

### Oregon Highway Bridge Maintenance Training Course / Workshop

### **Timber Preventative Maintenance**

Richard King, P.E.







### Timber Bridge Members

- The age of wood spans human history.
- Wood was probably the first material used by humans to construct a bridge
- Timber's strength, light weight properties desirable for bridge construction
- Timber is capable of supporting short-term overloads without adverse effects
- Timber bridges can be constructed in virtually any weather conditions
- Wood is not damaged by freezing & thawing and harmful effects of de-icing agents.
- Timber bridges are easily constructed and they look good in natural surroundings

### Timber Bridge Members

With all of the positives and good properties of wood:

- •Timber structures can not be installed and then simply walk away, hoping that all will be well
- Poor design, poor construction and poor management practices can be major factors in the degradation of a timber structure
- •life of a timber bridge, deterioration can be minimized:
  - ➤ By proper inspection
  - >Timely maintenance

BURNT RIVER (LIME)
BR# 01788 HWY 449 MP 0.46
BENT 4 7/27/11
M01788 A5.ipg

### What Defects to Look For in Timber

- Decay (interior and surface)
- Bug infestation
- Crushing of wood
- Cracks, splits, checks, and shakes
- Loose connections
- Loose wood members
- Cupping, curling of planks
- Fire damage



### What Causes Decay?



### Four Conditions Necessary For Decay to begin:

- Sufficient Supply of Oxygen
- Favorable Temperature Range
- Adequate Food Supply
- Available Water



#### Fungi





#### **Insect Activity**







#### **Soil Conditions**

Perched Water Table





#### **Soil Conditions**

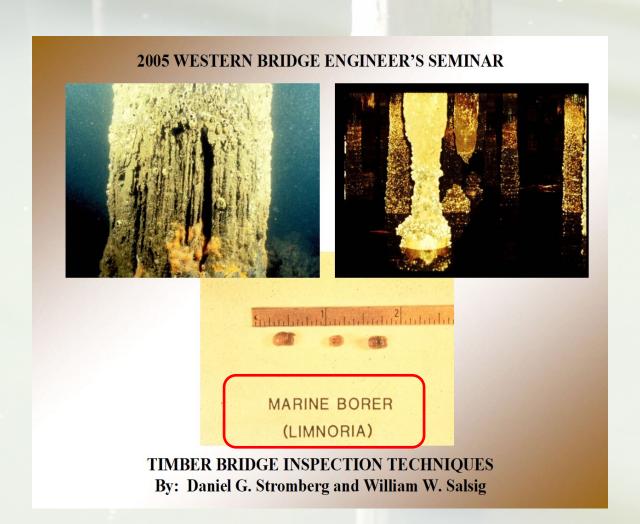
Granular or Impermeable Soil







Marine Borers (gribble or ship worm)





#### **Wearing Surface**

Check for "alligator" cracking, potholes, or panholes





#### **Drain holes**





#### **Substructure**

**Check under Leaking Joints** 







#### **Substructure**

Check areas in Inter-Tidal Zone





#### **Substructure**

Check bracing areas and drift pin area







#### **Substructure**

**Check Timber Piling at/Below Ground Line** 







#### **SUBSTRUCTURE**

Check for bulging in members







#### **Substructure**

Check bearing areas







- ☐ Contrary to popular belief, large wood
  Members provide good
  Fire resistance
- ☐ Fire damage generally only burns the surface of the timber
- ☐ If Fire burns through the treatment, this can set up conditions for decay





#### **Substructure**

Check members with checks, splits, and cracks







### Definition: Checks, Splits, and Cracks

#### Commentary & Definitions

Check - Lengthwise separation of the wood fibers that generally follows the grain of wood (occurs only on one side of the member). Checks are generally caused by differential shrinkage within the member.



Split - Lengthwise separation of the wood fibers from one surface to the opposite or adjacent surface. Can be called a "through" check.

