



DAVID EVANS
AND ASSOCIATES INC.



Timber Bridge Maintenance

Presented by
Travis Kinney



Overview:

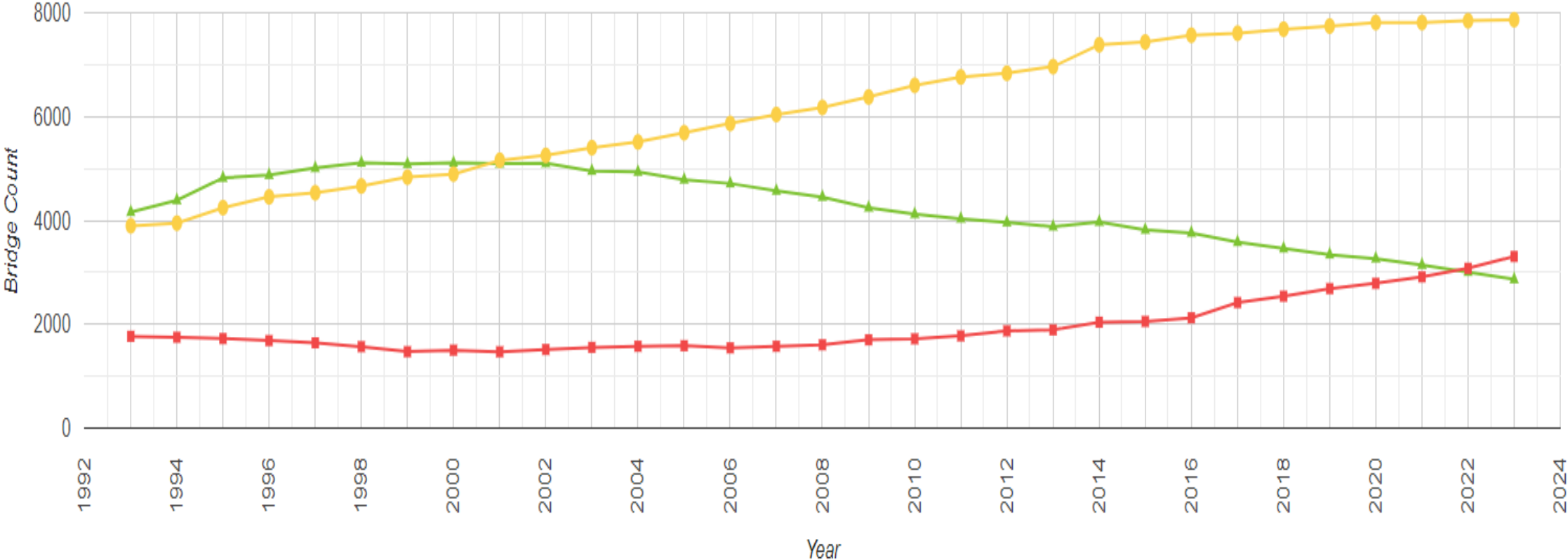
- Where and how to identify deterioration
- Preventative Maintenance
- Pile Repairs
- Girder Repairs
- Cap Repairs
- Additional Resources



Timber Bridge Inventory

Historical Performance

- Good
- Fair
- Poor



ROT - Requires

- Supply of Oxygen
- Moisture
- Favorable Temperature
- Food Supply (Wood)



Rot – Look near the ground line



Rot – Near the water line



- Timber that is always below the water line should be protected from rot.
 - Note: Marine borers can be an issue in submerged piles in ocean waters. Marine borers are invertebrates that burrow into the wood.

Rot – Overhangs and Leaking Joints



How do you find rot?

- Timber bridge members are typically treated with pressure treating preservatives.
- The treatments penetrate the outer shell of the timber members through incising.
- The preservatives protect against rot and insect damage.



Hammer Sounding

- Strike the member with a 3lb hammer and listen for dull or hollow sounds that would indicate a void within the wood.
- Requires training to detect smaller levels of rot.

