



DAVID EVANS
AND ASSOCIATES INC.

Timber Pile Repair

Presented by Travis Kinney



Overview

- Background on timber pile inventory.
- Previous pile repair standard.
- Development and Destructive Testing.
- In field installation of repair.
- Temporary Repairs

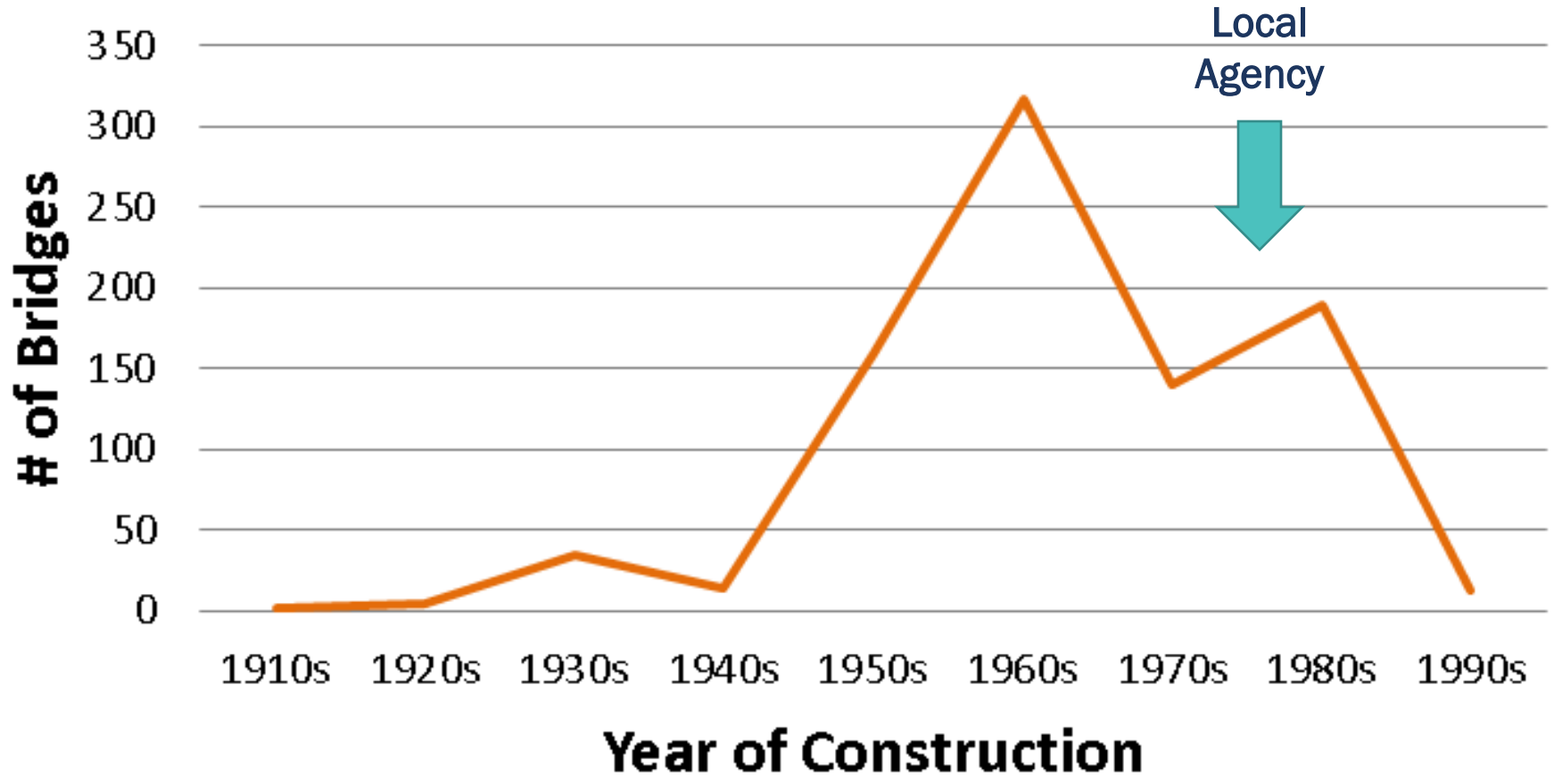


Timber Pile Inventory

