3. NO ALLOWANCE FOR VENT EQUIPMENT.
4. ALLOWANCE FOR OVERHEAD CATEGORY AND Feeder System NOT SHOWN.
5. REFER TO TM 1.1.10 AND TM 2.4.2 FOR ASSUMPTIONS ON GAUGES.
6. HIGH-SPEED EQUIPMENT ONLY.
7. STRUCTURE GAUGE FOR C&C SECTIONS ACCORDING TO TM 2.4.2-E.
NOTES:
1. MINED TWIN TUNNELS ARE AN OPTION FOR SHORT TUNNELS LOCATED BETWEEN ANF AND PALMDALE.
2. EXCAVATION GROUND SUPPORT PILLAR WIDTH, DRAINAGE..., TUNNEL LINING DESIGN AND WATER AND GAS TIGHTNESS PROVISIONS TBD.
3. PILLAR WIDTH BETWEEN TUNNELS TO BE ONE TUNNEL DIAMETER OR MORE BASED ON GUIDANCE IN TM 2.4.6.
4. SPACE PROOFING REQUIRES FURTHER STUDY TO EVALUATE DYNAMIC AIRFLOW/PRESSURE LEVELS UNDER HIGH-SPEED OPERATING CONDITIONS, AND TO FURTHER DEFINE SPACE ALLOTTED FOR STRUCTURES, EQUIPMENT AND EGRESS.
5. CROSS-PASSAGEWAYS SHALL NOT BE FARTHER THAN 800 FT APART (NFPA 130).
6. FOR EQUIPMENT STRUCTURE GAUGES, REFER TO DRAWINGS TN-C0004 TO TN-C0007.
MINED TWIN TUNNELS

NOTES:
1. MINED TWIN TUNNELS ARE AN OPTION FOR SHORT TUNNELS LOCATED BETWEEN PALMDALE AND PALMDALE.
2. EXCAVATION, GROUND SUPPORT, TUNNEL LINING DESIGN AND WATER AND GAS TIGHTNESS PROVISIONS TBD.
3. PILLAR WIDTH BETWEEN TUNNELS TO BE ONE TUNNEL DIAMETER OR MORE BASED ON GUIDANCE IN TM 2.4.6.
4. SPACE PROOFING REQUIRES FURTHER STUDY TO EVALUATE DYNAMIC AIRFLOW/PRESSURE LEVELS UNDER HIGH-SPEED OPERATING CONDITIONS, AND TO FURTHER DEFINE SPACE ALLOTTED FOR STRUCTURES, EQUIPMENT AND EXCESS.
5. CROSS-PASSAGEWAYS SHALL NOT BE FASTER THAN 800 FT (244 M) APART.
6. FOR EQUIPMENT STRUCTURE GAUGES, REFER TO DRAWINGS TN-C0004 TO TN-C0007.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
MINED TWIN TUNNELS
TUNNEL TYPICAL SECTIONS AND DETAILS
CLEARANCE DIAGRAM - SUPERELEVATED TRACK

CALIFORNIA HIGH-SPEED RAIL AUTHORITY
PEPD RECORD SET
PN-17-000
PN-18-000
PN-19-000
PN-20-000
PN-21-000
PN-22-000
NOT FOR CONSTRUCTION
DATE: 04/30/2021
 человек
MINED TWIN TUNNELS
TYPICAL Construction SEQUENCE AND Support MEASURES

CONTRACT NO.
HSR14-42
DRAWING NO.
TN-CO102
SCALE
AS SHOWN
SHEET NO.
C01

MINED TWIN TUNNELS
TYPICAL GEOMETRY

PRIMARY LINING TYPE FOR
POOR QUALITY ROCK (RMR <30)

MINED TWIN TUNNELS
TYPICAL GEOMETRY

PRIMARY LINING TYPE FOR
MEDIUM QUALITY ROCK (RMR 40-50)

THEORETICAL EXCAVATION LINE
SHOTCRETE T=17″ FIBERS + 2 LAYER WWM LATTICE ORDER EVERY 3′ PRIMARY LINING

INVERT CONCRETE
REGULATING CONCRETE (t=2″)

BASE INVERT
REINFORCED CONCRETE (T=20″)

CALIFORNIA HIGH-SPEED RAIL AUTHORITY
CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK

BASIC QUANTITIES PER FT OF TUNNEL

<table>
<thead>
<tr>
<th>TWIN TUNNELS</th>
<th>PRIMARY LINING TYPE</th>
<th>MEDIUM QUALITY ROCK</th>
<th>POOR QUALITY ROCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCAVATION AREA (SQ.FT.)</td>
<td>806</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td>PRIMARY LINING -SHOTCRETE AREA (SQ.FT.)</td>
<td>46</td>
<td>110</td>
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<tr>
<td>REGULATING CONCRETE (2 IN) (SQ.FT.)</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>STEEL ARCH/LATTICE GIRDER LENGTH (FT)</td>
<td>35/5=15</td>
<td>76/3=25.3</td>
<td></td>
</tr>
<tr>
<td>ROCKBOLTS (FT)</td>
<td>10×13/5=26</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>MICROPILES (FT)</td>
<td>26×40/30=34.6</td>
<td>-</td>
<td></td>
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<tr>
<td>INVERT CONCRETE (SQ.FT.)</td>
<td>26.7</td>
<td>-</td>
<td></td>
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</tbody>
</table>

NOTES:
1. SUPPORT MEASURES SHOWN ARE ORIENTATIVE ONLY AND FOR ORDER OF MAGNITUDE ESTIMATION. THEY MUST BE CALCULATED AND DETAIL IN GEOTECHNICAL INFORMATION IS AVAILABLE.
2. THE SECTIONS SHOWN ON THIS DRAWING ARE ONLY APPLICABLE IN THE ROCK QUALITY CONDITIONS SHOWN. OTHER POSSIBLE SCENARIOS ARE INCLUDED IN TABLES ON DRAWINGS TN-C0704 AND TN-C0705.
3. BASE INVERT NECESSARY IN CASE OF PRESENCE OF HIGH WATER TABLE. THE EXACT LOCATION OF THE AREAS WHERE IT WILL HAVE TO BE APPLIED MUST BE FORESEEN WHEN DETAILED GEOTECHNICAL INFORMATION IS AVAILABLE.
**MINED TWIN TUNNELS PRIMARY LINING FOR MEDIUM QUALITY ROCK**

### LEGEND:
- **STEEL ARCH TH-21**
- **REINFORCED SHOTCRETE PRIMARY LINING +1 LAYER WWM**
- **REINFORCED SHOTCRETE SECONDARY LINING**

| PRIMARY LINING (EXAMPLE ONLY, NOT ACTUAL DESIGN) | FOR | SHOTCRETE THICKNESS (IN) | STEEL ARCHES | SHOTCRETE | ADVANCE LENGTH (FT) | ROCKBOLTS PATTERN AND LENGTH (FT) | PIPE MARETTI
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>DOGE QUALITY ROCK</td>
<td>50-60</td>
<td>6</td>
<td>NO ROCKBOLTS</td>
<td>5 TON TIP</td>
<td>5 TOP HEADING</td>
<td>SALT 5 SALT 5 SALT 5 SALT 5 SALT</td>
<td>YES</td>
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<tr>
<td>MEDIUM QUALITY ROCK</td>
<td>40-50</td>
<td>6</td>
<td>TH-21</td>
<td>5 SALT 5 SALT 5 SALT 5 SALT</td>
<td>5 TOP HEADING</td>
<td>SALT 5 SALT 5 SALT 5 SALT</td>
<td>YES</td>
</tr>
<tr>
<td>POOR QUALITY ROCK</td>
<td>30-60</td>
<td>10</td>
<td>TM-25</td>
<td>5 SALT 5 SALT 5 SALT 5 SALT</td>
<td>3 TOP HEADING</td>
<td>SALT 5 SALT 5 SALT 5 SALT</td>
<td>YES</td>
</tr>
<tr>
<td>SELF DRILLING BOLTS INSTEAD OF ROCKBOLTING IF ROCK</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### NOTES:
1. SUPPORT MEASURES SHOWN ARE ORIENTATIVE ONLY AND CAN BE USED AS A GUIDELINE. ADAPT TO SPECIFIC SITE CONDITIONS AND REQUIREMENTS.
2. POOR QUALITY ROCK CAN OCCUR AT PORTALS AND FAULT ZONES AMONG OTHERS. ADAPT TO SPECIFIC SITE CONDITIONS.
3. SELF DRILLING BOLTS WILL BE USED IN MULTIPLE CONDITIONS.
4. TUNNELS DIMENSIONS ACCORDING TO TUNNEL SAGITARY LINE TO TUNNEL TUNNEL.

### STAGE DESCRIPTION
- **Stage 1:** Excavation of bench and application of stabilization layer of shotcrete.
- **Stage 2:** Installation of shotcrete primary lining.
- **Stage 3:** Installation of shotcrete secondary lining.
- **Stage 4:** Installation of steel arch and rockbolting.
- **Stage 5:** Rockbolting.
- **Stage 6:** Extermination of shotcrete primary lining and application of stabilization layer of shotcrete.

### PRIMARY LINING FOR MEDIUM QUALITY ROCK
- **INNER LINING**
- **SECONDARY LINING**
- **WATERPROOFING MEMBRANE**

### NOTES:
- **Support measures shown are orientative only and can be used as a guideline. Adapt to specific site conditions and requirements.**
- **Poor quality rock can occur at portals and fault zones among others. Adapt to specific site conditions.**
- **Self drilling bolts will be used in multiple conditions.**
- **Tunnel dimensions according to tunnel sagitary line to tunnel. These dimensions must be adapted to the conditions that will be used in construction.**

### LEGEND:

**CALIFORNIA HIGH-SPEED RAIL PROJECT**
**PALMDALE TO BURBANK**

**MINED TWIN TUNNELS**

**TYPICAL CONSTRUCTION SEQUENCE AND SUPPORT MEASURES**

(2 of 3)
NOTES:

1. TBM construction method identified for tunnels longer than 3 miles.
2. Excavation ground support, pile, tieback reinforcement, tunnel lining design & water leak & gas emissions provisions TBD.
3. Pile/loss to tunnel panels to be evaluated by soil testing to determine construction tolerances.
4. Space proofing requires further study to evaluate tunnel convergence, tunnel deformations, etc. to further define splices, plotted for structures, equipment, drainage and egress.
5. Pile allowances shall not be further than 300 ft apart (NFPA 130).
6. For equipment structure gauges, refer to drawings TN-C0004 to TN-C0007.
7. Tunnel inner diameter shown in.Chart. According to notes in Designers No. 10.
8. The space proofing support is the result of the planned design speeds for each tunnel, in agreement to the 3% expansion allowance for post-construction ground movement due to permanent fault displacement to allow for post-earthquake clear passage and track realignment.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PACIFIC PALISADES TO BURBANK
TBM BORED TUNNELS
TUNNEL TYPICAL SECTIONS AND DETAILS
CLEARANCE DIAGRAM - TANGENT TRACK

NOTES:

1. TBM construction method identified for tunnels longer than 3 miles.
2. Excavation ground support, pile, tieback reinforcement, tunnel lining design & water leak & gas emissions provisions TBD.
3. Pile/loss to tunnel panels to be evaluated by soil testing to determine construction tolerances.
4. Space proofing requires further study to evaluate tunnel convergence, tunnel deformations, etc. to further define splices, plotted for structures, equipment, drainage and egress.
5. Pile allowances shall not be further than 300 ft apart (NFPA 130).
6. For equipment structure gauges, refer to drawings TN-C0004 to TN-C0007.
7. Tunnel inner diameter shown in Chart. According to notes in Designers No. 10.
8. The space proofing support is the result of the planned design speeds for each tunnel, in agreement to the 3% expansion allowance for post-construction ground movement due to permanent fault displacement to allow for post-earthquake clear passage and track realignment.
NOTES:
1. TBM construction method identified for tunnels longer than 3 miles.
2. Excavation ground support, fill height, drainage, tunnel lining design and water and gas tightness provisions TBD.
3. Fill-up width between tunnels to be one tunnel diameter or more based on guidance in TM 2.4.6.
4. Space proofing requires further study to evaluate dynamic airflow and pressure levels under high-speed operating conditions. Allow for structures, equipment, drainage and emergency.
5. Cross-passageways shall not be farther than 600 ft apart (NFPA 500).
6. For equipment structure spaces, refer to drawings TN-C0004 to TN-C0007.
7. Tunnel inner diameter shown is 29 ft, according to notice to designers No. 1.
8. The inner diameter will be governed by the separate criteria for the planned design speeds for each tunnel, in accordance with any permanent ground movements due to permanent fault displacement, to allow for post-earthquake clear passage and track realignment.

CALIFORNIA HIGH-SPEED RAIL AUTHORITY
CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
TUNNEL TYPICAL SECTIONS AND DETAILS
CLEARANCE DIAGRAM - SUPERELEVATED TRACK

FOR TUNNEL SEGMENTAL LINING
6" ALLOWANCE ON DIAMETER FOR CONSTRUCTION TOLERANCE

TUNNEL - AXES
MAINTENANCE WALKWAY
DRAINAGE PIPELINE

VARIES

66' (TYP)
Bored twin tunnels - superelevated track
68.5' (TYP)
Track centers

11'-4" 4'-0"

NOT FOR CONSTRUCTION
NOTES:
1. THE DESIGN REPRESENTS THE ONE PASS LINING FOR THE TBM TUNNEL WITH WATER PRESSURE BELOW 25 bar (=362.5943 psi).
2. TAPERED UNIVERSAL RING WITH PRE MANUFACTURED SEGMENTS TO BE PLACED BT FOR TBM.
3. THE LINING SEGMENTS SHALL BE EQUIPPED WITH A WATER TIGHT GASKET TO PREVENT THE ENTRY OF WATER FOR THE MAXIMUM EXPECTED WATER PRESSURE WITH A SAFETY FACTOR OF 2.0.
4. ALL RINGS AND SEGMENTS SHALL BE EQUIPPED WITH BOLTS.
5. LINING SEGMENTS SHALL FURTHER BE EQUIPPED WITH GROUTING INSERTS, GUIDING RODS, PACKERS IDENTIFICATION MARKS AND ALL OTHER NECESSARY ITEMS TO ACHIEVE A HIGH QUALITY TUNNEL LINING.
6. MINIMUM COMPRESSION STRENGTH OF CONCRETE AT 28 DAYS fC' = 8000 psi
7. THE CONCRETE MIX SHALL BE CHEMICAL RESISTANT AGAINST THE LOCAL GROUND AND GROUNDWATER CONDITIONS.
8. A QUANTITY OF 0.125 pcf OF POLYPROPYLENE MICROFIBERS SHALL BE ADDED TO THE CONCRETE MIX TO REDUCE CONCRETE SPALLING IN CASE OF FIRE.
9. FOR THE PURPOSE OF COST ESTIMATION, THE NECESSARY QUANTITY OF REINFORCEMENT FOR THE LINING SEGMENTS CAN BE ASSUMED AS 8 pcf OF CONVENTIONAL REBAR, GRADE 60. THIS ASSUMPTION NEEDS TO BE VERIFIED DURING THE FINAL DESIGN STAGE.

EXTRADOS EPDM GASKET
TYPE DATWYLER M80157 OR SIMILAR

LOAD DISTRIBUTION PAD
EXTRADOS
LOAD DISTRIBUTION PAD
INTRADOS
RECESS

INTRADOS DEVELOPED VIEW
DETAIL AT RING JOINT 1
SCALE N.T.S.
DISCLAIMER:
The design shown in this drawing corresponds to the conceptual design of the project and needs to be developed further to be valid for construction.

