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CALDECOTT
Fourth Bore Project

Project Fact Sheet

The Caldecott Fourth Bore Project is a partnership between the California Department of Transportation (Caltrans), the Contra Costa Transportation Authority (CCTA) and the Alameda County Congestion Management Agency (ACCMA) to build a two-lane fourth tunnel bore north of the existing three Caldecott tunnels. The Caldecott Fourth Bore Project will be built using federal, state, regional and county funds.

Project Overview

The Caldecott Fourth Bore Project is located on busy State Route 24 between Oakland and Orinda. The $420 million project will take approximately four years to build and includes two smaller projects that will enhance traffic flow in the vicinity of the tunnels, as well as a future project to landscape the area once the tunnel project is completed.

The tunnel construction contract includes a new two-lane tunnel north of the existing three bores, and construction of retaining walls and portals at the new tunnel openings, both temporary (during construction) and permanent sound walls at the West side, seven cross-passages between the third and fourth bore as emergency exits, various roadway improvements approaching and exiting the tunnel, demolition of an existing maintenance building and construction of a new operations and maintenance building and associated tunnel operations, communications and emergency response systems.

Specifics on the tunnel

Excavated Size:
Length – 1036 m (3399 ft)

Cross-Section:
15 m (50 ft) wide and 9.7 m (32 ft) high

Two 3.6 m (12 ft) traffic lanes with two shoulder areas 3 m (10 ft) and 0.6 m (2 ft) wide

Geologic Formations:
- Sobrante Formation with Marine Shale and Sandstone (Western End)
- Claremont Formation with Chert, Shale, and Sandstone (Middle)
- Orinda Formation with Non-marine Claystone, Siltstone, Sandstone, and Conglomerate (Eastern End)
- Four Major Faults and Three Minor Faults

Tunnel Structure:
The tunnel uses a double shell lining with plastic waterproofing membrane separating the linings

Volume of Shotcrete in Initial Lining: 19,732 cubic meters (696,294 cubic ft)

Volume of Concrete for Final Lining: 30,677 cubic meters (1,082,516 cubic ft)

Total Excavation Volume:
182,734 cubic meters (6,448,236 cubic ft) of insitu material

Estimated Excavation Time – 18.5 Months

Design Life:
75 Years

Seismic Design Criteria:
Safety – 1500 Yr. Earthquake

Operation – 300 Yr. Earthquake

East Portal simulation (far right)

West Portal simulation (far left)

State Route 24 between Oakland (Alameda County) and Orinda (Contra Costa County) serves as a major commuter access route in the East Bay of the San Francisco area.

Bores 1 & 2, built in the 1930s replaced the initial single lane "Kennedy Tunnel" built in 1903 as the first road tunnel through the Berkeley Hills. The third bore, built in the 1960's, added two more lanes and allowed the second bore to operate in both directions depending on the predominant flow of traffic.

With State Route 24 currently carrying about 160,000 vehicles per day traveling through the three tunnels, the new fourth bore will relieve congestion in the off-peak direction (eastbound in the morning and westbound in the afternoon), and eliminate the need to switch the direction of traffic flow in the middle bore to accommodate shifting traffic demands. When the Fourth Bore Project is completed, two bores will be permanently dedicated to westbound traffic and two bores to eastbound traffic.

Construction Methodology

The Caldecott Fourth Bore Tunnel will be constructed using the New Austrian Tunneling Method (NATM) or Sequential Excavation Method (SEM). Tunneling proceeds using specialized excavation equipment, in this case a roadheader, to carve out a prescribed distance of tunnel before installing an initial structural lining support system, consisting of shotcrete, lattice girders and rock-bolts. Once the excavated cross-section of tunnel is supported, excavation resumes for the next portion of the tunnel.

The roadheader, a large track-mounted machine with a rotating drilling head on the boom, grinds the exposed rock tunnel face, and deposits the cuttings on to a conveyor belt for discharging out of the back of the machine. Cuttings are then hauled out of the tunnel and off site. Shotcrete, concrete material sprayed with a pneumatic nozzle, is applied directly to the excavated rock face, and builds up in thick enough layers to seal the face from groundwater and support the tunnel arch and surrounding ground. Lattice girders span the circumference of the tunnel and get embedded in the shotcrete lining. Rock-bolts, long steel rods, are periodically drilled and installed to provide additional support of the tunnel in conjunction with the shotcrete lining. Once the tunnel has been excavated, a waterproof membrane is installed between the initial tunnel lining and final tunnel structural which gets cast in place with conventional concrete.

Key Facts About the Roadheader

The Wirth T3.20 (E 242) Boom-type roadheading machine is designed specifically for tunneling in medium to hard rock and is capable of cutting a cross-section up to 7.88 m (25.9 ft) high and 9.48 m (31.3 ft) wide from a single central position without moving. The telescopic boom allows the machine to be used in conjunction with the New Austrian Tunneling Method and also permits a further 1200 mm (3.9 ft) to be cut below the level of the crawler tracks.

The machine is equipped with a longitudinal rotary cutting head mounted on the end of a boom which can be raised, lowered and slewed from side to side by hydraulic rams. The boom is also telescopic, allowing the cutting head to be extended forward by up to 1.2 m (3.9 ft). In operation the cutting head is sumped into the face either by means of the crawler tracks or by telescoping the boom and the rock excavated in a milling action by vertical and horizontal movements of the boom.

Loading apron

The excavated material falls onto and in front of the loading apron which can be raised and lowered hydraulically to allow the machine to follow changes in vertical grade.

Conveyor

The central conveyor transfers the material from the loading apron through the main frame to the rear of the machine. At this point the muck is transferred on to a slewing belt conveyor, suitable for loading directly into trucks.

Machine Overall Weight Including Belt Conveyor:

130 tons

Length with Boom Retracted Without Belt Conveyor:

16860 mm (55.3 ft)
Height (without railing) 3940 mm (12.9 ft)

Height overall:

Max. cutting height

- boom extended 7880 mm (25.8 ft)
- boom retracted 7230 mm (23.8 ft)

Max. cutting width:

- boom extended 9480 mm (31.3 ft)
- boom retracted 8100 mm (26.6 ft)

Total installed power:

(1000 V) approx. 495 kW

FOR MORE INFORMATION

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