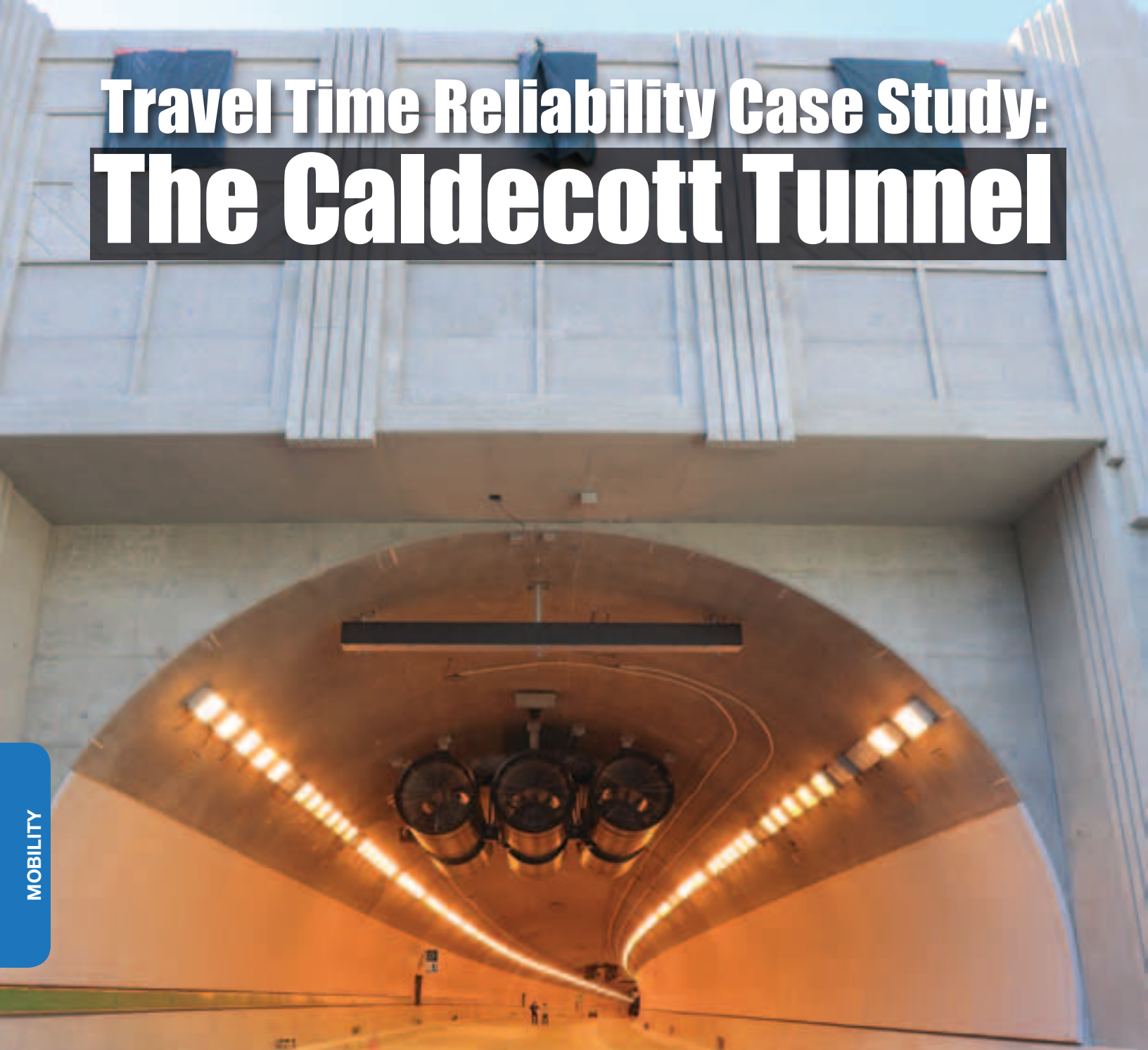
Travel Time Reliability Case Study: The Caldecott Tunnel



At Caltrans, we want to help reduce greenhouse gas emissions, and we want you to be able to reach your destination on time. Travel time reliability allows us to measure the benefits of projects such as the Caldecott Tunnel's new fourth bore, in the San Francisco Bay Area. The new bore has improved travel time reliability for drivers in the area.