NOTES:
1. The design represents the two-pass lining for the TBM tunnel with water pressure higher than 25 bar and lower than 50 bar.
2. Primary lining with tapered universal ring of pre-manufactured segments to be placed by TBM.
3. Primary precast lining is a temporary support designed to resist all loads during construction and until the secondary lining is completed.
4. Temporary lining segments shall be equipped with grouting inserts, guiding rods, bolts, identification marks, and all other necessary items required for the construction and a smooth interior surface ready for the installation of the drainage foil and waterproofing membrane.
5. Primary lining is drained with water pressure relief pipes.
6. Precast segments for primary lining should have minimum compression strength of concrete at 28 days of 5000 psi.
7. For the purpose of cost estimation, the necessary quantity of reinforcement for the primary lining segments can be assumed as 6.5 pcf of conventional rebar, grade 60. This assumption needs to be verified during the final design stage.
8. Drainage foil and waterproofing membrane to be installed between temporary and final lining. Water pressure relief pipe shall resist maximum expected water pressure during the initial design life of 100 years without suffering any negative impacts due to the presence of methane in the ground water.
9. Interior, final lining to be designed as water tight concrete structure with a maximum allowable crack width of 0.006 in. The effects of shrinkage shall be taken into account.
10. Concrete for interior lining should have a minimum compression strength at 28 days of 10 000 psi.
11. For the purpose of cost estimation, the necessary quantity of reinforcement for the interior lining can be assumed as 9 pcf of conventional rebar, grade 60. This assumption needs to be verified during the final design stage.
12. A quantity of 0.125 pcf of polypropylene microfibers shall be added to the concrete mix to reduce concrete spalling in case of fire.
NOTES:
SEE NOTES ON DRAWING PB-TN-C0302

DISCLAIMER
THE DESIGN SHOWN IN THIS DRAWING CORRESPONDS TO THE CONCEPTUAL 33% STAGE OF DESIGN AND NEEDS TO BE DEVELOPED FURTHER TO BE VALID FOR CONSTRUCTION.

CALEIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
FAULT CHAMBER
CONCEPT DESIGN FAULT CHAMBER
CROSS-SECTION

CELLULAR CONCRETE
AS CAST DENSITY
25pcf (~400kg/m³)

ROCKBOLTS (TYP)
IN SITU CAST
INTERIOR LINING

PRIMARY SEALING
WITH SHOTCRETE

STEEL FIBER
REINFORCED
SHOTCRETE

WATER PRESSURE
RELIEF PIPE

PVC WATERPROOFING
MEMBRANE

DRAINAGE FOIL

SECTION
SCALE N.T.S.

DETAIL
SCALE N.T.S.

NOTES:
SEE NOTES IN DRAWING PB-TN-C0302

CALIFORNIA HIGH-SPEED RAIL AUTHORITY
1. This design represents the concept for the fault chambers to be developed at the detailed design stage for the potentially hazardous fault zones at the San Gabriel fault and Sierra Madera fault (north and south) for alignments E1, E2 and E3.

2. The track gauge and interior diameter of the adjacent TBM tunnels as well as the interior linings of the fault chambers shall be oversized to allow the alignment recovery after the event of fault displacement for a design speed of 220 mph.

3. The structure of the fault chamber shall be designed to meet the non-collapsible requirement at any moment before, during and after the event of fault displacement.

4. The structure of the fault chamber shall allow the construction of the connecting transition tunnels.

5. The interior tunnel lining shall be permanently water and gas tight. Water tightness after the event of fault displacement shall be achieved with minimum repairs in the area of the joint of the interior lining.

6. In order to achieve the performance requirements described above, the structure of the fault chamber shall consist of the following components:
   - Steel fiber reinforced concrete lining
   - Rotational joint
   - Water proofing membrane
   - Primary sealing with shotcrete
   - Secondary lining consisting of cellular concrete with an as cast density of 25pcf (400 kg/m3)
   - Interior lining consisting of an in situ casted water tight reinforced concrete lining with flexible joints
   - Rotational joints as per reinforcement of the cellular concrete
   - Failure is assumed at a maximum crack width of 0.006 in. The effects of shrinkage shall be taken into account.

7. For the purpose of preliminary cost estimation, the necessary quantity of reinforcement for the exterior lining can be assumed as a mix of conventional rebar, grade 60. This assumption needs to be verified during the final design stage.

8. For the purpose of preliminary cost estimation, the necessary quantity of reinforcement for the interior lining can be assumed as 0.125pcf of polypropylene microfibers to reduce concrete spalling in case of fire.

9. The necessary quantity of reinforcement for the interior lining can be assumed as 0.125pcf of polypropylene microfibers to reduce concrete spalling in case of fire.

10. For the purpose of preliminary cost estimation, the outer lining can be assumed as follows:
   - Two layers of steel plate with a minimum thickness of 0.125 in., reinforced with 25% of steel fibers
   - Drainage pipes for relief of water pressure
   - The necessary quantity of reinforcement for the outer lining can be assumed as 0.125pcf of conventional rebar, grade 60.

11. The quantities for the outer lining are approximate only and need to be confirmed in the detailed design stage.
### Cross-Passageway Envelope
- Minimum 44” wide by 7 feet tall

### Longitudinal Section
- Cross-Passageway
- Invert concrete
- Waterproofing membrane
- Cable duct
- Secondary, in-situ concrete lining
- Waterproofing membrane
- Primary sprayed concrete lining

### Cross-Passage Length
- Varies

### Notes:
1. Cross-Passages for emergency egress shall not be farther than 800 feet apart. (NFPA-130 6.3.1.6)
2. Cross-Passages for emergency egress shall be a minimum of 44” in clear width and 7 feet in height. (NFPA-130 6.3.2.2)
3. Cross-Passages for emergency egress equipment TBD. Equipment in cross-passages will comply with NFPA-130 (6.3.1.7)
   a) The use of cross-passages for the installation of non-combustible equipment is allowed.
   b) Installed equipment does not intrude into the required clear width of the cross-passage.
4. Cross-Passages for technical equipment will have the same structure and dimensions, but will be located elsewhere in the tunnels, one every mile approximately.
LONGITUDINAL SECTION CROSS-PASSAGE

PRIMARY LINING (EXAMPLE ONLY, NOT ACTUAL DESIGN)

<table>
<thead>
<tr>
<th>DENOMINATION</th>
<th>RN</th>
<th>SHOTCRETE THICKNESS (in)</th>
<th>STEEL ARCHES</th>
<th>FIBRES &amp; WWM</th>
<th>ADVANCE LENGTH (ft)</th>
<th>ROCKBOLT PATTERN &amp; LENGTH (ft)</th>
<th>PIPE UMBRELLA</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOOD QUALITY ROCK</td>
<td>390</td>
<td>6</td>
<td>NO FIBRES</td>
<td>0 FULL FACE</td>
<td>4.5 x 7.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MEDIUM QUALITY ROCK</td>
<td>25-50</td>
<td>8</td>
<td>1 LAYER</td>
<td>1 FULL FACE</td>
<td>4.5 x 7.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>POOR QUALITY ROCK</td>
<td>60-10</td>
<td>10</td>
<td>2 LAYERS</td>
<td>2 FULL FACE</td>
<td>7.5 x 15</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* IN CASE GROUND IS SOIL TYPE, INSTEAD OF ROCKBOLTS

NOTES:
1. TYPICAL SUPPORT MEASURES GIVEN WITH ORIENTATIVE PURPOSES ONLY. ACTUAL DESIGN WILL REQUIRE RESULTS OF GEOTECHNICAL INVESTIGATION.
2. SQUEEZING GROUND CONDITIONS UNDER OVERBURDEN OF MORE THAN 300 FT WILL REQUIRE THE STUDY OF DIFFERENT EXCAVATION AND LINING TECHNIQUES IN ORDER TOcope with the extreme conditions.
3. THIS DRAWING IS NOT ACTUAL DESIGN, ITS ONLY PURPOSE IS TO BUILD UNIT PRICES AT PEPD LEVEL.
### Typical Support Measures for Poor Rock Quality

1. **Typical Support Measures Given with Orientative Purposes Only.** Actual design will require results of Geotechnical Investigation.

2. **Squeezing Ground Conditions Under Overburden of More Than 300 FT Will Require the Study of Differrent Excavation and Lining Techniques in Order to Cope with the Extream Conditions.**

3. **Excavation Should Be Divided in Top Heading and Design in Geotechnical Conditions Are More Than 120 FT, Final Design Will Be Provided Once Geotechnical Information Is Complete.**

4. **This Drawing Is Not Actual Design. Its Only Purpose Is to Build Unit Prices at PEPD Level.**

5. **Support Measures For Poor Rock Quality Might Be Carried Out As in Detailed Design.**

---

**Basic Quantities Per Ft of Cross-Passage**

<table>
<thead>
<tr>
<th>Cross-Passage</th>
<th>Primary Lining Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavation Area (sq.ft)</td>
<td>242</td>
</tr>
<tr>
<td>Primary Lining Area (sq.ft)</td>
<td>26</td>
</tr>
<tr>
<td>Regulating Concrete (sq.ft)</td>
<td>5</td>
</tr>
<tr>
<td>Steel Arches (ft)</td>
<td>34.5/2 = 17.25</td>
</tr>
<tr>
<td>Waterproofing Membrane (ft)</td>
<td>52</td>
</tr>
<tr>
<td>Formwork (ft)</td>
<td>30</td>
</tr>
<tr>
<td>Secondary Lining Area Connect (sq.m) (sq.ft)</td>
<td>12</td>
</tr>
<tr>
<td>Secondary Invert (sq.m) (sq.ft)</td>
<td>15</td>
</tr>
<tr>
<td>Invert Concrete Fill (sq.ft)</td>
<td>25</td>
</tr>
<tr>
<td>MicroPiles Total Length per CP (ft)</td>
<td>924</td>
</tr>
<tr>
<td>Steel Permanent Collar (lbs)</td>
<td>5500 lbs (x2)</td>
</tr>
</tbody>
</table>

**Notes:**

- USE REGULATING CONCRETE (2 in) (FULL ROUND)
- CAST IN-SITU REINFORCED CONCRETE INNER LINING (t=16")
- WATERPROOF MEMBRANE (FULL ROUND)
- PRIMARY Lining (Example Only, Not Actual Design)
- Waterproof Umbrella (full round)
OVERHEAD DOORS
LEADING OUTSIDE

REINFORCED
CONCRETE WALL

RIGID EXCAVATION
SUPPORT

PROVISION SPACE
FOR CROSS-PASSAGE
EQUIPMENT (100) AND
SLIDING DOOR

WATER PROOFING
MEMBRANE

PRIMARY SPRAYED
CONCRETE LINING
CABLE EXIT

CROSS-PASSAGEWAY
ENVELOPE MINIMUM
6'6" WIDE BY 7 FEET
-TALL (NRP-130)

SECTION A

EMERGENCY EGRESS STATIONING SIDE
EE-01-E1 2060493.75 LEFT
EE-02-E1 2085493.75 LEFT
EE-03-E1 2110493.75 LEFT

EMERGENCY EGRESS STATIONING SIDE
EE-01-E2 1850430.00 RIGHT
EE-02-E2 1885430.00 LEFT
EE-03-E2 1920430.00 LEFT
EE-04-E2 1955430.00 LEFT

EMERGENCY EGRESS STATIONING SIDE
EE-01-SR14 2168400.00 LEFT
EE-02-SR14 2193400.00 LEFT
EE-03-SR14 2218400.00 LEFT

SECTION

EMERGENCY EXIT STAIR

EMERGENCY WALKWAY STATIONING SIDE

REINFORCED
CONCRETE WALL

NOTES:
1. TYPES, LOCATIONS AND DIMENSIONS OF EXCAVATION SUPPORT NOT DESIGNED.
2. PERMANENT LINING ASSUMED WATERPROOF/MEMBRANE IN PERMANENT CASE.
3. STRUCTURE COMPONENTS NOT DESIGNED. DRAWINGS NOT BASED ON ACTUAL DESIGN AND DEVELOPED FOR PRELIMINARY COST ESTIMATE.
4. TEMPORARY INTERNAL BRACING WILL BE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT GREATER THAN 20 FT.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
EMERGENCY EGRESS FOR SHM TUNNELS CROSS AND LONGITUDINAL SECTION GEOMETRY
NOTES:
1. CONSTRUCTION PROCEDURES AND SUPPORT MEASURES SIMILAR TO CROSS-PASSAGES (TN-C0402, TN-C0403)
2. DRAWINGS TN-C0500 AND TN-C0501 ARE INTENDED TO FOR SPACE PROOFING ONLY.
3. THE DESIGN OF THE STRUCTURE REQUIRES RESULTS OF GEOTECHNICAL INVESTIGATION

SCALE 1"=4'

SECTION

OILS SUMP (DEPOT) 6m3
1085 gal (US)
(0.76 x 1.16 x 0.34')

GUIDANCE VIEW DETAIL

SHEET NO._/__/--

DESIGNED BY

E. VELASCO

DRAWN BY

F. J. DOMINGUEZ

CHECKED BY

W. GUO

IN CHARGE

A. RELANO

DATE

04/30/2021

REV DATE BY CHK APP DESCRIPTION

OILS SUMP DEPOSIT 6m3
1585 gal (US)
(0.76 x 1.16 x 0.34')

1"=4'

TN-0500

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK

UNDERGROUND TRACTION POWER PARALLELING STATION (PS)
TYPICAL GEOMETRY (1 of 2)
NOTES:

1. CONSTRUCTION PROCEDURES AND SUPPORT MEASURES SIMILAR TO CROSS PASSAGES (TN-C0402, TN-C0403)
2. DRAWINGS TN-C0502 AND TN-C0503 ARE INTENDED FOR SPACEPROOFING ONLY.
3. THE DESIGN OF THE STRUCTURE WILL REQUIRE RESULTS OF GEOTECHNICAL INVESTIGATION.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
UNDERGROUND SWITCHING STATION (SWS)
TYPICAL GEOMETRY (1 of 2)
ELEVATION CROSS-SECTION
NOTES:
1. CALIFORNIA FIRE CODE 2016 CHAPTER 5
   UNOBSTRUCTED WIDTH NO LESS THAN 22FT
   UNOBSTRUCTED VERTICAL CLEARANCE OF NO LESS THAN 14.5FT.
2. CLEARANCE FOR TWO TRUCKS OR DUMPERS TO PASS EACH OTHER.
   TWO VENTILATION DUCTS OF 5FT DIAMETER WALKWAY STACKED CONVEYOR BELT.
3. CLEARANCE FOR TBM PARTS TO BE TRANSPORTED THROUGH THE ADIT.
4. INFILL NECESSARY IN CASE OF RMR <40 OR IN PRESENCE OF HIGH WATER TABLE.
   THE EXACT LOCATION OF THE AREAS WHERE INFILL WILL BE APPLIED TO BE DECIDED UPON COMPLETION OF DETAILED GEOTECHNICAL INFORMATION.
   FOR PEOR DESIGN LEVEL IT WILL BE APPLIED TO POOR QUALITY ROCK AREAS.

FREE CROSS-SECTION 703 SQ.FT.
ADIT USED FOR CONSTRUCTION

TYPICAL CROSS SECTION

THEORETICAL EXCAVATION LINE
PRIMARY SUPPORT
WATERPROOFING MEMBRANE
REINFORCED CONCRETE LINING / FINAL LINING
THEORETICAL EXCAVATION LINE

FREE CROSS-SECTION 703 SQ.FT.
ADIT USED FOR CONSTRUCTION

TYPICAL CROSS SECTION

THEORETICAL EXCAVATION LINE
PRIMARY SUPPORT
WATERPROOFING MEMBRANE
REINFORCED CONCRETE LINING / FINAL LINING

FREE CROSS-SECTION 703 SQ.FT.
ADIT USED FOR CONSTRUCTION

TYPICAL CROSS SECTION

THEORETICAL EXCAVATION LINE
PRIMARY SUPPORT
WATERPROOFING MEMBRANE
REINFORCED CONCRETE LINING / FINAL LINING

FREE CROSS-SECTION 703 SQ.FT.
ADIT USED FOR CONSTRUCTION

TYPICAL CROSS SECTION
CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ADIT FOR CONSTRUCTION
INCLINED DESCENDING GALLERY
TYPICAL CONSTRUCTION SEQUENCE
AND SUPPORT MEASURES (1 of 3)

NOTES:
1. THIS DRAWING IS NOT ACTUAL DESIGN. ITS PURPOSE IS TO ESTABLISH UNIT PRICES AT PEDS LEVEL.
2. TYPICAL SUPPORT MEASURES AND INNER LINING THICKNESSES ARE GIVEN WITH ORIENTATIVE PURPOSES ONLY. ACTUAL DESIGN WILL REQUIRE RESULTS OF ADEQUATE GEOTECHNICAL INVESTIGATION.
3. THE SECTIONS SHOWN ON THIS DRAWING ARE ONLY APPLICABLE IN THE ROCK QUALITY CONDITIONS SHOWN.
4. FILTER NEEDED IN CASE OF RMR <40 TO PREVENT INFILTRATION OF WATER FROM THE EXCAVATION AREA. WHERE GEOTECHNICAL INFORMATION IS AVAILABLE, FULL ROUND WATERPROOFING MEMBRANE IS REQUIRED. FOR THIS STAGE OF DESIGN IT WILL BE APPLIED ONLY TO POOR QUALITY ROCK AREAS.
5. TUNNELS DIMENSIONS ACCORDING TO USUAL MACHINERY USED IN MINED TUNNELS. THESE DIMENSIONS MUST BE ADJUSTED TO THE MACHINERY THAT WILL BE USED IN CONSTRUCTION.
6. SHOTCRETE AND/OR FIBER GLASS BOLTS MIGHT BE REQUIRED TO ENSURE FACE STABILITY IN SOME AREAS. A FURTHER STUDY OF FACE STABILITY MUST BE CARRIED OUT IN DETAILED DESIGN.
7. ADIT SECTION MUST BE INCREASED IN A TELESCOPIC WAY TO ALLOW THE CONSTRUCTION OF THE CAVEN USING THE PROPOSED PHASES. A SKETCH IS SHOWN ON DRAWING TN-C0707.