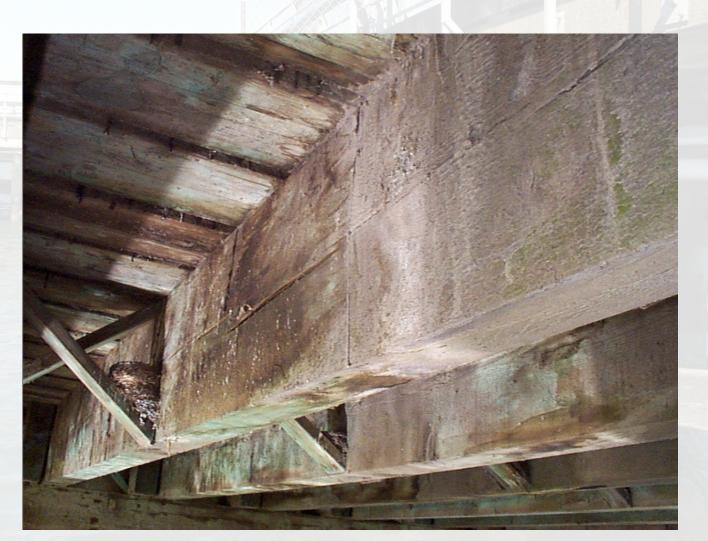


Crack - a crack is generally load related. It propagates from the tension face, can cross the wood grain, and occurs full width of the member, reducing capacity.



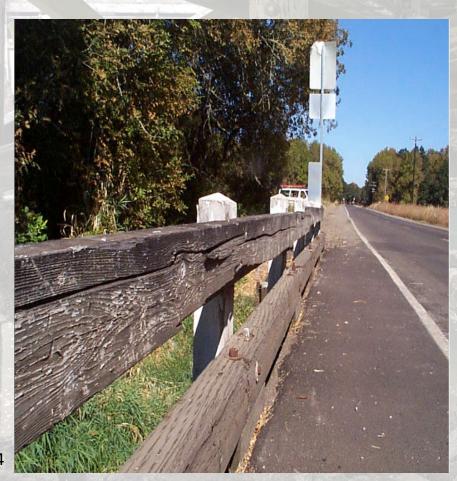


#### **Checks**





#### **Splits**





#### **Cracks**







•Timber inspection is a learned process that requires some knowledge of wood properties and technology.

#### **Methods for Detecting Exterior Deterioration**

1.) Visual Inspection:

Fruiting bodies

Sunken faces

**Bulging faces** 

Staining or discoloration

**Insect activity** 

Plant or moss growth





Methods for Detecting Exterior Deterioration cont.

- 2) Probing
- 3) Pick Test

### Methods for Detecting Interior Deterioration

1) Sounding



sounding the wood surface by striking it with a <u>3lb</u> <u>hammer</u> or other object and based on the tonal quality of the sounds, a trained inspector can interpret dull or hollow sounds that may indicate the presence of large interior voids or decay.



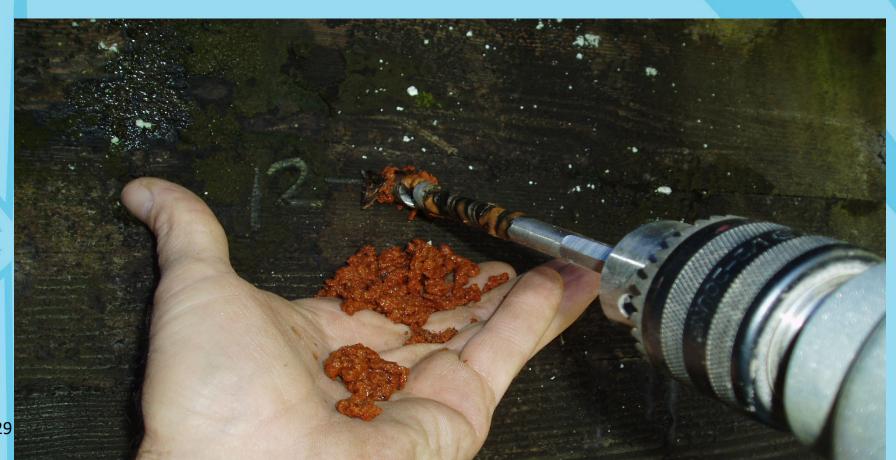
Methods for Detecting Interior Deterioration cont.

2) Drilling and Coring

To ensure that bridge inspectors are not spreading decay fungi, throughout a structure, while boring, drill bits should be sterilized after every hole is drilled.



