



# **Bridge Repair Methods**

- Over the past decade over 100 deficient bridges have been successfully repaired by Durable
- Repairs utilized improvements in existing techniques with composites and creative approaches
- Repairs are long lasting, cost-effective, tested and accepted by USDA Forest Service and multiple LADOTD districts
- Durable's techniques can be utilized where environmental or location restrictions had led some to assume bridges were cost prohibitive to repair



## **Abutment and Wing Walls**

- Shore up, repair, replace or modify abutment and wing walls on a case by case basis based on their
  - location
  - damage





## Abutment Walls, Wing Walls and Approach Slabs

- No signs of settling add flowable fill into the voids
- With signs of settling and abutment boards decayed – ID cause, remove approach, replace wallboards, add filter cloth and backfill with compaction
- For failing walls from damage or natural scour – install sheet piles



## Timber Bridge Components (Caps)

- Options to improve timber bridge components
  - Epoxy / Resin
    - Fill cleaned and decayed areas with epoxy resin
  - Gunstocks
    - Timbers added to side of cap with another to support bridge deck
  - Cap Replacement
    - Remove decking
    - Jack up the deck
    - Replace existing cap



### Timber Bridge Components (Caps)





### Timber Bridge Components (Caps)



Epoxy Resin Cap Repair



### Timber Bridge Components (Stringers)

- Common Repairs
  - Remove decking and stringer and install a matching stringer
  - Replace stringer from beneath bridge
    - Original must be cut out from beneath the bridge
    - Notch stringer ends to allow replacement to be slid in to match the cap
    - Slide stringer back on top of the opposing cap
    - Shim/brace to support the deck load





- Needed due to weathering decay or damage from contact
- Focus is on drift pins, cross brace bolts and ground line of pile
- Repair can consist of a pile wrap or pile splice depending on circumstances
- Durable wraps, splicing and FRP composite material methods
  - Seal repair connection at cap
  - Seal connection to existing pile to prevent water intrusion



- Lasting repairs may require existing piles be replaced with new pile material rather than a new pile
  Compression load is key
- Other repairs have been used to sleeve or cover decayed and weathered areas of pile
  - Without addressing the compression load of the pile and the structural integrity of the bridge
- Durable's FRP repairs address both load compression and water intrusion
  - Durable's approach to splice connections is centered around sealing new connections





Durable FRP Repair







## **Concrete Cap, Pile, Deck Repairs**

- Carbon Fiber
  - Approved to add strength and repair concrete deficiencies
  - Added to caps and bridge decks to increase load capacity
  - Carbon Fiber repairs usually require installation by certified installers (Durable is a certified installer)
- Concrete decks with spalling can be repaired with structural concrete where needed
- Concrete piles can be repaired using the same methods as caps
- Joint sealing is done to prevent water intrusion



### Carbon Fiber Repair







#### FRP Bridge Deck Reinforcement





#### Structural Concrete Encased in Carbon Fiber

#### Before









**Guard Rails** 



Typically repaired in-kind.



## Conclusion

- Avoiding water infiltration to vulnerable bridge components is key to the longevity of any bridge
- Durable's methods were developed with watershed as a focus
- Repairs are delivered with minimum down time
- Repairs are done with bridges remaining open for traffic
- Durable's FRP pile splice repair method has been tested
  - Testing completed at the USDA Research and Development Center with results available upon request
- Carbon Fiber repairs on concrete structures are more important as structures age
  - Carbon Fiber repairs are tested on site
  - Durable is a Certified Installer!



## **Durable Piling Restoration, L.L.C.**

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