

Hard truths about concrete ties

Research seeks improvements in fasteners and systems to prevent decay and ensure longevity

Replacing faulty concrete ties was once part of Massachusetts Bay Transportation Authority's business. In 2011, the railroad settled a lawsuit against a manufacturer whose faulty concrete ties began to crumble less than a decade after installation on Massachusetts commuter lines in 1997. The concrete ties had been marketed as having a 50-year life and were warranted up to 15 years.

In the agency's case, the problem ties lacked adequate steel reinforcement, causing the ties to split lengthwise over time as trains passed. An inadequate amount of water or poor quality aggregates can also result in concrete that won't stand up to the weight of trains or ordinary weather.

Problems like these beg the question: Can railroads rely on concrete ties? The answer is "yes," and research is unlocking more of the hard truths about concrete ties.



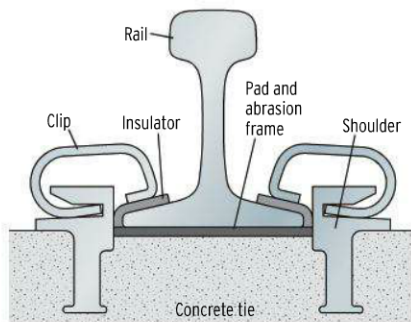
A Union Pacific worker stands guard at a grade crossing with newly laid and installed concrete ties between Williamsville and Elkhart, Ill., in December 2010. Steve Smedley

>> Clips and pads

More than 25 million concrete ties are in use on North American freight railroads out of an estimated 690 million total ties.

For more than 150 years, cut spikes and steel tie plates have been used to hold rails to timber ties. Spikes rely on the gripping power of timber to keep them in place and, in turn, keep rails from moving underneath a heavy train. They are still the predominant type of cross tie and fastening system in the U.S. On the most demanding lines, however, both passenger and freight railroads use concrete ties, including many high-speed rail lines.

Concrete ties use a system of clips, shoulders, and pads that ensure the rail is in alignment with the tie underneath. Rather than grip like spikes, steel shoulders cast into concrete ties provide an anchor for the clip to attach to. The system tends to maintain track geometry more consistently than traditional methods.



>> Water and fines

J. Riley Edwards is a research scientist and senior lecturer in the Rail Transportation and Engineering Center at the University of Illinois at Urbana-Champaign. He and his colleagues have been researching the issue and are focusing on the design and performance of ties in challenging operating conditions: locations with tight curvature, steep grades, or heavy tonnage. Riley says such conditions would stress any cross tie — timber, concrete, or otherwise.

Concrete ties can begin to fail when components of the fastening system work incorrectly, or when water or fine particles seep into the contact between the rail and tie, causing "rail seat deterioration" akin to grinding the pieces. If left alone, the untreated wear or flaws spread throughout the tie to the point where it fails.

"Where people see a concrete tie problem, most of the research we do indicates it's a system level problem that involves the tie and fastening system as a whole," Riley says.

>> Future 'tie'-ins

Concrete ties tend to meet or exceed expectations where they've been placed in service. Florida East Coast is a good example. The first of 74,000 ties were laid on that road in 1966. Riley says the FEC ties are successful because of Florida's mild winter weather, a relatively straight railroad, and modest 30-to-50 million gross tons of traffic per year. Similar results have been seen on other railroads with higher annual tonnages and more demanding track geometry. Riley says concrete ties will remain a practical piece of railroading. "We're working with all the major railroads, the tie manufacturers, the fastening system manufacturers, and we're committed to improving all these components," he says. "Our vision is that concrete ties and elastic fastening systems are an absolute necessity with heavy axle freight and shared passenger-freight railway operations."

SAYRE C. KOS, of Round Lake Park, Ill., is a frequent TRAINS "Technology" contributor.

Typical U.S. concrete ties

Weight: 600 to 750 pounds.
Length: 8 to 9 feet
Width: 8 to 13 inches
Height: 6 to 10 inches
Shapes: Rectangle, dog bone



Concrete ties weigh as much as 750 pounds each and stabilize track with their weight and tight fastenings. TRAINS: Brian Schmidt