BASIC QUANTITIES PER FT OF TUNNEL

<table>
<thead>
<tr>
<th>Primary Lining Type</th>
<th>Medium Quality Rock</th>
<th>Poor Quality Rock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavation Area</td>
<td>150 ft²</td>
<td>212 ft²</td>
</tr>
<tr>
<td>Primary Lining Area</td>
<td>44 ft²</td>
<td>78 ft²</td>
</tr>
<tr>
<td>Regulating Concrete</td>
<td>6 ft²</td>
<td>6 ft²</td>
</tr>
<tr>
<td>Steel 4% fiber/Lattice Girder</td>
<td>68/s13.6 ft²</td>
<td>67.5/s13.6 ft²</td>
</tr>
<tr>
<td>Waterproofing Membrane</td>
<td>102 ft²</td>
<td>103 ft²</td>
</tr>
<tr>
<td>Formwork (ft²)</td>
<td>31 ft²</td>
<td>31 ft²</td>
</tr>
<tr>
<td>Secondary Lining Area Concrete</td>
<td>56 ft²</td>
<td>56 ft²</td>
</tr>
<tr>
<td>Micropiles (ft²)</td>
<td>44 ft²</td>
<td>44 ft²</td>
</tr>
<tr>
<td>Rockbolts (ft)</td>
<td>31.2 ft</td>
<td>-</td>
</tr>
<tr>
<td>Micropiles at Elephant's Foot (ft²)</td>
<td>-</td>
<td>9.5 ft²</td>
</tr>
<tr>
<td>Invert Concrete (ft²)</td>
<td>-</td>
<td>52 ft²</td>
</tr>
</tbody>
</table>

TYPICAL GEOMETRY AND PRIMARY LINING FOR
POOR QUALITY ROCK (RMR<30)

ADIT

TYPICAL GEOMETRY AND PRIMARY LINING FOR
MEDIUM QUALITY ROCK RMR (40-50)

---

CALIFORNIA HIGH-SPEED RAIL AUTHORITY
PEPD RECORD NO. 02
REVISION DATE 04/30/2021

ADIT SECTION MUST BE INCREASED IN A TELESCOPIC WAY TO ALLOW THE CONSTRUCTION OF THE CAVERN USING THE PROPOSED PHASES. A SKETCH IS SHOWN ON DRAWING TN-C0707.
INCLINED DESCENDING GALLERY
PRIMARY LINING FOR MEDIUM QUALITY ROCK

**LEGEND:**
- **WATERPROOFING**
- **REINFORCED SHOTCRETE PRIMARY LINING**
- **STAGE 1:** INSTALLATION OF WATERPROOFING MEMBRANE.
- **STAGE 2:** INSTALLATION OF STEEL ARCH AND ROCKBOLTING.
- **STAGE 3:** SPRAYING OF REINFORCED CONCRETE INVERT.
- **STAGE 4:** INSTALLATION OF PRIMARY LINING +1 LAYER WWM.
- **STAGE 5:** SPRAYING OF REGULATING CONCRETE INVERT.
- **STAGE 6:** INSTALLATION OF INNER (SECONDARY) LINING.
- **STAGE 7:** INSTALLATION OF WATERPROOFING MEMBRANE.

**TYPICAL CONSTRUCTION SEQUENCE:**
1. Pre-excaVation Grouting
2. Excavation of Top Heading and Application of Stabilization Layer of Shotcrete
3. Installation of Steel Arch and Rockbolting
4. Spraying of Reinforced Shotcrete +1 Layer WWM
5. Installation of Regulating Concrete Invert
6. Installation of Waterproofing Membrane
7. Installation of Inner (Secondary) Lining
8. Self-drilling Bolts instead of Rockbolting at Pun 35

**NOTES:**
1. Support measures estimated only, more detailed geotechnical information is available.
2. Poor quality rock may occur at portals and fault zones among other.
3. Some elements of the design may vary according to the ground conditions.
4. Tunnel dimensions according to usual machinery used to make tunnels.
NOTES:

1. EXAMPLE ONLY OF TYPICAL PRE-EXCAVATION GROUTING FOR MINED TUNNEL (ADIT). SCHEME, AND LOCATIONS WHERE IT MUST APPLY, MUST BE CHECKED WHEN DETAILED GEOTECHNICAL INFORMATION IS AVAILABLE.

2. THE PRE-EXCAVATION GROUTING IS INTENDED FOR MINIMIZATION OF WATER INFILTRATION FROM THE SURFACE, AS A TEMPORARY MEASURE DURING CONSTRUCTION, TO PREVENT LOWERING OF THE GROUNDWATER TABLE.

3. THE PRE-EXCAVATION GROUTING METHODOLOGY AND INTENSITY TO BE DESIGNED WHEN APPROPRIATE GEOTECHNICAL INFORMATION IS AVAILABLE.

4. WORKING PROCEDURE WILL CONSIST ONLY OF SYSTEMATIC, CONTINUOUS AND OVERLAPPING PROBE DRILLING LINES OR THE EXCAVATION.

5. PRE-EXCAVATION GROUTING SCHEME AND INTENSITY AS FUNCTION OF MEASURED LEAKAGE IN PROBE HOLES.

6. WORKING PROCEDURE WILL CONSIST ON:

1) SYSTEMATIC, CONTINUOUS AND OVERLAPPING PROBE DRILLING LINES OR THE EXCAVATION.

2) PRE-EXCAVATION GROUTING SCHEME AND INTENSITY AS FUNCTION OF MEASURED LEAKAGE IN PROBE HOLES.

5. GROUT MIX CHARACTERISTICS TBD THROUGH A PROGRAMME OF GROUT MIX TRIALS. CEMENTITIOUS MATERIALS TO BE USED IN ADJUNCT TO COMPLY WITH ENVIRONMENTAL REQUIREMENTS.

SCALE 1"=10'
**NOTES:**

1. This drawing is not an actual design. Its purpose is to build unit prices at PEPD level.
2. Cavern dimensions are intended for TBM assembly and gantry crane.
3. Cavern is assumed to be located in good rock (verification boreholes required, outside fault zones).
4. Support measures are only orientative. They may be calculated when detailed geotechnical information is available.
5. Cavern dimensions according to usual machinery used in other tunnels. These dimensions must be adapted to the machinery that will be used in construction.

**FREE CROSS-SECTION 4865 SQ.FT.**

**SECTION**

**SCALE 1"=5'**

### BASIC QUANTITIES FOR CAVERN (PER FT OF CAVERN MAIN AXIS)

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavation Area (50 ft.)</td>
<td>5600</td>
</tr>
<tr>
<td>Waterproofing Membrane (ft.)</td>
<td>275</td>
</tr>
<tr>
<td>Formwork (ft.)</td>
<td>181</td>
</tr>
<tr>
<td>Secondary Lining Area Concrete (50 ft.)</td>
<td>320</td>
</tr>
<tr>
<td>Secondary Lining Area Concrete (sq ft.)</td>
<td>120</td>
</tr>
</tbody>
</table>

### NOTES:

1. This drawing is not an actual design. Its purpose is to build unit prices at PEPD level.
2. Cavern dimensions are intended for TBM assembly and gantry crane.
3. Cavern is assumed to be located in good rock (verification boreholes required, outside fault zones).
4. Support measures are only orientative. They may be calculated when detailed geotechnical information is available.
5. Cavern dimensions according to usual machinery used in other tunnels. These dimensions must be adapted to the machinery that will be used in construction.

**FREE CROSS-SECTION 4865 SQ.FT.**
### TYPICAL CONSTRUCTION SEQUENCE AND SUPPORT MEASURES

<table>
<thead>
<tr>
<th>PHASE</th>
<th>STEEL ARCHES</th>
<th>ROCKBOLT PATTERN AND LENGTH (Ft)</th>
<th>WEIGHT OF EXCAVATED SECTION (Tons)</th>
<th>EXCAVATED CROSS SECTION AREA (SQ FT)</th>
<th>PRIMARY LINING CONCRETE (CUBIC FT)</th>
<th>STEEL ARCH (FT)</th>
<th>ROCKBOLTS (FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6&quot; NO FIBRES</td>
<td>5'-5&quot; x 3'-5&quot;</td>
<td>6,464</td>
<td>500 SQ.FT.</td>
<td>17</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>12&quot;+</td>
<td>7'-5&quot; x 3'-9&quot;</td>
<td>6,464</td>
<td>500 SQ.FT.</td>
<td>22</td>
<td>13</td>
<td>9</td>
</tr>
</tbody>
</table>

*For total steel arch length, see drawing TN-C0710.*

**Total primary lining area shown on Phase 4 (TN-C0710).**

### NOTES:
1. This drawing is not an actual design. It is to provide unit prices at PEPD level.
2. Cavern built in sound rock, outside fault zones.
3. Boreholes to be drilled to confirm adequate location.
4. Drill & blast as excavation method assumed.
5. Phases must be excavated sequentially. The maximum advance length must be defined on detailed design when complete geotechnical information is available.
6. Tunnel dimensions according to usual machinery used in mined tunnels. The dimensions are not related to the machinery that will be used in construction.
7. Rockbolts not shown on drawings.
8. Access to each working level shown on drawing TN-C0707.
NOTE:
1. THIS DRAWING IS NOT AN ACTUAL DESIGN. ITS PURPOSE IS TO BUILD UNIT PRICES AT PEPD LEVEL.
2. CAVERN BUILT IN GOOD ROCK, OUTSIDE FAULT ZONES.
3. BOREHOLES TO BE DRILLED TO CONFIRM ADEQUATE LOCATION.
4. DRILL & BLAST AS EXCAVATION METHOD ASSUMED.
5. PHASES MUST BE EXCAVATED SEQUENTIALLY. THE MAXIMUM ADVANCE LENGTH MUST BE DEFINED DURING DESIGN PHASES WHEN COMPLETE GEOLOGICAL INFORMATION IS AVAILABLE.
6. ALL DETAILED DESIGNS MUST BE APPROVED BY THE CONTRACTOR THAT WILL BE USED IN CONSTRUCTION.
7. ROCKBOLTS NOT SHOWN ON DRAWINGS.
8. ACCESS TO EACH WORKING LEVEL SHOWN ON DRAWING TN-C0707.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ADIT FOR CONSTRUCTION
CAVERN (TBM ASSEMBLY CHAMBER)
TYPICAL CONSTRUCTION SEQUENCE AND SUPPORT MEASURES (2 of 3)
**NOTES:**

1. **THIS DRAWING IS NOT AN ACTUAL DESIGN. ITS PURPOSE IS TO BUILD UNIT PRICES AT PEPD LEVEL.**
2. **CAVERN BUILT IN SOUND ROCK, OUTSIDE FAULT ZONES.**
3. **BOREHOLES TO BE DRILLED TO CONFIRM ADEQUATE LOCATION.**
4. **DRILL & BLAST AS EXCAVATION METHOD ASSUMED.**
5. **ROCKBOLTS NOT SHOWN ON DRAWINGS.**

**PHASE 5:**
- INSTALL WATERPROOFING MEMBRANE (EXCEPT JUNCTION ZONES WITH RUNNING TUNNELS)
- INSTALL REINFORCEMENT AROUND JUNCTIONS
- INSTALL SECONDARY LINING (SIDES AND CROWN), EXCEPT JUNCTION ZONES WITH RUNNING TUNNELS

**PHASE 6:**
- INSTALL BASE SLAB.
- START EXCAVATION OF TBM LAUNCHING TUNNELS.
- FOR TYPICAL EXCAVATION SEQUENCE, SUPPORT MEASURES AND QUANTITIES OF TBM LAUNCHING TUNNELS, FOLLOW TN-C0102 TO TN-C0104

**TBM ASSEMBLY TUNNEL**

**SECONDARY LINING 1.5" THICKNESS**

**WATERPROOFING MEMBRANE (FULL ROUND)**

**BASE SLAB**

---

**CALIFORNIA HIGH-SPEED RAIL PROJECT**

**PALMDALE TO BURBANK**

**ADT FOR CONSTRUCTION**

**CAVERN (TBM ASSEMBLY CHAMBER)**

**TYPICAL CONSTRUCTION SEQUENCE AND SUPPORT MEASURES (3 of 3)**
**NOTES:**

1. CALIFORNIA FIRE CODE 2016, CHAPTER 5. UNOBSTRUCTED WIDTH NO LESS THAN 22FT, UNOBSTRUCTED VERTICAL CLEARANCE OF NO LESS THAN 14.5FT.

2. CLEARANCE FOR TWO TRUCKS OR DUMPERS TO PASS EACH OTHER, TWO VENTILATION DUCTS OF 5FT DIAMETER, WALKWAY AND STACKED CONVEYOR BELT AND WATER PIPES ON ONE SIDE.

3. CLEARANCE FOR Ten Parts TO BE TRANSPORTED THROUGH THE ADIT.

4. INVERT NEEDED IN CASE OF RMR <40 OR IN PRESENCE OF HIGH WATER TABLE. THE EXACT LOCATION OF THE AREAS WHERE IT WILL HAVE TO BE APPLIED WILL BE DETERMINED AS GEOTECHNICAL INFORMATION IS AVAILABLE. FOR THE STAGE OF DESIGN IT WILL BE APPLIED ONLY TO POOR QUALITY ROCK AREAS.

5. ADIT FOR VENTILATION PURPOSES REQUIRES 900 SQ.FT. OF FREE CROSS-SECTION. ADIT USED FOR CONSTRUCTION AND VENTILATION (E1)
1. This drawing is not an actual design. Its purpose is to build unit prices at PEPD Level.

2. Typical support measures and inner lining thicknesses are only applicable to the rock quality conditions shown.

3. The sections shown on this drawing are only applicable to the rock quality conditions shown.

4. Invert necessary in case of RMR < 40 and in presence of high water table. It will have to be applied must be determined after detailed geological investigation is available for this stage of design. It will only be applied in poor quality rock areas.

5. Tunnels dimensions according to usual machinery used in mined tunnels. These dimensions must be adjusted to the machinery that will be used in construction.

6. Shotcrete and/or Fiber Glass bolts might be required to ensure face stability in some areas. A further study of face stability must be carried out in detailed design.

