Over Seventy Attend Caldecott Tunnel Tours

RAY MAILHOT AND MIKE HART, CALTRANS DISTRICT 4 — MARCH 3, 2001

By Dan Day, from the April 2001 newsletter

Caltrans District 4 superintendents Ray Mailhot and Mike Hart led over seventy NCGS members, friends, and family on a tour of the historical Caldecott Tunnel. This major Bay Area traffic thoroughfare has a colorful history that highlights the obstacles, tragedies, and engineering achievements that are an intimate part of its lore.

The Superintendent Building at the west portal is an unassuming structure. But inside its walls feature historical newspaper clippings and other memorabilia that chronicle its major historical events. One spectacular tragedy imprinted on many visitors' minds is the infamous April 7, 1982, fiery crash that closed the tunnel's third bore for several days. The accident occurred in the early morning hours and involved an inebriated motorist whose disabled car stopped a gasoline tanker near the west tunnel exit. The truck was sideswiped by a bus that swerved to miss colliding with it. The ensuing fireball ignited by the collision killed seven people and melted the side panels off a beer truck trapped behind the vehicles. The fleeing tanker driver miraculously escaped unscathed. This was by far the most spectacular crash in the tunnel's 64-year history. But the ever-present threat of an accident in this heavily traveled commuter tunnel has honed the skills of Caltrans emergency response teams.

The tours reviewed tunnel keepsakes exhibited throughout the Superintendent Building that span the six decades of its operation: signs, computer terminals, telephones, and ubiquitous press clippings. But how did it all begin? Back in the 1880s a trip from Lafayette to Oakland took over 2 hours by stagecoach to traverse the steep ridges of the Berkeley Hills. Some encounters between horse-drawn vehicles on the steep summit roads were fatal. Talk of a tunnel joining Oakland and Berkeley on the Alameda County side with Orinda and Walnut Creek on the Contra Costa County side had been bantered around since the 1860s. Projects had been initiated and abandoned by the Oakland and Contra Costa Tunnel Company in the late 1870s, then revived by leading citizens in the 1890s. In 1903 the 1100 foot long single-lane Kennedy Tunnel was opened, circumventing the treacherous final 320 feet of the steep Summit Road route over the hills. In 1926, a special joint highway commission was formed to tackle the construction of the Berkeley Low Level Tunnel to join Berkeley and Orinda. The project was finally begun in December 1934, and the two-bore Broadway Tunnel, later renamed the Caldecott Tunnel in honor of highway district president Thomas F. Caldecott, was opened in November 1937.

The Caldecott Tunnel No. 1 and 2 bores are heavily reinforced concrete-lined arched structures 610 feet long and 34 feet high. The roadways are on the bottom level and accommodate two 11 foot-wide traffic lanes. Vertical roadway clearance is 14 feet 10 inches. The upper portion of the arches houses two ventilation chambers, one for fresh air intake and the other for tunnel exhaust. The tunnels are 15 feet apart at the portals and average 150 feet apart throughout their lengths. The tunnel construction posed significant engineering problems. Geologically, the rocks represent an Upper Cretaceous forearc basin formed by a convergent plate collision. Beginning at the west portal, the tunnel bores pass through lower Miocene deepwater cherty sediments and similar sediments of the middle to upper Miocene Claremont Formation (Monterey Group) which are overlain by fluvial to lacustrine terrestrial sediments of the Pliocene [late Miocene] Orinda Formation. The latter marks the transition of tectonic activity along the plate boundary from subduction to the San Andreas strike-slip regime. The upper Orinda sediments interfinger with the ~10 million year old basal volcanics of the Berkeley Volcanics [Moraga Formation]. The west end of the bore passes through highly fractured and crushed chert and shale less than 400 feet from the entrance that collapsed on August 28, 1935, filling 125 feet of the tunnel with debris, killing 3 workers, and affecting the ground surface 100 feet above. This catastrophe halted tunnel construction for several months and prompted a detailed geologic survey of the tunnel by the Six Companies of California, a consortium of six skilled construction firms that had been awarded the tunnel contract. Completed portions of the tunnels and a preliminary drift passing completely through the mountain were examined by the late Ben M. Page of Stanford University, then a student under Professor C. F. Tolman. Dr. Page's published report, "Geology of the Broadway Tunnel, Berkeley Hills, California" appears in *Economic Geology*, Volume 45, No. 2, March 1950, pages 142–166. It is an exceptionally well-written and detailed account of the tunnel's geology and its construction, with vivid descriptions of the unforeseen rock conditions underground that delayed its completion and increased its final cost.

After a second collapse on February 22, 1936, which fortunately injured no one, the tunnel construction continued until two years had elapsed. At that time the tunnel was about 70% complete, and the contractors were fined in accordance with the original contract for failing to complete the project on schedule. The contract had originally been awarded on a unit-cost basis for about $3.7 million. The Six Companies sued the highway district for $3.26 million and lost. The bores were finished by other companies using the same construction techniques, and were opened to the public on November 13, 1937. The final cost of the project was $4.2 million. A third tunnel bore was commissioned and completed after 3½ years in 1964 for a cost of $24 million. A fourth bore was planned but abandoned during Ronald Reagan's tenure as California Governor.

