GUARDRAIL WOOD POST DETERIORATION

TESTING AND RESEARCH DIVISION
RESEARCH LABORATORY SECTION

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John P. Woodford, Director
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In 1971, while inspecting the performance of galvanized coatings on steel beam guardrail, Laboratory personnel noted that some of the wood posts on an installation suffered appreciable ground-line rotting after 10 years of service. This was reported to L. T. Oehler, Engineer of Research. This was then communicated to the Testing and Research Engineer and subsequently to the Maintenance Engineer.

After an interchange of correspondence, M. N. Clyde, on June 4, 1971, approved the Laboratory's field study to determine the extent of the problem and later suggested that the surveys be made cooperatively with District Maintenance personnel due to P. J. Marek's approval of the project.

Initially, the project was to combine the subject survey with a previously approved survey to determine the comparative performance of hot-dip vs. pregalvanized coatings on steel beam guardrail installations. At about that time, however, the Department began minimizing the use of the galvanized guardrail in favor of the unpainted low-alloy steel guardrail and the concrete barrier type. In effect, this change relegated prospective information on the comparative performance of the two galvanized coatings to an academic question, so it was not pursued. Because of this, and for other reasons, only some exploratory surveys were made of wood post decay.

On October 31, 1973, the Laboratory, in reply to a Wisconsin Highway Department inquiry relative to checking of water-borne treated posts, made a supplementary statement that the above fragmentary survey information indicated "that penta-treated or creosoted posts are likely more resistant to rotting at the ground line than are water-borne treated posts." After reading his copy of that letter, K. A. Allemeier, on November 9, 1973, requested that the survey be expedited in order to make a decision based upon adequate information.

Accordingly, in 1974 the survey was completed to determine the relative effectiveness in minimizing ground-line decay of the three wood preservative treatments in service on wood guardrail posts. The three treatments were: creosote, pentachlorophenol, and water-borne[1].

Survey Plan

In order to minimize the effect of local environmental conditions (soil, elevation, water table level, etc.) on ground-line decay, wood posts of steel

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[1] In the interim covering installation of the posts, the Department revised this specification regarding permitted formula, method of application, and retention. Generally, it covered the Fluor-Chrome-Arsenate-Phenol formula as designated by ASTM D 1034 carrying the trade names of "Osmosalts" and "Tanalith."

beam guardrail installations in the six Districts in the Lower Peninsula were condition surveyed. All installations were to be at least seven years old.

A survey area containing 20 adjoining posts was selected in an installation as representative of it. Each post was then examined for deterioration at and below ground line by removing surrounding earth and probing the post with an ice pick to determine depth of decay (Figs. 1 and 2). The type of treatment being surveyed was identified either visually or by laboratory analysis of a core sample. The examination results were recorded, with the averaged results listed in Tables 1 through 3, covering the three treatments.

Survey Results

Of the 1,740 posts examined, 1,120 were water-borne treated, 500 with creosote, and 120 with pentachlorophenol treatments.

Reviewing data in Table 1 covering water-borne treated posts (excluding the questionable installations marked with an asterisk) one finds that the minimum cross-sectional ground-line loss of surveyed posts was 2 percent on a 12-year old installation on westbound I 96, while the maximum was 100 percent on several installations 11-years old, and older.

Reviewing data in Table 2 covering creosote treated posts, one finds that the minimum cross-sectional loss of surveyed posts at least 9-years old was 0 percent while the maximum was 10 percent on two installations 16-years old.

Reviewing data in Table 3 covering pentachlorophenol treated posts, one finds that the minimum cross-sectional loss of surveyed posts at least 11-years old was 0 percent while the maximum was 15 percent on a 12-year old installation.

Reviewing the above and returning to data in Table 1, one finds that a few water-borne treated post installations, 12-years old and older, showed only 5 to 10 percent cross-sectional loss to decay, and thereby were much better than the others. The ground-line decay resistance provided by the latter, during the indicated service period, was almost equivalent to that provided by the creosote and pentachlorophenol treatments.

Though the surveyed wood posts were apt to show decay confined to the ground line, a small percentage also showed some rotting at the top as shown in Figure 3.