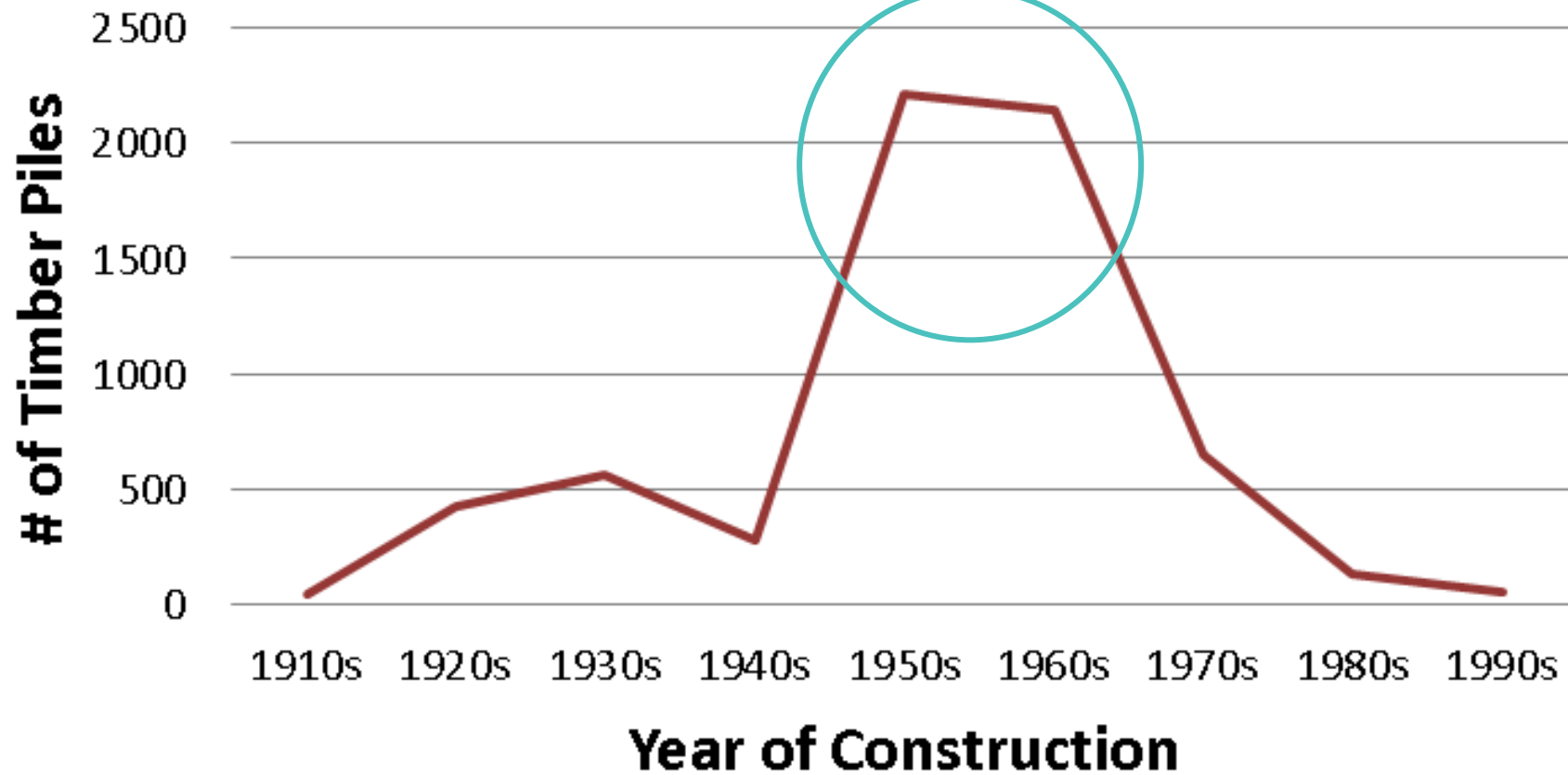
- Oregon has 874 bridges with exposed timber piling.
 - 296 are state owned.
 - 578 are local agency.
- Most were constructed between the 1950's and 1980's, but the range goes from 1906 to 1996.
- Local agency bridges account for the majority of these built during the 1970's and 1980s.