A Reliable Commute

We have been measuring congestion on our state highway system, but now we are starting to analyze travel time reliability. Travel time reliability is not just the amount of congestion—it's how consistent congestion is each day. Travel reliability is often as important as reducing congestion. Reliability allows travelers to accurately predict how long it will take them to reach their destinations.

Consider the following example: Every weekday you drive 10 miles to work. You leave at the same time and take the same route. In free-flow traffic, your journey takes 15 minutes, but when you travel to work in the morning, you typically get caught in some traffic congestion and your journey takes 20 minutes. Sometimes you get stuck in bad congestion, and that same drive takes 30 minutes. Since you never know when congestion will be bad, you give yourself 30 minutes to get to work so you aren't late.

When Caltrans works to improve travel time reliability, we are trying to make it so that the 30-minute trip doesn't happen. Rather, the trip should always take 20 minutes in the morning. That means you'll find some congestion, but it will be consistent each day. It means you can spend an extra 10 minutes at home with your kids, eating breakfast, or even sleeping in a little longer—and still get to work on time.

How We Measure Travel Time Reliability

We are beginning to assess travel time reliability and evaluate if our projects and activities improve reliability. A common way we measure travel time reliability is to compare the 95th percentile travel time to the 50th percentile, or median, travel time. Simply put, if we evaluate your morning commute for 100 consecutive weekdays, we have 100 different travel times to analyze. We put those travel times in order from shortest to longest. The 50th longest trip is the median—half the trips were shorter and half were longer. The 95th longest, meaning 95 trips were shorter and only five were longer, is then compared to the 50th. If the trip is reliable, the 95th longest trip and the 50th longest trip are similar. If it is unreliable, there is a substantial difference between the two.

New Bore Makes Travel Time More Reliable

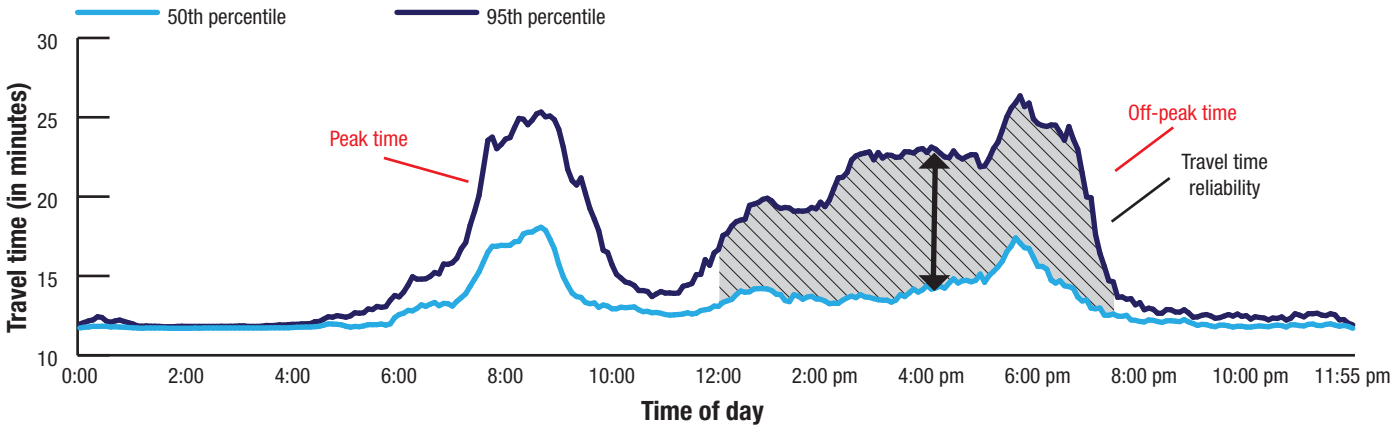
In November 2013, Caltrans completed the fourth bore of the Caldecott Tunnel on State Route 24 in the Oakland Hills. Each tunnel bore has two traffic lanes, for a total of eight lanes. When the tunnel had only three bores, or six lanes total, four lanes were used in the morning for the peak travel direction (westbound), and two lanes for the off-peak direction (eastbound). In the afternoon, one of the bores switched direction to alleviate rush-hour traffic. When only two lanes were open for the off-peak direction, drivers often experienced delayed traffic and incidents because traffic had to merge from four lanes to two to get through the tunnel. The new fourth bore improved travel time reliability in the off-peak travel direction, as well as made safety and emergency response improvements.