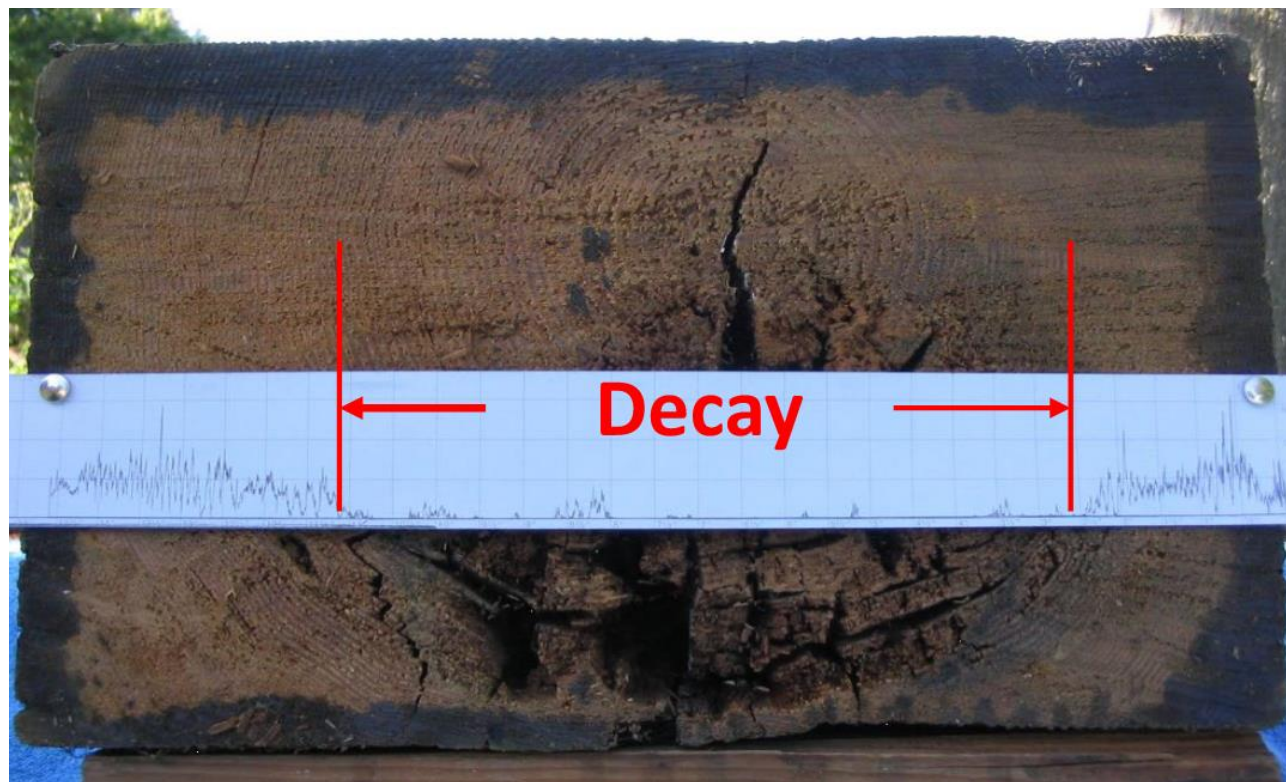


Drilling:

- 3/8" x 18" ship augers.
- Watch the material coming out of the hole (a glove would be a good idea)
- Rotted and wet material won't advance the auger.
- It'll look like mud at times.
- PLUG THE HOLES.
- Sterilize the bit before going to the next hole.



Drilling: Specialized Equipment



Preservation Actions: Fumigation

- Produce gases that move within the pole both vertically and horizontally.
- Especially helpful for treating Western species (Fir and cedar).
- Helps protect the heartwood.
- Requires Certification for Use.



Source: Osmose.com



Preservation Actions: Borate Rods

- Commercially available. Widely used in log homes, railroads and utility companies.
- Activated at 25% moisture content.
- Effective against insects and fungus.
- Follow manufacturer instructions on spacing and sizing.
- Check with regulatory requirements.



Protect the wood from Moisture

- Install flashing to keep the moisture off the end grain or overhangs.
- Maintain bridge joints to keep water off caps.
- Install waterproofing membranes on decks to prevent leakage.



Other Common Problems?

- Cracks/Splits



- Crushing



When should you perform repairs?

ROT:

- Depends on the member.
- Piles may still be OK at a 2-3" shell.
- Caps and beams may become more critical sooner.
- Check with Load Raters to determine if posting or repairs is required.

Crack/Split/Crushing:

- Probably caused by load.
- Should trigger and immediate repair, shoring or restricting the bridge.



Pile Repairs: Wraps

- FRP wrap pile and epoxy inject voids

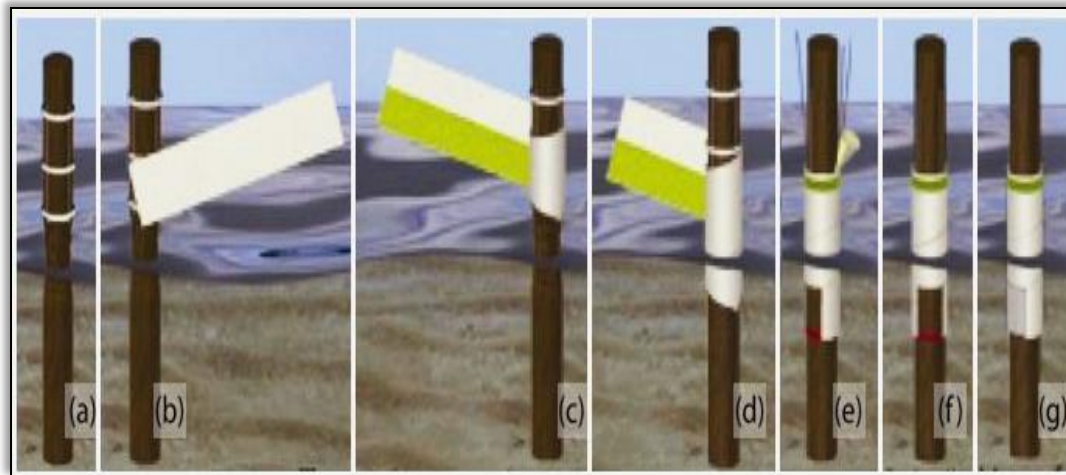
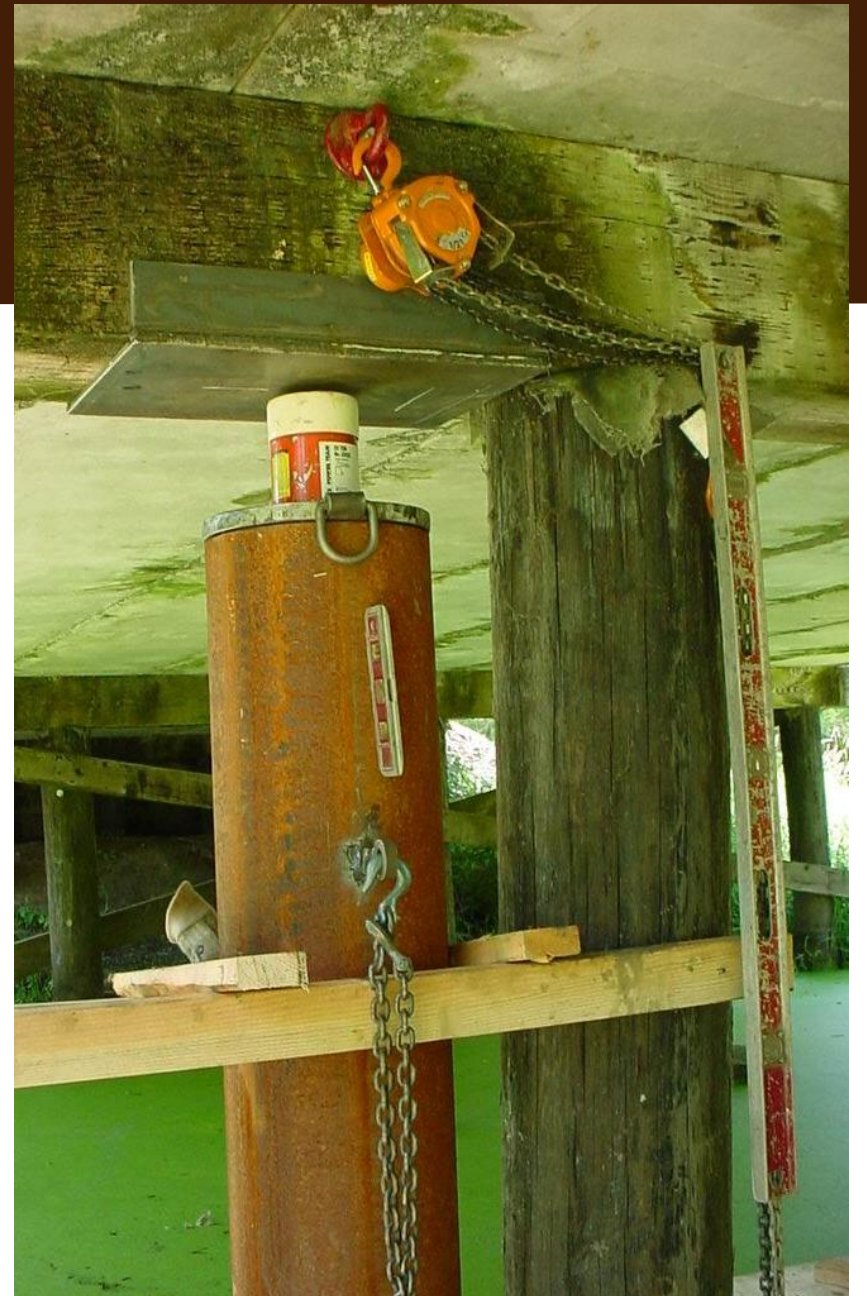