### Basic Quantities

<table>
<thead>
<tr>
<th>Adit Type</th>
<th>Excavation Area (sq. ft.)</th>
<th>Primary Lining Area (sq. ft.)</th>
<th>Regulating Concrete (2 in) (sq. ft.)</th>
<th>Steel Arch/Lattice Girder (ft)</th>
<th>Water Proofing Membrane (ft)</th>
<th>Formwork (ft)</th>
<th>Secondary Lining Area Concrete (sq. ft.)</th>
<th>Rockbolts (ft)</th>
<th>Micro Piles (ft)</th>
<th>Invert Concrete (sq. ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adit</td>
<td>1140</td>
<td>61</td>
<td>8</td>
<td>125</td>
<td>75</td>
<td>105</td>
<td>71.3</td>
<td>125</td>
<td>-</td>
<td>9.4</td>
</tr>
<tr>
<td>Poor Quality Rock (RMR &lt; 30)</td>
<td>1266</td>
<td>100</td>
<td>7</td>
<td>125</td>
<td>75</td>
<td>105</td>
<td>72.5</td>
<td>125</td>
<td>-</td>
<td>9.4</td>
</tr>
</tbody>
</table>

**Notes:**

- Typical support measures and inner lining thicknesses are only applicable to the rock quality conditions shown.
- Invert necessary in case of RMR < 40 and in presence of high water table. It will have to be applied must be determined after detailed geological investigation is available for this stage of design. It will only be applied in poor quality rock areas.
- Tunnels dimensions according to usual machinery used in mined tunnels. These dimensions must be adjusted to the machinery that will be used in construction.
- Shotcrete and/or Fiber Glass bolts might be required to ensure face stability in some areas. A further study of face stability must be carried out in detailed design.

**Basic Quantities Per Ft of Tunnel**

- **Adit:**
  - Primary Lining Area (sq. ft.): 61
  - Regulating Concrete (2 in) (sq. ft.): 8
  - Steel Arch/Lattice Girder (ft): 125
  - Water Proofing Membrane (ft): 75
  - Formwork (ft): 105
  - Secondary Lining Area Concrete (sq. ft.): 71.3
  - Rockbolts (ft): 125
  - Micro Piles (ft): 56
  - Invert Concrete (sq. ft.): 9.4

**Theoretical Excavation Line**

- Primary Lining
- Shotcrete (T=8") + Fibres + 1 Layer WWM Steel Arches TH-29
- Water Proofing Membrane (FULL ROUND)
- Secondary Lining
- Shotcrete (T=12") + Fibres + 2 Layers WWM - Lattice Girder Every 3'
- Waterproofing Membrane System (FULL ROUND)
- Micro Piles Umbrella 00
- Micro Piles at Elephant's Foot (ft): 9.4
- Invert Concrete (sq. ft.): 76

**Adit TYPICAL GEOMETRY AND PRIMARY LINING FOR POOR QUALITY ROCK (RMR<30)**

- Invert Concrete
- Base Layer
- Reinforced Concrete (T=2")
- Regulating Concrete (4")
- CAST-IN-SITU Reinforced Concrete Secondary Lining
- Water Proofing Membrane (FULL ROUND)
- Lt. 50' LATTICE GIRDER EVERY 3'
- Rockbolts (ft) 12x13/5 = 31.2
- Micro Piles Umbrella (ft) 56
- Micro Piles at Elephant's Foot (ft) 9.4
- Invert Concrete (sq. ft) 76

**Adit TYPICAL GEOMETRY AND PRIMARY LINING FOR MEDIUM QUALITY ROCK RMR (40-50)**

- Invert Concrete
- Base Layer
- Reinforced Concrete (T=8")
- Regulating Concrete (4")
- CAST-IN-SITU Reinforced Concrete Secondary Lining
- Water Proofing Membrane (FULL ROUND)
- Lt. 50' LATTICE GIRDER EVERY 3'
- Rockbolts (ft) 12x13/5 = 31.2
- Micro Piles Umbrella (ft) 56
- Micro Piles at Elephant's Foot (ft) 9.4
- Invert Concrete (sq. ft) 76

**Notes:**

1. This drawing is not an actual design. Its purpose is to build unit prices at PEPD Level.

2. Typical support measures and inner lining thicknesses are only applicable to the rock quality conditions shown.

3. The sections shown on this drawing are only applicable to the rock quality conditions shown.

4. Invert necessary in case of RMR < 40 and in presence of high water table. It will have to be applied must be determined after detailed geological investigation is available for this stage of design. It will only be applied in poor quality rock areas.

5. Tunnels dimensions according to usual machinery used in mined tunnels. These dimensions must be adjusted to the machinery that will be used in construction.

6. Shotcrete and/or Fiber Glass bolts might be required to ensure face stability in some areas. A further study of face stability must be carried out in detailed design.

**Basic Quantities Per Ft of Tunnel**

- **Adit**
  - Primary Lining Area (sq. ft.): 61
  - Regulating Concrete (2 in) (sq. ft.): 8
  - Steel Arch/Lattice Girder (ft): 125
  - Water Proofing Membrane (ft): 75
  - Formwork (ft): 105
  - Secondary Lining Area Concrete (sq. ft.): 71.3
  - Rockbolts (ft): 125
  - Micro Piles (ft): 56
  - Invert Concrete (sq. ft): 9.4

**Notes:**

- Typical support measures and inner lining thicknesses are only applicable to the rock quality conditions shown.
- Invert necessary in case of RMR < 40 and in presence of high water table. It will have to be applied must be determined after detailed geological investigation is available for this stage of design. It will only be applied in poor quality rock areas.
- Tunnels dimensions according to usual machinery used in mined tunnels. These dimensions must be adjusted to the machinery that will be used in construction.
- Shotcrete and/or Fiber Glass bolts might be required to ensure face stability in some areas. A further study of face stability must be carried out in detailed design.

**Basic Quantities Per Ft of Tunnel**

- **Adit**
  - Primary Lining Area (sq. ft.): 61
  - Regulating Concrete (2 in) (sq. ft.): 8
  - Steel Arch/Lattice Girder (ft): 125
  - Water Proofing Membrane (ft): 75
  - Formwork (ft): 105
  - Secondary Lining Area Concrete (sq. ft.): 71.3
  - Rockbolts (ft): 125
  - Micro Piles (ft): 56
  - Invert Concrete (sq. ft): 9.4

**Notes:**

- Typical support measures and inner lining thicknesses are only applicable to the rock quality conditions shown.
- Invert necessary in case of RMR < 40 and in presence of high water table. It will have to be applied must be determined after detailed geological investigation is available for this stage of design. It will only be applied in poor quality rock areas.
- Tunnels dimensions according to usual machinery used in mined tunnels. These dimensions must be adjusted to the machinery that will be used in construction.
- Shotcrete and/or Fiber Glass bolts might be required to ensure face stability in some areas. A further study of face stability must be carried out in detailed design.

**Basic Quantities Per Ft of Tunnel**

- **Adit**
  - Primary Lining Area (sq. ft.): 61
  - Regulating Concrete (2 in) (sq. ft.): 8
  - Steel Arch/Lattice Girder (ft): 125
  - Water Proofing Membrane (ft): 75
  - Formwork (ft): 105
  - Secondary Lining Area Concrete (sq. ft.): 71.3
  - Rockbolts (ft): 125
  - Micro Piles (ft): 56
  - Invert Concrete (sq. ft): 9.4

**Notes:**

- Typical support measures and inner lining thicknesses are only applicable to the rock quality conditions shown.
- Invert necessary in case of RMR < 40 and in presence of high water table. It will have to be applied must be determined after detailed geological investigation is available for this stage of design. It will only be applied in poor quality rock areas.
- Tunnels dimensions according to usual machinery used in mined tunnels. These dimensions must be adjusted to the machinery that will be used in construction.
- Shotcrete and/or Fiber Glass bolts might be required to ensure face stability in some areas. A further study of face stability must be carried out in detailed design.

**Basic Quantities Per Ft of Tunnel**

- **Adit**
  - Primary Lining Area (sq. ft.): 61
  - Regulating Concrete (2 in) (sq. ft.): 8
  - Steel Arch/Lattice Girder (ft): 125
  - Water Proofing Membrane (ft): 75
  - Formwork (ft): 105
  - Secondary Lining Area Concrete (sq. ft.): 71.3
  - Rockbolts (ft): 125
  - Micro Piles (ft): 56
  - Invert Concrete (sq. ft): 9.4

**Notes:**

- Typical support measures and inner lining thicknesses are only applicable to the rock quality conditions shown.
- Invert necessary in case of RMR < 40 and in presence of high water table. It will have to be applied must be determined after detailed geological investigation is available for this stage of design. It will only be applied in poor quality rock areas.
- Tunnels dimensions according to usual machinery used in mined tunnels. These dimensions must be adjusted to the machinery that will be used in construction.
- Shotcrete and/or Fiber Glass bolts might be required to ensure face stability in some areas. A further study of face stability must be carried out in detailed design.
1. EXAMPLE ONLY OF TYPICAL PRE-EXCAVATION GROUTING FOR MINED TUNNEL (ADIT).
2. THE PRE-EXCAVATION GROUTING IS INTENDED FOR MINIMIZATION OF WATER INFILTRATION FROM THE SURFACE, AND TEMPORARY MAINTENANCE OF THE GROUNDWATER TABLE.
3. THE PRE-EXCAVATION GROUTING METHODOLOGY AND INTENSITY TO BE DESIGNED AND APPROPRIATE TECHNICAL INFORMATION IS AVAILABLE.
4. WORKING PROCEDURE WILL CONSIST OF:
   1) SYSTEMATIC, CONTINUOUS AND OVERLAPPING PROBE DRILLING AHEAD OF THE EXCAVATION.
   2) PRE-EXCAVATION GROUTING SCHEME AND INTENSITY AS FUNCTION OF MEASURED LEAKAGE IN PROBE HOLES.
5. GROUT MIX CHARACTERISTICS TBD THROUGH A PROGRAMME OF GROUT MIX TRIALS. CEMENTITIOUS MATERIALS TO BE USED IN GROUT MIX TO COMPLY WITH ENVIRONMENTAL REQUIREMENTS.
1. An underground cavern for TBM disassembly is expected for the long tunnel under all alternatives.
2. Cavern dimensions should fit a gantry crane.
3. Excavation width, construction sequence, support measures and final lining to be designed when appropriate geotechnical information is acquired and space requirements are assessed.
4. This is only a conceptual design.
NOTES:

1. AN UNDERGROUND CAVERN FOR TBM DISASSEMBLY IS EXPECTED FOR THE LONG TUNNEL UNDER ANY FALL ALTERNATIVES.

2. CAVERN DIMENSIONS SHOULD FIT A GANTRY CRANE.

3. EXCAVATION METHODS, CONSTRUCTION SEQUENCE, SUPPORT MEASURES AND FINAL LINING TO BE DESIGNED ONLY AFTER APPROPRIATE GEOTECHNICAL INFORMATION IS ACQUIRED AND SPACE REQUIREMENTS ARE ASSESSED.

4. THIS IS ONLY A CONCEPTUAL DESIGN.
NOTES:
1. THIS DRAWING IS NOT ACTUAL DESIGN. ITS PURPOSE IS TO BUILD UNIT PRICES AT PEPD LEVEL.
2. THIS SHAFT IS INTENDED AS AN INTERMEDIATE ACCESS FOR CONSTRUCTION.
3. THE CONSTRUCTION SHAFT IS INTENDED FOR ASSEMBLY AND LAUNCH OF TUNNEL BORING MACHINES (TBMS) SOUTHWARDS, AND FOR MINED TUNNELS NORTHWARDS.
4. THE SHAFT WILL HAVE AUXILIARY MINED TUNNELS TO ALLOW CONCURRENT TBM SHIELD AND BACKUP ASSEMBLY.
5. SHAFT STRUCTURAL THICKNESSES AND GENERAL DIMENSIONS ARE GIVEN BASED ON SURVEY AND GEOTECHNICAL SUPPORTS. ACTUAL DESIGN WILL REQUIRE RESULTS OF GEOTECHNICAL INVESTIGATION AND ASSESSMENT OF THE CONSTRUCTION LOGISTIC NEEDS.
6. THE SHAFT IS TO BE BACK FILLED AND CLOSED AFTER CONSTRUCTION IS COMPLETED.
7. SECANT PILES ARE INCLUDED TO TAKE INTO ACCOUNT THE POSSIBLE PRESENCE OF SOILS AND OR VERY WEATHERED ROCK IN THE FIRST METERS. IF THE EXCAVATION AS NO PRECISE GEOTECHNICAL INFORMATION IS AVAILABLE, A COMBINATION OF ROCKBOLTS, MESHES, SHOTCRETE AND WEEPS IS PROPOSED AS MAIN SUPPORT.

DOUBLE CIRCULAR SHAFT WITH CENTRAL DIAPHRAGM INTERMEDIATE WINDOW AT ARRASTRE CANYON. STA 870+00 TWIN SHAFT

SECTION
SCALE 1"=10'-0"
NOTES:
1. THIS DRAWING IS NOT ACTUAL DESIGN.
   ITS PURPOSE IS TO BUILD UNIT PRICES AT PIECE LEVEL.
2. THIS SHEET IS INTENDED AS AN INTERMEDIATE ACCESS FOR CONSTRUCTION.
3. THE CONSTRUCTION SHEET IS INTENDED FOR ASSEMBLY AND LAUNCH OF TUNNEL BORING MACHINES
   (TBMs) CONTAINING ONE FOR MINE TUNNELS SOUTHWARDS,
   AND FOR MINE TUNNELS NORTHWARDS.
4. THE SHAFT WILL HAVE AUXILIARY HOUSED TUNNELS TO ALLOW CONSTRUCTION PER OR SHELLS AND SECANT ACCESS.
5. SHAFT STRUCTURAL THICKNESSES AND
general dimensions are given with orientative purposes. Only actual design will require results of
technical investigation and assessment of the construction logistic needs.
6. THE SHAFT IS TO BE BACK FILLED AND CLOSSED AFTER CONSTRUCTION IS COMPLETED.
7. SECANT PILES ARE INCLUDED TO TAKE INTO ACCOUNT THE POSSIBLE PRESENCE OF SOILS
   AND VERY WEATHERED ROCK IN THE MELO. REWEBS ARE PROPOSED AS MAIN SUPPORT.

DOUBLE CIRCULAR SHAFT
WITH CENTRAL DIAPHRAGM
INTERMEDIATE WINDOW
AT ARRASTRE CANYON.
STA 870+00 TWIN SHAFT

SECTION
SCALE 1"=10'-0"
NOTES:
1. THIS DRAWING IS NOT ACTUAL DESIGN. ITS PURPOSE IS TO BUILD UNIT PRICES AT PEPD LEVEL.
2. THIS SHAFT IS INTENDED AS AN INTERMEDIATE ACCESS FOR CONSTRUCTION USE.
3. THE CONSTRUCTION SHAFT IS INTENDED FOR ASSEMBLY AND LAUNCH OF TUNNEL BORING MACHINES (TBMs) NORTHWARDS AND RECEIVING TBMs FROM SOUTH.
4. THE SHAFT WILL HAVE A LOGISTIC OPENING TUNNEL TO ALLOW CONCURRENT TBM SHIELD AND BACKUP ASSEMBLY.
5. SHAFT STRUCTURAL THICKNESSES AND SHEAR, SHEETING, OR OTHER WALL THICKNESSES THE FINAL DESIGN WILL REQUIRE RESULTS OF GEOTECHNICAL INVESTIGATION AND ASSESSMENT OF THE CONSTRUCTION LOGISTIC NEEDS.
6. THE SHAFT IS TO BE BACK FILLED AND CLOSED AFTER CONSTRUCTION IS COMPLETED.

