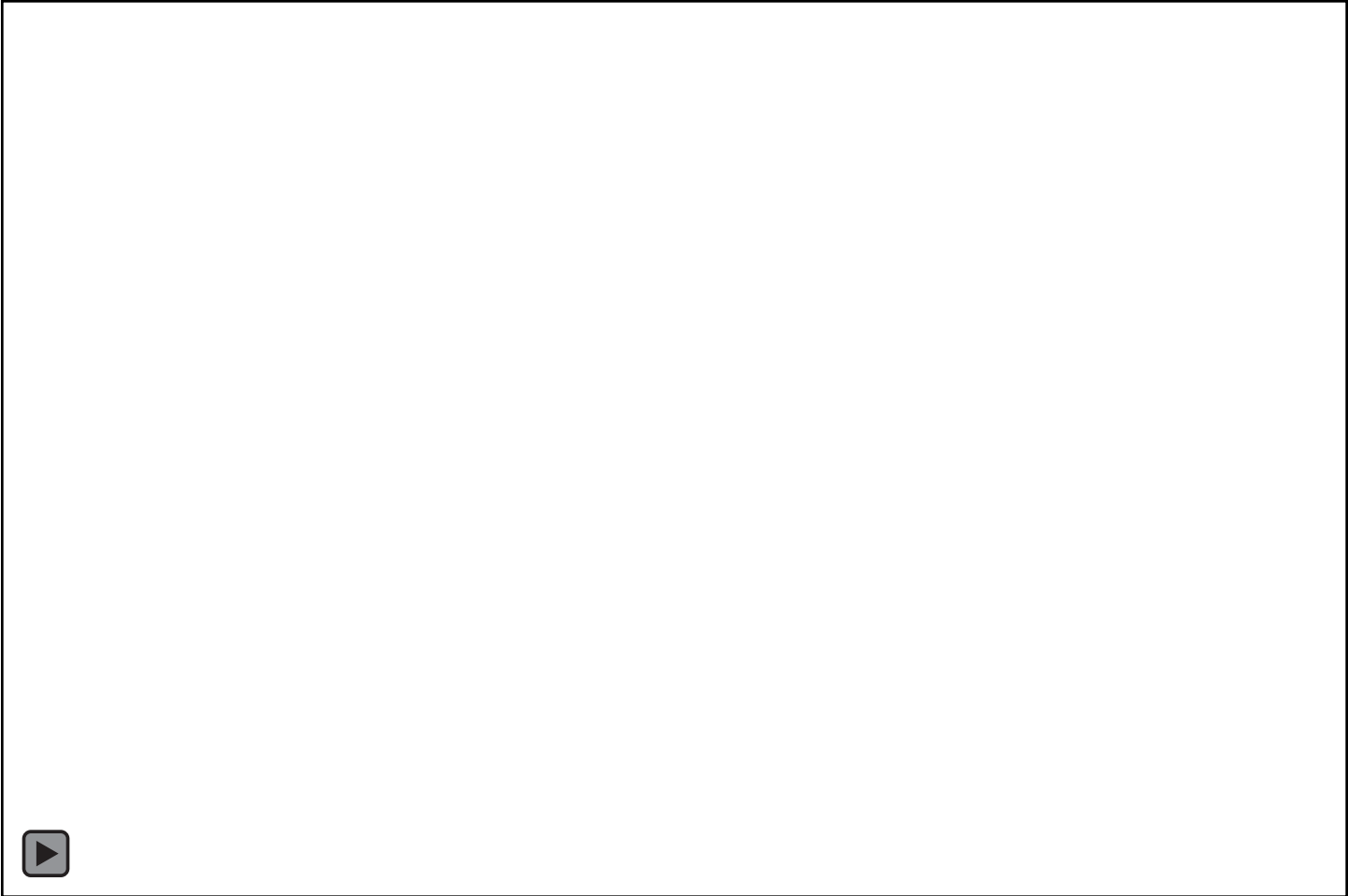


Strengthening & Rehabilitation of Bridge Structures Using Fiberwrap Materials

Gaetano Bologna, P.E.



