CALIFORNIA High-Speed Rail Authority

SOUTHERN CALIFORNIA

# Palmdale to Burbank Project Section
# TUNNELING FACT SHEET


NORTHERN CALIFORNIA REGION
- San Francisco Salesforce Transit Center
- San Francisco 4th & King Station
- Millbrae (SFO)
- San Jose Diridon Station
- Gilroy
- Merced

CENTRAL VALLEY REGION
- Fresno
- Kings/Tulare Regional Station
- Bakersfield

BAKERSFIELD TO PALMDALE PROJECT SECTION
- Palmdale

PALMDALE TO BURBANK PROJECT SECTION
- Burbank Airport Station

BURBANK TO LOS ANGELES PROJECT SECTION
- Los Angeles Union Station

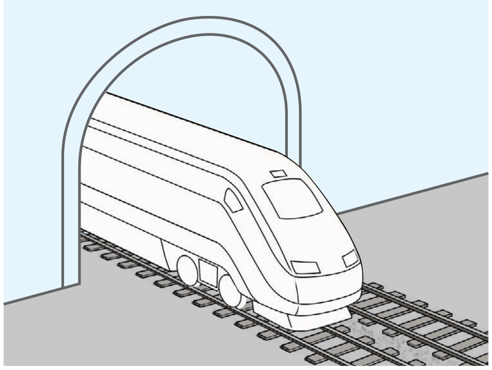
LOS ANGELES TO ANAHEIM PROJECT SECTION
- Anaheim

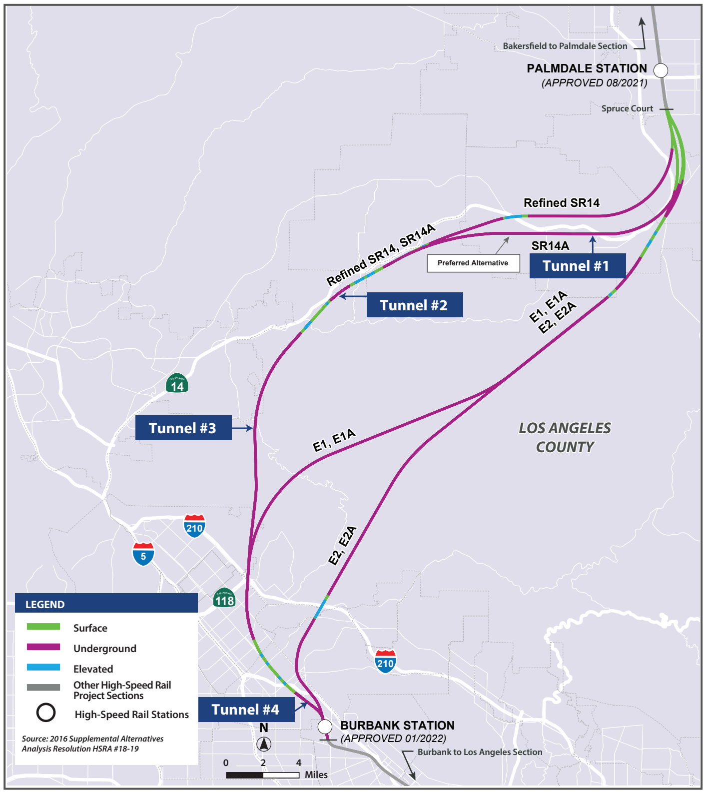
## Project Section Overview

Construction of California's high-speed rail system will require between 40 and 50 miles of tunneling through mountainous regions in both Northern and Southern California. The Palmdale to Burbank Project Section Preferred Alternative (SR14A) will feature approximately 28 miles of tunnels, including through the Angeles National Forest:

### Tunnel Options

- **Tunnel #1:** approximately 13 miles long
- **Tunnel #2:** approximately 1 mile long
- **Tunnel #3:** approximately 12 miles long
- **Tunnel #4:** approximately 1 mile long






*Map showing the locations of tunnels (purple) in the Palmdale to Burbank Project Section*

The mountainous terrain of the San Gabriel Mountains between Palmdale and Burbank necessitates tunnels. Without tunnels, steep grades and sharp curves will prevent trains from traveling safely at high speeds, up to 220 mph. Tunnels will permit the rail line to maintain a relatively straight and level path in such terrain. This includes crossing of the Angeles National Forest between the Antelope Valley and the San Fernando Valley, reducing travel times significantly.