Oregon Timber Pile Inventory



Oregon Timber Pile Inventory





ODOT Bridge Maintenance Program

- Average 20 Major Timber Repair Projects per year.
- Annual Timber Repair cost of \$850,000.
- Accounts for 10% of entire budget and a significant amount of crew resources.

South Yamhill Bridge



South Yamhill Bridge

- Built in 1951.
- Located in Willamette Valley.
- Reinforced Concrete Deck Girder on Timber Pile Trestles.
- 990 ft. in length.
- 34 Timber Bents.
- 204 timber piles (as constructed).
- Estimated cost of replacement = \$35 Million.



Replacing Bridges 1-piece at a Time

- 85 of the original 204 timber piles have been repaired.
- The remaining 119 are just waiting their turn.



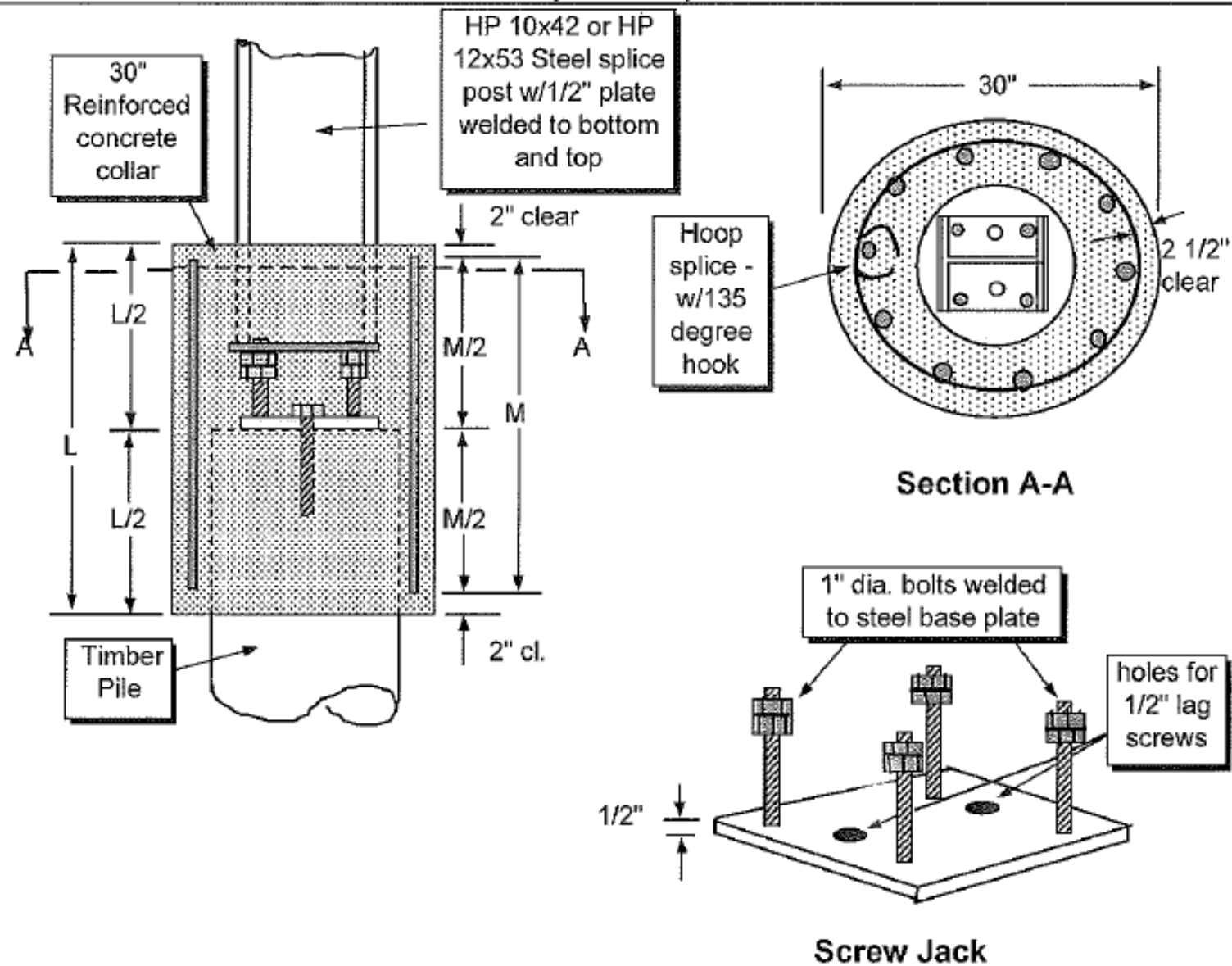
Previous Standard Pile Repair

- Splice new steel H-Pile to existing timber with reinforced concrete collar.
- Standard detail provided in 1983.
- Make splice at 100% solid timber section.
- Concrete splice has a 30" diameter and is 4' in length.
- Uses 10 #6 reinforcing bars w/ #5 hoops at 6" spacing.

OREGON DEPARTMENT OF TRANSPORTATION

Timber Pile - Steel Splice Repair

(7/18/83)







