USE OF UV RESISTANT PRE-SATURATED GFRP

For Protection of Wood Pilings

STRUCTURAL STRENGTHENING

CASE STUDY

Wood pilings are known to deteriorate in marine environments overtime due to their natural affinity to rot and deteriorate in the presence of moisture and marine bore organisms. Though methods such as pressure-treatment using preservatives have been used to treat timber to prevent these types of damages, the treatments are not always long-lasting. Depending on the exposure and location of the piling, some pressure treated pilings may lose much of their cross-sectional area in less than 5 years. Though more economical compared to common building materials (i.e. reinforced concrete, steel, etc), if required to be replaced frequently, timber piles can add up to be very expensive due to permitting and construction costs.

A two year study was set underway to determine if wrapping wood piles with a pre-saturated UV resistant glass fiber reinforced polymer system (GFRP) would slow-down or prevent the damage of them. The test was based on AWPA E5-15 “Standard Test Method for Evaluation of Wood Preservatives to be Used in Marine Applications.” Per the standard’s recommendations, two locations, with different degrees of marine borer attack, were chosen to submerge the piles. The first location was a at dock along a residential area in a brackish water canal in Lake Park, FL and the second location was at a dock along the intracoastal waterway in West Palm Beach, FL. Per AWPA E5-15 standard, the evaluation process is based on visual inspection of the pilings. A grading system from 0 to 10 is used to evaluate the pilings. Table 1 shows the grading criteria from AWPA E5-15.

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Table 1: AWPA E5-15 grading criteria for evaluating wood preservatives in marine environments

RATING	
10	No attack
9.5	Suspicion of attack
9	Slight attack, up to 3% of any cross-sectional area affected
8	Moderate attack, 3-10% of any cross-sectional area affected
7	Moderate/severe attack, 30-50% of any cross-sectional area affected
6	Severe attack, 30-50% of any cross-sectional area affected
4	Very severe attack, 50-75% of any cross-sectional area affected
0	Failure

In order to ensure there is activity of marine borer attack, two types of pilings were wrapped and submerged at each location. The first type included 6in OD un-treated timber, commonly used to build residential fencing. The second type is 12in OD treated marine pilings. Inspection of the piles was completed at the 3-month, 1-year, and 2-year mark and testing was concluded after 2 years of submersion. A summary of the results based on the grading criteria of AWPA E5-15 are shown in Tables 2 and 3. It should be noted that the grading of the pilings wrapped with GFRP is based on the exposed wood sections of the pile, not under or on the GFRP wrap.

Table 2: A summary of the pile conditions submerged in brackish water canal during inspections, graded in accordance with AWPA E5-15

PILE TYPE	PILING	3 MONTH	1 YEAR	2 YEARS	2 YEARS - AREA UNDER GFRP WRAP
Treated Wood	Control	10	9.5	9	N/A
	Wrapped	10	9.5	9	10
Untreated Wood	Control	10	9	7	N/A
	Wrapped	10	9	8	10

Table 3: A summary of the pile conditions submerged in intracoastal waters during inspections, graded in accordance with AWPA E5-15

PILE TYPE	PILING	3 MONTH	1 YEAR	2 YEARS	2 YEARS - AREA UNDER GFRP WRAP
Treated Wood	Control	10	10	9.5	N/A
	Wrapped	10	10	9.5	10
Untreated Wood	Control	10	9.5	9	N/A
	Wrapped	10	9.5	9	10

The results are very promising, showing great ability of the GFRP to protect and prevent attacks from marine borers. Figures 1, 2, 3, and 4 show the condition of the pilings from the canal water at 3month, 1 year, 2 year submersion mark and after the wraps were removed at the end of the test. Figure 5, 6, 7, and 8 show the condition of the pilings from the intracoastal waterway location.

The ability of the GFRP to prevent attacks and preserve the pilings is attributed to the creation of a barrier between the timber substrate and the GFRP, preventing the borers from penetrating and thriving on the timber substrate. Marine borers thrive in slow moving and shallow waters because of the high oxygen levels present in them. This is why it is believed the canal water pilings experienced more damage than the intracoastal pilings.

While this study was targeted for new pilings that need protection, the same technology has been used previously to wrap damaged piles. For hourglass shaped pilings, which have experienced extensive damage, a filler material is required to restore the original shape of the piling, prior to the application of the product.

