BUREAU of BRIDGES and STRUCTURES

SPANNING SAFETY CONNECTING EFFICIENTLY

Bridge Washing

Statewide Bridge Support Unit
Bridge Preservation
Bureau of Bridges and Structures

2024 Michigan Highway Maintenance Conference – Bridge Workshop

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Agenda

- Why Bridge wash?
- This is what happens
- Equipment used to clean
- Research

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Why Bridge Wash?

BACKGROUND: Bridge washing is an important part of the maintenance of bridges. The salt that is poured onto highways during the winter accumulates and attacks steel girders and soaks into concrete where it attacks the reinforcement. When a bridge is washed in the spring, that salt is removed and the bridge is preserved for a longer time. The durability of all bridges is increased when bridges are washed on a regular schedule.

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This is what happens

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STANDARD PRACTICE FOR WASHING AND CLEANING CONCRETE BRIDGE DECKS AND SUBSTRUCTURE BRIDGE SEATS INCLUDING BRIDGE BEARINGS AND EXPANSION JOINTS TO PREVENT STRUCTURAL DETERIORATION

by

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Research

This study is a supplement to a previous study of bridge washing practices that focused on steel superstructures. This study examined the perceived costs and benefits of routine washing of both steel and concrete bridges, with emphasis on substructure seats and bridge decks, by exploring current practices around the U.S. A literature review was conducted in order to learn more about these elements and their failure mechanisms. Then a nationwide survey was conducted with state DOTs around the U.S. regarding the washing practices of decks, expansion joints, and bearings. A follow-up survey was conducted soon afterward to collect more detailed information. A summary of the common washing practices is given in conclusion.

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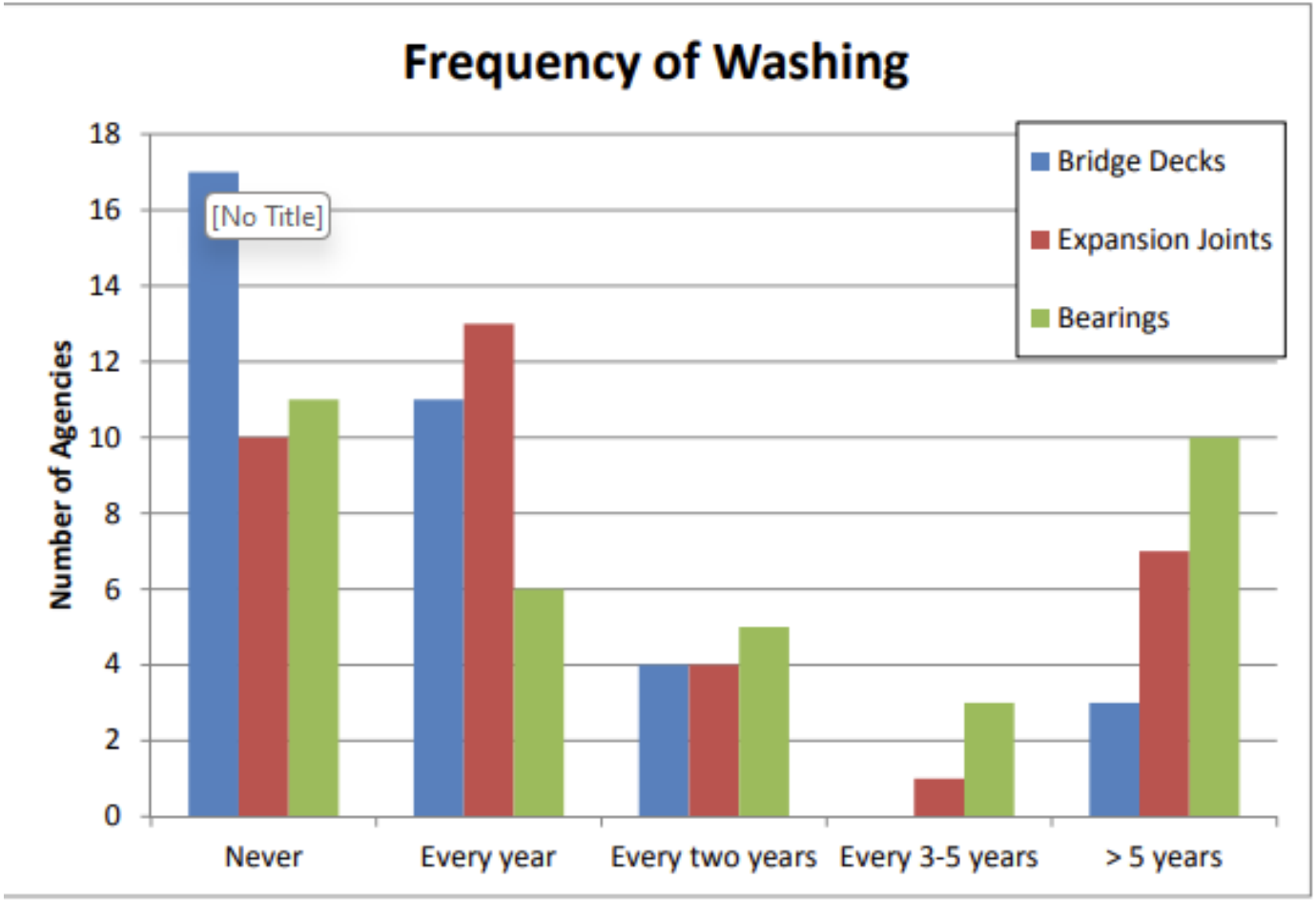