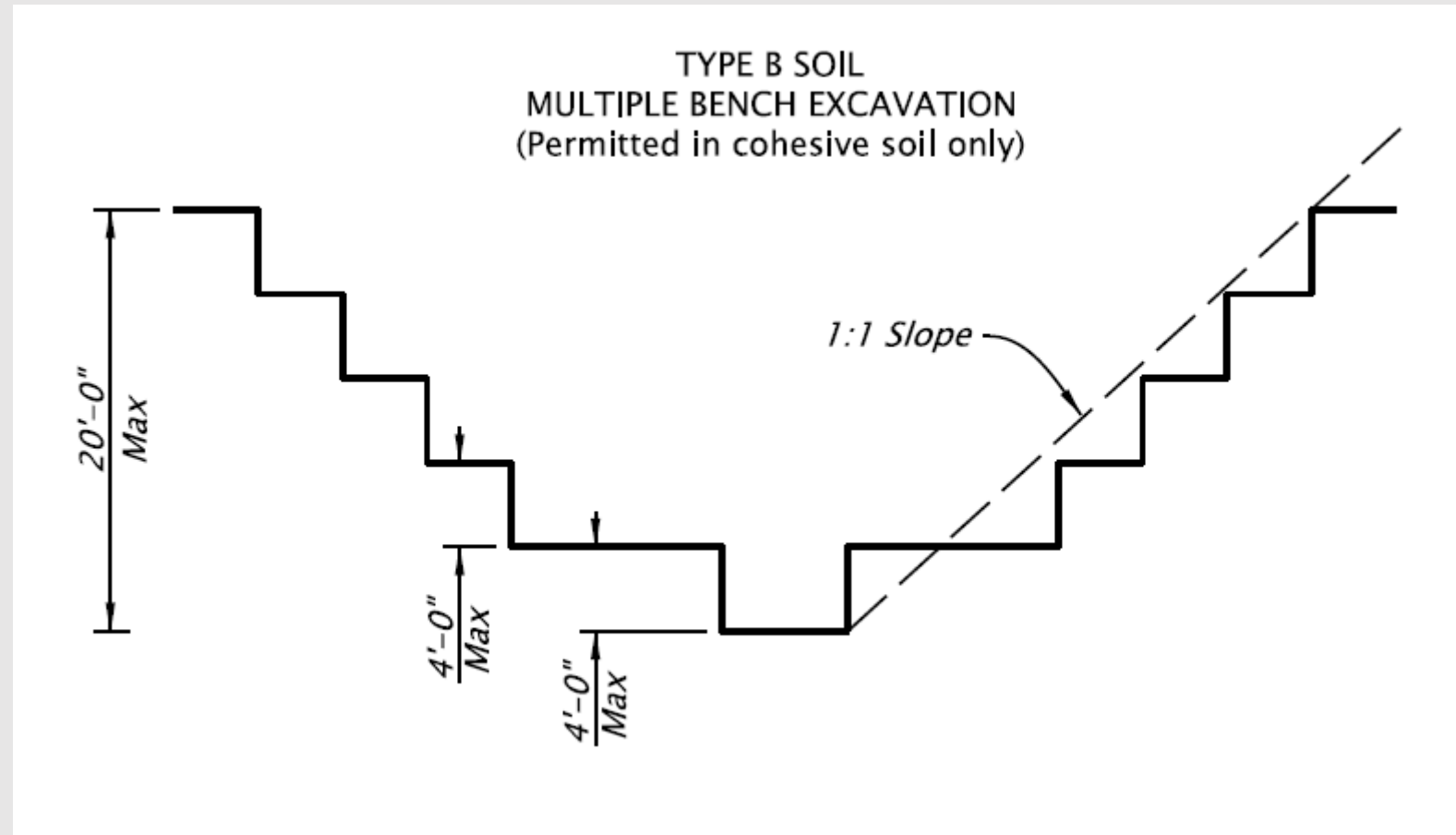
Drawbacks

- Difficult to install in tight spaces. (abutments).
- Steel cage difficult to stage.



Drawbacks

- Required excavation to continue at least 2' deeper than rot.
- If rot extended more than 2' below ground level then shoring or benching excavation was required.



Proposed Pile Repair Method

- Replace reinforced concrete collar with oversized steel pipe pile grouted to timber pile.
- Allow splice at a location with less than 100% solid timber section.
- Auger out remaining rotten timber pile core and fill cavity with high early strength concrete.

How much rot is too much to repair?



Timber Pile Splice Testing

- ODOT contracted with Oregon State University to destructively test pile splice detail.
- 6 piles in total were tested; 3 flexure and 3 compression.
- Rot was simulated to varying depths:
 - 2 feet
 - 3 feet
 - 4 feet



Compression Test Setup





Compression Test Results:

- The jack wasn't big enough!
- No piles failed at maximum load of 300,000 lbs.

Bending Test Setup





Bending Test Results

- All three failed at the base of the splice.
- Loading at failure was about what you'd expect for an unrepaired pile with 2" shell.
- Load remained about constant through 12" – 24" of deflection.