The product used is a pre-saturated UV resistant glass FRP system that comes in hermetically sealed pouch, which cures in the presence of moisture and can be applied fully underwater. Check-out our website at www.cs-nri.com for more information and other similar products that are easy to install and can be used to protect your structure for decades to come.

(a) (b)

Figure 1: Conditions of the (a) treated and (b) untreated piling 3 months after submersion in the canal water

(a) (b)

Figure 2: Conditions of the (a) treated and (b) untreated piling 1 year after submersion in the canal water

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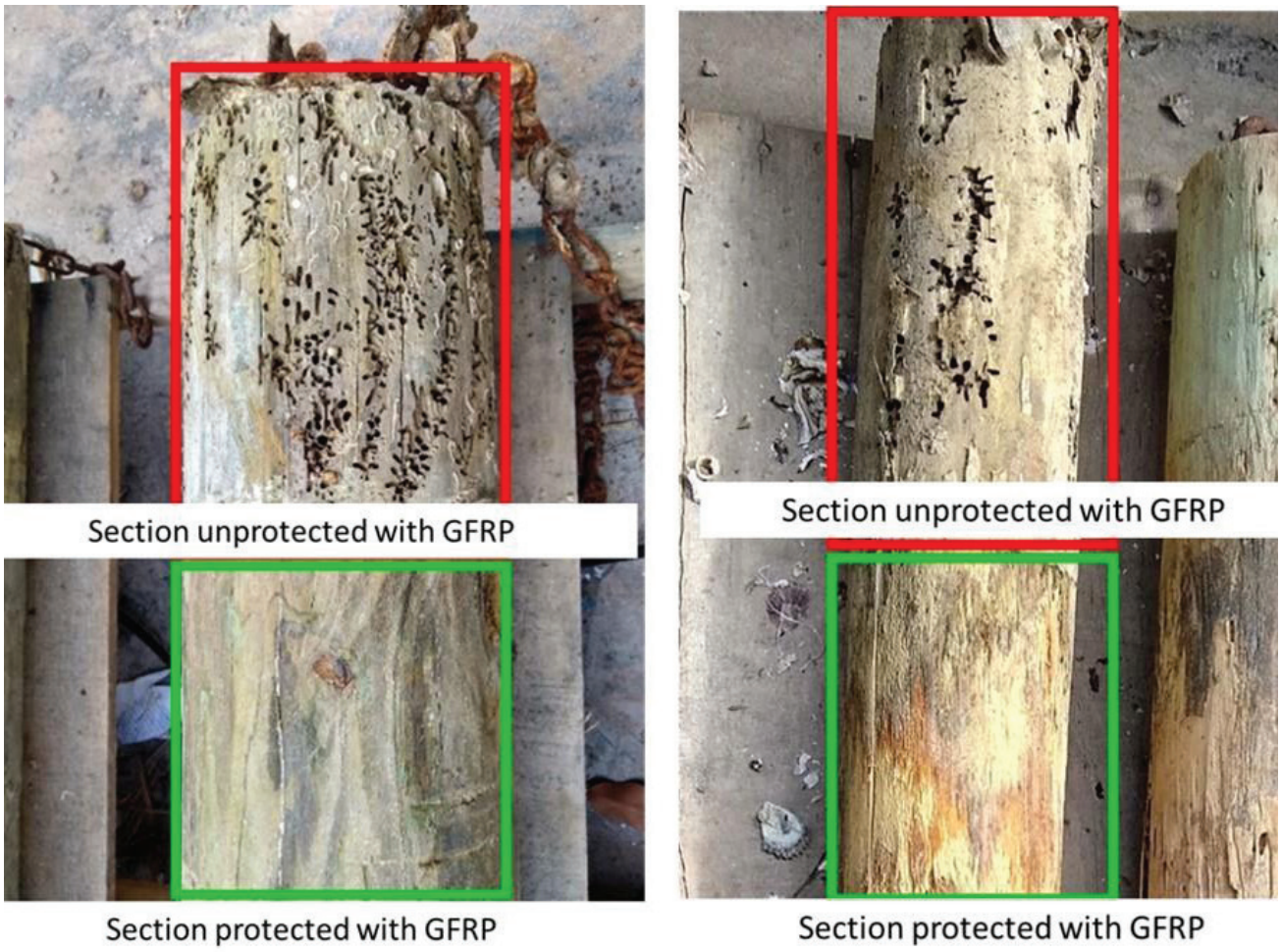
Figure 3: Conditions of the treated and untreated piling 2 years after submersion in the canal water

