Protecting Wooden Railway Infrastructure For The Next Generation

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Scientists rarely have the opportunity to see a theoretical project become a commercial reality. Yet for TASKpro researchers, seeing such a project come to fruition, one that fundamentally changes the way industrial railway timbers are protected against wood-destroying organisms, has been a uniquely satisfying experience.

Over a quarter of a century ago, an idea was formulated to answer the problem of "properly" treated crossties failing due to decay in less than 10 years of service in the humid American Wood Protection Association (AWPA) Hazard Zones 4 and 5.

The challenge was to treat the interiors of wood species (e.g., white oak) that could not be treated by pressure processes with conventional oily or oil-borne preservative systems due to the physical structure of the wood cells.

When the wood cracked and split in service due to repetitive wetting and drying, untreated wood beneath the treated zone was exposed to the natural elements, resulting in attack by wood-destroying fungi and insects.

The same phenomena were happening to the untreated timbers on the air-dry yards prior to treatment, resulting in degrade and product devaluation. A cooperative project between the Railway Tie Association (RTA), Association of American Railroads (AAR), and Mississippi State University was developed and implemented to address these challenges through a 25+ year in-track evaluation, the results of which indicated that treating ties with the well-proven, safe and cost-effective Disodium Octaborate Tetrahydrate (DOT) prior to air-drying and creosote treatment resulted in a significant increase in crosstie service life.

Articles documenting the results of this project and related studies have been published in both *Crossties* (2003. May/June, p. 10, 12, 14-16; 2009. Nov/Dec, p. 20, 22) and the AWPA Proceedings (2006. 102:155; 2007. 103:109-111). As a result of these studies, DOT is gradually becoming the workhorse, in conjunction with conventional preservatives, for protecting large-dimension industrial timbers from biodegradation.

One of the major benefits of the current TASKpro borate program is that the sterilization cycle was eliminated during the treatment process since the borates prevent biodeterioration during air-drying. This benefit significantly reduces cylinder time per charge, which, in turn, increases the efficiency and reduces energy consumption of the treating plant.

TASKpro introduced a commercially viable application procedure (delivery and diffusion systems) for treating crossties with borates in 2003 and has developed the initial technical path based on the cooperative program. Several Class I railroads are currently utilizing this system to implement borate programs into their infrastructure procurement plans.

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Due to the nature of converting a research project into a commercial application, many alterations were made along the way and continue to be addressed to increase the efficiency and cost-effectiveness of a successful borate program. While borates are very easy to work with, the method of application/delivery of borates to a piece of wood requires a very broad understanding of wood anatomy and science.

It is also critical to have efficacy data on new or proposed procedures to ensure that the borate (1) is diffusing through and treating cell wall tissues as it moves into the interior of a large-dimension product (in contrast to simply existing inside the cell), and (2) remains mobile so that it can move through the wood, as moisture is introduced through checks, to the most critical areas for total protection.

Over the last nine years, TASKpro has worked to improve the application process (delivery and diffusion systems) addressed many industry questions (e.g., borate loss during air-drying and in-track, electrical conductivity and corrosion as it relates to spike kill) and currently has several ongoing projects to further increase the system's efficiency, broaden the materials treated, and quantify the overall benefits of treating non-seasoned white ties with borates

One major treating plant is cooperating in an air-drying study of borate-treated and non-borate ties, and yet another major treating plant is currently evaluating the study plan for possible cooperation. These two plants are also evaluating the maxxBOR™ quality control program developed by TASKpro that will allow for a precise long-term treatment plan and record log of all products treated at individual plants. This certification/quality control program will function as a "third-party" independent testing and evaluation tool that will allow long-term tracking, management, and ultimately certification of the borate-treated products to ensure that a standard product is produced year in and year out.

As new products and processes come online, this certification program may become an important tool for railroads in the development, implementation and management of current and future borate programs for protecting wooden railway infrastructure.

In addition to this quality control program development TASKpro researchers continue to invest in many "behind the scenes" projects. One such project is designed to quantify the benefits of borate-treated products in air-dry yards. Others include finalizing, then implementing, the initial stages of a total quality control program for any borate treated products, increasing the efficiency of the delivery and diffusion systems for commercial borate applications, evaluating existing and researching new and improved over-treatments for borates, developing new concepts for treating bridge timbers and switch ties, and developing a new concept for treated wooden tie plugs, and creating supplemental and remedial treatments for in-track ties and those removed from service.

Of these, one of the most important is evaluating the secondary preservative system (over-treatment) used with borate-treated ties. Through the earlier stages of the commercialization process it was learned that the current industry standard over-treatment (creosote) could be reduced by as much as 30-50 percent by implementing the borates into the wood protection programs. Since the function of the secondary preservative system is largely to provide water repellency over the top of a borate reservoir, TASKpro is exploring using the current "over-treatments" at even lower retentions than now specified or developing or using systems that also add not only the necessary water repellency but also other qualities to the ties.

It is believed that there are many more improvements that can be made to increase the service life of railway wooden infrastructure components and, in cooperation with RTA members, research will continue the push to improve current wood protection systems and create new systems, all the while maintaining the scientific justification needed to ensure long service life from the treated products.

For instance, can borate-treated ties be produced for use in urban areas or in bridge applications that are not oily, are odorless, and have surfaces that are clean or pigmented to present different colors to the public? What about blue or green crossties, switch ties, or trestles to allow visual identification of new systems in use? Do all of the secondary treatments need to contain registered biocides? Do all of these treatments need to be equally effective in providing water repellency and/or provide efficacious data against wood destroying organisms? Can the Boulton cycle be eliminated through the implementation of creative wood science principles when treating switch ties, bridge timbers rush orders?

These questions are being looked at by the TASKpro research team and participating RTA members and who knows…one of these may be the next innovation for increasing the biological durability and improving the performance of timber railway infrastructure. ■