### **Timber Boring**





#### **Suggested Equipment:**

- 1/2" Electric Drill (w/reverse)
- Gas Powered Drill (optional)
- Increment Borer (optional)
- 3/8" x 12" ship augers and 3/8" x 18" ship augers (1/2" bits optional)
- 25% Chlorine-Water or Boric Acid Solution in Squirt Bottle
- Cleaning Rags
- Treated or hardwood plugs (1/8" larger than bit size)
- Generator, Hammers, Keel
- Extension Ladder, Measuring Tapes, Ropes
- 3-wire Extension Cords, Bit File, Shovel
- Paper and Pencils, Clipboard, Straight Edge
- Harness, Lanyard, Goggles



#### 2005 WESTERN BRIDGE ENGINEER'S SEMINAR



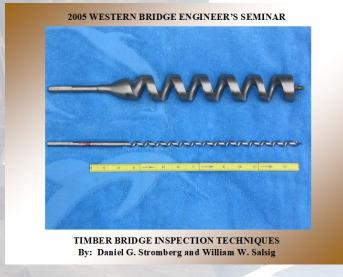




TIMBER BRIDGE INSPECTION TECHNIQUES By: Daniel G. Stromberg and William W. Salsig



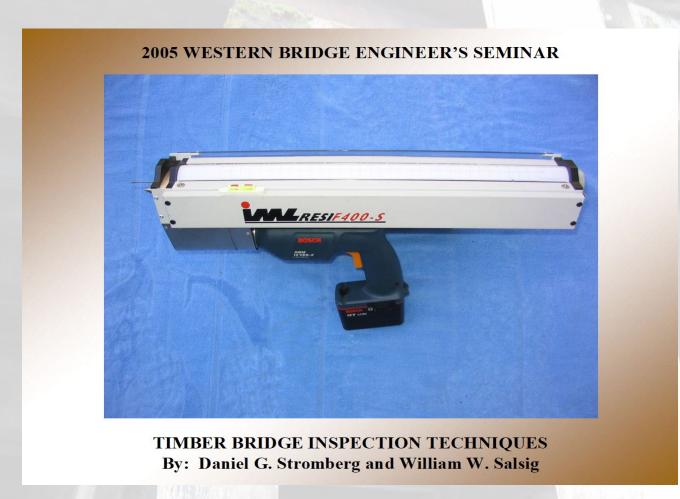
- Boring Procedure:
- Sterilize drill bit with disinfectant before drilling each hole (25% chlorine or boric acid solution
- Get base reading: measure the exposed bit in the drill chuck
- Drill and record findings on face of timber in consecutive order
- In some instances, another boring may be useful to get both a horizontal And vertical dimension of a rotten member
- Plug the drill hole with a treated wooden plug.
- Reasons why a bit will not feed:
  - Decay
  - Drilling with grain of wood
  - Season checks and splits





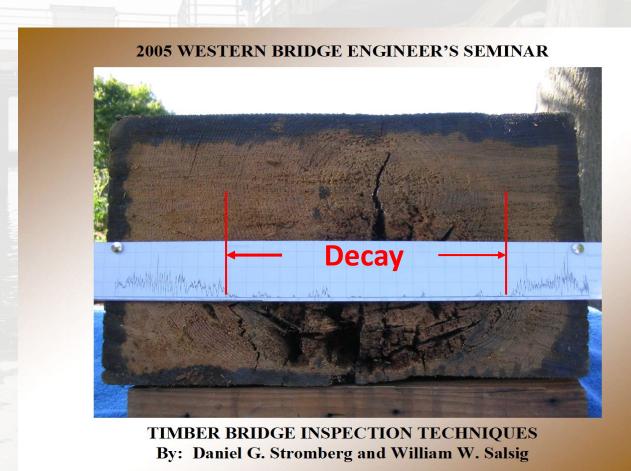


Other devices for detecting decay (Resistograph F400-S)





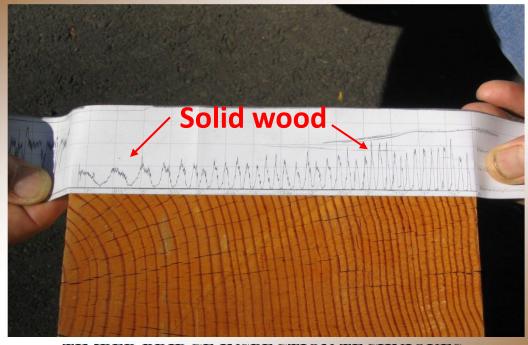
Other devices for detecting decay





#### Other devices for detecting decay

#### 2005 WESTERN BRIDGE ENGINEER'S SEMINAR



TIMBER BRIDGE INSPECTION TECHNIQUES By: Daniel G. Stromberg and William W. Salsig