Summary and Conclusions [2]

1) Creosote and pentachlorophenol preservative treated wood posts, used in a minority ratio, on Department steel beam guardrail installations showed a maximum cross-sectional loss at ground line of 15 percent after 12-years of service on any of the surveyed posts, and generally less after longer service, and thereby are considered as providing good resistance against decay.

2) Water-borne preservative treated wood posts, used in a majority ratio, on Department guardrail installations showed 100 percent cross-sectional loss at ground-line on some posts after 11-years of service. Since they also showed a higher incidence of decay, the older specification water-borne treatment is significantly inferior to the creosote and pentachlorophenol treatments, though there were a few exceptions in surveyed installations where the performance was about comparable.

3) The above water-borne treatments, Osmosalts and Tanalight, have apparently given poor service nationally in this end-use, since ASTM's D 1760-69 Specification no longer recommended them for "ground contact" service. The Department adopted this specification in 1967. A current inquiry to Sawyer-Stoll Wood Preserving Co. in the Upper Peninsula, a Michigan supplier, revealed that they changed to the copper containing salt, recommended by ASTM for "ground contact" service in about 1970. Since the latter would have been in Department service less than the arbitrarily chosen period of seven years, it was not covered by subject survey.

4) For information, Department steel beam guardrail installations were mounted on either wood or steel posts. Subsequently, the steel posts required a galvanized coating. In about 1970, the use of steel posts was restricted due to observed ground-line corrosion of the earlier ungalvanized type in the Detroit area. Subject survey did not check the condition of any steel posts, nor determine the ratio of wood to steel posts in Department installations.

Recommendations

Since the creosote and pentachlorophenol preservative treatments are providing good protection to guardrail wood posts against ground line decay,

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[2] This supplements Footnote 1. Department specifications covering Wood Preservative Treatments, in the late 1950's, allowed both pressure and brush treatments and different preservative retention in the wood. This variable certainly had effect on the performance of the posts treated under the older specifications, though this study could not inter-relate the two, primarily due to lack of Construction File test data.

we recommend that the Department endeavor to obtain these types for new installations and as replacements rather than the currently allowed water-borne treatment containing the chromated copper arsenate formula, until the latter proves to give equivalent protection in the Michigan environment.

REFERENCES

Cognate Research Reports, issued earlier by the Research Laboratory are:

1. Frederick, W. L., "Decayed Dimension Guard Rail Posts Near Farmington," MDSHT Research Report R-454, 1964.

2. Pocock, B. W., "Guard Rail Post Preservative Investigation," MDSHT Progress Report P-1, 1939.

TABLE 1

WATER-BORNE TREATED WOOD POSTS (6-in. by 8-in. Nominal Size)

1974 Condition Survey

Project	Location	Age, Years	Deterioration, percent	Cross-Section Loss, percent	
				Minimum	Maximum
83031	US 131 SB 2.6 miles S M 115	7	60	5	15
83031	US 131 SB 2.9 miles S M 115	7	40	5	10
83031	US 131 NB 3.1 miles S M 115	7	20	5	10
68012	M 33 SB 1.2 miles N of Rebek	7	0	0	0
33035	I 127 SB 1st line before Willoughby Rd	8	25	5	10
33035	I 127 NB N of Willoughby Rd	8	75	5	15
76012	M 47 now M 52 at Shiawassee River Bridge	9	25	5	20
76012	M 47 now M 52 six miles S of Saginaw Co. Line	9*	0	0	0
34033	M 66 SB four miles S Montcalm Co. Line	9	55	10	15
78054	M 66 between M 60 and M 86	9	40	5	20
35032	US 23 NB N of Aster Rd	10	35	5	15
35032	US 23 SB S of Johnson Rd	10	75	10	25
10011	M 22 0.7 mile N Herron Rd	11	65	20	50
10011	M 22 2.3 mile N Manistee Co. Line	11	100	25	100
51031	M 22 0.7 mile N Maidens Rd	11	35	10	20
51031	M 22 0.6 mile N Domers Rd	11	70	10	25
51031	M 22 300 ft S Dontz Rd	11	85	5	15
09091	M 47 US 10 SB Interchange	11	100	35	100
44032	M 53 SB 1st Line S of Deanville Rd	12	85	10	20
44032	M 53 SB @ Willis Rd	12	90	25	100
69014	I 75 NB 0.9 mile S Parmator Rd	12	35	5	15
69014	I 75 NB 0.7 mile N Parmator Rd	12	15	5	10
69014	I 75 NB 1.4 mile S Sturgeon Valley Rd	12	95	15	35
S09 of 23152	I 96 at US 27	12	50	5	10
X01 of 19022	I 96 WB RR Overpass W Eaton Hwy	12	15	2	5
25101	M 57 WB W limits of Clio	14	100	35	85
16091	I 75 NB one mile S Topinabee Exit	14*	0	0	0
01023	M 72 WB 0.7 mile W of Cohler	14	100	20	60
01023	M 72 WB 1.2 mile W of Cohler	14	100	60	100