Tyfo Fibrwrap Systems for Bridges



Externally-Bonded FRP Systems

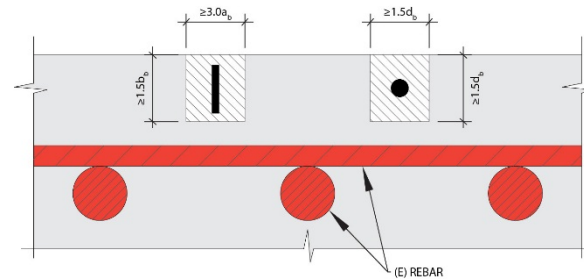
Wet Lay-Up

Dry fiber sheets or fabrics impregnated with resin on-site

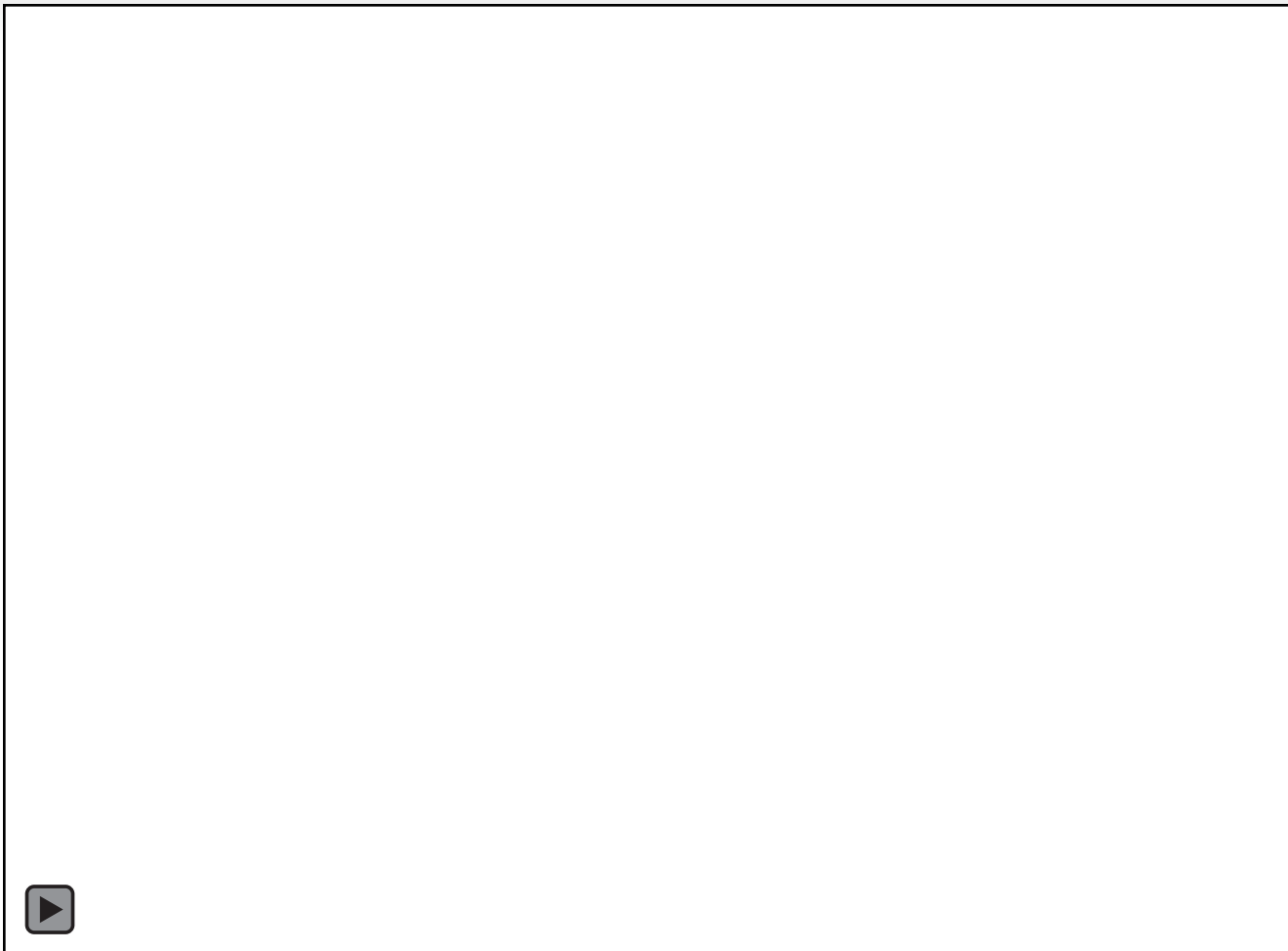


Pre-Cured / NSM