**Resistograph in Action** 





# How to Detect Decay in Timber Bridge Members

Other devices for detecting decay (Resistograph MD 300)





## How to Detect Decay in Timber Bridge Members

- Important for Owner/Agency personnel to understand timber inspection procedures
  - Check inspectors work to verify results or in case member is missed
  - Ability to perform cursory inspections for monitoring timber members
  - Help understand condition of timber bridge inventory



# Pre-Construction Protection Methods of Timber

- Pre-treated with preservatives to protect against:
  - Moisture penetration
  - Fungus development
  - Pest infestation





# Post-Construction Timber Deck Protection Methods

- Overlays
- Water repellents
- Paints



# Timber Deck Protection Methods: Overlays

- Overlays:
  - Asphalt
  - Protect against moisture penetration and abrasion
- "Runners" applied along wheel lines:
  - Protect the wood from abrasion and decay
  - Distribute wheel loads







# Timber Deck Protection Methods: Water Repellents

- Economical and simple method
- Used to lower the absorbed water content of timber deck members
  - Requires frequent application
- Inhibits fungal and insect growth



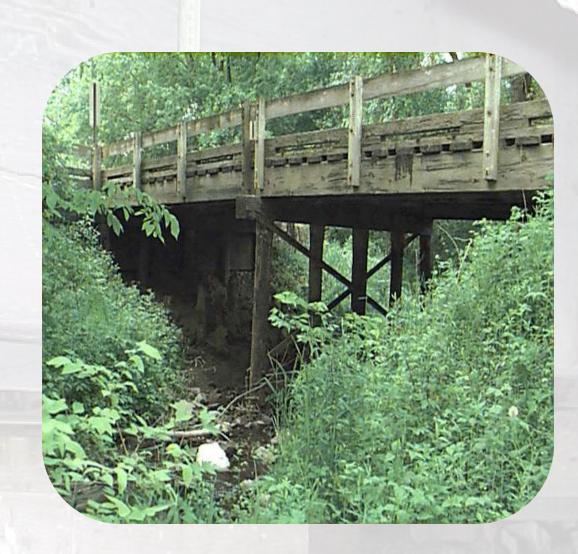
# Timber Deck Protection Methods: Paints

- Complete cover and regular reapplication
- Paint systems will generally begin to crack and allow moisture into the wood
- Paint on roadway surface quickly worn away by traffic
- In areas where snow and ice collect paint deterioration can also occur quickly



## Preventive Maintenance

- Washing and cleaning
- Moisture control
- In-place preservation treatment
- Sealing



## Preventive Maintenance

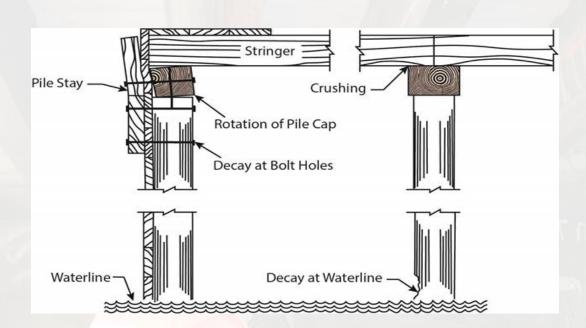
Cleaning
 debris and
 vegetation
 growth and
 covering
 exposed
 wood

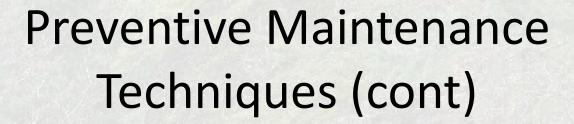




# Preventive Maintenance Techniques

- Cleaning
- Moisture control
- Preservative treatments







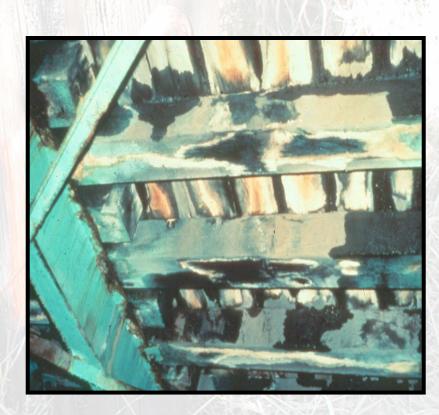
- Preservative treatments
  - Surface treatments
  - Pressure treatments
  - In-place treatments