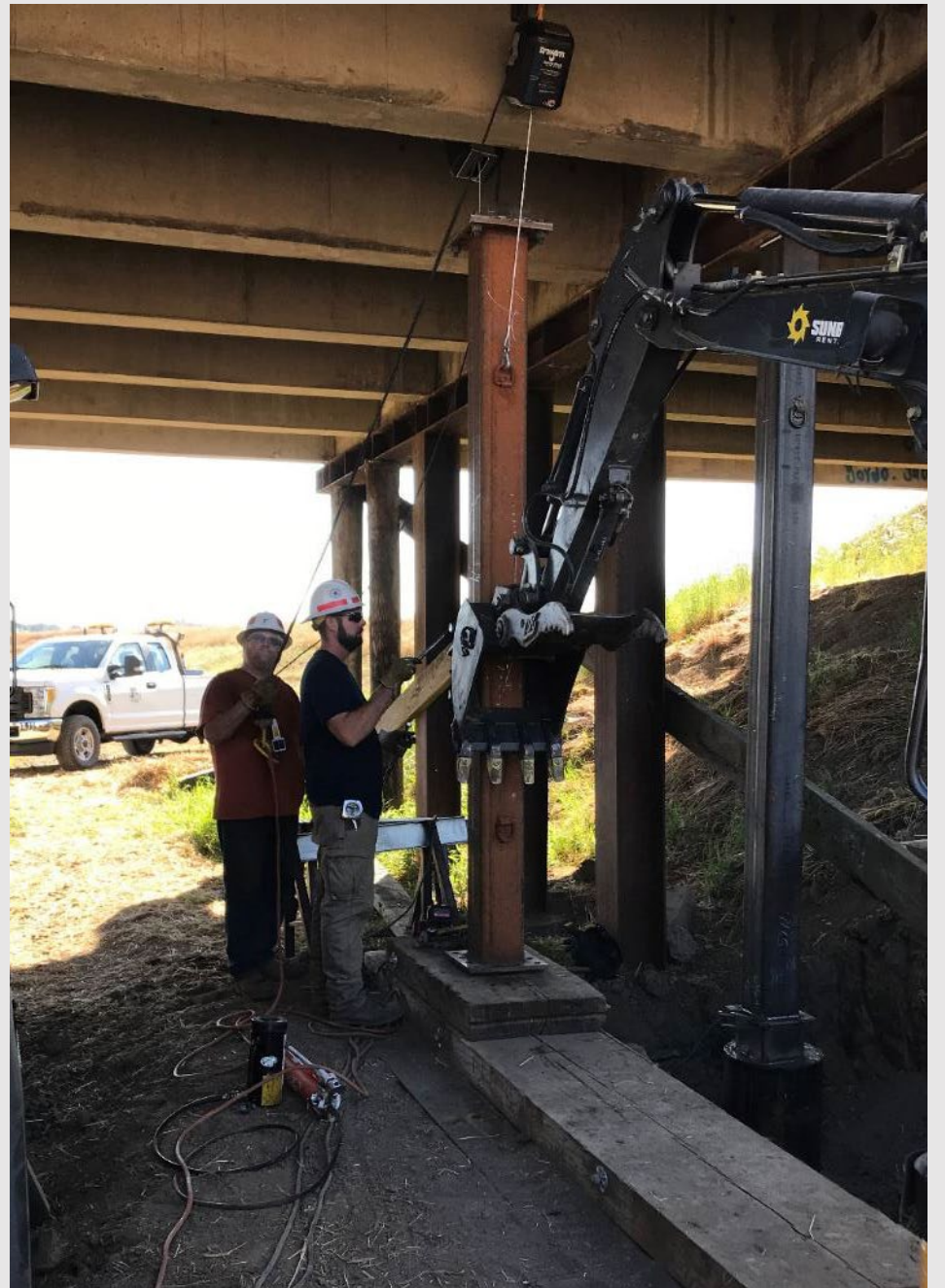
Testing Summary:

- New pile repair can be used to fully restore axial capacity for short columns.
- Lateral demand and remaining capacity should be evaluated as part of repair plan.
- May need to add some bracing depending on application, or make the splice at a section with no rot.