Image source: PileMedic



Pile Repairs: Helper Piles

- Very useful in water or when shoring can't be feasible.
- Challenge is getting enough load capacity in the helper to replace the one pile.
- May need two piles to completely replace one.
- If the rotted pile isn't removed, the inspectors will still rate it. (Temporary)



Helper Piles: Custom Jacking Sleeve



Helper Piles:



Helper Piles:



Helper Pile: Weld Segments



Helper Pile: Push, Block, Repeat



Helper Pile: Push some more...



Pile Repair: Banding

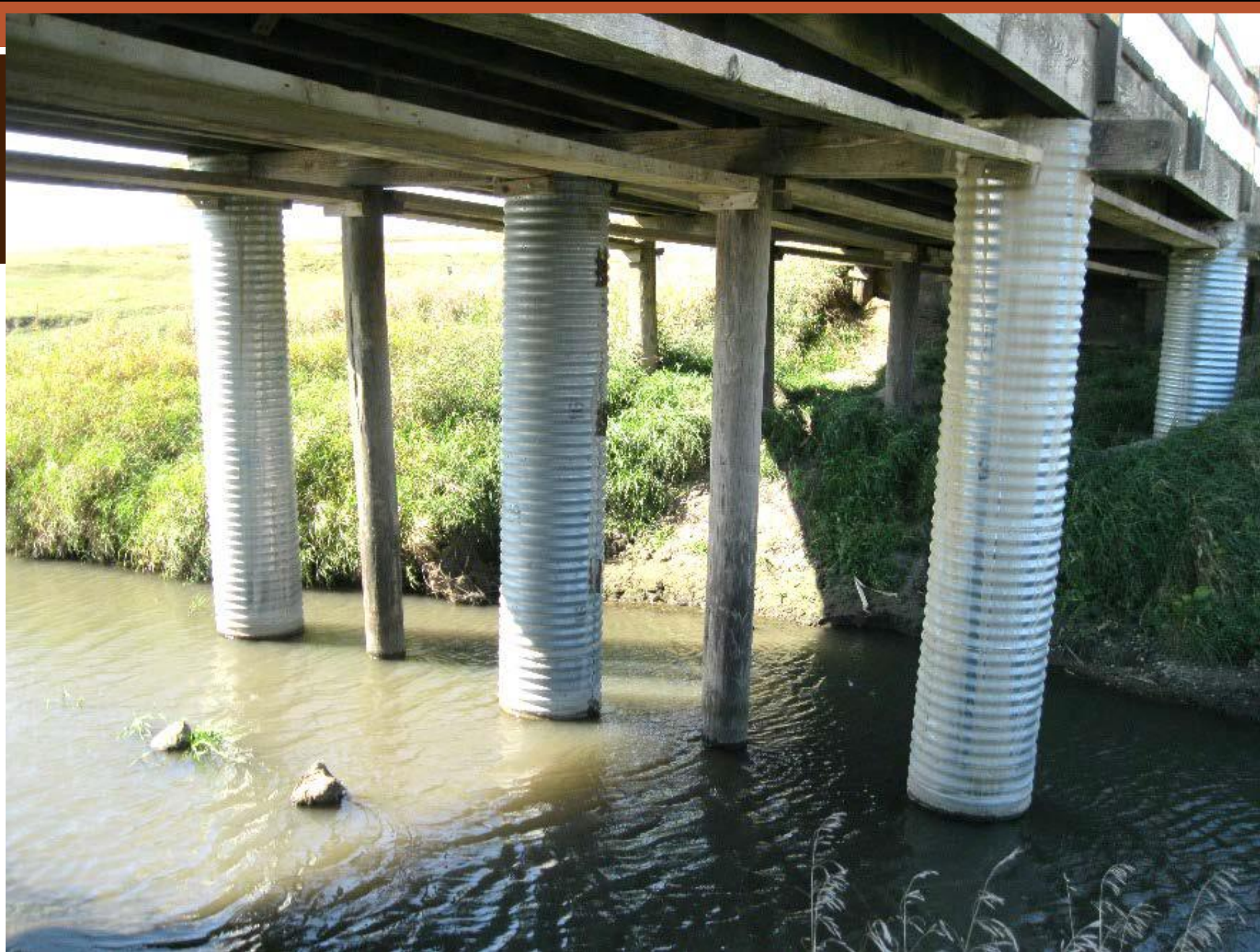
- Piles tend to fail but mushrooming outwards.