## In-place Preservative Treatment

#### **Surface treatments**

- Protect against fungi growth and decay
  - Brown rot fungi
  - White rot fungi
  - Soft rot fungi
- Reduce the effect of weathering,
- drying out, and surface rotting
- Applied by brushing or spraying
  - Preferable to apply to dry wood
  - Oil-based copper naphthenate
  - Boron





## **Preservative Treatments**

#### **Surface treatments**

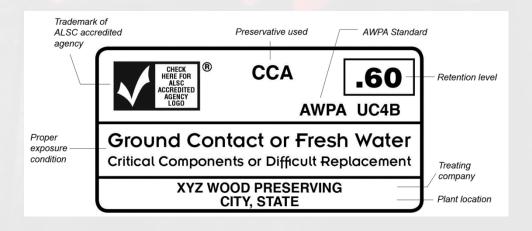
- Non-pressure methods
- Applied to newly exposed, untreated wood
  - Liquid
  - Powder
  - Solid
- Applied before decay begins



### **Preservative Treatments**

#### **Pressure treatments**

- Completed at the plant
- Three classes:
  - Waterborne
  - Oil-type
  - Creosote

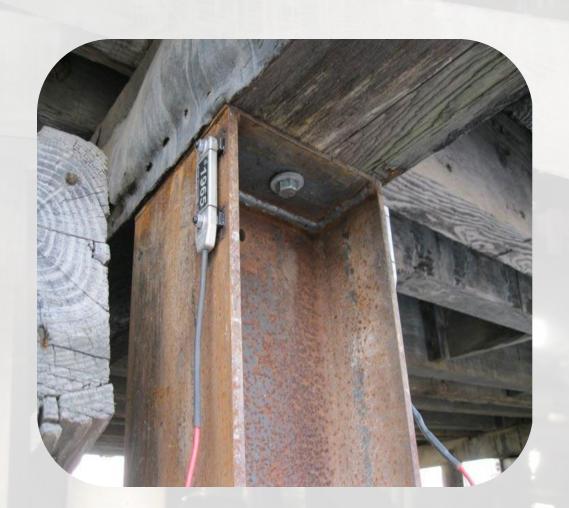




## **Preservative Treatments**

# In-place treatments

- Surface treatments
- Internal treatments





## Pile Preservation

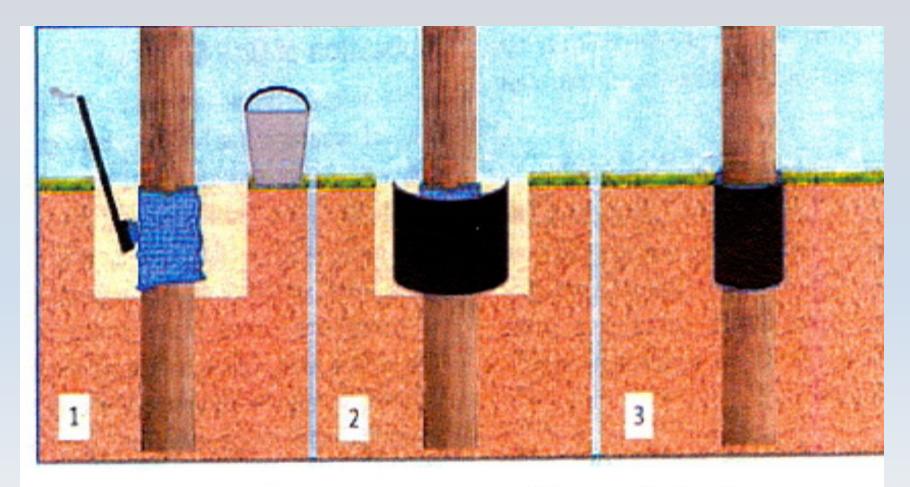


Figure 45. Steps in application of an external groundline wrap treatment.



United States Department of Agriculture In cooperation with the

United States

Department of

Transportation

Highway Administration

Forest Service

Forest Products Laboratory

General Technical Report FPL-GTR-205





#### Guide for In-Place Treatment of Wood in Historic Covered and Modern Bridges

Stan Lebow Grant Kirker Robert White Terry Amburgey H. Michael Barnes Michael Sanders Jeff Morrell



### Prevention

- Borate Rods
- Fumigation



### Use of borate rods

- Low cost means to prevent rot by killing the fungus that causes the rot.
- In use by the log home industry, railroads, utility companies
- Activated at 25% moisture content same as when fungus activates.
- Kills wood destroying insects
- Can act as a Fire retardant
- Protection lasts about ten years.
- Available at paint stores.