**Step 1:
Install shoring as
required by
jacking plan.**









**Step 2:
Excavate 2'
below
ground line.**



**Step 3:
Cut out
section of
rotted pile.**



**Step 4:
Remove
remaining
rotten core.**



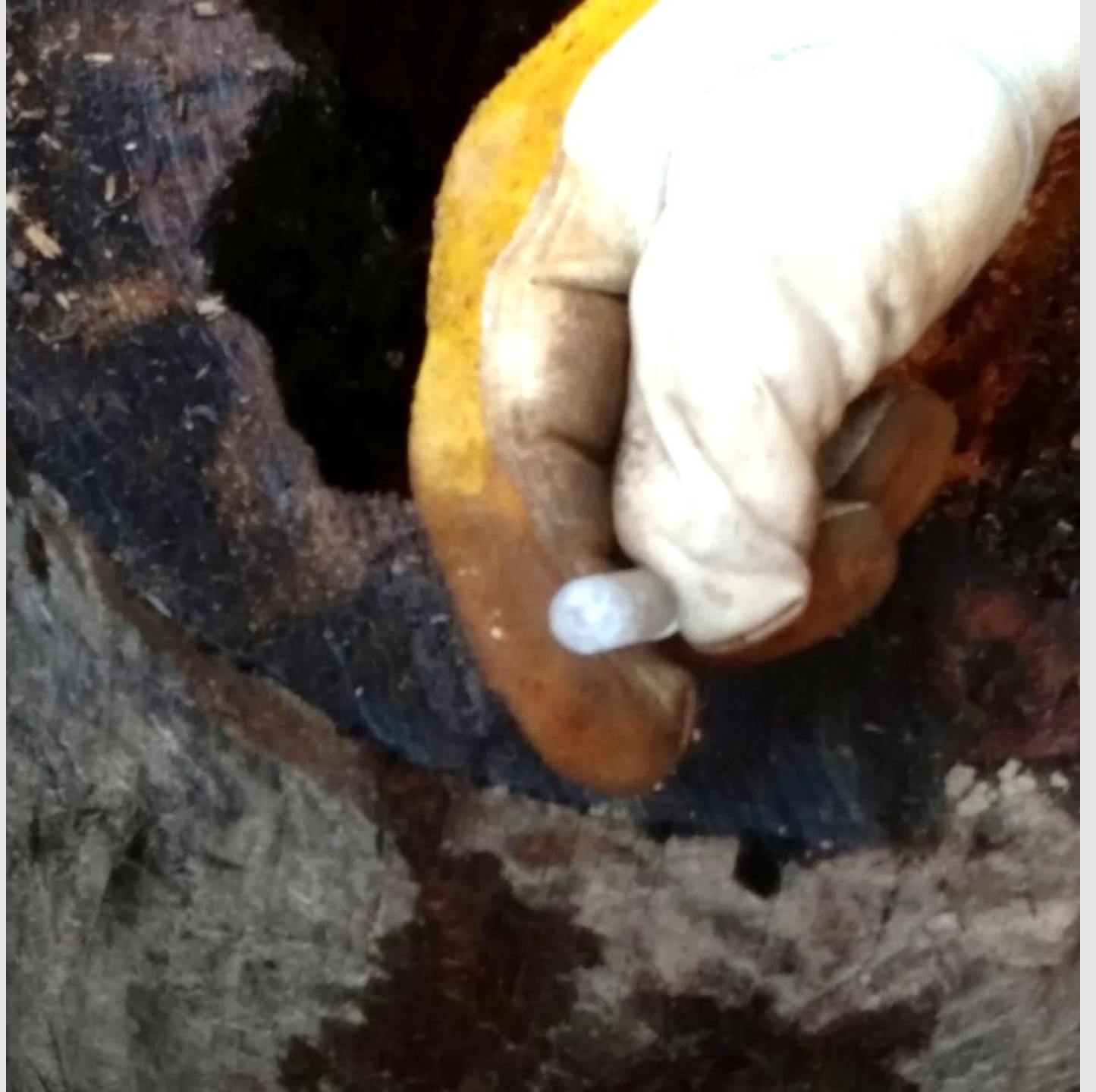


**Clean out
the hole.**





**Step 5:
Install borate
rods or other
preservative**





Step 6: Fill cavity with high early strength concrete.