Figure 3. Preliminary survey responses

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Section 5 Conclusions and Recommendations

5.1 Conclusions and State-of-Practice Summary

From the literature review it is clear that bridge bearings and expansion joints tend to collect debris and salts during normal use of the bridge. If the salts are allowed to remain on steel surfaces they greatly increase the speed of corrosion. The collection of debris can affect the proper function of these elements by restricting movement which can cause damage to the elements themselves or the parts of the bridge they interact with. This debris can either be collected solids or water that has pooled and has the potential to freeze during winter months. A routine cleaning of bearings and expansion joints would help to abate the collection of salt and debris.

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5.2 Recommendations

Based on the literature review and current state of practice, it appears that annual washing of decks, bearings, joints and substructure seats can elongate the usable life of those elements and delay the need for replacement. While there is little empirical data to support this, the majority of bridge maintenance engineers indicate that they believe washing to be beneficial and offered experiential evidence. The following recommendations are based the literature review, common practice and the collective experience of the maintenance engineers surveyed:

1. For states where runoff does not need to be collected and winter weather results in significant salt deposits, it is recommended that bridges be washed each spring with the common method described above consisting of dry cleaning of the decks, bearings, joints and substructure seats followed by pressure washing.

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WASHING BRIDGES TO REDUCE CHLORIDE

Final Report [No Title]

SPR 304-031

by

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The difference in chloride content can be quantified by comparing the areas under the curves as shown in Table 3.1. Included in Table 3.1 is the percent reduction in chloride content achieved with each washing frequency compared to no washing (wash frequency of 0). Based on the water used and a comparison of the areas under the curve, the data showed that the uptake of chloride ion was reduced by 86% by applying 11 liters/square meter/day of fresh water for 49 months. Applying 11 liters/square meter/week of fresh water reduced the chloride ion uptake by 36%, and applying 11 liters/square meter/month reduced the chloride ion uptake by 5%.

Table 3.1: Percent reduction in chloride ion concentration due to washing

Wash Frequency	25 Months	49 Months
0	15.9	27.4
1/day	1.69 (89%)	3.90 (86%)
1/week	11.7 (26%)	17.4 (36%)
1/month	12.5 (21%)	25.9 (5%)

(Note: Values are the areas under the curves from Figures 3.2 and 3.3, with percent reduction shown in parentheses.)

3.3 DISCUSSION

Clearly, washing with fresh water did not stop the ingress of chloride, but the data showed that frequent washing could appreciably reduce the amount of chloride that would otherwise be taken up by concrete. Unfortunately, daily washing would require installing a sprinkler system, which may not be practical. The results indicated that occasional washing with the expectation of reducing chloride uptake probably has little value.

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4.0 CONCLUSIONS

Based on the results of the laboratory tests, the following conclusions can be made:

- Washing with fresh water is ineffective in removing chloride ions from concrete.
- Daily washing with fresh water can appreciably reduce the amount of chloride ion uptake in concrete exposed to salt in the environment.
- Occasional washing to reduce chloride ion uptake is ineffective.

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Concrete benefits from the application of silane sealer. Silane penetrates the surface of the concrete and prevents chloride-laden water from entering. Silane penetrates better and is more effective when the concrete surface is properly prepared by pressure washing. The concrete pores are opened, giving the silane a better path to the interior of the concrete, where it does a better job repelling water.

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Questions?????

Clogged drains and debris accumulation were also noted in almost every inspection report. The 2005 report noted that water leakage from the drainage system of the bridge decking was allowing water to drain directly onto the southwest leg (B1R). This buildup of water and debris prevented a protective patina from forming on the bridge. In 2009, a rehabilitation project to replace the bridge downspouts was completed, and the October 2009 routine inspection report described the drains as being clear. However, the 2011 inspection report noted that some of the drains had become clogged again. The 2020 inspection report specifically stated that the "legs and cross-bracing are deteriorating at an accelerated rate, due to malfunctioning drainage systems and deterioration, contamination and seepage through the deck concrete."

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