The Angeles National Forest and other areas along the Preferred Alternative (SR14A) are also home to sensitive wildlife corridors, natural habitats, and ecologically sensitive lands. The California High-Speed Rail is designing a system with features aimed at avoiding, minimizing, and mitigating potential impacts to biological and aquatic resources that may result from construction and operation of the project. By tunneling portions of high-speed rail underground, the surface area will remain similar to today's conditions and maintain existing wildlife movement and habitat connectivity.

## INTERNATIONAL EXAMPLES

Because tunneling sections are among the most complex elements of the high-speed rail system, project engineers draw upon international expertise to deliver these tunnels for high-speed rail in the United States.

International examples include Japan and China, which are home to 14 of the 20 longest railway tunnels in the world; the United Kingdom, whose HS2 project connecting London and the West Midlands includes extensive tunnel sections; and Switzerland, Italy, and Austria, whose high-speed rail tunnels connect cities and countries located on opposite sides of the Alps. Many of these international examples are also in zones with seismic activity, similar to California and this project section, and their operational best practices to manage such risk have been reviewed in designing the California High-Speed Rail system.

## TUNNEL FAST FACTS

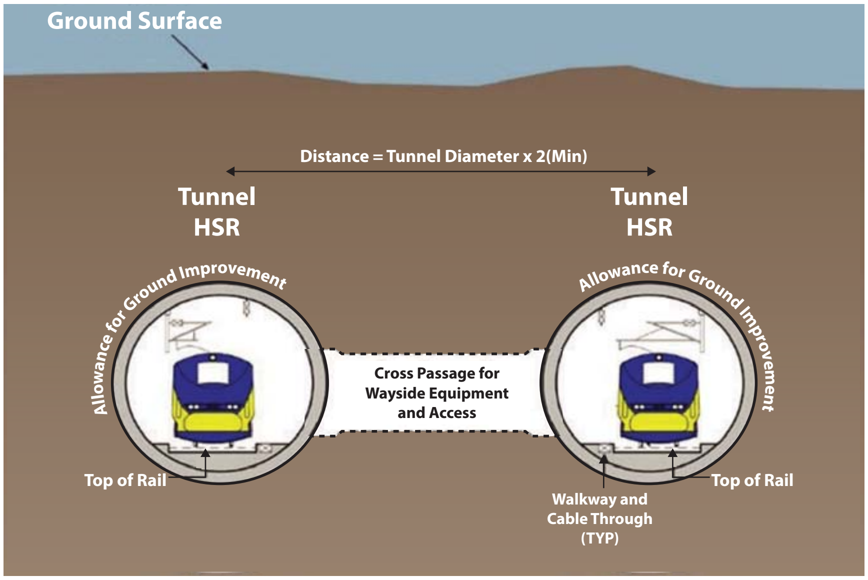
- At approximately 13 miles in length, Tunnel 1 is the longest contemplated tunnel for the Palmdale to Burbank Project Section Preferred Alternative (SR14A).
- High-speed trains can maintain high speed in the tunnels. A train traveling south will pick up speed as it leaves Palmdale, with the design capacity to reach up to 220 mph, and will continue at that speed until it exits the tunnel and joins the Metrolink corridor in the San Fernando Valley before arriving at the Burbank Airport station.
- The project section is designed to support a 13-minute nonstop travel time between Palmdale and Burbank through complex mountainous terrain.