DOUBLE CIRCULAR SHAFT WITH CENTRAL DIAPHRAGM
INTERMEDIATE WINDOW SOUTH OF I-210 INTERSECTION
STA. 1775+00 (E1 ALIGNMENT) / 1882+50 (REFINED SR14 ALIGNMENT)
DOUBLE CIRCULAR SHAFT WITH CENTRAL DIAPHRAGM INTERMEDIATE WINDOW SOUTH OF I-210 INTERSECTION STA. 1775+00 (ALIGNMENT E1) / 1882+50 (ALIGNMENT SR14)

SECTION
SCALE 1"=10'-0"
NOTES:
1. THIS DRAWING IS CONCEPTUAL AND NOT AN ACTUAL DESIGN. ITS PURPOSE IS TO BE A GUIDE TO DETERMINE PRICES AT PER LEVEL.
2. THE CONSTRUCTION TRENCH IS INTENDED FOR ASSEMBLY AND LAUNCH OF TUNNEL BORING MACHINES NORTHWARDS.
3. THE DESIGN OF THIS SHEET IS INTENDED TO BE DONE AT A MORE ADVANCED STAGE OF DESIGN WHEN SPECIFIC GROUND CONDITIONS, GEOTECHNICAL, HYDRAULIC, AND SEISMIC DESIGN CRITERIA AND SITE RESPONSE ANALYSIS ARE AVAILABLE.
4. GENERAL DIMENSIONS AND THICKNESSES ARE GIVEN WITH ORIENTATIVE PURPOSES ONLY.
TRANVERSE SECTION A
SCALE 1"=20'-0"

TRANVERSE SECTION B
SCALE 1"=20'-0"

NOTES:
1. THIS DRAWING IS CONCEPTUAL AND NOT AN ACTUAL DESIGN. ITS PURPOSE IS TO BE A GUIDE TO BUILD UNIT PRICES AT PEPD LEVEL.
2. THE CONSTRUCTION TRENCH IS INTENDED FOR ASSEMBLY AND LAUNCH OF TUNNEL BORING MACHINES NORTHWARDS.
3. THE DESIGN OF THIS SOE TO BE DONE AT A MORE ADVANCED STAGE OF DESIGN WHEN SPECIFIC GEOTECHNICAL INFORMATION, SEISMIC DESIGN CRITERIA AND SITE RESPONSE ANALYSIS ARE AVAILABLE.
4. GENERAL DIMENSIONS AND THICKNESSES ARE GIVEN WITH ORIENTATIVE PURPOSES ONLY.

FALL PROTECTION AND FLOOD PROTECTION IF REQUIRED (TYP) ANCHOR (TIE-BACK) AND BRACING BEAM
DIAPHRAGM SHAPED PANEL BOTTOM SLAB WITH TBM CRADDLES BARRETTES

FALL PROTECTION, AND FLOOD PROTECTION IF REQUIRED (TYP) ANCHOR (TIE-BACK) AND BRACING BEAM
DIAPHRAGM SHAPED PANEL BOTTOM SLAB WITH TBM CRADDLES BARRETTES

CALIFORNIA HIGH-SPEED RAIL PROJECT PALMDALE TO BURBANK ALIGNMENT E1/REFINED SR14
TBM LAUNCHING TRENCH AT PORTAL 4 (E1)/10 (REFINED SR14) STA. 1891+47.74 (E1)/STA. 1998+80.00 (REFINED SR14) (2 of 2)
3. THE SOE (SUPPORT OF EXCAVATION) FOR THE TUNNELS COULD BE DONE IN TWO ALTERNATIVE WAYS:

CONSTRUCTION METHOD 1: SOLDIER PILE WALL WITH TIEBACKS, PARALLEL TO THE EXISTING STREETS.
CONSTRUCTION METHOD 2: SOIL NAILING WALL, PERPENDICULAR TO THE ALIGNMENT.
NOTES:
1. THIS IN IS FORESEEN AS A DOUBLE PORTAL FOR SEM TUNNELS:
   TWIN TUNNELS NORTHWARDS AND TWIN TUNNELS, BIFURCATION &
   SINGLE TUNNEL SOUTHWARDS.
2. THE CHOSEN LOCATION IS THE CALMAT SUN VALLEY MINE, WHICH
   IS AT PRESENT EXCAVATED AT THE TUNNELS TOP DEPTHS,
   APPROXIMATELY.
3. THE SEE SUPPORT OF EXCAVATIONS FOR THE TUNNELS COULD BE
   DONE IN NO ALTERNATIVE WAYS:
   - CONSTRUCTION METHOD 1: SOLDIER PILE WALL WITH TIEBACKS,
     PARALLEL TO THE EXISTING STREETS.
   - CONSTRUCTION METHOD 2: SOIL NAILING WALL, PERPENDICULAR
     TO THE ALIGNMENT.

CALEIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT E2
INTERMEDIATE WINDOW 2
CONSTRUCTION AND SUPPORT
DETAIL 2

HIGH-SPEED RAIL AUTHORITY
CALIFORNIA

E. VELASCO
FJ. DOMINGUEZ

04/30/2021
1. This design represents the concept for the alternative Adit 2 at 1460+83 for Alignment E2.
2. All dimensions are indicative only and need to be checked in the detailed design to guarantee structural safety.
3. The vertical shaft is an alternative design to the adit constructed with an inclined gallery.
4. The structure of the shaft shall be designed for the following purposes:
   A. Nine and built edge fault chamber northwards
   B. Receive and dismantle TBMs from the southern direction
   C. Ensure adequate space for the installation of an crane with enough capacity for the needs of the construction.
   D. The shaft shall be completely reflected after the tunnel works have been concluded. All concrete elements between the surface level and a depth of 10m shall be demoulded and removed.
5. The structure of the shaft shall be designed to allow the installation of a crane with enough capacity for the needs of the construction.
6. The shaft shall be completed reflected after the tunnel works have been concluded. All concrete elements between the surface level and a depth of 10m shall be demoulded and removed.
7. The design is based on the expected favorable ground conditions with moderately soft to very hard granodiorite with low hydraulic conductivity.
8. The structure of the shaft is designed with the following components:
   - Secant pile wall forming a binocular shape
   - Angular RC beams at the top and base of the secant pile wall
   - Binocular steel fiber reinforced shotcrete lining down to the bottom of excavation
   - Water pressure relief pipes shall be installed to reduce the water pressure on the shotcrete lining
   - Intermediate RC wall in the center of the shaft
   - Service stairs and access for intermediate RC wall
   - Access ramp to allow the TBM break-in and the excavation and construction of the fault chamber
   - Pumps for water drainage
   - Access ramps and elevator
9. Secant piles are designed to take into account the possible presence of soils and/or very weathered rock in the first meters of the excavation. As no precise geotechnical information is available, a combination of moderately soft to very hard rock is assumed.
10. The structure of the shaft is designed with the following components:
    - Secant pile wall forming a binocular shape
    - Angular RC beams at the top and base of the secant pile wall
    - Binocular steel fiber reinforced shotcrete lining down to the bottom of excavation
    - Water pressure relief pipes shall be installed to reduce the water pressure on the shotcrete lining
    - Intermediate RC wall in the center of the shaft
    - Access ramp to allow the TBM break-in and the excavation and construction of the fault chamber
    - Pumps for water drainage
    - Access ramps and elevator
11. The design shown in this drawing corresponds to the conceptual PEPD of design and needs to be developed further to be valid for construction.

Disclaimer:
The design shown in this drawing corresponds to the conceptual PEPD of design and needs to be developed further to be valid for construction.
The Design Shown in this Drawing Corresponds to the Conceptual Pepd of Design and Needs to Be Developed Further to Be Valid for Construction.

Notes:
1. This design represents the concept for the Alternative ADIT 2 at 1460+82 for alignment E2.
2. All dimensions are indicative only and need to be checked in the detailed design to guarantee structural safety.
3. The vertical shaft is an alternative design to the ADIT constructed with an inclined gallery.
4. The structure of the shaft shall be designed for the following purposes:
   A. Mine and build no to fault chamber northwards.
   B. Receive and dismantle TMs from the southern direction.
5. The structure of the shaft shall be designed to allow the installation of a crane with enough capacity for the needs of the constructor.
6. The shaft shall be completely refilled after the tunnel works have been concluded. All concrete elements between the surface level and a depth of 10 ft shall be demolished and removed.
7. The design is based on the expected favourable ground conditions with moderately soft to very hard granodiorite with low hydraulic conductivity.
8. The structure of the shaft is designed with the following components:
   - RCBW forming a singular shape.
   - Annular RC beams at the top and base of the secant pile wall.
   - Annular steel fiber reinforced shotcrete lining down to the bottom of excavation.
   - Water pressure relief pipes shall be installed to reduce the water pressure on the shotcrete lining.
   - Intermediate RC wall in the center of the shaft.
   - ROCK bolts for anchorage of intermediate wall.
   - Bottom slab and all other necessary elements to allow the TBM break-in and the excavation and construction of the fault chamber.
   - Pumping pits.
   - Access stairs and elevator.
9. Secant piles are included to take into account the possible presence of soils where only rock excavation in the shaft methods of the excavation are not possible.
10. Contact between weathered and sound rock is supposed. It must be confirmed by geotechnical investigation.

Disclaimer:
This drawing corresponds to the conceptual design of the ALTERNATIVE ADIT 2 at 1460+82 for alignment E2. Dimensions are indicative only and need to be checked in the detailed design to guarantee structural safety.
NOTES:
1. SINGLE MINED TUNNEL, DOUBLE TRACK IS AN OPTION FOR SHORT TUNNELS AT BURBANK AREA.
2. EXCAVATION, GROUND SUPPORT, DRAINAGE, TUNNEL LINING AND WATER AND GAS TIGHTNESS PROVISIONS TBD.
3. FOR EQUIPMENT STRUCTURE CATEGORIES REFER TO DRAWINGS TN-C0004 TO TN-C007.
4. SPACE PROOFING REQUIRES FURTHER STUDY TO EVALUATE DYNAMIC AIRFLOW/PRESSURE LEVELS UNDER HIGH-SPEED OPERATING CONDITIONS. ONE TO FURTHER DEFINE SPACE ALLOTTED FOR STRUCTURES, EQUIPMENT, DRAINAGE AND EGRESS.
5. EMERGENCY EGRESS SHALL NOT BE FURTHER THAN 1000 FT APART (NFPA 130).
6. CROSSED SECTION SHOWS A FREE TUNNEL CROSS-SECTIONAL AREA OF 45 SQ FT. COMPLIANT WITH THE FARM AREA OF 2.5 X 12 FT REQUIRE GENERO LA MPE DESIGN. TUNNEL LENGTH FROM 0.6 TO 22 MILES (REF. TN /32-32). TUNNEL LENGTH REQUIRE A DIFFERENT MINIMUM FREE CROSS-SECTIONAL AREA.
7. SPACE PROOFING REQUIRES FURTHER STUDY TO EVALUATE DYNAMIC AIRFLOW/PRESSURE LEVELS UNDER HIGH-SPEED OPERATING CONDITIONS. ONE TO FURTHER DEFINE SPACE ALLOTTED FOR STRUCTURES, EQUIPMENT, DRAINAGE AND EGRESS.
**Table: Basic Quantities Per Ft of Tunnel**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Microperfs Canopy Installation (Every 30')</td>
</tr>
<tr>
<td>1</td>
<td>Excavation of Phase 1 and Application of Stabilization Layer of Shotcrete, Installation of Phase 1 Lattice Crossbeams, Installation of Phase 1 Underpinning at Right Tunnel Sides, Spraying of Reinforcing Shotcrete + 2 Layers of WWM and Spraying of Regulating Concrete, 1st Layer of WWM</td>
</tr>
<tr>
<td>2</td>
<td>Excavation of Phase 2 and Application of Stabilization Layer of Shotcrete, Excavation of Phase 1 Temporal Support and Installation of Phase 2 Lattice Crossbeams by Joining the Lattice Crossbeams Placed in Phases 1 and 2, Installation of Phase 2 Underpinning at Left Tunnel Sides, Spraying of Reinforcing Shotcrete + 2 Layers of WWM and Spraying of Regulating Concrete, 1st Layer of WWM</td>
</tr>
<tr>
<td>3</td>
<td>Excavation of Phase 3 and Application of Stabilization Layer of Shotcrete, Extension of Lattice Crossbeams at Both Tunnel Sides, Spraying of Reinforcing Shotcrete + 4 Layers of WWM and Spraying of Regulating Concrete</td>
</tr>
<tr>
<td>4</td>
<td>Excavation of Phase 4</td>
</tr>
<tr>
<td>5</td>
<td>Installation of Water and Gas Proofing Membrane</td>
</tr>
<tr>
<td>6</td>
<td>Installation of Inner (Secondary) Lining, 1st Invert, 2nd Invert, and 2nd Lifts of Shotcrete</td>
</tr>
</tbody>
</table>

**Notes:**
- Microperfs Canopy Placed with an Inverted Silt Fence to Prevent Erosion. No Groundwater Expected.
- Single-Wide Median Sand and WWM Silt Fence to Very Dense, No Groundwater Expected.
NOTES:

1. SINGLE MINED TUNNEL, DOUBLE TRACK is an option for short tunnels at Burbank area.

2. Excavation, ground support, drainage, noise limits and water and gas tightness provisions TBD.

3. FOR EQUIPMENT STRUCTURE GAUGES REFER TO DRAWINGS TN-C0004 TO TN-C0007.

4. SPACE PROVISIONS REQUIRES FURTHER STUDY TO EVALUATE DYNAMIC AIRFLOW/PRESSURE LEVELS UNDER HIGH SPEED OPERATING CONDITIONS, AND TO FURTHER DEFINE SPACE ALLOWED FOR STRUCTURES, EQUIPMENT, DRAINAGE AND EGRESS.

5. EMERGENCY EGRESS SHALL NOT BE FURTHER THAN 2500 FT APART (NFPA 130).

6. CROSS-SECTION SHOWN HAS A FREE TUNNEL CROSS-SECTIONAL AREA OF 27.12 SQ FT, WHICH MEETS THE US DOT REQUIREMENT FOR 55 MPH DESIGN SPEED AND TUNNEL LENGTH OF 22 MILES. REFER TO TN-C0012. SHEET TUNNEL LENGTH REQUIRE A DIFFERENT MINIMUM FREE CROSS-SECTIONAL AREA.

7. SPACE PROVISIONS REQUIRES FURTHER STUDY TO EVALUATE DYNAMIC AIRFLOW/PRESSURE LEVELS UNDER HIGH SPEED OPERATING CONDITIONS, AND TO FURTHER DEFINE SPACE ALLOWED FOR STRUCTURES, EQUIPMENT, DRAINAGE AND EGRESS.
NOTES:
1. FOR ALIGNMENT E2, TRACK REALIGNMENT DUE TO FAULT DISPLACEMENT Requires an ENLARGED TUNNEL DIAMETER OF 33.5 FT OVER THE NOMINAL 28 FT.

ALIGNMENT 1
SEM TWIN TUNNELS
& BIFURCATION ETD
[ENLARGED TUNNEL DIAMETER]

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT E2
SEM TUNNELS
TWIN TUNNELS AND BIFURCATION
TYPICAL CROSS SECTIONS

DESIGNED BY
E. VELASCO
DRAWN BY
FJ. DOMINGUEZ
CHECKED BY
W. GUO

CHARGE
LD

DATE
04/30/2021

REV DATE BY CHK APP DESCRIPTION
PEPD RECORD SET
REV 02
TN-C0904
AS SHOWN
 REV 01

CALIFORNIA HIGH-SPEED RAIL AUTHORITY
### Basic Quantities per Ft of Tunnel

<table>
<thead>
<tr>
<th>SEM TUNNELS</th>
<th>PRIMARY LINING AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCAVATION AREA (sq. ft.)</td>
<td>1241</td>
</tr>
<tr>
<td>PRIMARY LINING AREA (sq. ft.)</td>
<td>105</td>
</tr>
<tr>
<td>REGULATING CONCRETE (12 in. thick)</td>
<td>6</td>
</tr>
<tr>
<td>LATTICE GIRDER (ft)</td>
<td>90/120</td>
</tr>
<tr>
<td>WATER &amp; GAS PROOFING MEMBRANE (ft)</td>
<td>110</td>
</tr>
<tr>
<td>FORMWORK (ft)</td>
<td>19</td>
</tr>
</tbody>
</table>

| SECONDARY LINING AREA CONCRETE (in. thick) | 128 |
| SECONDARY LINING AREA CONCRETE (in. thick) | 128 |
| MICROPILES MIDDLE (ft) | 43 |
| MICROPILES FOR ELEMENTS (ft) | 9.5 |

### Phase Description

1. **Micropiles Canopy Installation (Every 30')**
   - Excavation of Top Heading and Application of Stabilization Layer of Shotcrete.
   - Installation of Underpinning and Lattice Girder.
   - Spreading Reinforced Shotcrete + 2 Layers of WWM, Spraying of Regulating Concrete.

2/3. **Removal & Excavation, Application of Stabilization Shotcrete**
   - Extension of Lattice Girder and Spreading of Reinforced Shotcrete + 2 Layers of WWM.

