

# Norfolk Southern, RTA Showcase Long-Term Research

## Field Trip To 23-Year-Old Test Site Eye-Opening For 50 Wood Tie Industry Members

### From Staff Reports

More than a quarter century ago, a concept was born that has led to a significant change in railroading today. That idea was to partner creosote with a diffusible wood preservative containing boron in a dual-treatment process to extend and maximize the useful life of hardwood crossies in track.

The success and commercialization of this technology has been reported on before, but the Railway Tie Association (RTA) and Norfolk Southern (NS) believed that one last look at the original test site might yield important information that would be of benefit to all railroads. Thus, an RTA Mini Field Trip to Cordele, Ga., sponsored and hosted by NS, was arranged for Feb. 16.

The test site that was revisited in this trip began in 1987 after many months of planning and discussion. Utilizing the pioneering work of Dr. Terry Amburgey of Mississippi State University (MSU), MSU, RTA and the Association of American Railroads installed borate pre-treated and dual-treated creosote ties in five test sections throughout the United States. The most *severe* location for service was a stretch of track in Cordele right along the borderline of the American Wood Protection Association's (AWPA) two most *severe* decay hazard zones 4 and 5.

This test was considered important to wood tie producers because several refractory (hard-to-treat) hardwood species, most notably one of the industry's most significant species, white oak, were failing in as few as seven to nine years in high-decay zones. The theory was that by using a diffusible preservative, disodium octaborate tetrahydrate (DOT), complete penetration of hard-to-treat species, even the heartwood, could occur, thus increasing the service life of the treated product.

It was hypothesized that the borates



Terry Amburgey and Jim Watt mark ties for removal in 2010 just prior to the field trip.



NS Track Supervisor Tom Thornhill delivers a safety briefing prior to the track walk.

would penetrate and protect the interior against wood-destroying organisms (decay, termites, etc.), while the traditional creosote treatment would weatherproof the outer portion of the treated product. In other words, researchers were hopeful that this technology could double, triple or even quadruple the service life of refractory species of hardwood crossies.

The site was monitored for several years, and in 2002 several white oak ties were pulled for destructive testing. During that testing, it was learned that even in these most severe conditions the white oak test ties were all in virtually perfect condition. There were no signs of decay, spikes were all tight, and the ancillary benefit of no iron degradation of the wood by rusting spikes was

observed. Borates are corrosion inhibitors as well as excellent wood preservatives.

The destructive testing also illustrated another key feature of borate preservative ►

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## Comparison Of Tie Conditions



Premature failure, such as the middle tie shown here, is what borate pre-treatments prevent.



An example of a creosote-only white oak tie failing after nine years of service.



In comparison, this center tie is a dual-treated test tie that remains in near perfect condition after 23 years of service.

technology. It became clear that because the borates remained mobile and would diffuse to the highest moisture locales inside a tie, protection was being delivered just where it was needed most. Decay fungi could never get a foothold in a tie and, thus, 15 years after the test's inception, the dual-treated ties were performing as if new.

But just how long will borates provide protection? Because they remain soluble in water and thus can move inside a tie to areas of greatest need, they also have the potential to leach out of the tie over time. Creosote had proven to be an effective barrier preventing significant borate loss for the first 15 years, but how long would this continue?

That is one of the questions 50 RTA members, including engineers, quality control staff, and purchasing directors from UPRR, CSX, BNSF, and, of course NS, along with tie and wood preservative manufacturers, tried to answer in their mid-February gathering.

The first stage of the trip actually occurred the week before event attendees were expected to arrive. Amburgey, along with Jim Watt of The Crosstie Connection and RTA Executive Director Jim Gauntt, traveled to Cordele to pull test ties for destructive testing and document any findings.

Twenty-seven ties were removed from track and cross-sectioned. It was clear from using the AWPAs' color test for borate presence and from the physical condition of the ties themselves that the dual-treatment process was still alive and well and protecting the ties from decay. Out of 27 ties, only two showed

any signs of decay and, even in those two ties, the spikes were still tight and hard to pull out.