- Installing steel sleeves to hold the pile together can buy some time.



Encapsulation:



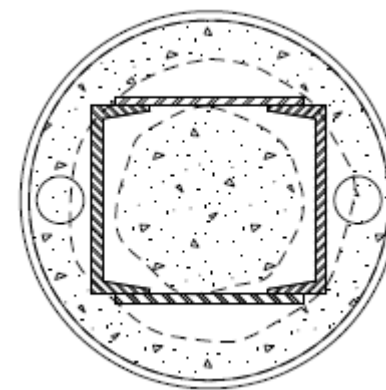
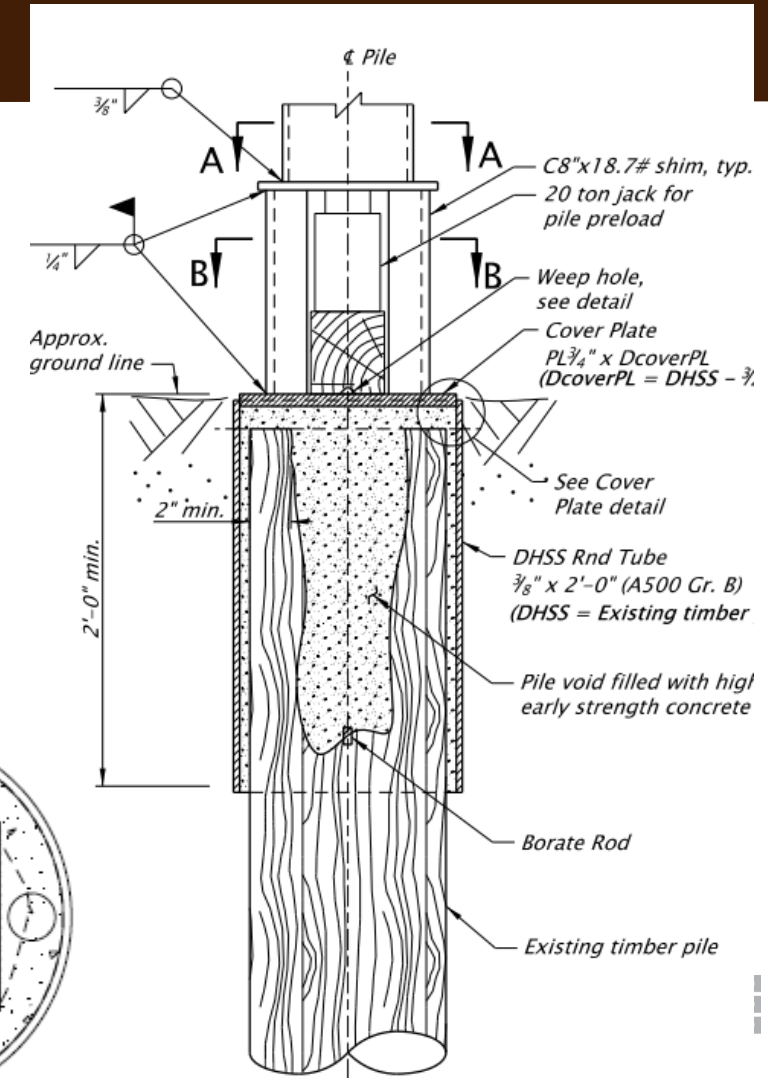
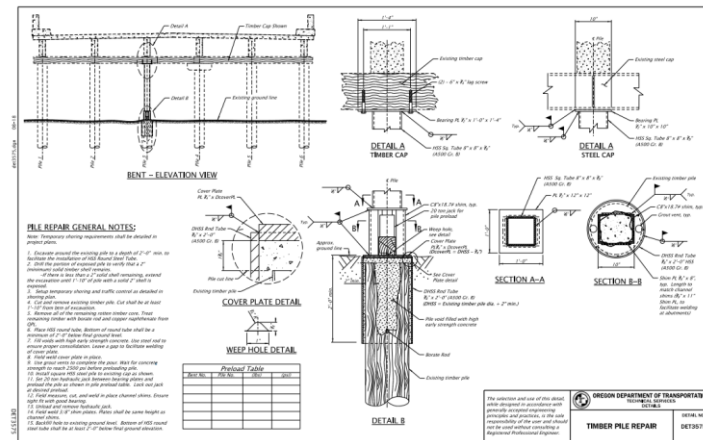
Pile Repair: SPLICING