5. **Excavation of Invert**

4. **Spraying of Regulating Concrete Invert**

6. **Installation of Inner (Secondary) Lining (First, Inner; Second, Outer; and Crown)**

### Notes:

1. This SEM TUNNELS are an option for TUNNELS in Burbank Area only.
2. This Drawing is not an actual design.
4. Typical Support Measures and Inner Lining Thickness are Given. Actual Design Will Require Pile Results of Quality Geotechnical Investigation.
5. Design of Concrete, Including a Concrete Cover, Must Be Established in Accordance with Geotechnical Information Available.
6. Additional Ground Treatment in D.O. When Additional Geotechnical Information is Available for Expected Best Conditions That are Achieved to Achieve Safe Excavation Conditions.
7. The sections shown on this Drawing are Not Applicable in the Soil Quality Conditions Shown.
8. Tunnels Dimensions Accord to Usual Machinery Used in Open Tunnels, these dimensions must be Geometric to the Description That Will be Used in Construction.
9. Shotcrete and/or Fiber Glass Bolts Might be Required to Ensure Face Stability in Some Areas. A Further Study of Face Stability Must be Carried Out in Detailed Design.
NOTES:
1. SINGLE MINED TUNNEL, DOUBLE TRACK IS AN OPTION FOR SHORT TUNNELS AT BURBANK AREA.
2. EXCAVATION, GROUND SUPPORT, DRAINAGE, TUNNEL LINING AND WATER AND GAS TIGHTNESS PROVISIONS TBD.
3. FIXED EQUIPMENT STRUCTURE GAUGES REFER TO DRAWINGS TN-C0004 TO TN-C0007.
4. SPACE PROOFING REQUIREMENTS ARE TO EVALUATE DYNAMIC AIRFLOW/PRESSURE LEVELS UNDER HIGH SPEED OPERATING CONDITIONS, AND TO FURTHER DEFINE SPACE ALLOCATED FOR STRUCTURES, EQUIPMENT, DRAINAGE AND EGRESS.
5. EMERGENCY EGRESS SHALL NOT BE FURTHER THAN 2500 FT APART PER NFPA 130.
6. CROSS-SECTION SHOWN HAS A FREE TUNNEL CROSS-SECTIONAL AREA OF 1358.20 SQ FT, COMPLIANT WITH THE MINIMUM AREA OF 2x595.00 SQ FT REQUIRED FOR 25 MPH DESIGN SPEED AND TUNNEL LENGTH FROM 0.6 TO 22 MILES PER TN 2.42-C. SHORT TUNNEL LENGTH REQUIRE A DIFFERENT MINIMUM FREE CROSS-SECTIONAL AREA.
7. SPACE PROOFING REQUIREMENTS ARE TO EVALUATE DYNAMIC AIRFLOW/PRESSURE LEVELS UNDER HIGH SPEED OPERATING CONDITIONS, AND TO FURTHER DEFINE SPACE ALLOCATED FOR STRUCTURES, EQUIPMENT, DRAINAGE AND EGRESS.

ALIGNMENT E2 SEM SINGLE TUNNEL 2 TRACKS
ETD (Enlarged Tunnel Diameter)
NOTES:
1. SINGLE MINED TUNNEL, DOUBLE TRACK IS AN OPTION FOR SHORT TUNNELS AT BURBANK AREA.
2. EXCAVATION, GROUND SUPPORT, DRAINAGE, TUNNEL LINING AND OTHER AND GAS TIGHTNESS PROVISIONS TBD.
3. FOR EQUIPMENT STRUCTURE GAUGES REFER TO DRAWINGS TN-C004 TO TN-C007.
4. SPACE PROOFING REQUIRE FURTHER STUDY TO EVALUATE DYNAMIC AIRFLOW/PRESSURE LEVELS UNDER HIGH-SPEED OPERATING CONDITIONS AND TO DETERMINE SPACE ALLOWED FOR STRUCTURES, EQUIPMENT, DRAINAGE AND EGRESS.
5. EMERGENCY EGRESS SHALL NOT BE FURTHER THAN 2500 FT APART (NFPA 130).
6. CROSS-SECTION SHOWN HAS A FREE TUNNEL CROSS-SECTIONAL AREA OF 1358 SQ FT, COMPLIANT WITH THE SHOWN AREA OF 2x595 SQ FT REQUIRED FOR 22 MPH DESIGN SPEED AND TUNNEL LENGTH FROM 0.6 TO 22 MILES (REF. TN 2.42-C). OTHER TUNNEL LENGTH REQUIRES A DIFFERENT MINIMUM FREE CROSS-SECTIONAL AREA.
7. SPACE PROOFING REQUIRE FURTHER STUDY TO EVALUATE DYNAMIC AIRFLOW/PRESSURE LEVELS UNDER HIGH-SPEED OPERATING CONDITIONS AND TO DETERMINE SPACE ALLOWED FOR STRUCTURES, EQUIPMENT, DRAINAGE AND EGRESS.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT E2
TUNNEL TYPICAL SECTION AND DETAILS
SEM SINGLE TUNNEL, 4 TRACKS ETD
CLEARANCE DIAGRAM - TANGENT TRACK

ALIGNMENT E2
SEM SINGLE TUNNEL
4 TANGENT TRACKS
ETD
NOTES:
1. SEM TUNNEL TRANSITION DAY FROM STA. 1810+40 TO 1820+90 APPROX.
2. USE MINIMUM GROUND PILLAR WIDTH BETWEEN TUNNELS 16.5' TO 38.5 FT. OTHERWISE INCLUDE CONCRETE PILLAR.
3. FOR WIDTH BETWEEN TUNNELS 16.5' TO 38.5' IT WILL BE USED SECTION B. WHEN WIDTH IS REDUCED TO 16.5' SECTION D WILL APPLY.

ALIGNMENT E2 TRANSITION FROM SEM TWIN TUNNELS TO SEM SINGLE TUNNEL

<table>
<thead>
<tr>
<th>TUNNEL</th>
<th>STATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEM TWIN</td>
<td>FROM 1764+36.75 TO 1804+55</td>
</tr>
<tr>
<td>SEM RUNNING TUNNELS (A)</td>
<td>FROM 1804+40 TO 1820+90</td>
</tr>
<tr>
<td>SEM RUNNING TUNNELS (B)</td>
<td>FROM 1810+36 TO 1810+40</td>
</tr>
<tr>
<td>SEM SINGLE TUNNEL</td>
<td>FROM 1820+90 TO 1843+79</td>
</tr>
<tr>
<td>SEM SINGLE TUNNEL</td>
<td>FROM 1843+79 TO 1899+90</td>
</tr>
</tbody>
</table>

PLAN
SCALE 1"=300'-0"

CALIFORNIA HIGH-SPEED RAIL PROJECT PALMDALE TO BURBANK
ALIGNMENT E2 SEM TUNNELS IN BURBANK PLAN LAYOUT AND SECTIONS
### Basic Quantities Per Ft of Tunnel

<table>
<thead>
<tr>
<th>SEM TWIN TUNNELS</th>
<th>PRIMARY LINING TYPE</th>
<th>SOIL QUALITY *</th>
<th>PRIMARY LINING EXAMPLE ONLY, NOT ACTUAL DESIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCAVATION AREA</td>
<td>SOIL QUALITY A</td>
<td>1241</td>
<td>PRIMARY LINING TYPE</td>
</tr>
<tr>
<td>PRIMARY LINING AREA</td>
<td>105</td>
<td></td>
<td>1. TWIN SEM TUNNELS ARE AN OPTION FOR TUNNELS IN UBERHAIN AREA ONLY. (E2 ALIGNMENT)</td>
</tr>
<tr>
<td>REGULATING CONCRETE (sq ft)</td>
<td>6</td>
<td></td>
<td>2. THIS DRAWING IS NOT AN ACTUAL DESIGN. ITS PURPOSE IS TO BUILD UNIT PRICES AT PEPD LEVEL.</td>
</tr>
<tr>
<td>LATTICE GIRDER (ft)</td>
<td>90/40</td>
<td></td>
<td>3. EXCAVATION, GROUND SUPPORT, TUNNEL LINING AND WATER AND GAS TIGHTNESS PROVISIONS.</td>
</tr>
<tr>
<td>WATER &amp; GAS PROOFING MEMBRANE (ft)</td>
<td>120</td>
<td></td>
<td>4. TYPICAL SUPPORT MEASURES AND INNER LINING THICKNESS ARE GIVEN WITH ORIENTATIVE PURPOSES. ONLY ACTUAL DESIGN WILL REQUIRE RESULTS OF COMPLETE GEOTECHNICAL INVESTIGATION.</td>
</tr>
<tr>
<td>FORMWORK (ft)</td>
<td>99</td>
<td></td>
<td>5. EXCAVATION SEQUENCE AND PHASE (INCLUDING A POSSIBLE SUBDIVISION OF THE TOP HEADING) MUST BE REVISITED WHEN ADEQUATE GEOTECHNICAL INFORMATION IS AVAILABLE.</td>
</tr>
<tr>
<td>SECONDARY LINING AREA DOUBLE CONCRETE (sq ft)</td>
<td>128</td>
<td></td>
<td>6. ADDITIONAL GROUND TREATMENT IN LIEU OF GROUND IMPROVEMENT MIGHT BE ORDERED WHEN ADDITIONAL GEOTECHNICAL INFORMATION IS AVAILABLE AND EXPECTED GROUND CONDITIONS MAKE IT NECESSARY TO ACHIEVE SAFE EXCAVATION CONDITIONS.</td>
</tr>
<tr>
<td>SECONDARY LINING AREA CONCRETE (in)</td>
<td>121</td>
<td></td>
<td>7. THE SECTION SHOWN ON THIS DRAWING IS ONLY APPLICABLE IN THE SOIL QUALITY CONDITIONS INDICATED.</td>
</tr>
<tr>
<td>MICROPILES CANOPY (ft)</td>
<td>55</td>
<td></td>
<td>8. TUNNELS DIMENSIONS ACCORDING TO THIS DRAWING ARE TO BE ADJUSTED TO THE MACHINERY THAT WILL BE USED IN CONSTRUCTION.</td>
</tr>
<tr>
<td>MICROPILES FOR ELEPHANT'S FOOT (ft)</td>
<td>9.5</td>
<td></td>
<td>9. SHOTCRETE AND/OR FIBER GLASS BOLTS MIGHT BE REQUIRED TO ENSURE FACE STABILITY IN SOME AREAS. A FURTHER STUDY OF FACE STABILITY MUST BE CARRIED OUT IN DETAILED DESIGN.</td>
</tr>
</tbody>
</table>

### Notes
1. Twin SEM Tunnels are an option for Tunnels in Uherbain Area only (E2 Alignment).
2. This drawing is not an actual design. Its purpose is to build unit prices at PEPD level.
3. ExcaVation, ground support, drainage, tunnel lining and water and gas tightness provisions.
4. Typical support measures and inner lining thicknesses are given with orientative purposes. Only actual design will require results of complete geotechnical investigation.
5. Excavation sequence and phase (including a possible subdivision of the top heading) must be revisited when adequate geotechnical information is available.
6. Additional ground treatment in lieu of ground improvement might be ordered when additional geotechnical information is available and expected ground conditions make it necessary to achieve safe excavation conditions.
7. The section shown on this drawing is only applicable in the soil quality conditions indicated.
8. Tunnels dimensions according to this drawing are to be adjusted to the machinery that will be used in construction.
9. Shotcrete and/or fiber glass bolts might be required to ensure face stability in some areas. A further study of face stability must be carried out in detailed design.

### SEM Twin Running Tunnels
**Typical Geometry and Primary Lining**

- Microplates canopy installation (every 30')
- Excavation of top heading and application of stabilization layer of shotcrete.
- Installation of lattice girder.
- Spraying reinforced shotcrete + 2 layers of mud, spraying of regulating concrete.
- Overhang of elephant's foot.

2/3 - Excavation and application of stabilization shotcrete.
- Extension of lattice girder and spraying of reinforced shotcrete + 2 layers of mud.

4 - Excavation of invert.
- Spraying of regulating concrete invert.

5 - Installation of water and gas proofing membrane.

6 - Installation of inner (secondary) lining (first, invert; second, sides and crown).

### Notes
- Twin SEM tunnels are an option for tunnels in Uherbain area only (E2 alignment).
- This drawing is not an actual design. Its purpose is to build unit prices at PEPD level.
- Excavation, ground support, drainage, tunnel lining and water and gas tightness provisions.
- Typical support measures and inner lining thicknesses are given with orientative purposes. Only actual design will require results of complete geotechnical investigation.
- Excavation sequence and phase (including a possible subdivision of the top heading) must be revisited when adequate geotechnical information is available.
- Additional ground treatment in lieu of ground improvement might be ordered when additional geotechnical information is available and expected ground conditions make it necessary to achieve safe excavation conditions.
- The section shown on this drawing is only applicable in the soil quality conditions indicated.
- Tunnels dimensions according to this drawing are to be adjusted to the machinery that will be used in construction.
- Shotcrete and/or fiber glass bolts might be required to ensure face stability in some areas. A further study of face stability must be carried out in detailed design.
**CALIFORNIA HIGH-SPEED RAIL PROJECT**

**ALGONQUIN TO BURBANK**

**ALIGNMENT ED**

**SEM TWIN TUNNELS AND DIVERGENCE CONSTRUCTION SEQUENCE AND SUPPORT MEASURES**

**NOTES:**
1. **MIN.** DEEPENINGS ARE ONE OPTION FOR DEEPENINGS IN BURBANK AREA TUNNELS IS ALGONQUIN.
2. **MIN.** DEEPENINGS ARE ONE OPTION FOR DEEPENINGS IN BURBANK AREA TUNNELS IS ALGONQUIN.
3. **MIN.** DEEPENINGS ARE ONE OPTION FOR DEEPENINGS IN BURBANK AREA TUNNELS IS ALGONQUIN.
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8. **MIN.** DEEPENINGS ARE ONE OPTION FOR DEEPENINGS IN BURBANK AREA TUNNELS IS ALGONQUIN.

**CALIFORNIA HIGH-SPEED RAIL PROJECT**

**ALGONQUIN TO BURBANK**

**ALIGNMENT ED**

**SEM TWIN TUNNELS AND DIVERGENCE CONSTRUCTION SEQUENCE AND SUPPORT MEASURES**

**NOTES:**
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**CALIFORNIA HIGH-SPEED RAIL PROJECT**

**ALGONQUIN TO BURBANK**

**ALIGNMENT ED**

**SEM TWIN TUNNELS AND DIVERGENCE CONSTRUCTION SEQUENCE AND SUPPORT MEASURES**

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8. **MIN.** DEEPENINGS ARE ONE OPTION FOR DEEPENINGS IN BURBANK AREA TUNNELS IS ALGONQUIN.

