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Maintenance Practices for Wood Bridges

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Abstract

Proper maintenance is necessary for the continued safe performance of bridges. In times of fiscal constraint, maintenance becomes increasingly important as funding for bridge replacement decreases and existing bridges must continue to safely support traffic loads. Many bridges in our transportation system are made of wood and require specific maintenance unique to wood structures. This paper summarizes several inexpensive maintenance practices for wood bridges, including moisture control, surface treatments, and fumigants.

Introduction

Pressure-treated wood is one of the most durable bridge materials, but over extended periods it may be subject to deterioration from decay, insect attack, or mechanical damage. Wood bridges must be periodically maintained in order to keep them in a condition that will give optimum performance and service life. Effective bridge maintenance programs improve public safety, extend the service life of the structure, and reduce the frequency and cost of repairs. When tied to a competent bridge inspection program, regular maintenance represents the most cost-effective approach for achieving long service life from existing structures. Unfortunately, maintenance is often neglected until critical problems develop which require costly repairs.

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In general terms, bridge maintenance includes those activities necessary to preserve the utility of a bridge and ensure the safety of road users. In practice, all maintenance is either preventative or remedial. Preventative maintenance involves keeping the structure in a good state of repair before decay or deterioration has started. Early remedial maintenance is performed when decay or other deterioration is present but does not affect the capacity or performance of the bridge in normal service. These types of maintenance are very important to prevent costly future repairs. Three inexpensive practices for preventative and early remedial maintenance involve moisture control, surface treatments, and fumigants.

Moisture Control

Moisture control is the simplest, most economical method of reducing the decay hazard in wood bridges. It can be used as an effective and practical maintenance technique to extend the service life of many existing bridges. When exposure to wetting is reduced, members can dry to moisture contents below that required to support most fungal and insect attack (approximately 25 percent). Moisture control was the only method used for protecting many covered wood bridges constructed of untreated wood, some of which have been in service for more than 100 years. Although modern wood bridges are protected with preservative treatments, decay can still occur in areas where the preservative layer is shallow or broken.

Moisture control involves a common sense approach of identifying areas with visible wetting or high moisture contents, locating the source of water, and taking corrective action to eliminate the source. For example, drainage patterns on approach roadways can be rerouted to channel water away from the bridge rather than onto the deck. Cleaning dirt and debris from the deck surface, curbs, drains, abutment caps, and other horizontal components also reduces moisture trapping and improves air circulation. Common roofing cement can be applied to wood end-grain and around openings at joints and fasteners to provide a watertight seal. Another option is to place protective covers over exposed end-grain IO restrict direct exposure to the elements.

One of the most effective approaches to moisture control is restricting or preventing water passage through the deck. Decks that are impervious to moisture penetration will protect critical structural members and substantially reduce the potential for decay. On many wood decks, the addition of an asphalt wearing surface with a watertight geotextile membrane provides a moisture barrier that protects not only supporting members but also the deck. If cracks develop in the asphalt surface, they should be thoroughly cleaned with a stiff brush and compressed air, then filled with an emulsion slurry or liquid asphalt mixed with sand. If pavement is broken or missing, surrounding pavement must be removed to the point where it is sound and tightly bonded to the deck, and a patch must be applied.

Surface Treatments

Surface treatments are applied to existing bridge members to protect newly exposed, untreated wood from decay or to supplement the initial treatment after installation. This type of treatment is most effective when applied before decay begins and is commonly used for treating areas with checks, splits, delaminations, mechanical damage, or areas that were field-fabricated during construction. The ease of application and effectiveness of surface treatments as toxic barriers make them useful in preventive maintenance; however, the shallow penetration limits their effectiveness against established internal decay.

Surface treating normally involves conventional liquid wood preservatives that are applied by brushing, squirting, or spray-flooding of the wood surface. The wood surface should be thoroughly saturated with preservative so that all cracks and crevices are treated; however, care must be exercised to prevent excessive amounts from spilling or running off the surface and contaminating water or soil. In addition to preservative liquids, some preservative compounds are available in semisolid greases or pastes. These preservatives are useful for treating vertical surfaces or openings because larger quantities of preservative can be locally applied in heavy coatings that adhere to the wood. Preservative adsorption over an extended period can produce deeper penetration than single surface applications of 1iquid treatments. Semisolid preservatives are commonly used at the ground line of posts, poles, and piling, where they are brushed on the surface; the wood is then wrapped with an impervious material to exclude moisture and prevent leaching of the treatment into the surrounding soil.

The effectiveness of surface treatments depends on the thoroughness of application, wood species, wood size, and moisture content at the time of treatment. Wet wood absorbs less preservative than does dry wood. This factor is significant in wood bridges because many areas requiring treatment are subject to wetting. Although field tests show that surface treatments in aboveground locations can prevent decay infections for more than 20 years (Scheffer & Eslyn 1982), it is recommended that treatments used for bridge applications be systematically reapplied at intervals of 3 to 5 years to ensure adequate protection from decay.

Fumigants

Fumigants are specialized preservative chemicals in liquid or solid form that are placed in prebored holes to arrest internal decay. In time, the fumigants volatilize into toxic gases that move through the wood, eliminating decay fungi and insects. Fumigants can diffuse in the direction of the wood grain for 3 m or more from point of application in vertical members, such as poles. In horizontal members, the distance of movement is approximately 0.5 to 1 m from the point of application. The most common fumigants are liquids, but solid fumigants are also available. Solid fumigants are normally easier to use, provide increased safety, and reduce risk of environmental contamination.

To be most effective, fumigants must be applied to sound wood. When applied in very porous wood or close to surfaces, some of the fumigant is lost by diffusion to the atmosphere. Before applying fumigants, the condition of the member should be carefully assessed to identify the optimal boring pattern that avoids fasteners, seasoning checks, badly decayed wood, and other openings to the atmosphere. In vertical members such as piles, holes should be bored at a steep downward angle toward the center of the member to avoid crossing seasoning checks. For horizontal members, holes are bored in pairs straight down to within 40 to 50 mm of the bottom side. If large seasoning checks are present in horizontal members, holes should be bored on each side of the check to more completely protect the wood. The amount of chemical and the size and number of treatment holes depend on member size and orientation. Information on fumigants and recommended dosages may be obtained from the chemical manufacturers.

Liquid fumigants are applied using commercial equipment, but they can also be applied from polyethylene squeeze bottles (Morrell and others 1984). Solid fumigants are inserted directly into the prebored holes. Both types of fumigants will eventually diffuse from wood. Fumigants can be reapplied at periodic intervals in the same holes used for the initial treatment. The retreatment interval depends on the condition of the wood and the presence of checks, splits, fasteners, and other features that allow the fumigant to escape. In the absence of specific site information, it is recommended that a 10-year treatment cycle be used with a regular inspection program at 5-year intervals.

As with other preservatives and pesticides, fumigants for in-place treating are toxic to humans and must be used in accordance with State and Federal laws. When properly applied, the treatments pose no environmental or health hazard; however, the potential for environmental damage can be higher in some field locations because of variable conditions and the proximity to streams and other water sources. In-place treatments must be applied only by trained and licensed personnel who fully understand their use and the required safeguards.

References

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