Rehabilitation Options

- Design was destructively tested by Oregon State University
- Limits excavation depths by reducing splice length and allowing splices at locations with 2" shells
- Replaces reinforced concrete splice with steel casing
- Preloading done by hydraulic jack for pile dead load control

ODOT Std:
DET3575



Pile Splice

- Excavate at least 2' below ground line
- Remove remaining rotten core



Pile Splice

- Place oversized steel sleeve around pile
- Treat with borate rods or copper naphthenate
- Fill with non-shrink grout leaving space towards top
- Weld cover plate and fill remaining portion with grout



Photo courtesy of Travis Kinney, ODOT



Pile Splice

- Once grout is cured, install new steel section
- Preload with 20 ton hydraulic jack



Pile Splice

- Cut and weld channels to fit
- Remove hydraulic jack
- Cut and weld cover plates



Photo courtesy of Travis Kinney, ODOT

Beams (Rot, Crack, Split): Jump Stringers

- Install new beam(s) right next to the cracked beam.
- Bigger is not better
- We want the capacity, but don't want it really stiff that'll damage the deck.

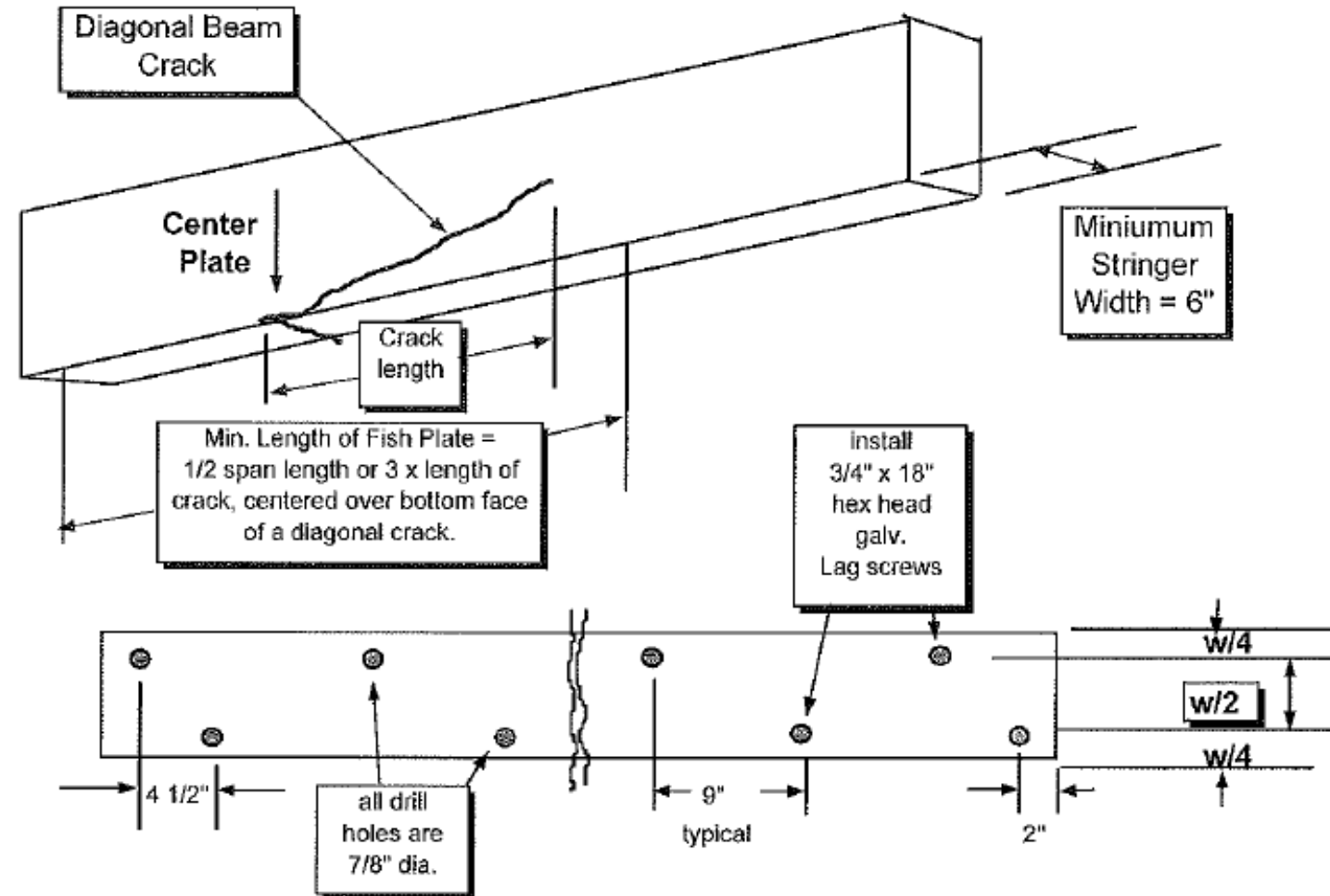


Beams: Jump Stringers

- Shimming and modifications to diaphragm is required
- Can be difficult to fit.