**CALIFORNIA HIGH-SPEED RAIL PROJECT**

**ALGONQUIN TO BURBANK**

**ALIGNMENT ED**

**SEM TWIN TUNNELS AND DIVERGENCE CONSTRUCTION SEQUENCE AND SUPPORT MEASURES**

**NOTES:**
1. **MIN.** DEEPENINGS ARE ONE OPTION FOR DEEPENINGS IN BURBANK AREA TUNNELS IS ALGONQUIN.
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7. **MIN.** DEEPENINGS ARE ONE OPTION FOR DEEPENINGS IN BURBANK AREA TUNNELS IS ALGONQUIN.
8. **MIN.** DEEPENINGS ARE ONE OPTION FOR DEEPENINGS IN BURBANK AREA TUNNELS IS ALGONQUIN.
NOTES:
1. SINGLE SEM TUNNEL DOUBLE TRACK IS AN OPTION FOR SHORT TUNNELS AT BURBANK AREA.
2. 2D USES APPROXIMATE LEVEL, HIGH-SPEED RAIL AUTHORITY AMENDMENTS MAY BE APPLIED.
3. PASSIVE SUPPORT MEASURES MAY BE USED IN ADDITION TO ACTIVE MEASURES.
4. PASSENGER SERVICE SPEED LIMITS, TUNNEL LINING AND CONDITION ASA REQUIREMENTS ARE GOVERNED BY THE CONTRACT THUS THE CONTRACT DOCUMENTS WILL PREVAIL OVER THIS SHEET.
5. EXCAVATION SEQUENCE AND PHASES (INCLUDING AS A REQUIRED MODIFICATION OF THE TOP MOLDING UNIT FOR RELIEF OF AND SCHEDULE SCHEDULE OF EXCAVATION CONDITIONS TO BE DETERMINED.
6. THE SECTION SHOWN ON THIS DRAWING IS ONLY SPECIFIC TO THE SCENARIO CONDITIONS SHOWN.
7. TUNNEL CROSS-S SECTION IN DJ 09-05-2021 CONSTRUCTION SEQUENCE AND SUPPORT MEASURES ARE TO BE MODIFIED AS SHOWN IN CONSTRUCTION.
8. HIGHLIGHTED AREAS OF THE SUPPORT HAVE TO BE DEMOLISHED DURING CONSTRUCTION AS SHOWN IN PHASE DESCRIPTION TABLE.
9. SHOTCRETE AND/OR FIBER GLASS BOLTS MIGHT BE REQUIRED TO ENSURE FACE STABILITY IN SOME AREAS. A FURTHER STUDY OF FACE STABILITY MUST BE CARRIED OUT IN DETAILED DESIGN.
10. HIGHLIGHTED AREAS OF THIS SUPPORT HAVE TO BE DEMOLISHED DURING CONSTRUCTION AS SHOWN ON PHASE DESCRIPTION TABLE.

BASIC QUANTITIES PER FT OF TUNNEL

<table>
<thead>
<tr>
<th>PHASE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>MICROPILES CANOPY INSTALLATION (EVERY 30')</td>
</tr>
<tr>
<td>1</td>
<td>MICROPILES CANOPY INSTALLATION (EVERY 30')</td>
</tr>
<tr>
<td>2</td>
<td>MICROPILES CANOPY INSTALLATION (EVERY 30')</td>
</tr>
<tr>
<td>3</td>
<td>MICROPILES CANOPY INSTALLATION (EVERY 30')</td>
</tr>
<tr>
<td>4</td>
<td>MICROPILES CANOPY INSTALLATION (EVERY 30')</td>
</tr>
<tr>
<td>5</td>
<td>MICROPILES CANOPY INSTALLATION (EVERY 30')</td>
</tr>
</tbody>
</table>

TUNNEL TYPICAL SECTION SEM SINGLE TUNNEL ETD (2 TANGENT TRACKS SEPARATED FROM 16.5' TO 38.5')

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT E2
SEM SINGLE TUNNEL 4 TANGENT TRACKS ETD
CONSTRUCTION SEQUENCE AND SUPPORT MEASURES

[Diagram of tunnel section with detailed dimensions and sections labeled]
NOTES:
1. TYPES, LOCATIONS AND DIMENSIONS OF EXCAVATION SUPPORT NOT DESIGNED.
2. PERMANENT LINING ASSUMED WATERPROOF/UNDRAINED IN PERMANENT CASE.
3. STRUCTURE COMPONENTS ARE NOT DESIGNED. DRAWINGS NOT BASED ON ACTUAL DESIGN AND ARE DEVELOPED FOR PRELIMINARY COST ESTIMATE.
4. TRACK, GUTTER, CABLE DUCTS AND DRAINAGE ARE SCHEMATIC AND DO NOT REPRESENT DESIGN.
5. EQUIPMENT AND STRUCTURE GAUGES NOT SHOWN. REFER TO DRAWINGS TN-C0006 AND TN-C0007 FOR FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE.
6. TIEBACKS OR GROUND ANCHORS ARE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT GREATER THAN 20 FT. CANTILEVER SOLDIER PILE WALLS ARE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT LESS THAN 20 FT.
7. TYPICAL SECTION ON THIS SHEET IS APPLICABLE AT THE FOLLOWING LOCATIONS:

<table>
<thead>
<tr>
<th>Alignment</th>
<th>Begin STA</th>
<th>End STA</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1 &amp; E2 Central</td>
<td>481+50</td>
<td>486+50</td>
</tr>
<tr>
<td>E1 &amp; E2 Central</td>
<td>510+00</td>
<td>531+80</td>
</tr>
<tr>
<td>E1 &amp; E2 Central</td>
<td>537+60</td>
<td>539+00</td>
</tr>
<tr>
<td>E1 Central</td>
<td>2014+40</td>
<td>2036+60</td>
</tr>
<tr>
<td>Refined SR14 Central</td>
<td>2121+91</td>
<td>2143+10</td>
</tr>
</tbody>
</table>

* An open cut excavation will be required to a maximum vertical cut of 30 ft.
NOTES:
1. TYPES, LOCATIONS AND DIMENSIONS OF EXCAVATION SUPPORT NOT DESIGNED.
2. PERMANENT LINING ASSUMED WATERPROOF/UNDRAINED IN PERMANENT CASE.
3. STRUCTURE COMPONENTS ARE NOT DESIGNED. DRAWINGS NOT BASED ON ACTUAL DESIGN AND ARE DEVELOPED FOR PRELIMINARY COST ESTIMATE.
4. TRACK, GUTTER, CABLE DUCTS AND DRAINAGE ARE SCHEMATIC AND DO NOT REPRESENT DESIGN.
5. EQUIPMENT AND STRUCTURE GAUGES NOT SHOWN, REFER TO DRAWINGS TN-C0006 AND TN-C0007 FOR FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE.
6. TIEBACKS OR GROUND ANCHORS ARE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT GREATER THAN 20 FT.
NOTES:
1. TYPES, LOCATIONS AND DIMENSIONS OF EXCAVATION SUPPORT NOT DESIGNED.
2. PERMANENT LINING ASSUMED WATERPROOF/UNDRAINED IN PERMANENT CASE.
3. STRUCTURE COMPONENTS ARE NOT DESIGNED. DRAWINGS NOT BASED ON ACTUAL DESIGN AND ARE DEVELOPED FOR PRELIMINARY COST ESTIMATE.
4. TRACK, CABLE DUCTS AND DRAINAGE ARE SCHEMATIC AND DO NOT REPRESENT DESIGN.
5. EQUIPMENT AND STRUCTURE GAUGES NOT SHOWN. REFER TO DRAWINGS TN-C0006 AND TN-C0007 FOR FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE.
6. TIEBACKS OR GROUND ANCHORS ARE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT GREATER THAN 20 FT. CANTILVER SOLDIER PILE WALLS ARE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT LESS THAN 20 FT.

TYPICAL SECTION ON THIS SHEET IS APPLICABLE AT THE FOLLOWING LOCATIONS:

<table>
<thead>
<tr>
<th>ALT.</th>
<th>END-SEC.</th>
<th>BEGIN ST.</th>
<th>END ST.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.75'</td>
<td>E1 &amp; E2</td>
<td>12.75'</td>
<td>E1 &amp; E2</td>
</tr>
<tr>
<td>12.75'</td>
<td>CENTRAL</td>
<td>12.75'</td>
<td>CENTRAL</td>
</tr>
<tr>
<td>12.75'</td>
<td>SB</td>
<td>12.75'</td>
<td>SB</td>
</tr>
</tbody>
</table>
NOTES:

1. TYPES, LOCATIONS AND DIMENSIONS OF EXCAVATION SUPPORT NOT DESIGNED.

2. PERMANENT LINING ASSUMED WATER-TIGHT/UNGRADED IN PERMANENT CASE.

3. STRUCTURE COMPONENTS ARE NOT DESIGNED, DRAWINGS NOT BOUND ON ACTUAL DESIGN AND ARE DEVELOPED FOR PRELIMINARY COST ESTIMATE.

4. TRACK, CABLE DUCTS AND DRAINAGE ARE SCHEMATIC AND DO NOT REPRESENT DESIGN.

5. EQUIPMENT AND STRUCTURE GAUGES NOT SHOWN, REFER TO DRAWINGS TH-C0006 AND TH-C0007 FOR FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE.

6. TIEBACKS OR GROUND ANCHORS ARE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT GREATER THAN 20 FT.

7. RIGID EXCAVATION SUPPORT SYSTEM IS ANTICIPATED FOR VERTICAL EXCAVATION HIGHER THAN 70 FT. SUITABLE RIGID EXCAVATION SUPPORT SYSTEMS SUCH AS SLURRY WALLS OR TANGENT SECANT WALLS ARE ANTICIPATED FOR THIS TYPICAL SECTION.

8. TYPICAL SECTION ON THIS SHEET IS APPLICABLE AT THE FOLLOWING LOCATIONS:

<table>
<thead>
<tr>
<th>ALIGNMENT</th>
<th>BEGIN STA</th>
<th>END STA</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1 CENTRAL</td>
<td>2035+67.74</td>
<td>2052+57.74</td>
</tr>
<tr>
<td>REFINED SR14 CENTRAL</td>
<td>2143+10.00</td>
<td>2160+00.00</td>
</tr>
</tbody>
</table>

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT E1/REFINED SR14
SINGLE CELL BOX 2 TRACKS
CUT-AND-COVER TUNNEL
TYPICAL SECTION
NOTES:
1. TYPES, LOCATIONS AND DIMENSIONS OF EXCAVATION SUPPORT SYSTEMS ARE DESIGNED FOR TYPICAL CONDITIONS AS SHOWN ON THIS SHEET.
2. PERMANENT LINING ASSUMED WATERTIGHT/UNDRAINED.
3. STRUCTURAL COMPONENTS ARE NOT DESIGNED.
4. EQUIPMENT AND STRUCTURE GAUGES NOT SHOWN. REFER TO DRAWINGS TN-C0006 AND TN-C0007 FOR FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE.
5. EQUIPMENT AND STRUCTURE GAUGES NOT SHOWN. REFER TO DRAWINGS TN-C0006 AND TN-C0007 FOR FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE.
6. HIGH-SPEED RAIL AUTHORITY (H.S.R.A.) RECOMMENDS USING SLURRY WALLS AS ONE TYPE OF COMMON RIGID EXCAVATION SUPPORT SYSTEM SUCH AS TANGENT/SECANT PILES MIGHT BE CONSIDERED FOR THIS LOCATION. HEAVY REINFORCEMENT WILL BE REQUIRED.
7. TIEBACKS OR GROUND ANCHORS ARE ANTICIPATED FOR TYPICAL CASE.
8. CABLE DUCTS AND DRAINAGE ARE SCHEMATIC AND DO NOT REPRESENT DESIGN.
9. SLOPES OF EXCAVATION SHEETS ARE APPROXIMATE.
10. BURBANK 2123+75.74 2124+34.74 ALIGNMENT SUB-SECTION BEGIN STA END STA
11. TYPICAL SECTION ON THIS SHEET IS APPLICABLE AT THE FOLLOWING LOCATIONS:
   - INSTALL GROUND IMPROVEMENT ZONE (SEE NOTE 6)
   - CONSTRUCT BOTTOM GRADE SLAB AND TIE IN TO THE EXCAVATION SUPPORT AS A PERMANENT BRACING SYSTEM
   - INSTALL RIGID EXCAVATION SUPPORT SYSTEMS USING HEAVILY REINFORCED SLURRY WALLS
   - INSTALL MOVEMENT MONITORING SYSTEMS

LEGEND:
1. GROUND IMPROVEMENT ZONE (SEE NOTE 6)
NOTES:
1. TYPES, LOCATIONS AND DIMENSIONS OF EXCAVATION SUPPORT SYSTEMS, OTHER SUITABLE RIGID EXCAVATION SUPPORT SYSTEMS SUCH AS SECANT PILES MIGHT BE CONSIDERED FOR THIS LOCATION. HEAVY REINFORCEMENT TANGENT/SECANT PILES MIGHT BE CONSIDERED WITH AN EXPOSED HEIGHT LESS THAN 20 FT.
2. INSTALL GROUND IMPROVEMENT AS PERM. BRACING SYSTEM AS PERMANENT BRACING SYSTEM TO THE EXCAVATION SUPPORT AS A PERMANENT BRACING SYSTEM
3. INSTALL TIEBACKS AND/OR TEMPORARY BRACING AS REQUIRED FOR INTERNAL BRACING AS REQUIRED FOR STAGE 3 TO BOTTOM OF STATION/TUNNEL.
4. INSTALL MOVEMENT MONITORING SYSTEMS AFTER GEOTECHNICAL INVESTIGATIONS ARE COMPLETED.
5. INSTALL FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE. REFER TO DRAWINGS TN-C0006 AND TN-C0007 FOR FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE.
6. CONSTRUCT THE INTERIOR OF THE STATION/TUNNEL ROOF SLAB AND RESTORE THE GROUND WATERPROOF THE ROOF SLAB, BACKFILL AND TIE IN TO THE EXCAVATION SUPPORT SYSTEM.
7. CONSTRUCT BOTTOM GRADE SLAB AND TIE IN TO THE EXCAVATION SUPPORT SYSTEM.
8. CONSTRUCT STATION/TUNNEL ROOF SLAB AND INSTALL MOVEMENT MONITORING SYSTEMS.
9. CONSTRUCT PLATFORM TRACK SB TRACK AND INSTALL WATERPROOFING SYSTEM AS SHOWN.

CONSTRUCTION SEQUENCE:
1. EXCAVATE IN LIFTS FROM ORIGINAL GROUND HIGH-LEVEL RAIL AUTHORITY.
2. DEWATER AS NEEDED.
3A. INSTALL TIEBACKS AND/OR TEMPORARY BRACING AS REQUIRED FOR INTERNAL BRACING AS REQUIRED FOR STAGE 3 TO BOTTOM OF STATION/TUNNEL.
3B. INSTALL MOVEMENT MONITORING SYSTEMS AFTER GEOTECHNICAL INVESTIGATIONS ARE COMPLETED. INSTALL FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE. REFER TO DRAWINGS TN-C0006 AND TN-C0007 FOR FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE.
3C. CONSTRUCT THE INTERIOR OF THE STATION/TUNNEL ROOF SLAB AND RESTORE THE GROUND WATERPROOF THE ROOF SLAB, BACKFILL AND TIE IN TO THE EXCAVATION SUPPORT SYSTEM. CONSTRUCT STATION/TUNNEL ROOF SLAB AND INSTALL MOVEMENT MONITORING SYSTEMS.
4. INSTALL MOVEMENT MONITORING SYSTEMS AFTER GEOTECHNICAL INVESTIGATIONS ARE COMPLETED.
5. INSTALL FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE. REFER TO DRAWINGS TN-C0006 AND TN-C0007 FOR FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE.
6. CONSTRUCT THE INTERIOR OF THE STATION/TUNNEL ROOF SLAB AND RESTORE THE GROUND WATERPROOF THE ROOF SLAB, BACKFILL AND TIE IN TO THE EXCAVATION SUPPORT SYSTEM. CONSTRUCT STATION/TUNNEL ROOF SLAB AND INSTALL MOVEMENT MONITORING SYSTEMS.
7. CONSTRUCT BOTTOM GRADE SLAB AND TIE IN TO THE EXCAVATION SUPPORT SYSTEM.
8. CONSTRUCT PLATFORM TRACK SB TRACK AND INSTALL WATERPROOFING SYSTEM AS SHOWN.