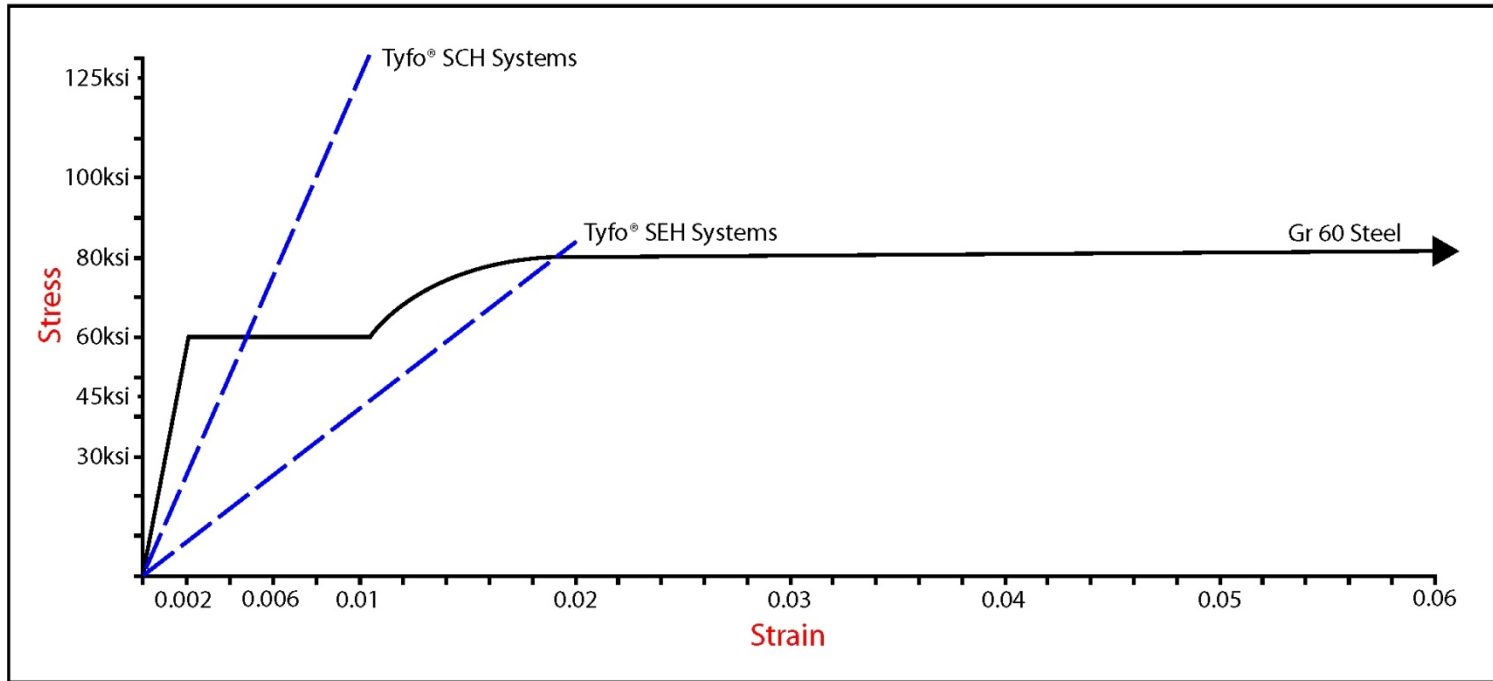
Pre-cured Composite shapes manufactured off-site



Saturation of Fabric



Comparison of Mechanical Properties

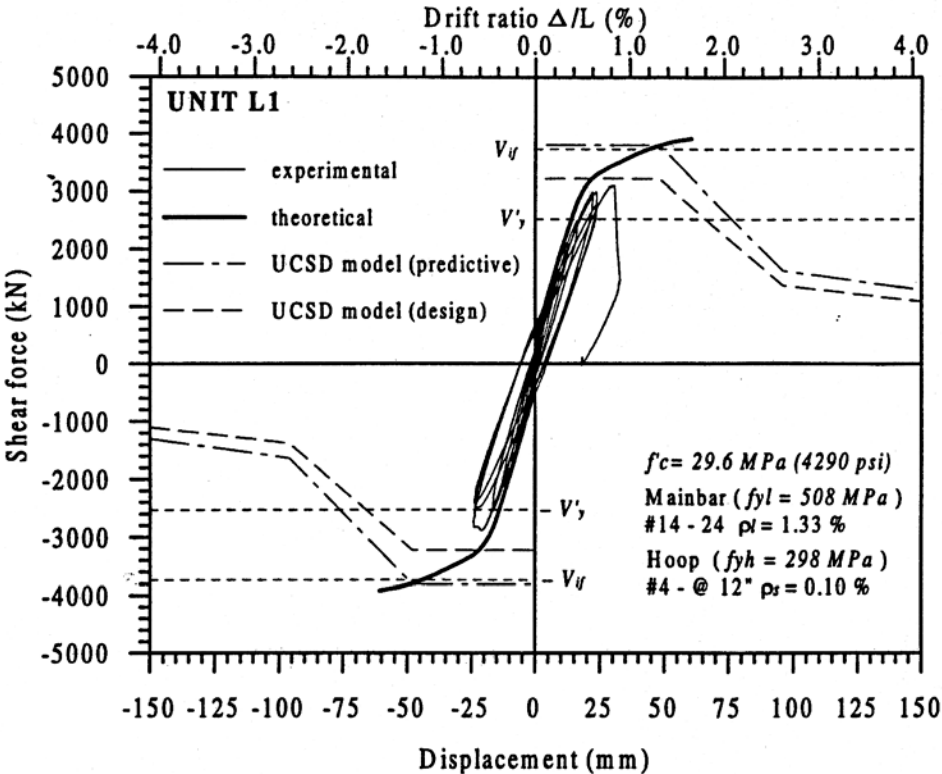
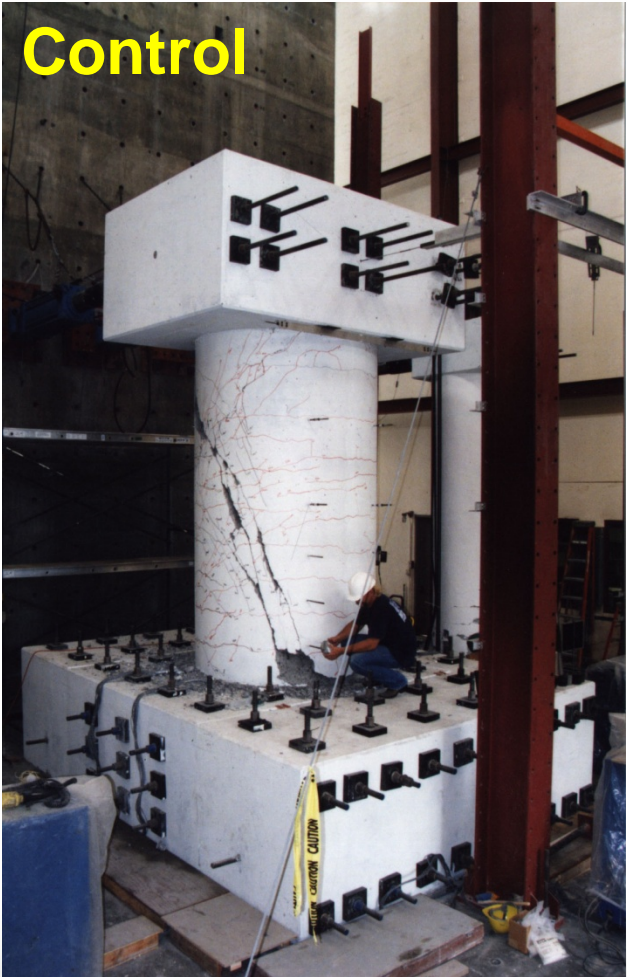