Caldecott Tunnel: Before and After

Caltrans uses vehicle detectors and the Performance Measurement System to analyze travel time reliability. The system stores and processes all of the vehicle detector data. We compared five months' worth of weekday travel times before construction started on the fourth bore (December 2009–April 2010) to weekday travel times after it was finished (December 2013–April 2014). We analyzed the stretch of State Route 24 from its junction with Interstate 580 near Oakland to its junction with Interstate 680 near Walnut Creek.

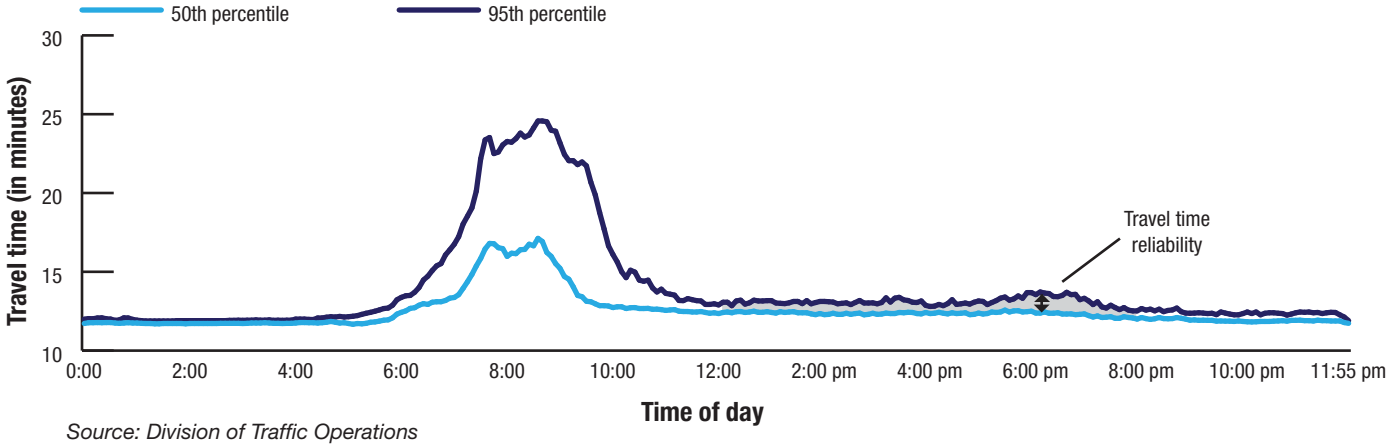
Before construction, the corridor's westbound direction was highly unreliable in the afternoon off-peak period. After construction, travel-time reliability improved significantly.