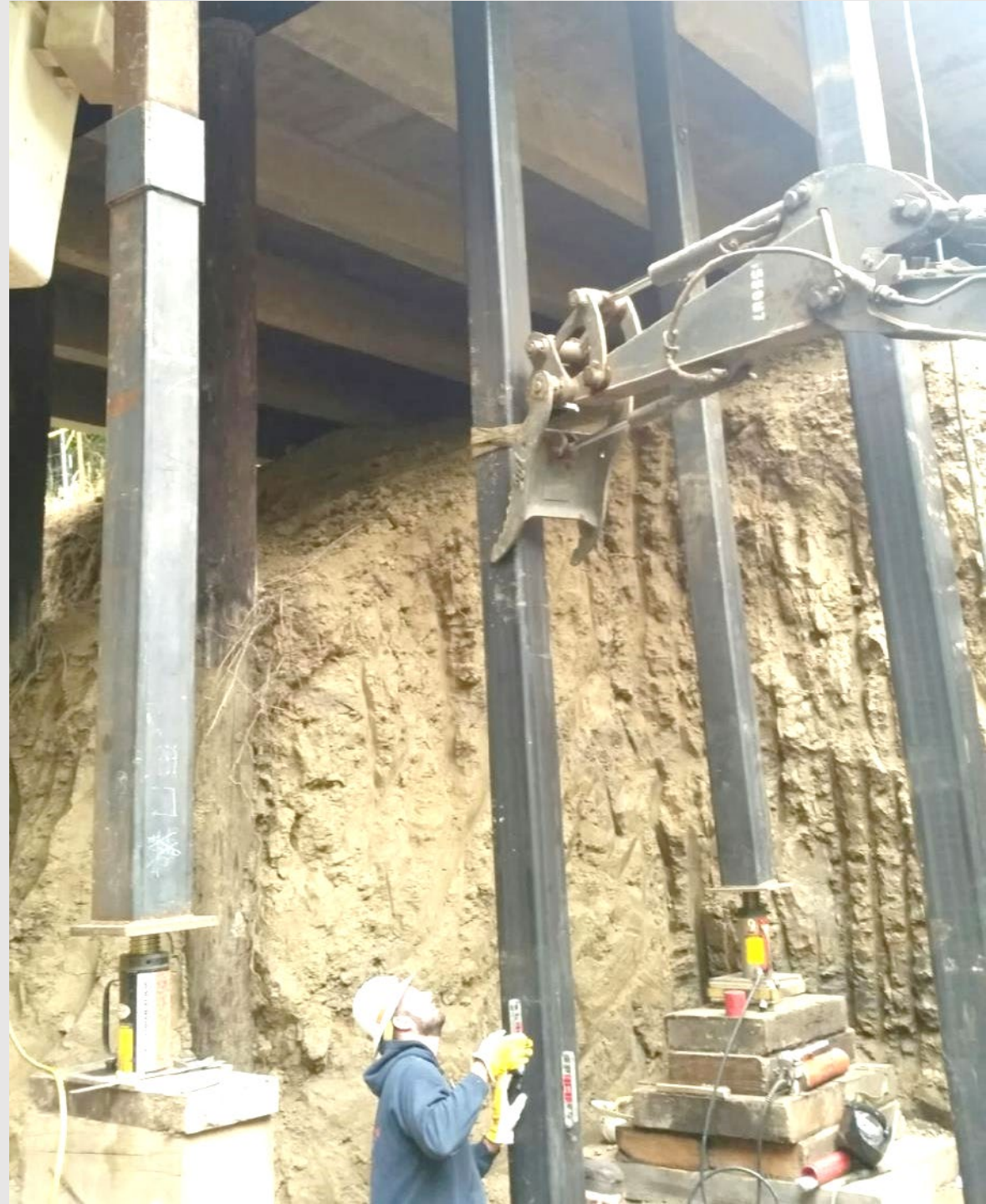
**Step 7:
Weld cover
plate in
place.**



**Step 8:
Use vent
holes to
finish pour.**



**Step 9:
Position
steel pile.**



**Step 10:
Preload with
20 ton
hydraulic jack.**





Step 11: Cut shims to fit and weld in place.



**Welding
channel
and plate
shims.**





Completed Splice.





**Step 12:
Back fill to
existing
ground
level.**



Modifications: “Dumbbell Repair”





Modifications: “Square post”





Temporary Repairs

- Jack in helper piles.
- Band the pile.
- Bolt on channels.
- Encapsulation.
- Mudsills and post.



Jack in 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...



Banding Piles:

- Piles tend to fail but mushrooming outwards.
- Installing steel sleeves to hold the pile together can buy some time.



Bolting Channels:





Encapsulation:





Mudsills and Posts:



Questions



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