Full Scale Column Testing at UC San Diego

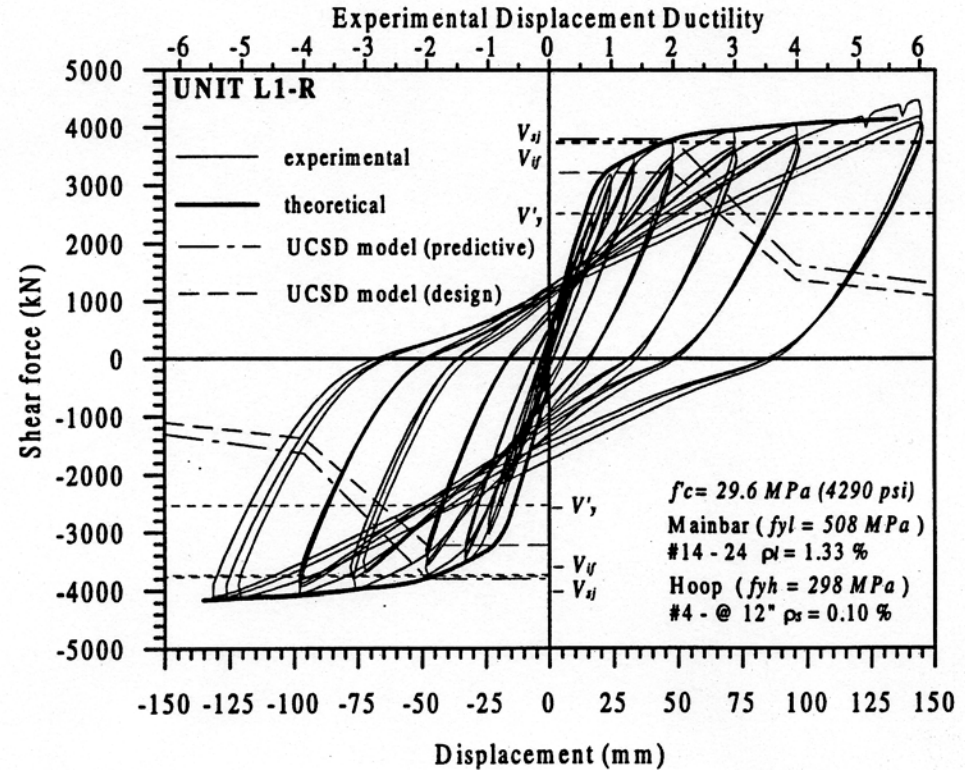
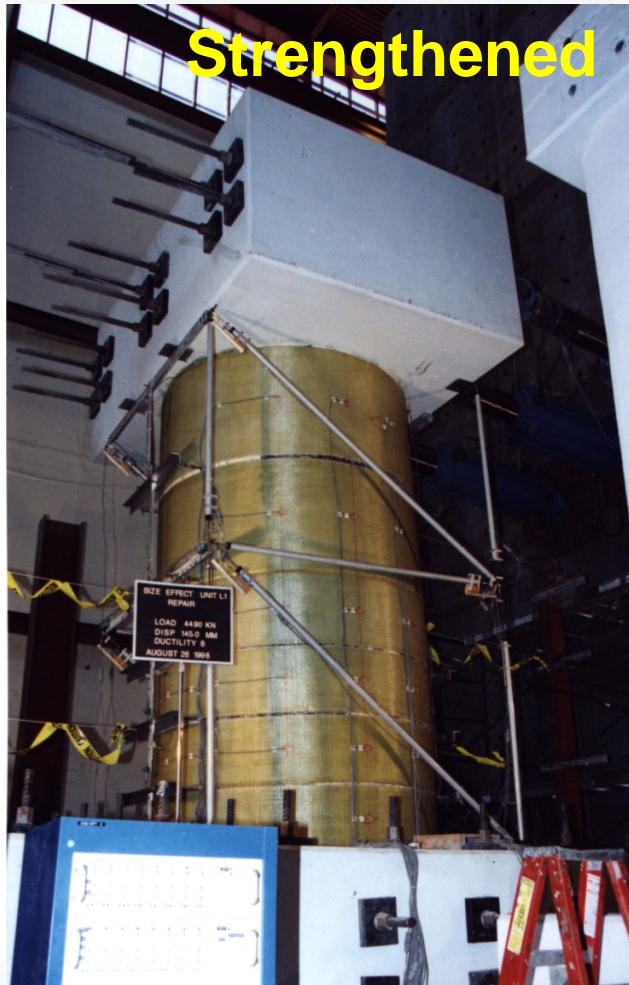