## In-place Treatment: Borate

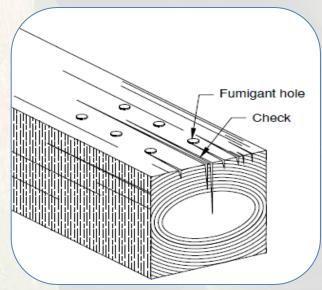
#### **Internal treatments**

- Products applied through drilled holes
- Liquid treatment
  - Liquids diffuse via wood moisture

#### Solid fumigants

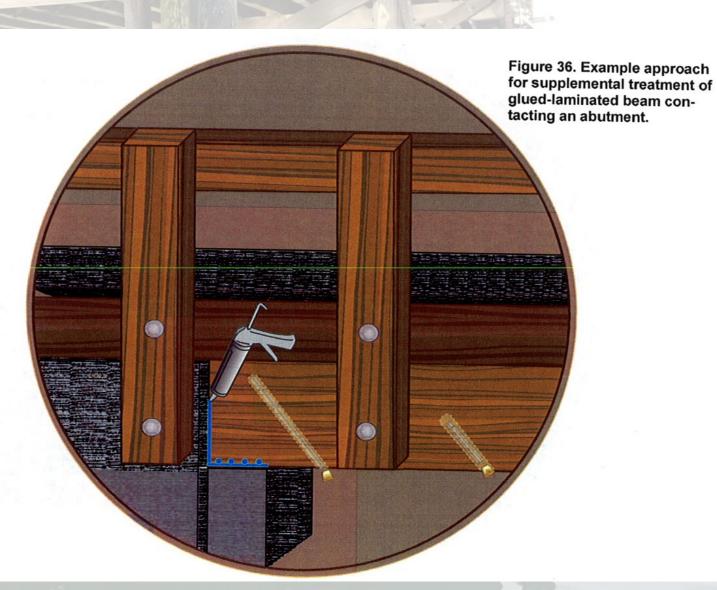
- Holes on both sides of treatment area
- Borate rods
- 10-year treatment cycle





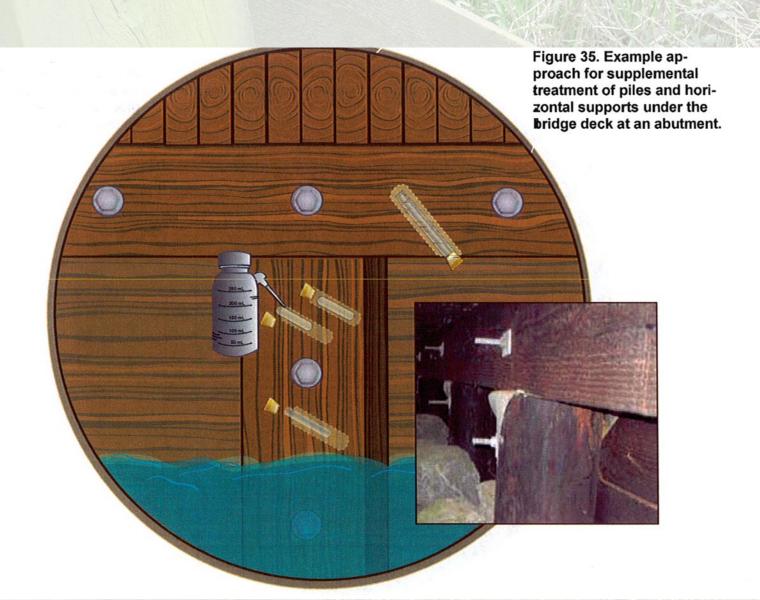


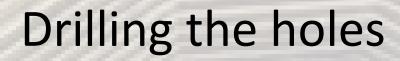
## Use of borate rods





## Use of borate rods













## When to Use of borate rods







# Tracking the Usage

Bridge number	Repair Date	Bridge Name	Repair Number	Borate installed
105/110	4/30/2013	1. O'Leary Creek	S13127	N Abutment Cap
101/140	5/28/2013	W Fork Hoquiam River	S13530	S Abutment cap
165/13	6/4/2013	Gulch # 1	S10002	Cap over pile 6D
101/254	6/6/2013	Little Quilcene	S12407	Pile 1F
108/106	5/23/2013	Skookum Creek	S12583	Cap pier 4
109/9	10/10/2013	Gillis Slough	S12798	Pile 1F
109/25	10/10/2013	Wreck Creek	S12426	Pile 1C



