# Copper Naphthenate Treatment Usage in Wood Sign Posts

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16. Abstract

This report concludes the final phase (phase 2) of the research project for the Evaluation of Wood Species and Preservatives for WisDOT Sign Posts (WisDOT SPR#0092-13-15). The usage of copper naphthenate wood preservative was evaluated in a field test to determine actual performance and resulted in no warpage and no corrosion on the aluminum signs.

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# Contents

# Introduction

The Wisconsin Department of Transportation (WisDOT) performed a study on the effects of copper naphthenate treatment on wood sign posts. This report concludes the final phase of the research project for the Evaluation of Wood Species and Preservatives for WisDOT Sign Posts (WisDOT SPR#0092-13-15). Phase 1 of the project was the literature review portion of the research, which concluded with the October 2013 Research Report. Phase 2 of the project was a two-year field review of a test section of signs installed on Copper Naphthenate treated wood posts on USH 51 in the Township of Windsor in Dane County.

# Background

## Copper Naphthenate

Copper naphthenate is an oil-based treatment that will decrease the warping of the posts. Copper naphthenate posts are a similar weight to other types of post treatments, however, copper naphthenate can have an undesired look and odor. According to the United States Environmental Protection Agency "Copper naphthenate was first registered in 1951 and is used to brush, dip, spray, and pressure treat wood that will be used in ground contact, water contact, and above ground such as utility poles, docks, posts, piers, fences, and landscape timbers. Copper naphthenate is effective in protecting wood against insect damage" (EPA.gov). Copper naphthenate can be dissolved in multiple solvents, however, heavy solvent is typically used for ground-contact applications (Lebow 181).

In one study, lumber treated with lower retentions of copper naphthenate has an estimated longevity of 65 years; however, lumber treated with higher retentions of copper naphthenate had lower average lives of 30 years.

## Chromated Copper Arsenate (CCA)

Chromated Copper Arsenate or CCA is defined by EPA as a "group of pesticides containing chromium, copper, and/or arsenic that protect wood against termites, fungi and other pests that can degrade or threaten the integrity of wood products. Chromated arsenicals-treated wood is used to produce commercial wood shake, shingles, permanent foundation support beams and other wood products" (EPA.gov). According to Lebow, "chromated copper arsenate (CCA), or 'green-treated' wood, has been widely used since the early 1940s and was the most widely used type of treated wood from the 1970s through the early 2000s. Although the use of CCA was partially restricted in 2004, CCA Type C (CCA-C) continues to be used for the treatment of poles, piles, and heavy timbers" (Lebow 181).

## Alkaline Copper Quaternary (ACQ)

Alkaline Copper Quaternary or ACQ is defined by the EPA as a "water-based wood preservative that prevents decay from fungi and insects (i.e., it is a fungicide and insecticide). It also has relatively low risks, based on its components of copper oxide and quaternary ammonium compounds" (EPA.gov). ACQ treatments leave a surface that is dry and paintable and is registered to be used on fence posts, building and utility poles, land, freshwater and marine pilings, sea walls, decking, wood shingles, lumber, timbers, landscape ties and other wood structures.

## WisDOT Current Practices

Currently WisDOT only allows the use of CCA as a treatment for wood posts. This method is permitted because it is inexpensive and effective; however, CCA is considered a Restricted Use Pesticide by the U.S. Environmental Protection Agency, and it is possible that it may not be available in the future. Another

potential issue with CCA is that product is water based, and, in turn, permits more moisture to be absorbed, which ultimately dries out any treated materials causing posts to warp.

WisDOT has, in the past, tried ACQ. The ACQ treatment was unsuccessful because the treatment caused corrosion to the aluminum signs, which in turn, resulted in signs falling off of posts. Evidence of the corrosion was most commonly found around the bolt holes.

## Findings

WisDOT conducted an experiment in order to determine how copper naphthenate treated posts affect aluminum signs. A test segment of 151 traffic signs was installed near Windsor, Wisconsin. The segment was installed during mid-summer of 2015. Signs followed Wisconsin DOT typical installation of signs with steel washer, followed by a nylon washer, followed by the face of the sign shown in the Appendix. Figure 1 shows two pictures of the signs after two years of installation. As shown below, no corrosion has occurred on the backside of the sign.

