

FRP Material Use on County Bridges

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Dean C. Foster P.E., P.S.

Outline

- Overview of FRP materials for strengthening
- Design process
- Construction process
- Other uses for FRP materials

Overview of FRP Materials for Strengthening



Overview of FRP Materials for Strengthening



Overview of FRP Materials for Strengthening



Overview of FRP Materials for Strengthening

- Strengthening Products
 - Plates, Sheets, and Rods
 - Manufactured
 - Pultruded plates and rods
 - Woven pre-preg fabric
 - Fibers
 - Glass and Carbon
 - Matrix
 - Epoxy and polyesters

Overview of FRP Materials for Strengthening

- Method of strengthening
 - Bonded plates and fabric sheets
 - Prestressed/post-tensioned near surface mounted tendons

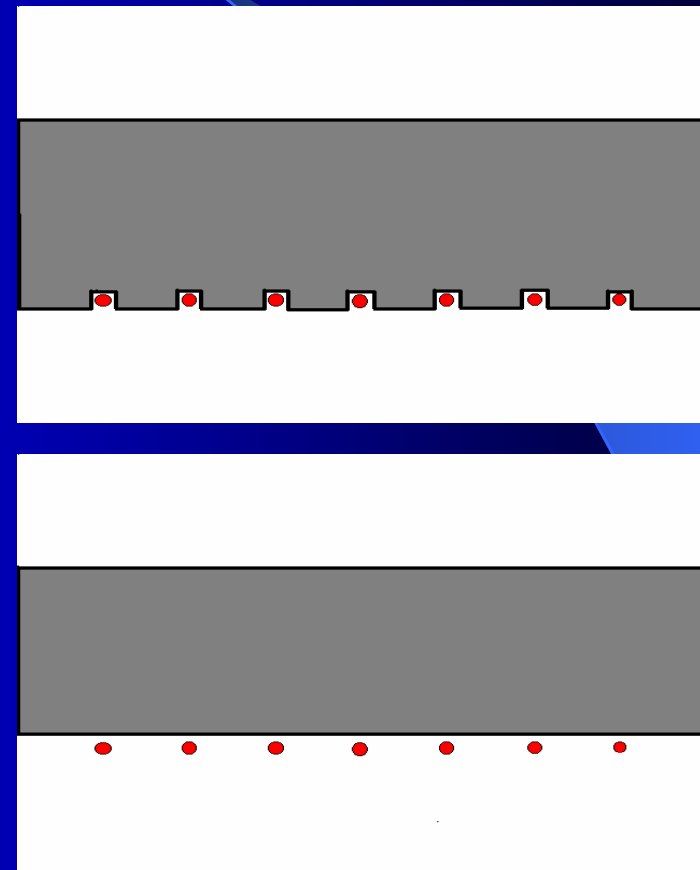
Overview of FRP Materials for Strengthening

- Plate bonding
- Fabric sheet bonding



Overview of FRP Materials for Strengthening

- FRP Rods bonded in grooves
- Prestressed FRP Rods mounted near surface



Overview of FRP Materials for Strengthening

- Applications
 - Tensile forces
 - Shears forces



Overview of FRP Materials for Strengthening

- Applications
 - Flexural strengthening
 - Compression strengthening



Design Process



- Strengthening of concrete bridges
 - Slab bridges
 - RC T-section beams
 - Prestressed beams

Design Process

- Through inspection
 - Determine cause
 - Deterioration
 - Overloaded
 - Poorly designed
 - Poorly constructed
 - Increase capacity

Design Process

- Through Inspection cont'd
 - Determine extent of deterioration
 - Gage amount of section loss
 - Quantity of deterioration

 - Non-destructive Evaluation
 - Load test

Design Process

- Analyze strengthening method
 - What works to fix problem
 - Plate bonding
 - Fabric sheets
 - Prestressed/Post-tensioned rods
 - Consider future inspections/health monitoring

Design Process

- Analyze deteriorated component
 - Determine existing load capacity
 - Analyze nearest neighbors
 - Compare to load test
 - Load test provides analysis check

Design Process

- Design FRP to compensate for strength loss
 - Restore to original cross section
 - Know properties of restoration concrete material
 - **Strengthening system importance**
 - FRP, adhesive, and concrete patch material thoroughly tested and developed to work together

Design Process

- Determine dimensions of FRP to restore strength
- Analyze interface of FRP and beam for adhesive thickness
- Analyze anchorage zone

Construction Process

- Strengthening of concrete bridges
 - Surface preparation is key
 - Remove all loose material
 - Remove all rust from rebar
 - Apply rust inhibitor
 - Clean all exposed areas of concrete

Construction Process

- Strengthening of concrete bridges cont'd
 - Apply sealant/binder compound
 - Apply concrete patch material
 - Apply FRP adhesive
 - Apply FRP strengthening material
 - Seal newly repaired areas

Construction Process



- Lightweight material
- No special equipment

Construction Process



- County forces
- Low cost w/r/t component or total replacement
- Repairs made under traffic

Other uses for FRP Materials



Column repair

Other uses for FRP Materials



Before



After

Other uses for FRP Materials



FRP Rebar

Other uses for FRP Materials



Composite piles

Other uses for FRP Materials

- Steel bridge repairs
 - Very active research area
 - Bonded/bolted plates
- Timber bridge repairs
 - Use in covered bridge restoration
 - Increased load capacity of glue-lam beams

Questions ?

Comments, Concerns?

Additional Information

Dean C. Foster

513-756-9038

Dean.Foster@wpafb.af.mil

Deanfoster@aol.com