These ties were set aside for the arrival of the field trip attendees where they would again be sectioned "live" to illustrate borate presence and the condition of the ties. That became the first stop of the day during the event.

In addition to reviewing all 27 ties, Jeff McCracken, assistant vice president maintenance-of-way for NS and host for the event, showed attendees two cross-sections of bridge ties that will be put in test that had been coated with a specialized polymer from Encore Rail. McCracken noted that in both the untreated tie sample and a creosote-only tie sample the polymer coating adhered flawlessly.

After the review of the test ties that had been sectioned, attendees traveled to the section of track where the ties had been in service for the past 23 years. There, during the track walk, each person was able to follow along with a guide who had been provided to explain more about the test ties that remained in track and more about some of the non-test ties in track that would soon be removed due to pre-mature failure. "This was the most eye-opening part of the trip for me," said George Caric of Tangent Rail.

Many people echoed that sentiment as they viewed white oak ties that had been placed in service after the test ties in 1987 but prior to NS adopting dual treatment as a standard in 2005. Approximately 20 creosote-only ties were marked that were hollowing out from decay, although they had only been in service from six to 13 years. Sitting right next to them were upwards of

270 remaining test ties that all were still sound and showing no signs of failure because they had been dual treated.

Kevin Hicks of UPRR remarked that there could be no better way to illustrate what all had gathered to see that day "than to walk this section of track and see the stark differences with our own eyes."

Following the track walk, attendees were invited to a luncheon and series of presentations hosted by NS.

Gauntt began the proceedings with thanks to all those who had made the day possible. Then he commented on one of the



Ties being sectioned by NS personnel.



Amburgey sprays color test reagent on sectioned ties.

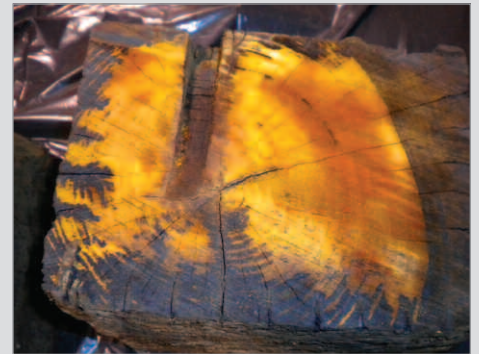
## Comparison Of Tie Conditions Based On Borate Treatment



As a reference point, this borate pre-treated tie from the 1987 test in Cordele was removed from track in 2002, sectioned and reagent applied to show borate retention.



These two Cordele ties are from the 2010 field trip and illustrate that borates remain present at efficacious levels throughout the center of the tie.



more important aspects of the efforts over the years. "Change in the railroad industry does not come easily or fast," he said. "But 23 years after this research was initiated, the fact that nearly a million dual-treated ties are now being installed annually by Class 1s is testament to the perseverance of those in this room. Had it not been for Norfolk Southern maintaining the in-service test site for over two decades and RTA working with others to keep a focus on this

research, the change that has occurred might never have been possible."

Gauntt continued by noting that the members of RTA should be proud of what it means to be part of a trade association like RTA. "Very few industries have an association with such a single-minded purpose as RTA. The dedication that RTA's leadership has exhibited over many decades, not getting side-tracked, but rather keeping RTA's aim on improv-

ing the performance of the wood crosstie, has resulted in RTA being a valuable industry asset to its members," he said.

McCracken outlined why NS had committed so strongly to dual treatments. "First, we know that this is saving us money by giving us significantly greater tie life. Second, we need to do everything we can to extend the resource. And third, we're not done yet." ►