Full Scale Column Testing at UC San Diego

Control



Full Scale Column Testing at UC San Diego



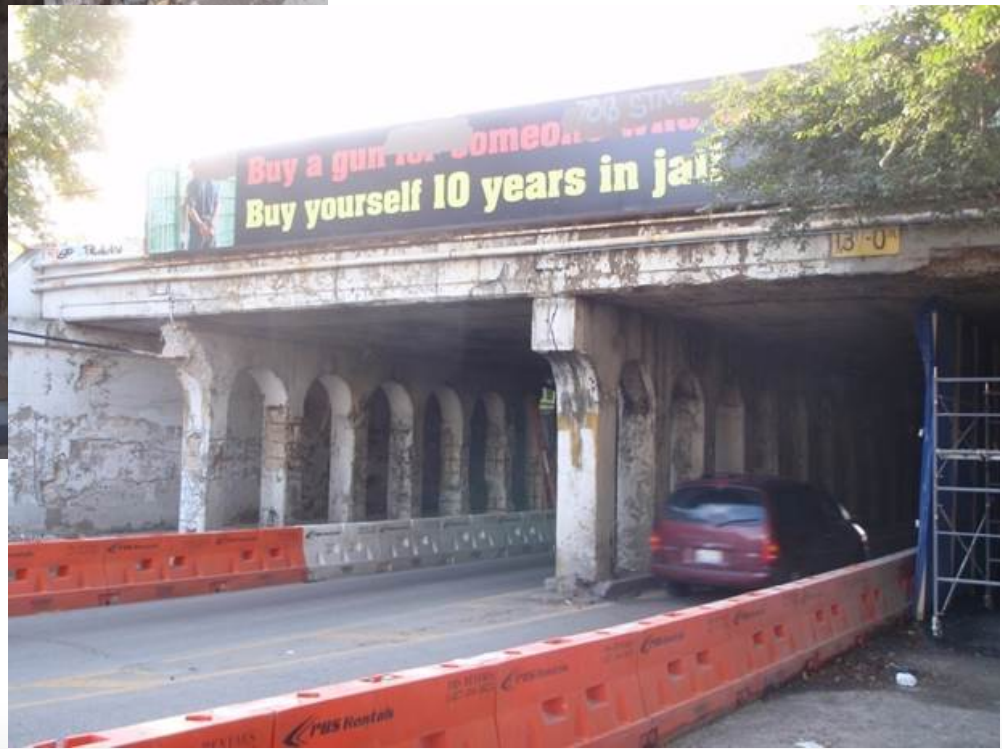
WisDOT Maintenance



CA 22 Seismic Upgrade



CN Chicago Protection



CN Chicago Protection



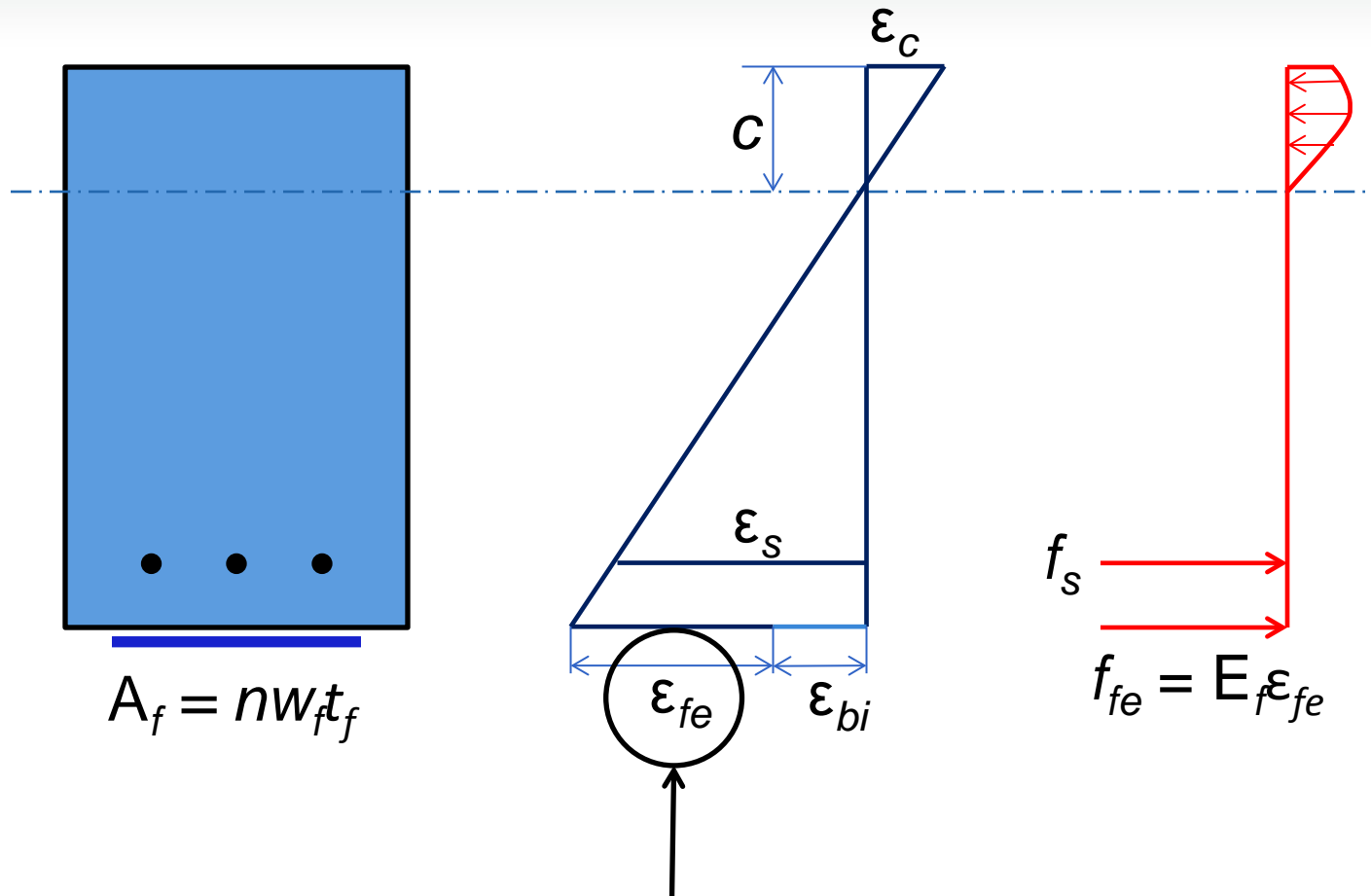
PennDOT I-84 Scranton Seismic Upgrade



PennDOT I-84 Scranton Seismic Upgrade 17 Year Inspection (2012)