CUT & COVER - 4 TRACKS + REFUGE TRACK

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT 41/REFINED SR14
SINGLE CELL 4 TRACKS + REFUGE TRACK
CUT-AND-COVER TUNNEL
TYPICAL SECTION
NOTES:
1. TYPES, LOCATIONS AND DIMENSIONS OF EXCAVATION SUPPORT SYSTEMS MAY NOT BE EXACT. ALL EXCAVATION SUPPORT SYSTEMS SHALL BE INSTALLED IN COMPLIANCE WITH THE CONTRACTOR'S PERMANENT DESIGN.
2. EQUIPMENT AND STRUCTURE GAUGES NOT SHOWN. REFER TO DRAWINGS TN-C0006 AND TN-C0007 FOR FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE.
3. STRUCTURE COMPONENTS ARE NOT DESIGNED. DRAWINGS NOT BASED ON ACTUAL DESIGN AND ARE DEVELOPED FOR PRELIMINARY COST ESTIMATE.
4. TYPICAL SECTION ON THIS SHEET IS APPLICABLE AT THE FOLLOWING LOCATIONS:

<table>
<thead>
<tr>
<th>ALIGNMENT</th>
<th>DRAWING NO.</th>
<th>CONTRACT NO.</th>
<th>SCALE</th>
<th>SHEET NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E2</td>
<td>TN-C1107</td>
<td>HSR14-42</td>
<td>AS SHOWN</td>
<td></td>
</tr>
</tbody>
</table>

CONSTRUCTION SEQUENCE:

1. INSTALL GROUND IMPROVEMENT
2. EXCAVATE IN LIFTS FROM ORIGINAL GROUND
3A. DEWATER AS NEEDED
3B. INSTALL TIEBACKS AND/OR TEMPORARY INTERNAL BRACING AS REQUIRED FOR THE SYSTEM STABILITY
3C. CONSTRUCT BOTTOM GRADE SLAB AND TIE IN TO THE EXCAVATION SUPPORT AS A PERMANENT BRACING SYSTEM
4. INSTALL MOVEMENT MONITORING SYSTEMS
5. CONSTRUCT THE INTERIOR OF THE STATION/TUNNEL (INTERIOR WALLS, SLABS, ETC.)
6. CONSTRUCT LOW-SLOPE PLANTING AREA
7. INSTALL RIGID EXCAVATION SUPPORT SYSTEMS USING HEAVILY REINFORCED SLURRY WALLS
8. WATERPROOF THE ROOF SLAB, BACKFILL AND RESTORE THE GROUND

LIMITS OF GROUND IMPROVEMENT TO BE DETERMINED AFTER GEOTECHNICAL INVESTIGATIONS ARE COMPLETED.

CABLE DUCTS AND DRAINAGE ARE SCHEMATIC AND DO NOT REPRESENT DESIGN.

GROUND IMPROVEMENT ANTICIPATED IN THIS AREA.

2. PERMANENT LINING ASSUMED WATERTIGHT/ UNDRAINED IN PERMANENT CASE.

1. TYPES, LOCATIONS AND DIMENSIONS OF EXCAVATION SUPPORT SYSTEMS MAY NOT BE EXACT. ALL EXCAVATION SUPPORT SYSTEMS SHALL BE INSTALLED IN COMPLIANCE WITH THE CONTRACTOR'S PERMANENT DESIGN.

THINGS TO CONSIDER:

- GROUND IMPROVEMENT ANTICIPATED IN THIS AREA.
- SLURRY WALLS ARE ONE TYPE OF COMMON RIGID EXCAVATION SUPPORT SYSTEM. OTHER SUITABLE RIGID EXCAVATION SUPPORT SYSTEMS SUCH AS CUT-AND-COVER TUNNELS MAY BE CONSIDERED.
- HEAVY REINFORCEMENT WILL BE REQUIRED.
- TIEBACKS OR GROUND ANCHORS ARE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT GREATER THAN 20 FT.
- CANTILEVER SOLDIER PILE WALLS ARE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT LESS THAN 20 FT.
- PB-RECORD-CUT-AND-COVER TUNNEL BID.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT E2
SINGLE CELL 4 TRACKS
CUT-AND-COVER TUNNEL
TYPICAL SECTION

CONSTRUCTION SEQUENCE:

1. INSTALL GROUND IMPROVEMENT
2. EXCAVATE IN LIFTS FROM ORIGINAL GROUND
3A. DEWATER AS NEEDED
3B. INSTALL TIEBACKS AND/OR TEMPORARY INTERNAL BRACING AS REQUIRED FOR THE SYSTEM STABILITY
3C. CONSTRUCT BOTTOM GRADE SLAB AND TIE IN TO THE EXCAVATION SUPPORT AS A PERMANENT BRACING SYSTEM
4. INSTALL MOVEMENT MONITORING SYSTEMS
5. CONSTRUCT THE INTERIOR OF THE STATION/TUNNEL (INTERIOR WALLS, SLABS, ETC.)
6. CONSTRUCT LOW-SLOPE PLANTING AREA
7. INSTALL RIGID EXCAVATION SUPPORT SYSTEMS USING HEAVILY REINFORCED SLURRY WALLS
8. WATERPROOF THE ROOF SLAB, BACKFILL AND RESTORE THE GROUND

LIMITS OF GROUND IMPROVEMENT TO BE DETERMINED AFTER GEOTECHNICAL INVESTIGATIONS ARE COMPLETED.

CABLE DUCTS AND DRAINAGE ARE SCHEMATIC AND DO NOT REPRESENT DESIGN.

GROUND IMPROVEMENT ANTICIPATED IN THIS AREA.

2. PERMANENT LINING ASSUMED WATERTIGHT/ UNDRAINED IN PERMANENT CASE.

1. TYPES, LOCATIONS AND DIMENSIONS OF EXCAVATION SUPPORT SYSTEMS MAY NOT BE EXACT. ALL EXCAVATION SUPPORT SYSTEMS SHALL BE INSTALLED IN COMPLIANCE WITH THE CONTRACTOR'S PERMANENT DESIGN.

THINGS TO CONSIDER:

- GROUND IMPROVEMENT ANTICIPATED IN THIS AREA.
- SLURRY WALLS ARE ONE TYPE OF COMMON RIGID EXCAVATION SUPPORT SYSTEM. OTHER SUITABLE RIGID EXCAVATION SUPPORT SYSTEMS SUCH AS CUT-AND-COVER TUNNELS MAY BE CONSIDERED.
- HEAVY REINFORCEMENT WILL BE REQUIRED.
- TIEBACKS OR GROUND ANCHORS ARE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT GREATER THAN 20 FT.
- CANTILEVER SOLDIER PILE WALLS ARE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT LESS THAN 20 FT.
- PB-RECORD-CUT-AND-COVER TUNNEL BID.

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT E2
SINGLE CELL 4 TRACKS
CUT-AND-COVER TUNNEL
TYPICAL SECTION

CONSTRUCTION SEQUENCE:

1. INSTALL GROUND IMPROVEMENT
2. EXCAVATE IN LIFTS FROM ORIGINAL GROUND
3A. DEWATER AS NEEDED
3B. INSTALL TIEBACKS AND/OR TEMPORARY INTERNAL BRACING AS REQUIRED FOR THE SYSTEM STABILITY
3C. CONSTRUCT BOTTOM GRADE SLAB AND TIE IN TO THE EXCAVATION SUPPORT AS A PERMANENT BRACING SYSTEM
4. INSTALL MOVEMENT MONITORING SYSTEMS
5. CONSTRUCT THE INTERIOR OF THE STATION/TUNNEL (INTERIOR WALLS, SLABS, ETC.)
6. CONSTRUCT LOW-SLOPE PLANTING AREA
7. INSTALL RIGID EXCAVATION SUPPORT SYSTEMS USING HEAVILY REINFORCED SLURRY WALLS
8. WATERPROOF THE ROOF SLAB, BACKFILL AND RESTORE THE GROUND

LIMITS OF GROUND IMPROVEMENT TO BE DETERMINED AFTER GEOTECHNICAL INVESTIGATIONS ARE COMPLETED.

CABLE DUCTS AND DRAINAGE ARE SCHEMATIC AND DO NOT REPRESENT DESIGN.

GROUND IMPROVEMENT ANTICIPATED IN THIS AREA.
NOTES:

1. TIEBACKS OR GROUND ANCHORS ARE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT GREATER THAN 20 FT. CANTILEVER SOLDIER PILE WALLS ARE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT LESS THAN 20 FT.

2. PERMANENT LINING ASSUMED WATERTIGHT/UNDRAINED IN PERMANENT CASE.

3. STRUCTURE COMPONENTS ARE NOT DESIGNED. DRAWINGS NOT BASED ON ACTUAL DESIGN AND ARE DEVELOPED FOR PRELIMINARY COST ESTIMATE.

4. EXCAVATION SUPPORT ANTICIPATED IN THIS AREA. OTHER SUITABLE RIGID EXCAVATION SUPPORT SYSTEMS SUCH AS SLURRY WALLS ARE ONE TYPE OF COMMON RIGID EXCAVATION SUPPORT SYSTEM. OTHER SUITABLE RIGID EXCAVATION SUPPORT SYSTEMS SUCH AS FORMWORK WITH BEARABLE BRACING ARE NOT SHOWN.

5. EQUIPMENT AND STRUCTURE GAUGES NOT SHOWN. REFER TO DRAWINGS TN-C0006 AND TN-C0007 FOR FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE.

6. STRUCTURE COMPONENTS ARE NOT DESIGNED. DRAWINGS NOT BASED ON ACTUAL DESIGN AND ARE DEVELOPED FOR PRELIMINARY COST ESTIMATE.

7. TIEBACKS OR GROUND ANCHORS ARE ANTICIPATED FOR WALLS WITH AN ExPOSED HEIGHT GREATER THAN 20 FT. CANTILEVER SOLDIER PILE WALLS ARE ANTICIPATED FOR WALLS WITH AN EXPOSED HEIGHT LESS THAN 20 FT.

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9. EQUIPMENT AND STRUCTURE GAUGES NOT SHOWN. REFER TO DRAWINGS TN-C0006 AND TN-C0007 FOR FIXED EQUIPMENT ENVELOPE AND STRUCTURE GAUGE.

10. CONSTRUCTION SEQUENCE:

<table>
<thead>
<tr>
<th>STAGE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. INSTALL MOVEMENT MONITORING SYSTEM</td>
</tr>
<tr>
<td>2. INSTALL RIGID EXCAVATION SUPPORT SYSTEMS USING HEAVILY REINFORCED SLURRY WALLS</td>
</tr>
<tr>
<td>3A. DEWATER AS NEEDED</td>
</tr>
<tr>
<td>3B. EXCAVATE IN LIFTS FROM ORIGINAL GROUND</td>
</tr>
<tr>
<td>3C. INSTALL TIEBACKS AND/OR TEMPORARY INTERNAL BRACING AS REQUIRED FOR THE SYSTEM STABILITY</td>
</tr>
<tr>
<td>4. INSTALL CABLE DUCTS AND DRAINAGE</td>
</tr>
<tr>
<td>5. CONSTRUCT BOTTOM GRADE SLAB AND TIE IN TO THE EXCAVATION SUPPORT SYSTEM AS A PERMANENT BRACING SYSTEM</td>
</tr>
<tr>
<td>6. INSTALL MOVEMENT MONITORING SYSTEMS</td>
</tr>
<tr>
<td>7. CONSTRUCT STATION/TUNNEL ROOF SLAB AND TIE IN TO THE EXCAVATION SUPPORT SYSTEM AS A PERMANENT BRACING SYSTEM</td>
</tr>
<tr>
<td>8. WATERPROOF THE ROOF SLAB, BACKFILL AND RESTORE THE GROUND</td>
</tr>
<tr>
<td>9. INSTALL CABLE DUCTS AND DRAINAGE</td>
</tr>
<tr>
<td>10. CONSTRUCT STATION/TUNNEL ROOF SLAB</td>
</tr>
</tbody>
</table>

LIMITS OF GROUND IMPROVEMENT TO BE DETERMINED AFTER GEOTECHNICAL INVESTIGATIONS ARE COMPLETED.

HIGH-SPEED RAIL AUTHORITY
CALIFORNIA

CALIFORNIA HIGH-SPEED RAIL PROJECT
PALMDALE TO BURBANK
ALIGNMENT ED
SINGLE CELL 4 TRACKS + REFUGE TRACK
CUT-AND-COVER TUNNEL
TYPICAL SECTION

CONSTRUCTION SEQUENCE:

<table>
<thead>
<tr>
<th>STAGE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. INSTALL MOVEMENT MONITORING SYSTEM</td>
</tr>
<tr>
<td>2. INSTALL RIGID EXCAVATION SUPPORT SYSTEMS USING HEAVILY REINFORCED SLURRY WALLS</td>
</tr>
<tr>
<td>3A. DEWATER AS NEEDED</td>
</tr>
<tr>
<td>3B. EXCAVATE IN LIFTS FROM ORIGINAL GROUND</td>
</tr>
<tr>
<td>3C. INSTALL TIEBACKS AND/OR TEMPORARY INTERNAL BRACING AS REQUIRED FOR THE SYSTEM STABILITY</td>
</tr>
<tr>
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<tr>
<td>5. CONSTRUCT BOTTOM GRADE SLAB AND TIE IN TO THE EXCAVATION SUPPORT SYSTEM AS A PERMANENT BRACING SYSTEM</td>
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<tr>
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<tr>
<td>7. CONSTRUCT STATION/TUNNEL ROOF SLAB AND TIE IN TO THE EXCAVATION SUPPORT SYSTEM AS A PERMANENT BRACING SYSTEM</td>
</tr>
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<td>8. WATERPROOF THE ROOF SLAB, BACKFILL AND RESTORE THE GROUND</td>
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<td>9. INSTALL CABLE DUCTS AND DRAINAGE</td>
</tr>
<tr>
<td>10. CONSTRUCT STATION/TUNNEL ROOF SLAB</td>
</tr>
</tbody>
</table>

LIMITS OF GROUND IMPROVEMENT TO BE DETERMINED AFTER GEOTECHNICAL INVESTIGATIONS ARE COMPLETED.
NOTES:
1. TYPES, LOCATIONS, AND DIMENSIONS OF EXCAVATION SUPPORTS SHOWN ARE NOT DESIGNED AND ARE FOR INFORMATIONAL PURPOSES ONLY.

2. PERMANENT LINING DESIGN IS REQUIRED TO BE DESIGNED AND TO BE PROVIDED.

3. STRUCTURAL COMPONENTS ARE NOT DESIGNED AND ARE FOR INFORMATIONAL PURPOSES ONLY.

4. WALLS, PLANTING PLANTING SYSTEMS ARE NOT DESIGNED AND ARE FOR INFORMATIONAL PURPOSES ONLY.

5. EQUIPMENT AND STRUCTURE SECTIONS SHOWN ARE NOT DESIGNED AND ARE FOR INFORMATIONAL PURPOSES ONLY.

6. GROUND IMPROVEMENT SHOWN IN THIS AREA MUST BE PERFORMED PRIOR TO BE DESIGNED WITHIN GEOLOGICAL INVESTIGATIONS ARE REQUIRED.

7. TYPE OF GROUND IMPROVEMENT SHOWN IN THIS AREA MUST BE PERFORMED PRIOR TO BE DESIGNED WITHIN GEOLOGICAL INVESTIGATIONS ARE REQUIRED.

8. TYPICAL SECTION SHOWN ON THIS SHEET IS APPLICABLE AT THE FOLLOWING LOCATIONS:

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TYPICAL SECTION - 4 TRACKS

CONSTRUCTION SEQUENCE:

1. INSTALL MOVEMENT MONITORING SYSTEMS
2. INSTALL TIEBACKS AND/OR TEMPORARY BRACING SYSTEM
3. INSTALL EXCAVATION SUPPORT SYSTEMS USING HEAVILY REINFORCED SLURRY WALLS
4. EXCAVATE IN LIFTS FROM ORIGINAL GROUND
5. CONSTRUCT BOTTOM GRADE SLAB AND TIE IN TO THE EXCAVATION SUPPORT AS A PERMANENT TUNNEL (INTERIOR WALLS, SLABS...)
6. WATERPROOF THE ROOF SLAB, BACKFILL AND RESTORE THE GROUND
7. INSTALL STATION/TUNNEL ROOF SLAB AND WATERPROOF THE ROOF SLAB, BACKFILL AND RESTORE THE GROUND
8. INSTALL THE GROUND IMPROVEMENT ECONOMICAL AND DESIGN. DRAWINGS NOT BASED ON ACTUAL DESIGN AND EMERGENCY (---)
9. INSTALL THE ECONOMICAL AND DESIGN. DRAWINGS NOT BASED ON ACTUAL DESIGN AND EMERGENCY (---)
10. INSTALL THE ECONOMICAL AND DESIGN. DRAWINGS NOT BASED ON ACTUAL DESIGN AND EMERGENCY (---)

CALIFORNIA HIGH-SPEED RAIL PROJECT
PAMDALE TO BURBANK
ALIGNMENT E1/EZ/REFINED SR14
OUT-AND-COVER TUNNEL
TYPICAL SECTION