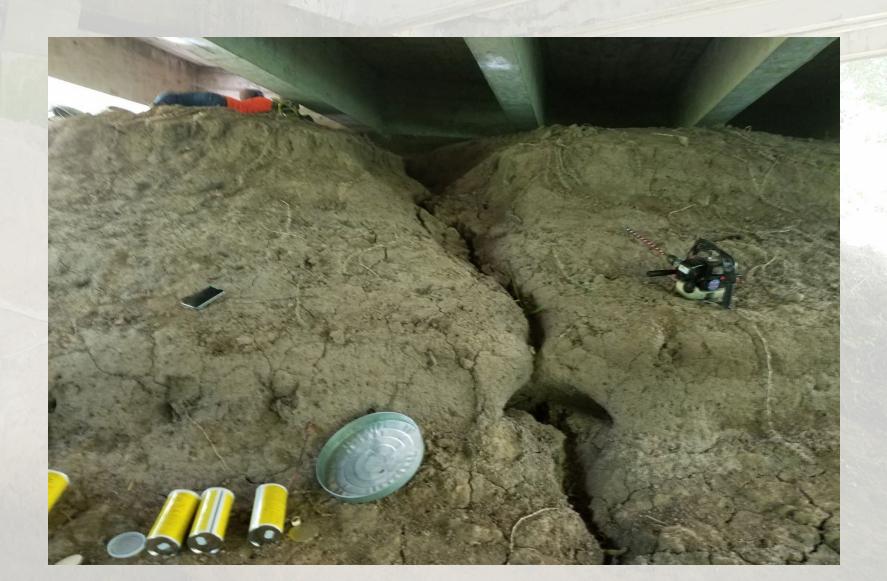






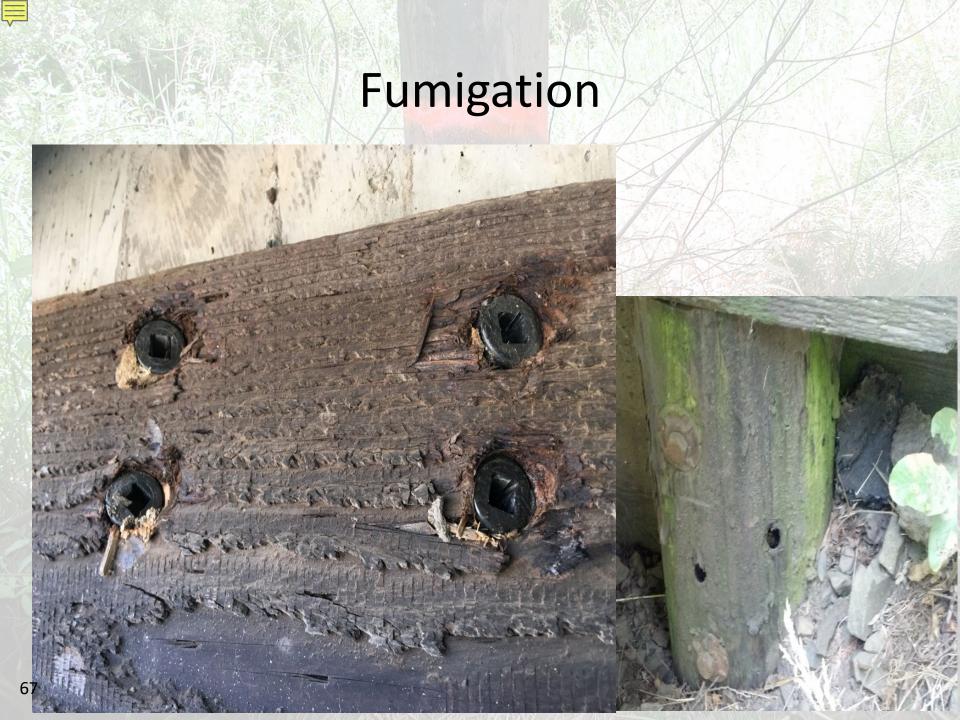












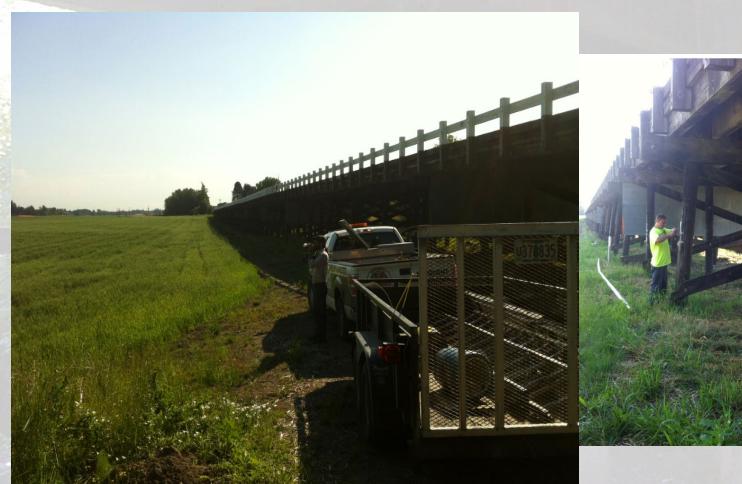






	PILING AND TIMBER INSPECTION AND ON-SITE TREATMENT SUMMARY  Page / / Control C		
NATIONAL WOOD TREATING CO. P.O. Box 1946 • Corvallis, Oregon 97339 • (603) 754-0552	Client: Marion County Facility: Gallon House Covered Bridge Inspectors: Zach Silbarwagel & Dylan Howard Date: 8/2015		
Type of project: Inspection On-Site Treatment General Survey States Other  Description of facility:	Sketch and Numbering System of Facility:		
,	1 N		
Number of piling: Bearing Fender Bulkhead Other	North approach south approach		
Number and dimensions of timbers:			
Contact person/address/phone no.:  SAR Chambes 5  Menton Co.  503-578-503(a.	-5.2 No decay found		
Serviceable members with decay:  Piling  Timbers  Cay 4 /	-5.2 No decay found		
	+43		
Rejected members:			