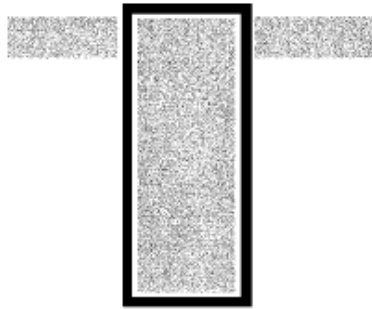


Flexural Strengthening

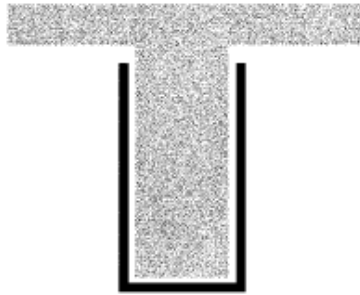


Effective fiber strain is basis for design

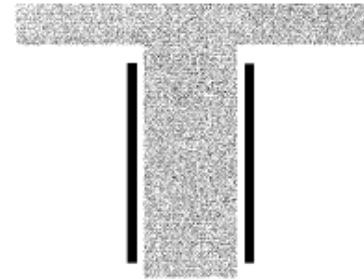
Flexural Strengthening



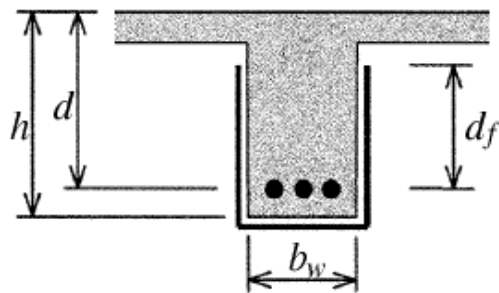
Completely wrapped



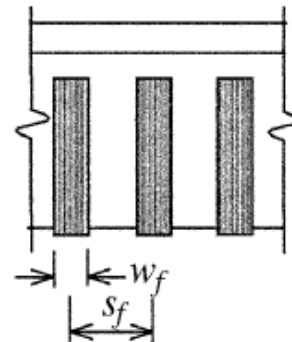
3-sided "U-wrap"



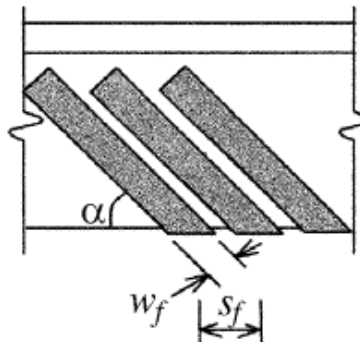
2 sides



(a)



(b)



(c)