*Figure 1: Back side of an aluminum sign after 2 years*

The system that was utilized to secure the sign to the post was 3” galvanized lag screws. After two years, the bolt holes and lag screws did not appeared to have corrosion, as shown in Figure 2.

*Figure 2: Lag screw after 2 years*

One method of corrosion prevention that was applied was the use of nylon washers installed between the face of the sign and the steel washer. The nylon washers aided in preventing corrosion from appearing on the front of the sign. Figure 3 has no evidence of any corrosion on the front of the sign. Additionally, the copper naphthenate or "oil-based treatment" did not show any signs of warping compared to the CCA or "water-based treatment."


*Figure 3: Front side of sign*

## Conclusion

WisDOT has explored various types of wood post treatments; however, this study specifically reviewed the use of the copper naphthenate treatment in a controlled study in Windsor, Wisconsin. The phase 2 study results were very positive in showing that copper naphthenate posts remained intact over the two-year experimental period.

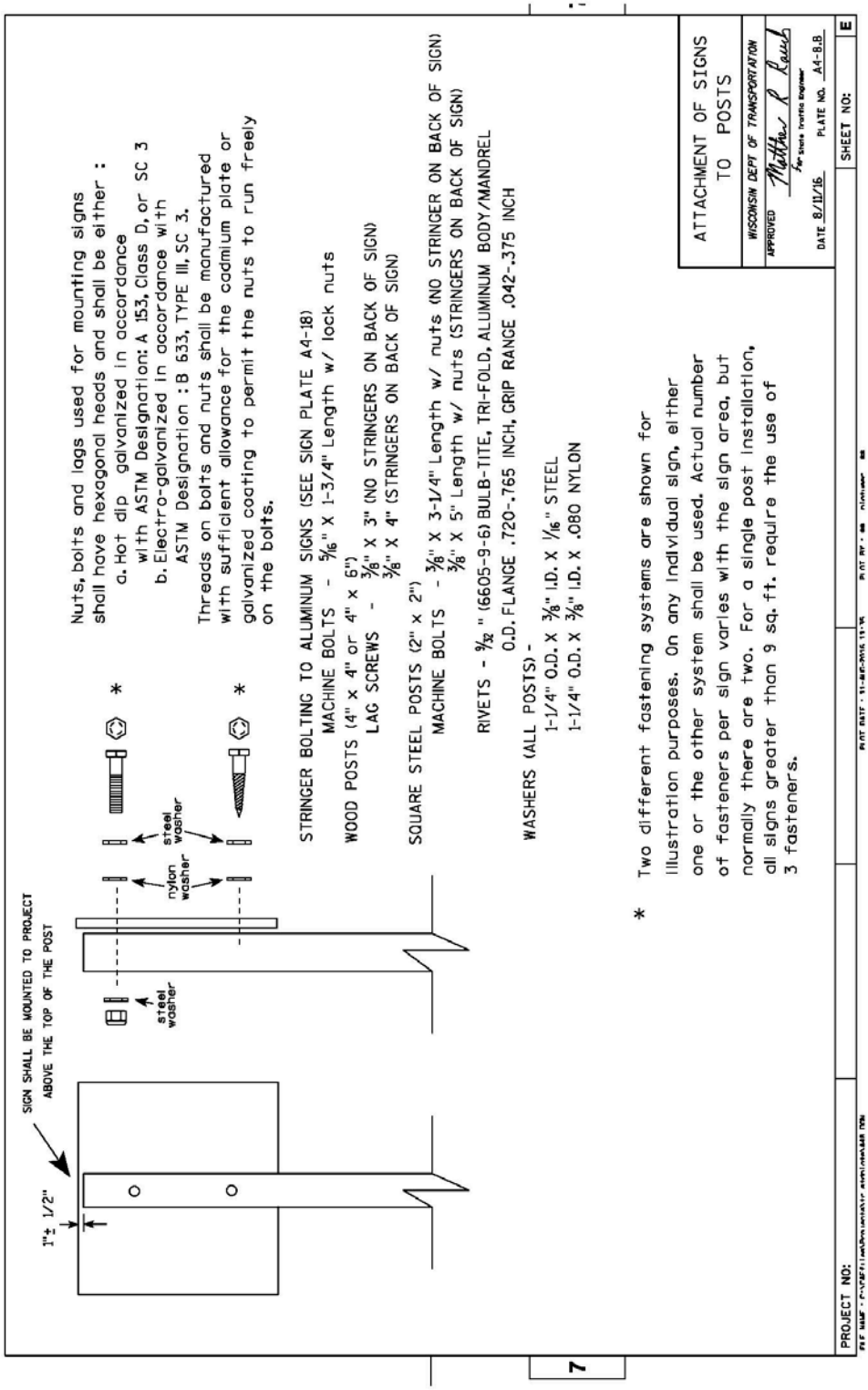
The aluminum signs that were installed did not provide any evidence of corrosion on the back of the signs or near the bolt holes. The use of the nylon washer as a corrosion preventative appeared to be successful in eliminating any corrosion over the two-year period. Additionally, the copper naphthenate or "oil-based treatment" also appeared to be successful in helping reduce warping of the wooden posts, which will in turn help reduce the amount of waste that is generated.