Westbound State Route 24
Before Construction: December 2009–April 2010



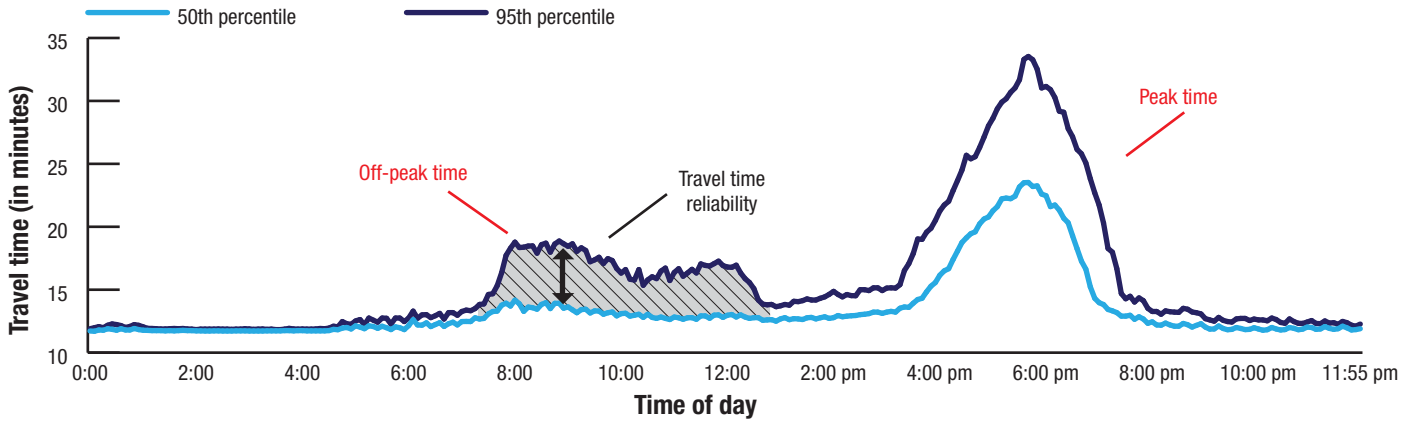
Important Point: **The closer the travel times are for the 95th percentile trip and the 50th percentile trip, the greater the travel time reliability.**

Westbound State Route 24
After Construction: December 2013–April 2014

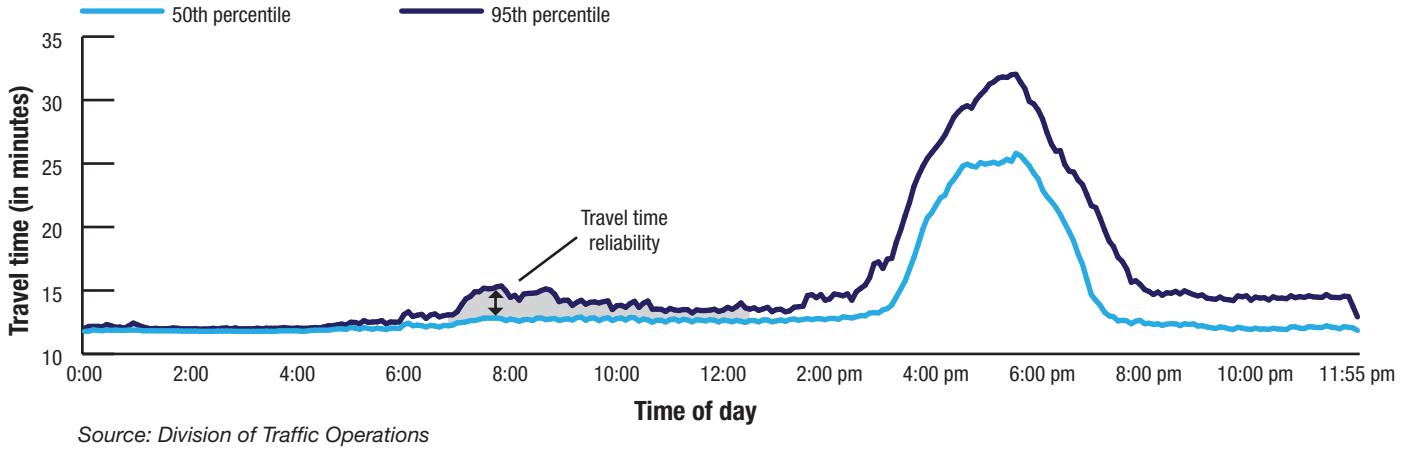


Source: Division of Traffic Operations

Eastbound State Route 24
Before Construction: December 2009–April 2010



Eastbound State Route 24
After Construction: December 2013–April 2014



Source: Division of Traffic Operations

Before the new bore was constructed, the corridor's eastbound direction was somewhat unreliable in the morning off-peak period. Similar to the westbound direction, congestion has been almost entirely eliminated in the off-peak period since the project was finished.

Travel time reliability is one way we can measure the benefits of improvement projects such as the Caldecott Tunnel Fourth Bore. Understanding reliability allows us to know if we are efficiently managing traffic or if we need to use additional measures such as ramp metering to regulate traffic flows onto the highway system, freeway service patrols to clear incidents, or electronic highway signs to notify travelers of conditions.

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