GDOT Girder Strengthening



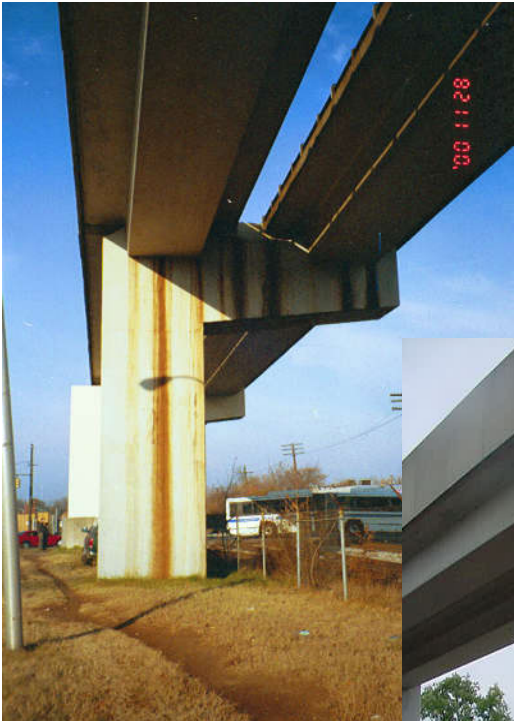
Impact Repair – Natchez Trace



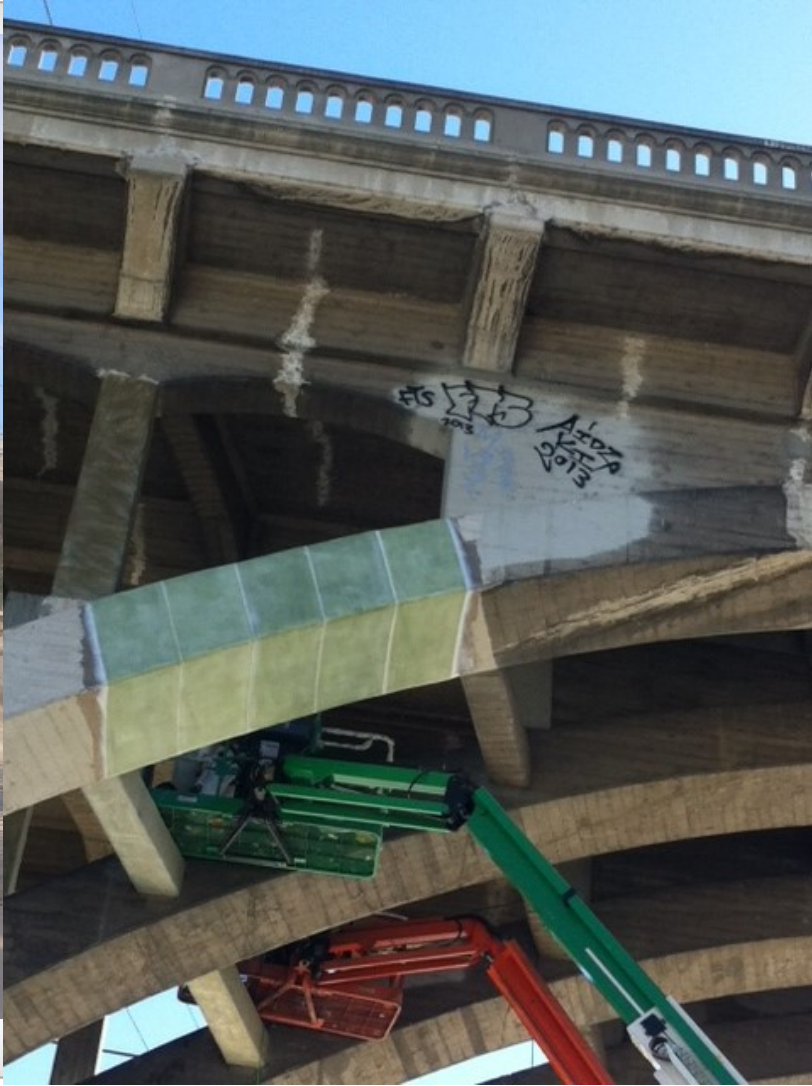
Lima, Peru Metro Retrofit



MTA Baltimore Corrosion Protection



Caltrans - North Spring Street Viaduct



Rhode Island DOT - Stillwater Viaduct



Concrete Pile Repair (Underwater Applications)



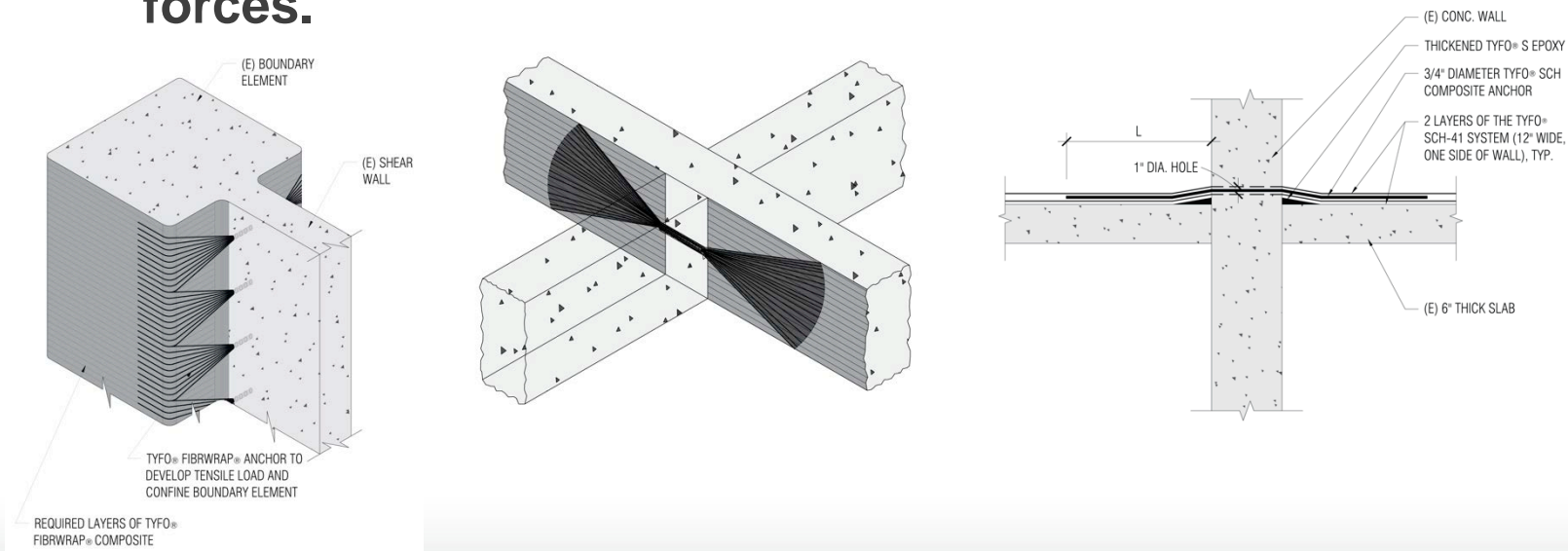
Timber Pile Repair (Underwater Applications)



Tyfo® Fiber Anchor Systems

• Tension Force Development

- Fiber Anchor area per unit width shall be equal or greater than the installed Fibrwrap® laminates.
- Fiber Anchor splay shall be no greater than 60-degrees. Typical details use 45-degree splay.
- Bonded area shall be sufficient to transfer tensile forces.



Performance Specification Requirements

- Trained and Certified Installers
- Structural & Durability Testing
- Third-Party Material Approvals
- Clearly Defined Design Criteria
- Stamped Calculations and Drawings
- Material Pull-Tests (ASTM D3039)
- Bond Tests (ASTM D4541)
- Remedial & Repair Procedures

Thank You

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 - Phone: 858-232-0124