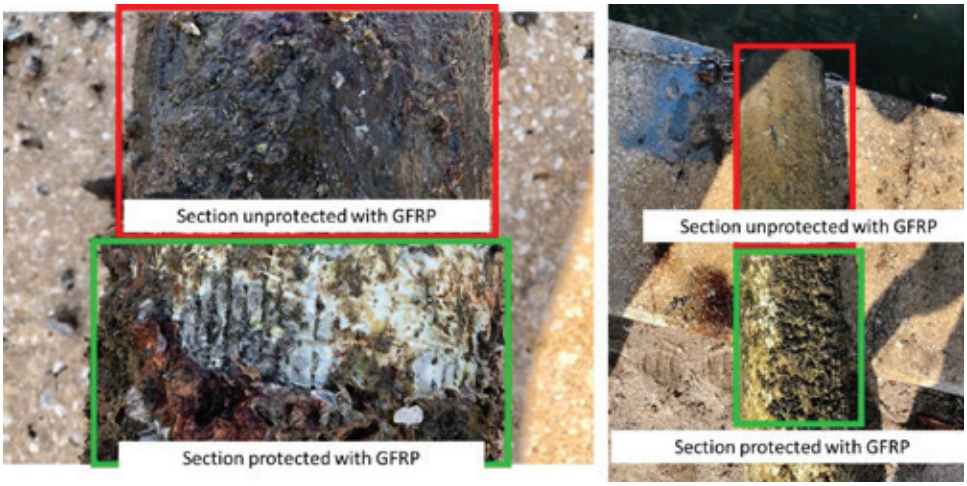


(a) (b)

Figure 4: Conditions of the (a) treated and (b) untreated piling 2 years after submersion in the canal water and removal of the GFRP wrap, showing how well the GFRP protected the timber substrate in canal water conditions

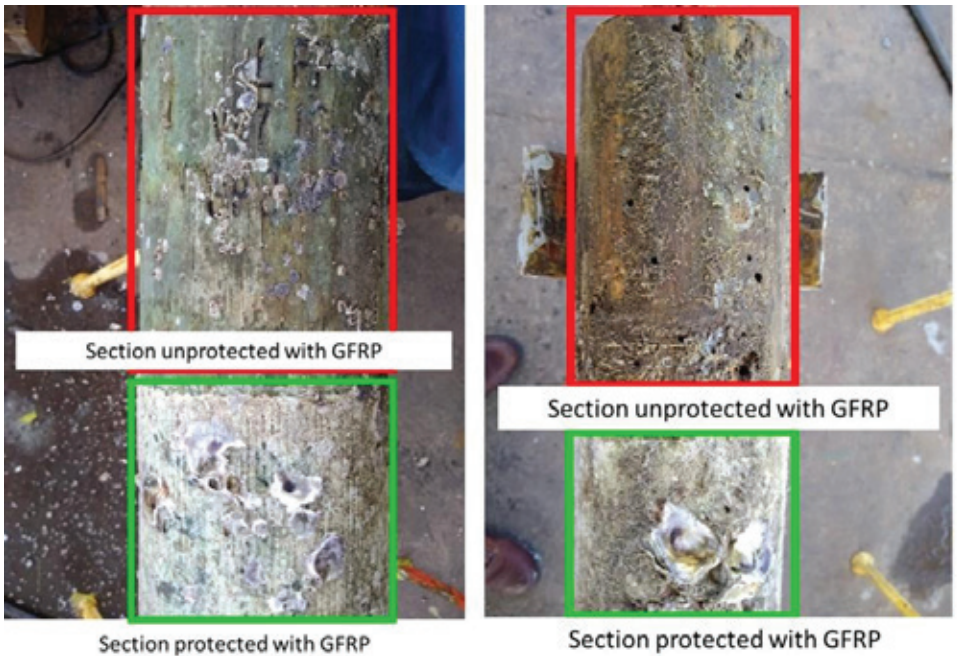
(a) (b)

Figure 5: Conditions of the (a) treated and (b) untreated piling 3 months after submersion in the intracoastal



(a) (b)

Figure 6: Conditions of the (a) treated and (b) untreated piling 1 year after submersion in the intracoastal



(a) (b)

Figure 7: Conditions of the (a) treated and (b) untreated piling 2 years after submersion in the intracoastal

(a) (b)

Figure 8: Conditions of the (a) treated and (b) untreated piling 2 years after submersion in the intracoastal and removal of the GFRP wrap, showing how well the wrap protected the timber substrate

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V: 07.31.2020

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