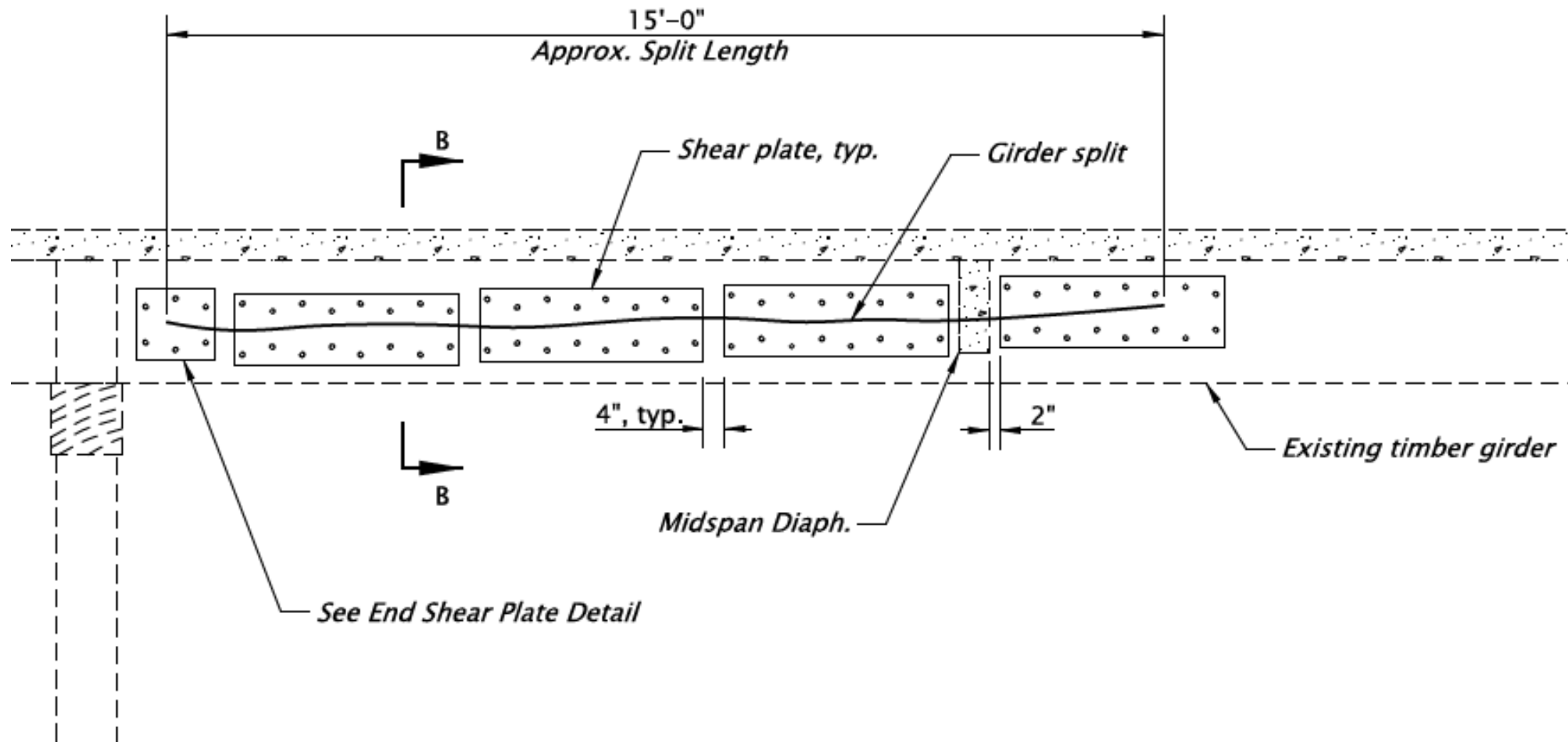
Beam Repair (Crack): Stitching



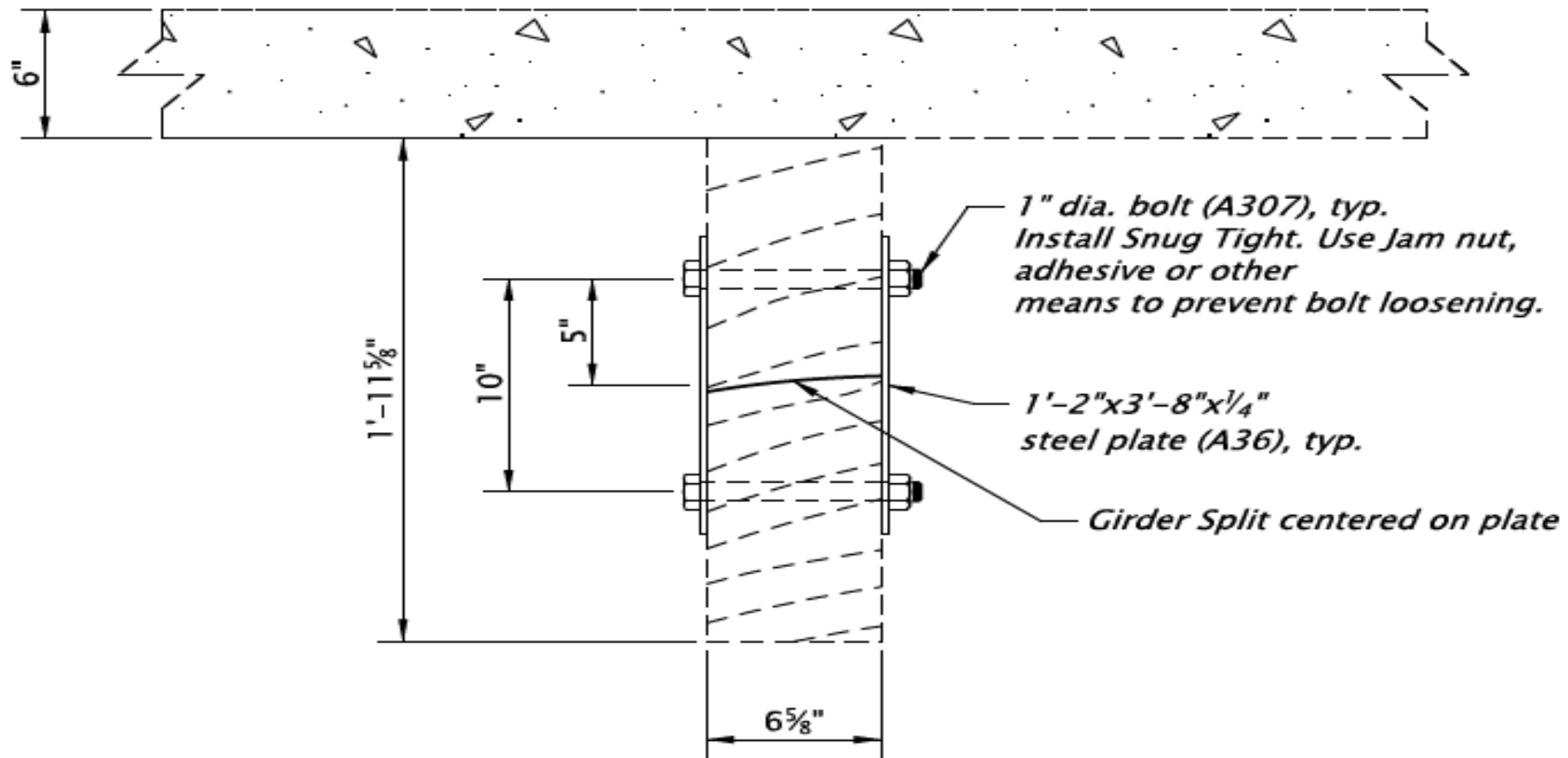
Beam Repair: Stitching



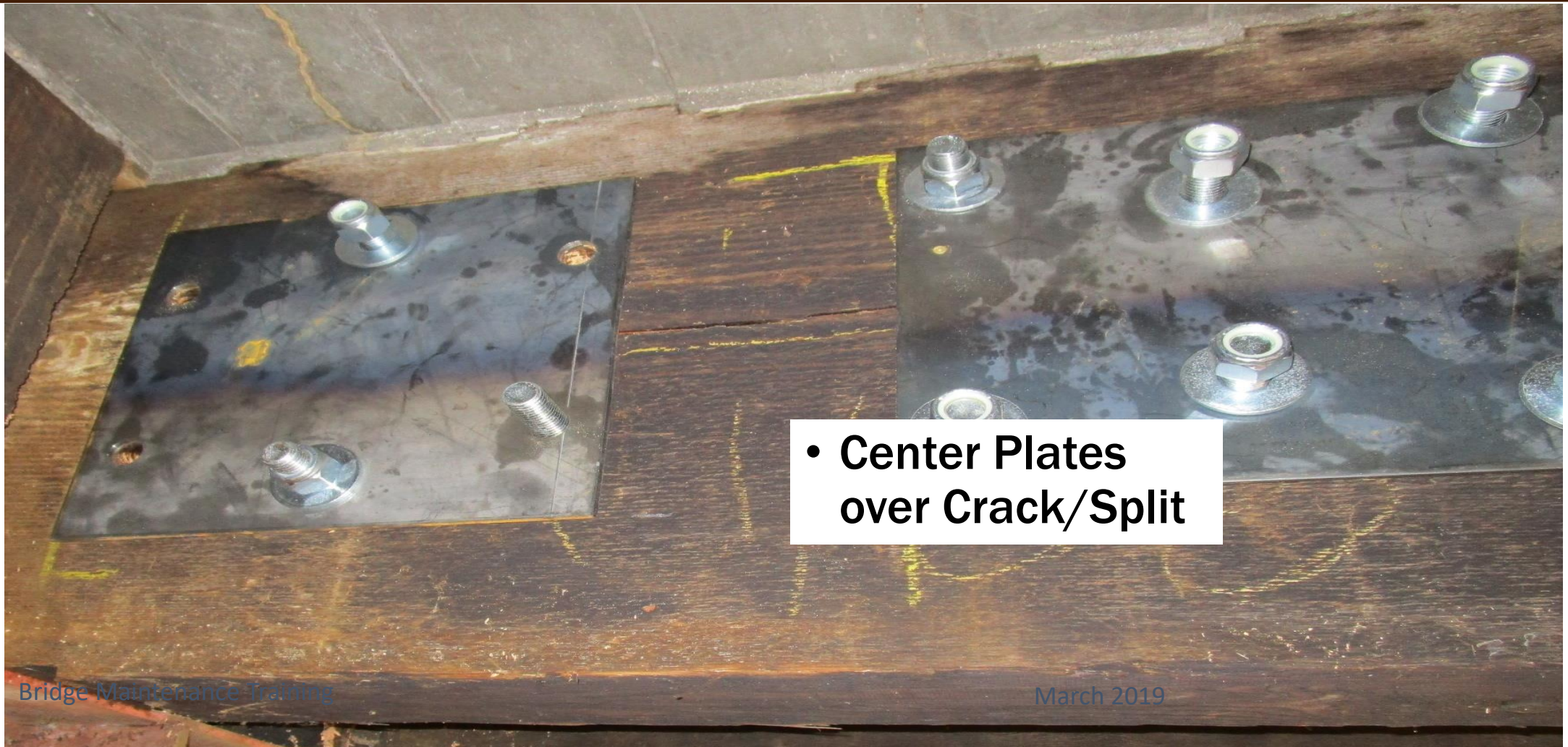
Beam Repair (Split): Fish Plating



Beam Repair (Split): Fish Plating



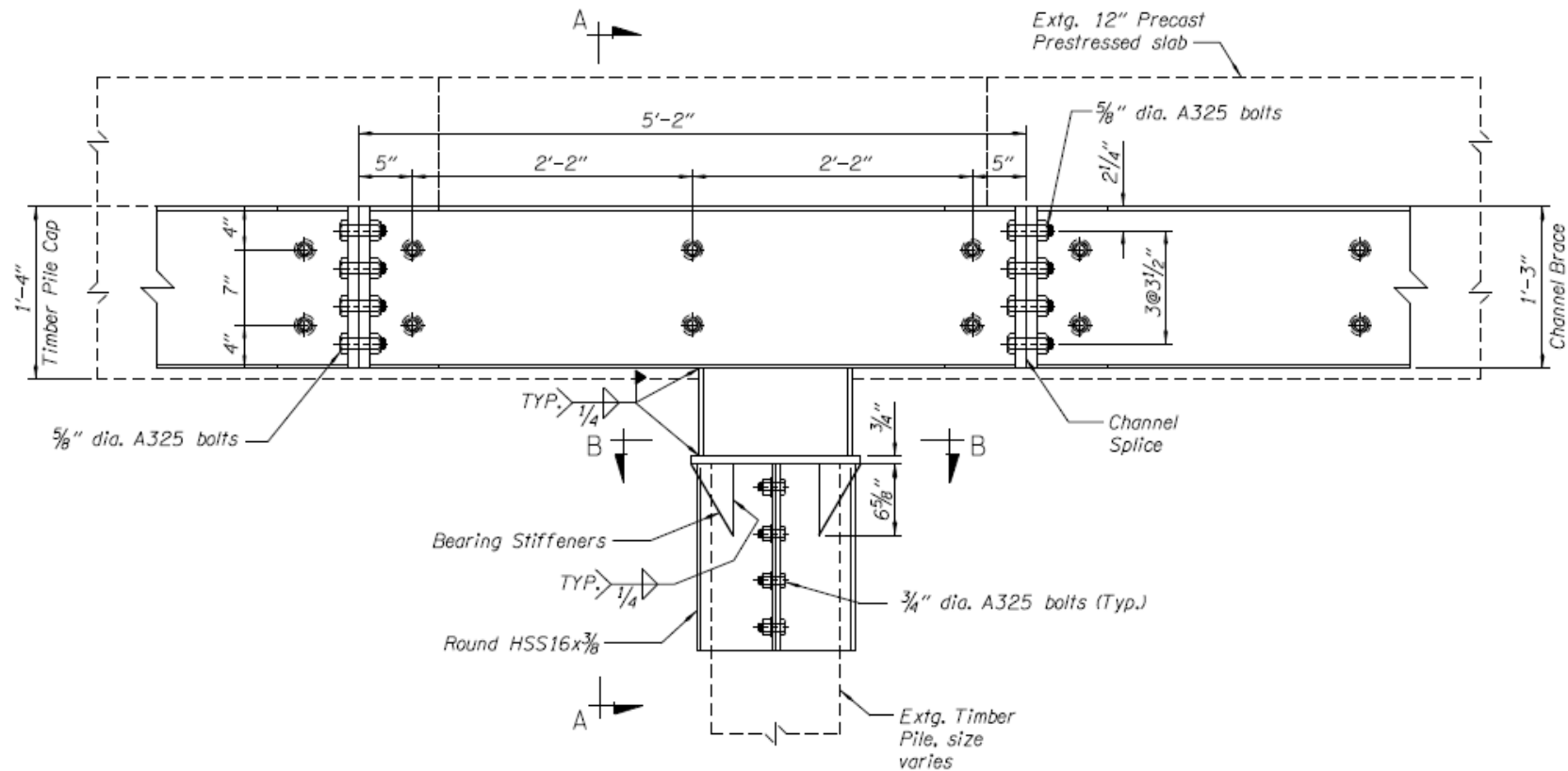
Beam Repair (Split): Fish Plating



Cap Repairs: Encapsulation



Encapsulation with fixed connection to piles



Like previous repair but...



New connection to piles



Timber Cap: Replacement

- Timber member usually replaced with Steel H Beam of similar size.
