Bridge Preventive Maintenance; Or Keeping the Water Out.

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Timber Bridges

Back in the day, before timber preservatives were developed, early bridge builders put a roof over the bridge to keep the water off the untreated timber. They had noticed that the wood they used to build their houses did not rot like wood left out in the elements. Many of these covered bridges still exist today, still without any preservative treatment just a roof to protect the structure.

The Grays River Covered Bridge, photo credit-Creative Commons.

Timber bridge caps can be protected the same way today. It is very difficult to get permits to use creosote treated timber. Other less effective treatments can be used to provide some protection. To enhance the protection simply place either aluminum or galvanized sheeting on the top of the cap when it is replaced. Crimp a little drip edge along the top edge of the cap to keep the water away.

Timber bridges have either a timber or concrete deck. For the concrete decks make sure to seal the joint. These are almost always directly over the timber cap. Again, keep the water out.

If your bridge inspection does find rot, the rot can be arrested using borate. Borate is effective in killing the fungus that causes wood to rot. The borate comes in a paste, powder, or compressed rods. The rods are activated at 26% moisture content, the same moisture content required for the fungus to grow. The borate migrates about 6 inches with the grain and a couple of inches against the grain. For full coverage the rods should be about 8 inches apart for the full extent of the rot pocket and a foot beyond. The rods should last about ten years before they need replacement.

If a timber member of the bridge is damaged, use Copper Napthanate to treat the damaged area. It is not water soluble and will help seal the wound.

Concrete Bridges and Elements

The deck of a bridge is a lot like the roof of the covered bridge. It helps to protect the rest of the structure. Unlike a good weatherproof roof, decks are porous and have cracks which allow moisture to get into the deck. The decks are reinforced with steel which rusts when it gets wet. In Washington most public agencies use chlorides in some form or another for winter maintenance. The chloride ion will accelerate the corrosion of the reinforcing steel. The means for the chloride to get into the deck is rainwater. A number of state transportation agencies waterproof their decks. They normally use a Silane product. This is sprayed on the deck. The Silane treatment needs to be renewed about every five years.

In California they use a methyl methacrylate deck sealer. The deck sealers help by sealing deck and filling any stable cracks. The sealer will need to be renewed every ten to fifteen years. In Idaho for new bridges they treat the decks with Silane before traffic is allowed on the bridge. They will then come back 3 to 5 years later and put a ¾ inch polymer overlay on the deck. It takes time for the cracks in concrete to fully develop. By coming back later to put the overlay on the deck, the polymer will help to seal the cracks and waterproof the deck. With Idaho winters and the use of chains and studs, the polymer also provides an additional sacrificial surface that will prolong the life of the deck. A low cost method to protect bridge decks is with an asphalt overlay with a protective membrane. This can be put on the bridge deck when it is new. As the asphalt wears it will need to be replaced. This is normally done by a partial grinding of the deck making sure that the grinder does not get into the membrane. A new overlay is then placed on top of the deck.

Other concrete bridge elements can also be protected by the use of Silane or concrete sealers. This is often done in the splash zones where the snow melt is splashed against columns and girders.

Epoxy coated reinforcing, galvanized reinforcing, and stainless steel reinforcing have all been used in the construction of concrete bridge elements. These three types of reinforcing do provide additional protection in the case that moisture and chlorides do get through the other protective measure and get down to the depth of the reinforcing.

Bridge Joints

Bridge joints allow for the expansion and contraction of a bridge. It is difficult to maintain the water proof integrity of the joints. The leaking joints allow water and chlorides to get into the substructure and superstructure elements of the bridge. The joints need to be monitored and the joints cleaned and resealed if they are leaking.

Bridge designs today try to eliminate the joints or try to move the joints off the bridge to the approach slab.

There are also a lot of older bridges that were built with either finger or sliding plate joints. These joints cannot be sealed. To protect the elements under the bridge a trough was sometimes placed under the joint. The trough is to catch the rainwater and channel it away from the bridge substructure elements. The troughs require a great deal of maintenance and need to be cleaned out often or the water will overflow the trough.

Bridge Cleaning

An important element of every bridge preventive maintenance plan is bridge cleaning. Debris will build up on bridge elements over time. This makes it difficult to inspect those portions of the bridge. Dirt, debris, and bird feces absorb moisture and keep the elements wet longer. They also trap chlorides against the element as well as other chemicals which help to accelerate corrosion. If you cannot clean all your bridges there are some that are more critical than others. First clean your steel bridges and all steel elements. Focus also on steel bearings and hangers

Sol Duc Before Cleaning-WSDOT Staff Photo

Sol Duc After Cleaning-WSDOT Staff Photo

Bird Control

All bridge owners have been faced with the problem of birds nesting on bridges. The bird droppings create a hazardous condition for bridge workers. The droppings also make inspections difficult and accelerate corrosion.

There are several ways to deter birds from inhabiting structures. Bird spikes can be very effective. The spikes are species specific. Careful selection of the spikes is important. For some portions of a bridge screening may also be effective in keeping the birds out. Birds can be persistent and will continue to peck away at the screening until they gain access. Use heavy gauge material for the best results.

In addition to preventing the birds from roosting on your bridges, you can contract with the United States Department of Agriculture (USDA), Animal and Plant Inspection Services (APHIS), Wildlife Services. They have methods of removing or deterring the birds from your bridges

Maintenance Painting of Steel Bridges

Bridge 507/114 Before Repair & Paint-WSDOT Staff Photo

Bridge 507/114 After Paint-WSDOT Staff Photo

The paint on steel bridges keeps the moisture that is necessary for steel to rust from getting to the steel. A good preventive maintenance program keeps the steel clean and touches up any and all rust blooms or chips in the paint. This will extend the life of the paint. The use of shrouded tools and HEPA vacuums to prepare the surface in small areas saves the cost of full containment.

Because of limited funding, steel bridges do not always get repainted at the most cost effective time. In these cases more extensive area painting of critical bridge elements may be necessary. The use of a penetrating sealer on steel plate joints and a calcium sulfanate paint coat is an effective way of extending the life of the protective paint coat on steel bridges.

LWD Removal

Water is most destructive to bridges during flooding. The buildup of large woody debris at piers can accelerate erosion. It is important during times of high flood waters to monitor all your scour critical bridges with piers in the water that collect debris. The debris can be removed from the piers and allowed to float on downstream. Consult with your Department of Fish and Wildlife for their permit requirements for your waterways.

Drift Removal at Nisqually River Bridge -WSDOT Staff Photo

Conclusion

A bridge Preventive Maintenance Plan is very simple if you focus on controlling the water, either the water flowing under the bridge or raining down on it. Prevention has a return on investment of from 6:1 to 20:1. Unfortunately it is the corrective side that gets the first and often the very last dollar. We cannot ignore the potholes in the deck or the damaged girder. These have to be repaired. A good bridge maintenance program, with money set aside to do the preventive maintenance, will in time reduce the cost of maintenance while at the same time extend the life of your bridges. Start today by developing your own bridge preventive maintenance plan.