New Bay Bridge would be safe after quake but not unscathed

Lisa Vorderbrueggen, Bay Area News Group, 5-25-13

OAKLAND -- Ask many Bay Area officials how the new Bay Bridge will fare when the Big One strikes and their answers may be shaky.

They might describe the $6.4 billion span between Oakland and Yerba Buena Island in vague terms such as "safe" or "earthquake resistant."

Even several Bay Area Toll Authority members didn't know or misstated in recent hearings what specific level of earthquake forces the bridge is designed to withstand.

It has been so many years since the 1989 Loma Prieta earthquake caused a section of the upper deck on the old Bay Bridge to collapse and a motorist died, many people have forgotten how vulnerable massive man-made structures can be in a major temblor, even when they are bright, shiny and brand-new.

The Bay Area bought the seismically safest bridge that money, international expertise and cutting-edge technology can buy, and it's much safer than the cantilever truss bridge motorists use now.

But it isn't invincible.

An earthquake on par with the 1906 San Francisco shaker -- whose epicenter was much closer to the bridge than Loma Prieta's -- could affect the critical transportation crossing for hours or days, said Caltrans principal bridge engineer Brian Maroney during a daylong seismic tour this spring.

It would be drivable, Maroney said. But motorists could experience closed lanes and slow speeds as they contended with bridge sections that shifted inches or feet and jammed expansion joints that would have to be covered with steel plates. Repairs could take weeks or months.

"Local officials, planners and the public need to understand, 'Hey, don't think you are going to drive across the Bay Bridge after a major earthquake at 70 miles per hour sipping your coffee and reading your email,'" Maroney said. "There are no guarantees in earthquakes. We are going to have damage."

He voiced concern that a seismic knowledge gap among many community leaders in charge of carrying out post-earthquake recovery plans could leave cities and residents ill-prepared for driving conditions after a major quake.

"As a young engineer, I was lucky enough to be in the room when a lot of the decisions were made to build the new Bay Bridge to seismic standards that didn't even exist in California at the time," said Maroney, who has been working on the Bay Bridge since 1994. "But over the years, the story has been modified and the details about the challenges have been lost."

Bay Area Toll Authority Chairwoman and Orinda Councilwoman Amy Worth agreed.

"I know I need to understand more about what will happen on this bridge during an earthquake," Worth said. "Many of those seismic design discussions happened 15 years ago and a lot of that information has been lost in time for elected officials and the public."

Worth's seismic knowledge might have remained untested through the planned Labor Day opening celebration

if three dozen high-strength steel fasteners hadn't snapped on the new span in March.

The news sent elected officials scrambling to reassure themselves and the public that the broken bolts in one of the bridge's key seismic stabilizers weren't a symptom of bigger safety concerns.

Caltrans engineers have designed a fix they say will leave the new bridge just as seismically safe as it was before the faulty steel cracked.

But what does "safe" mean?

Technically, the bridge is being constructed to the highest seismic standards in California and perhaps the world: minimal damage and full access to normal traffic almost immediately after an earthquake with the strongest ground motions predicted in 1,500 years.

The definition of "normal" is open to interpretation. To engineers, "normal" means emergency vehicles, supply trucks and even commuters could still drive on the span, perhaps under reduced conditions, while "immediate" means a few hours or days, Maroney said.

For the average person, though, the standard reads as though the bridge will shudder a bit during a whopper of an earthquake and keep on hauling tens of thousands of vehicles a day with little interruption.

"If you ask most people what they expect on the new Bay Bridge after a quake, a majority will say they will be able to drive over it immediately," said Degenkolb structural engineer Chris Poland, a member of the Oakland-based Earthquake Engineering Research Institute. "But you run into problems with these kinds of promises. Engineers take every lesson they learn in past earthquakes and try to anticipate what will happen, but there is a great deal of uncertainty."

Caltrans first tightened its road and bridge specifications after a magnitude-6.6 quake in San Fernando in 1971 killed 65 people. The deadly 6.9 Loma Prieta temblor in 1989, and the 6.7 quake in Northridge in 1994 spurred more rigorous regulations.

Back in 1998 when the Bay Area chose the unique suspension and skyway design, the public was told it would withstand a magnitude-8.5 temblor on the San Andreas Fault and a 7.25 on the Hayward Fault.

Today, state engineers no longer cite a Richter scale magnitude. Instead, they say the Bay Bridge is designed to hold up after the strongest ground movement predicted during a 1,500-year period.

Modern ground movement prediction models factor the epicenter's distance to the site, the quake's depth and the rate at which the frequencies travel through the soil and rock.

"Magnitude matters but so does the location," Poland said. "If a 7.8 magnitude quake occurs on the San Andreas Fault just offshore of Daly City, the ground shaking at the Bay Bridge will be a lot different than it would be if it hits to the north near Mendocino."

But if the new span would be battered yet operational after a major quake, the bridge it is replacing would be devastated. That means collapse, deaths and economically crushing closures of months or years.

Few motorists anywhere are more vulnerable.

One of the busiest crossings in the nation, the existing Bay Bridge carries 280,000 vehicles a day within 15

miles of two earthquake faults in a region where scientists predict a 63 percent chance of a magnitude-6.7 shaker in the next 30 years.

The existing western span and its approaches, also built in 1936, were seismically retrofitted in 2004 and 2009 to the same earthquake standards as the new eastern span. After the new self-anchored suspension span and viaduct opens between Oakland and Yerba Buena Island, the full Bay Bridge upgrade will be complete.

"I've been a structural engineer for over 60 years and I've never seen a structure designed to a level as high as the Bay Bridge," said Joseph Nicoletti, who has been looking over Caltrans' shoulder since 1995 as a member of the agency's Seismic Advisory Panel. "That bridge is safer than the old one even with damaged bolts."

Senate Transportation Committee Chairman Mark DeSaulnier, D-Concord, doesn't share Nicoletti's confidence.

He was on the Metropolitan Transportation Commission in 1998 and voted for a bridge he was told would cost $1.1 billion and open in 2003. Since then, the design costs have soared sixfold to $6.4 billion, and the opening pushed out a decade, making the new crossing the most expensive public works project in California history.

"I want confirmation that we have gotten what we paid for, which is a true lifeline bridge," DeSaulnier said. "That said, we need to get it done. God help us if there's an earthquake before the new bridge opens and we have been dithering around."