## Future Recommendations / Plan of Action

Based upon the results the literature review (phase 1) and the field evaluation (phase 2), the following plan of action is recommended:

- Continued observation effort should be considered over the duration of the life of the installed posts. This would aid in future recommendations for treatments.
- Upon research of available copper naphthenate wood preserver companies, there are no companies in Wisconsin that perform this work. Therefore, costs for this material could be high. WisDOT will be re-bidding its wood sign post contract in the fall of 2017. In addition to pricing for CCA treated posts, an alternative bid for copper naphthenate treated posts will be requested from bidders as well. This will aid in the final decision making on whether to use copper naphthenate versus chromated copper arsenate on the state contract.
- For improvement projects, revise the WisDOT standard specification 634.2.1 to allow the choice of either copper naphthenate or chromated copper arsenate treated wood posts. The final selection by contractors would be determined by price and availability.
- Continue to monitor the supply and cost of chromated copper arsenate treated posts. As the supply of chromated copper arsenate becomes more plentiful/available in Wisconsin, the prices could come down and make it more affordable to use.
- Perform a cost analysis of the two treatments. Even though the copper naphthenate treated posts are more expensive, the increased waste from the chromated copper arsenate may or may not be more expensive.

# Appendix


SIGN SHALL BE MOUNTED TO PROJECT ABOVE THE TOP OF THE POST
1"± 1/2"
steel washer
nylon washer
steel washer
Nuts, bolts and lags used for mounting signs shall have hexagonal heads and shall be either :
a. Hot dip galvanized in accordance with ASTM Designation: A 153, Class D, or SC 3
b. Electro-galvanized in accordance with ASTM Designation :B 633, TYPE III, SC 3.
Threads on bolts and nuts shall be manufactured with sufficient allowance for the cadmium plate or galvanized coating to permit the nuts to run freely on the bolts.
STRINGER BOLTING TO ALUMINUM SIGNS (SEE SIGN PLATE A4-18)
MACHINE BOLTS - 5/16" X 1-3/4" Length w/ lock nuts
WOOD POSTS (4" x 4" or 4" x 6")
LAG SCREWS - 3/8" X 3" (NO STRINGERS ON BACK OF SIGN)
3/8" X 4" (STRINGERS ON BACK OF SIGN)
SQUARE STEEL POSTS (2" x 2")
MACHINE BOLTS - 3/8" X 3-1/4" Length w/ nuts (NO STRINGER ON BACK OF SIGN)
3/8" X 5" Length w/ nuts (STRINGERS ON BACK OF SIGN)
RIVETS - 9/32" (6605-9-6) BULB-TITE, TRI-FOLD, ALUMINUM BODY/MANDREL O.D. FLANGE .720-.765 INCH, GRIP RANGE .042-.375 INCH
WASHERS (ALL POSTS) -
1-1/4" O.D. X 3/8" I.D. X 1/16" STEEL
1-1/4" O.D. X 3/8" I.D. X .080 NYLON
* Two different fastening systems are shown for illustration purposes. On any individual sign, either one or the other system shall be used. Actual number of fasteners per sign varies with the sign area, but normally there are two. For a single post installation, all signs greater than 9 sq. ft. require the use of 3 fasteners.
7
ATTACHMENT OF SIGNS TO POSTS
WISCONSIN DEPT OF TRANSPORTATION
APPROVED
DATE 8/11/16
PLATE NO. A4-8.8
PROJECT NO:
SHEET NO:
E

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