## POTENTIAL CHALLENGES

The remote location of the tunnels in the Angeles National Forest contributes to challenges in surveying and construction. Issues the Authority considered in its Final Environmental Impact Report/Environmental Impact Statement related to tunneling include:

- Building infrastructure and resources to support construction: tunneling requires large amounts of water and electricity.
- Complex excavation and construction activities: tunneling necessitates excavation of large volumes of materials, which may result in increased dust, emissions, and traffic at the tunnel entrance and exit throughout the duration of construction activities.
- Geological conditions: rock formations, faults and shear zones, and potentially high groundwater inflows all affect tunnel stability and pose risks to biological and natural resources.

The Palmdale to Burbank Project Section Environmental Impact Report/Environmental Impact Statement (EIR/EIS) contains additional details that will guide permitting, investigations, and tunneling in sensitive areas.




*Illustrated cross-section showing the typical configuration of a dual-bore tunnel.*

## TUNNEL CONSTRUCTION METHODS

Typical methods of tunnel construction include:

- Tunnel boring machine (TBM), a rotating cutter head that breaks up rock and soil
- Roadheaders, which act like a dog's front paws as it digs through material
- Cut-and-cover technique, which involves the excavation and covering of a trench
- Blasting, the controlled use of explosives to break rock for excavation

Preliminary engineering analyses have identified TBM as the most likely means of construction of the high-speed rail tunnels in the Angeles National Forest. Roadheaders will be used to dig the cross passages, which are constructed at certain intervals to move equipment and for evacuations in an emergency. Cut-and-cover and sequential excavation method were evaluated as methods to be considered for the section leading into Burbank airport.

These methods will be confirmed in a future phase of design once the final design has been completed.

Learn more about tunneling here.

***https://www.youtube.com/watch?v=S9ZkO44YrdQ***

*Tunnel boring machines constructing a dual-bore tunnel.*

## TUNNEL SAFETY

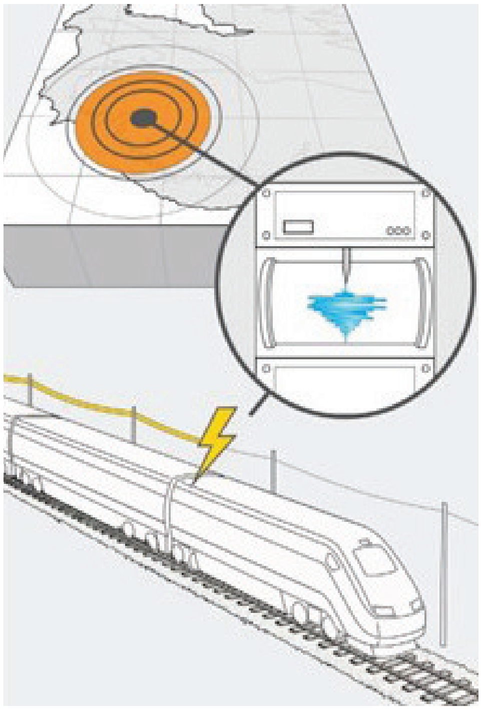
The Authority is using the best available practices from around the world to design safe tunnels. The design process includes identification of ground conditions, such as fault zones and liquifiable soil, and other measures to keep fault rupture and ground shaking hazards within established safety thresholds.

Also, tunnels need to be wide enough to account for the maximum displacement that an earthquake could cause, so tracks can be realigned, and service can be reinstated as quickly as possible.

The Authority has safety protocols in place in the event of an emergency occurring while the train is in a tunnel. Fire hazards are limited by adding ventilation and using noncombustible materials. Also, if the train needs to stop in a tunnel, cross passages or emergency exits will be available for passengers and workers to use for emergency evacuation.

The Authority will also be using an Earthquake Early Warning System (EEWS). The EEWS uses seismic stations to detect earthquakes that will send alerts to the California High Speed Rail system before the strongest shaking arrives.

All trains are autonomously brought to a stop when the detectors sense a seismic event of a certain magnitude, and other trains are prevented from entering the area. This type of technology was essential in bringing Japanese high-speed trains to a safe stop during the 9.1 magnitude Tohoku earthquake in 2011.



*A diagram of the EEWS detecting an earthquake and alerting a high-speed train.*

## Connect with Us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