Construction of the original two-bore tunnel was described by superintendent Mike Hart who narrated a 20 minute silent film of the construction that had been edited from footage found in storage at the tunnel site. It shows the various engineering techniques used in the tunnel construction, and also gives an excellent account of living conditions in the Berkeley Hills at that time. Caltrans engineering geologist Grant Wilcox followed Mike with a superb description of the tunnel geology and engineering hazards, supplemented by a comprehensive discussion of the local geology by Caltrans geologist and Cal State Hayward geology graduate Chris Risden. Both provided an excellent description of rock lithology and engineering obstacles that had to be dealt with by the construction companies. Chris also displayed rock samples to illustrate the various units present in the tunnel vicinity.

The groups were then taken on tunnel tours. It should be noted that the tunnel system is ably manned by a staff of 22 persons filling three shifts per day, and include a console operator, a tunnel supervisor, and three operations people on each shift. Keep in mind that these personnel orchestrate the safe passage of 170,000 vehicles through the tunnels every 24 hour work day. The latter does not include the added headaches caused by major Bay Area entertainment and sporting events that affect the normal daily or weekend traffic routines. These situations must be dealt with separately. The tours first entered the west portal. There they were shown a mock-up of the tunnel lighting system. With the advent of newer sodium vapor lights, the lamps have been changed to improve illumination and save energy. Lighting is on full brightness during daylight hours and is dimmed at night when motorists are using their headlights. The next stop was the ventilation room. Here four 50 horsepower belt-driven squirrel-cage fans feed fresh air into the intake tunnels that enters the room through large louvered vents in the east wall. The fans are capable of forcing air into the intake tunnels at 50 mph. The air enters the distribution chamber above the roadway and is forced downward through vents where the floor meets the walls. The pressurized air enters the roadway below through slotted vents a few feet above the roadbed. The exhaust fumes are driven upward and out of the tunnel through another set of slots in the tunnel ceiling into the return exhaust duct. The Alameda County and Contra Costa County halves of the tunnel have separate ventilating systems.

The groups left the ventilation system and were taken behind the portal building, where Ray and Mike showed visitors the small canyon leading up the hillside to the east. The Oakland Hills fire of October 1991 made its way down to the west portal building and destroyed the welding room on the south side. Aside from this minor damage, the structure was undisturbed by the flames. After a short stop to look at the special equipment used to clean the tunnel walls, the groups were taken to the main control room in the third bore portal. The third bore was opened in 1964 and cost $24 million to construct. It gave Caltrans flexibility in handling large traffic volumes by allowing the second bore to be used as either an east or west bound lane depending on their needs. Its portal houses a control room with 8 video screens for monitoring not only Caldecott Tunnel traffic, but conditions elsewhere in the East Bay that have a direct effect on its vehicle load. Ultimately Caltrans will install 13 monitors. The tunnels are fitted with carbon monoxide sensors and a fiber optic system for tracking traffic flow and triggering the ventilation system when toxic gases build up. Ray and Mike noted that even if the ventilation system failed, it would take about 4 hours for the CO concentration to reach a dangerous level from vehicles stalled in the tubes. The groups were shown a diesel generator that can supply 480 volts at 60 hertz in the event of a power outage and a live demonstration of the pneumatically operated pop-up plastic dividers used to change lane direction in the second bore. The bright yellow plastic cylinders are remotely controlled by two-person drivethrough teams who also operate several changeable overhead message signs. The final stop on the tour was the two propeller-driven 100 horsepower intake fans capable of moving 250,000 cubic feet of air per minute at a top speed of 50 mph. A fourth tunnel bore is again under consideration, and its cost estimates range from $135 to $353 million depending on various design features. The design costs alone will run $26 million—more than the entire cost of the third bore!

The NCGS is truly indebted to Ray Mailhot and Mike Hart of the Caltrans Tunnel staff for leading the introduction to and the foot tours of the Caldecott Tunnel west portal. Our sincerest thanks also go to Caltrans Oakland Office Chief Geologist Grant Wilcox assisted by Caltrans Engineering Geologist Chris Risden. Both did an outstanding job of describing the local geology and the underground geological conditions encountered by the original tunnel contractors. These individuals deserve our appreciation for taking time from their busy schedules to show members how the tunnel was constructed and is being operated today.

NCGS member Jean Moran of Stetson Engineers and her husband Bill Martin deserve credit for arranging the two tours with Caltrans and for handling the usual registration duties quite admirably. Special thanks go to NCGS Counselor Phil Reed who provided the coffee, juice, and pasteries for the morning session, and the ice and beverages for the afternoon tour. The tours impressed upon everyone the teamwork and coordination that goes into the efficient operation of the Bay Area's crowded highway system.