Reinforceable Wrappable Recommended Replacement Normal Accelerated Emergency			
	Note: The location of decay in wooden caps (lines) and pilling (circles) is represented above. The first of the pair of numbers is shell depth, the second is the width of the decay pocket.		









### **Covered Bridges**





### **Covered Bridges**





### **Covered Bridges**



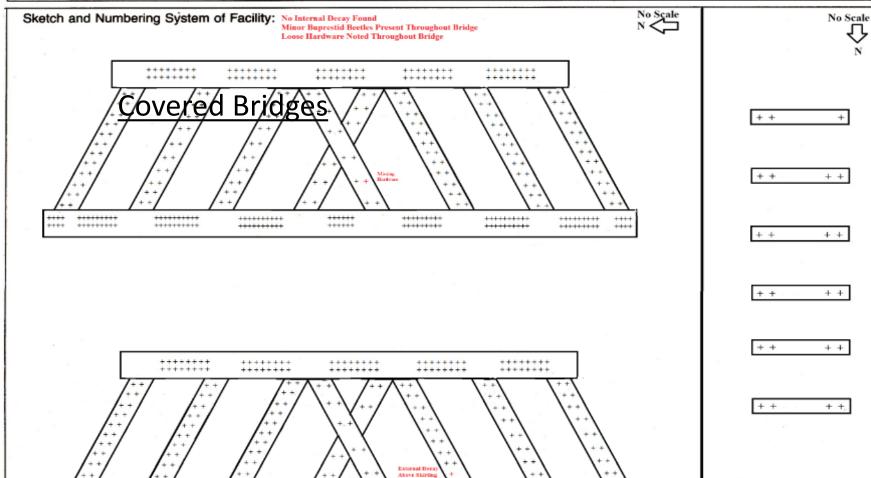


#### PILING AND TIMBER INSPECTION AND ON-SITE TREATMENT SUMMARY

Page 1/1

Client: Linn County Road Department Facility: Short Covered Bridge

Inspectors: Jon Crumpton and Alex Walker Date: 8/13/18 - 8/20/18



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Note: The location of decay in wooden caps (lines) and piling (circles) is represented above. The first of the pair of numbers is shell depth, the second is the width of the decay pocket.

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