- Requires shoring the structure while old cap is removed, and new cap is installed.



Timber Cap: Replacement



- Shoring the bridge while removing the existing cap and installing the new cap can be difficult.
- Pictured here is a pile clamp shoring system used in the NW.
- Shoring from the ground is doable if not over water.

Timber Cap: Replacement

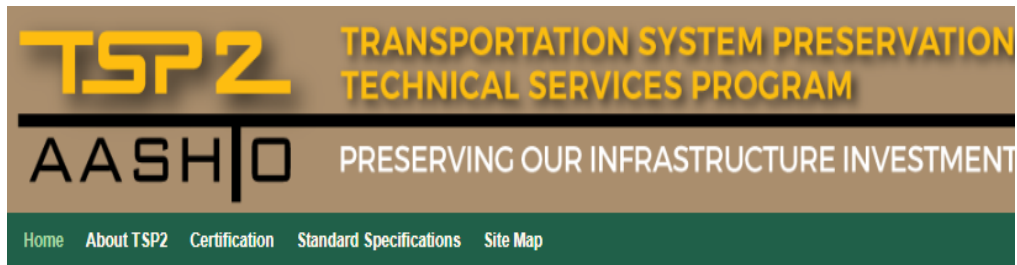


Doesn't Preservation Seem Easier?



Where do I get more info?

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PRESENTATION TITLE	PRESENTER	DATE	PDF
 Strengthening Nail Laminated Timber Superstructures	DeRyver, Jason	2018-04-10	
 Timber Bridge Preservation	Keegan, Chris	2018-04-10	
 Timber Pile Repairs	Kinney, Travis	2018-04-10	
 Oregon's Approach to Timber Pile Repair	Kinney, Travis	2016-05-18	
 Wood Cap and Pile Replacement	Kalsch, Kent	2015-09-30	
 Replacing a Timber Pile by Jacking a Steel Pipe	Gehring, Mike	2010-11-30	
 Replacing a Timber Pile by Jacking a Steel Pipe	Gehring, Mike	2010-11-30	
 Timber Pile Repair	Enchayan, Roe	2010-10-13	

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Questions?

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