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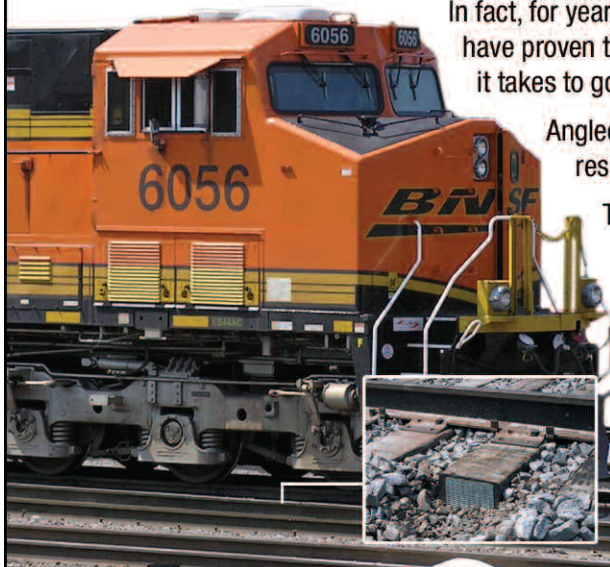
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**Amburgey of TaskPro discusses the excellent condition of the ties removed for further testing.**



McCracken said. “This technology will allow us to continue to experiment with creosote retentions to not only extend that resource in times of shortage but also to find savings there as we learn what the optimal combination of the two preservatives is.”

McCracken had also arranged for a presentation from the NS Communications and Signals (C&S) department. NS C&S Chief Engineer Mike Robinson gave a talk based on an abbreviated slide presentation made in 2005 to NS upper management by the then highest ranking C&S official at NS. “I was one of the stumbling blocks to using this product because I was concerned about how these ties could affect our signaling in track,” Robinson said. “But I am a true believer in dual-treated ties now.”

Robinson continued by giving the audience the history of NS research on track impedance with creosote-only and dual-treated tie installations. He noted that in their operating practices they have a maximum circuit adjustment range in most track applications of 44 to 48 percent.

“Installing new dual-treated ties required an 18 percent adjustment in the circuit, but we also found that installing new creosote-only ties required a 14 percent adjustment,” Robinson said. “The difference was negligible, and we haven’t seen anything in the past five years to cause concern about increasing usage of this technology.”

Robinson noted that NS would continue to monitor track circuitry exposed to increasing application of dual-treated ties. He went on to say that he did not expect any issues, because, in both cases noted above, a significant portion of the adjustments made was required just from the

introduction of the new ballast that is installed during a typical maintenance cycle.

NS participants Jack Hughes, senior research engineer, and Bill Rousis, director purchasing-engineering also made brief comments.

Rousis explained that a decision had been made to reduce creosote retentions in 2009 to a 6 pounds per cubic foot standard when using borate pre-treatments.

This change in specs had the effect of requiring 300,000 gallons less creosote for dual-treated ties.

At this point, Amburgey (now retired from MSU) along with Shane Kitchens who own and operate TASKpro, a company dedicated to solving wood preservation and deterioration problems, made the final presentation. He traced the research and commercialization from the beginning all the way through to the tests conducted within the past week. “The short

answer to the question, ‘Are the borates still working?’ is an unequivocal yes.”

Amburgey also reviewed quality control and other critical components of a successful commercial treating operation that utilizes a dual-treatment process. “I can’t stress enough the importance of establishing a repeatable and measurable production process,” he said. “Proper separation of species, proper delivery of the borates, sufficient diffusion time, and of course, proper delivery of the creosote at the specified retentions are mandatory quality control items for anyone producing these products.”

The presentations were followed by a vigorous question-and-answer session during which participants had ample time to vet the day’s events and presentations.

In closing, Gauntt said, “We may not have answered every question, such as how much longer the borates will continue to protect the ties in test in Cordele, but at 23 years and counting, it is apparent that triple the life of the average hard-to-treat tie is not too much to expect out of this unique process.” §



**Jeff McCracken of NS and Todd Wimmer of UPRR discuss ramifications of longer tie life with dual-treated ties.**



**The trip host, Jeff McCracken, leads the discussion on the engineering decisions behind the commitment to dual-treated ties.**



**50 RTA members gather for lunch and hear presentations from NS and TaskPro on the day’s events.**



**Clean, shiny spikes after 23 years of service illustrate boron corrosion-inhibiting properties.**