*Posts appeared much newer than age indicated.

TABLE 1 (Cont.)
WATER-BORNE TREATED WOOD POSTS (6-in. by 8-in. Nominal Size)
1974 Condition Survey

Project	Location	Age, Years	Deterioration, percent	Cross-Section Loss, percent	
				Minimum	Maximum
01023	M 72 WB 2.0 mile W of Cohler	14	100	50	100
56044	US 10 W and EB Ashman St Overpass	14	100	25	100
62041	M 82 EB 2nd Group E of park	14	100	25	70
62041	M 82 E and WB 0.2 mile W Beach Ave	14	100	15	100
63022	I 96 EB E of RR Bridge	15	100	10	20
67031	M 66 NB N US 10	15	60	5	15
67031	M 66 SB N US 10	15	75	15	30
63022	I 96 WB on ramp from Wixom Rd (S side)	16	100	15	25
44061	M 90 all of posts at Flint River Bridge	16	100	25	100
44061	M 90 2nd EB installation	16	80	15	35
01023	M 72 WB 0.6 mile W of Hubbord	16	85	10	20
01023	M 72 WB 0.1 mile E of Barton City	16	100	5	15
38131	US 127 NB on ramp Parnell Rd	16	95	5	10
38131	US 127 NB Station 160+59	16	55	5	10
38131	US 127 SB RR Overpass N of Morrell Rd	16	50	5	10
38131	US 127 SB Parnell Rd	16	90	5	25
67022	US 10 WB 1st posts W of M 66	16	50	5	30
67022	US 10 EB 2nd line W of M 66	16	85	10	25
67022	US 10 EB 1st line W of Evart	16	100	25	100
67022	US 10 WB 2nd line W of Evart	16	80	25	100
67022	US 10 WB opp golf course	16	65	5	15
S10 of 63022	I 96 EB on ramp from Grand River Ave	17	75	15	40
76021	M 78 EB 0.2 mile W of Beard Rd	17	100	25	75
76021	M 78 EB E of Colby Lake Rd	17	100	5	15
29011	US 27 SB 1st line S M 57	17	80	10	15
39022	I 94 WB Cork St Overpass	17	100	5	10
39022	I 94 WB Sprinkle St Overpass	17	100	5	10
19032	US 27 SB 1st line N Maple Rapids Rd	18	100	40	60

TABLE 2
CREOSOTE TREATED WOOD POSTS (6-in. by 8-in. Nominal Size)
1974 Condition Survey

Project	Location	Age, Years	Deterioration, percent	Cross-Section Loss, percent	
				Minimum	Maximum
62031	M 37 N and SB 0.3 mile N 136 St	9	0	0	0
62031	M 37 N and SB 0.5 mile S 136 St	9	0	0	0
62031	M 37 N and SB 25 yd N of White Rd	9	0	0	0
30033	M 99 NB S of Rainey Rd	10	0	0	0
30033	M 99 SB opp Wayside Memorial Park	10	0	0	0
44032	M 53 NB 1st line N of Deanville Rd	12	0	0	0
61073	M 31 BR 150 yd N of Walsh	13	0	0	0
62041	M 82 EB opp C. H. Cash Park	14	0	0	0
62041	M 82 EB 150 yd E C. H. Cash Park	14	0	0	0
62041	M 82 EB E of Tamarack Creek	14	0	0	0
S02 of 63022	I 96 EB New Hudson-Milford off ramp	15	0	0	0
63022	I 96 EB 1/3 mile E New Hudson-Milford Exit	15	15	0	5
63022	I 96 EB between Novi Rd and Meadowbrook	15	0	0	0
63022	I 96 WB 1st line W of RR Bridge	15	0	0	0
39042	I 94 WB 1/10 mile E of Miller Rd	15	0	0	0
39042	I 94 WB Miller Rd Overpass	15	0	0	0
63022	I 96 WB W of Farmington Rd-W end of line	16	10	5	10
63022	I 96 WB W of Drake Rd	16	0	0	0
19041	M 78 EB 1/4 mile E of Upton Rd	16	0	0	0
19041	M 78 EB 1/8 mile E of State Rd	16	10	5	10
19041	M 78 EB 0.6 mile E of Peacock Rd	16	0	0	0
S10 of 63022	I 96 EB Exit to Grand River Ave	17	0	0	0
76021	M 78 EB at Britton Rd	17	0	0	0
76021	M 78 WB 0.2 mile W of Bath Rd	17	0	0	0
76021	M 78 WB 0.1 mile W of Colby Lake Rd	17	0	0	0
19032	US 27 SB 1st line N Maple Rapids Rd	18	40	2	5

TABLE 3
PENTACHLOROPHENOL TREATED WOOD POSTS (6-in. by 8-in. Nominal Size)
1974 Condition Survey

Project	Location	Age, Years	Deterioration, percent	Cross-Section Loss, percent	
				Minimum	Maximum
09091	M 47 and US 10 Interchange Median	11	0	0	0
44032	M 53 SB 1st line S of Burnside	12	10	10	15
16091	I 75 NB one mile N Topinabee Exit	13	0	0	0
16092	I 75 NB 3.2 mile S Cheboygan Hwy Exit	13	0	0	0
56044	US 10 WB at Midland Exit	13	0	0	0
56044	US 10 E and WB Ashman St Overpass	14	0	0	0

Figure 1. Water-borne treated post allows full penetration of probe through rot and crack. The crack develops in some badly decayed posts presumably from lateral pressure exerted by snowplows. Post is 18 years old on southbound US 27, north of St. Johns.

Figure 2. Creosote treated post allows only minor penetration of probe below ground line signifying sound wood. Post is 18 years old on southbound US 27 near north Clinton Co. line.

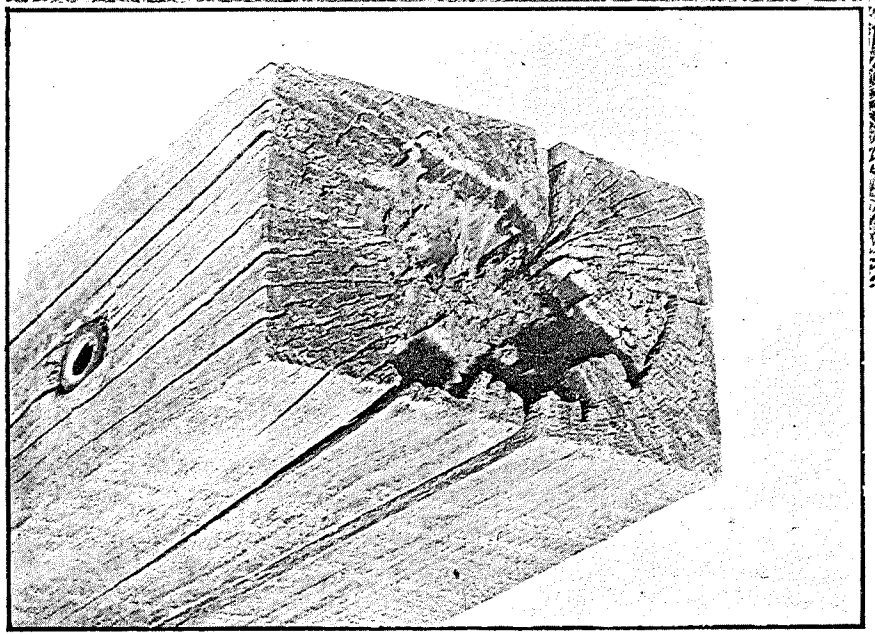

Figure 3. Water-borne treated post that had rotted out at ground line during 14 years of service also shows decay on top. Post was on M 82 near Newaygo.