Open Pile Bent Repairs

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February 25, 2025

Open Pile Bent Repairs

Presentation Topics

- Pile Bent Types
- Replacement versus Repair
- Repair Alternatives
- INDOT Bridge Design Aid (BDA)
    - Figures
    - Design Considerations
- BDA Example Projects

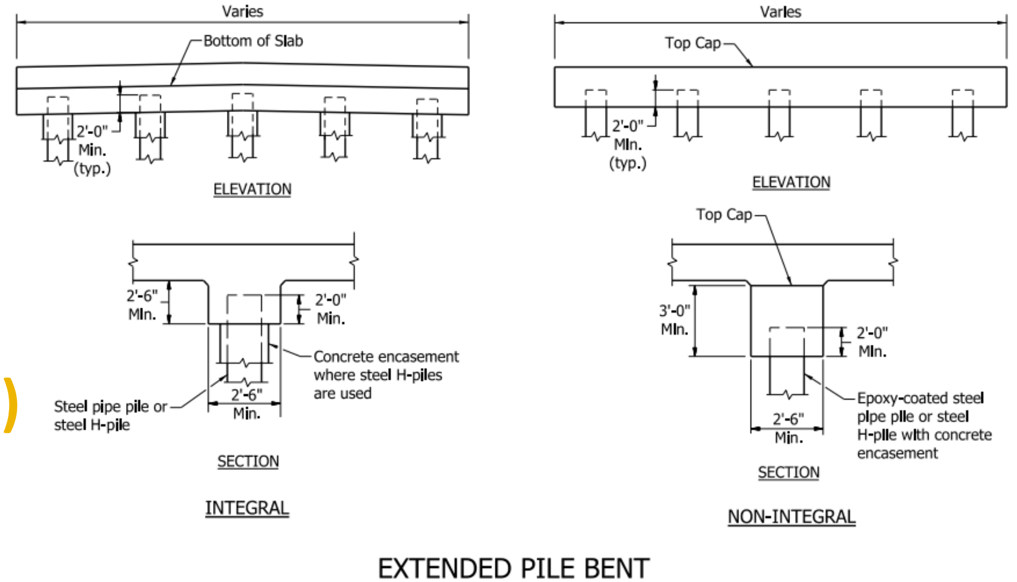
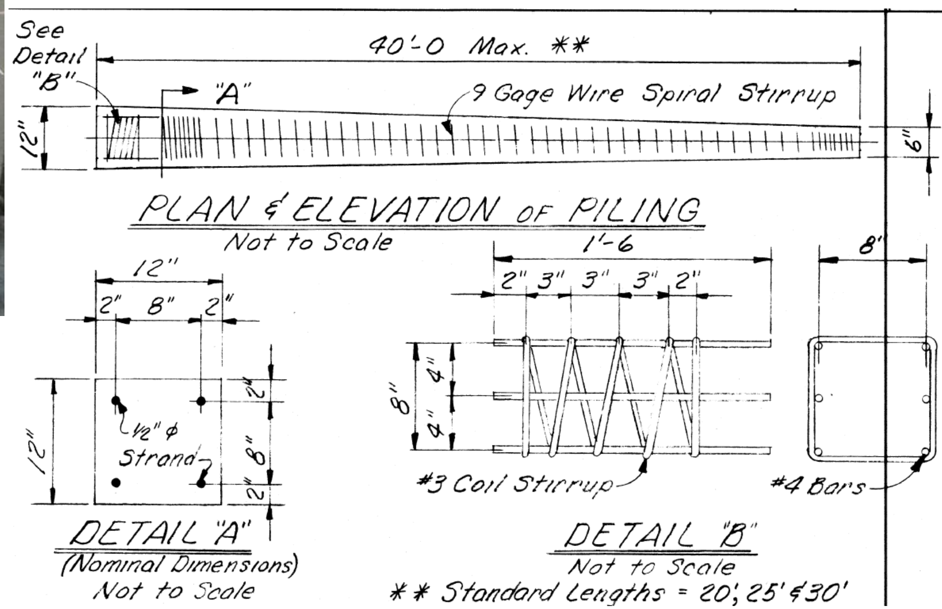


Figure 409-6A

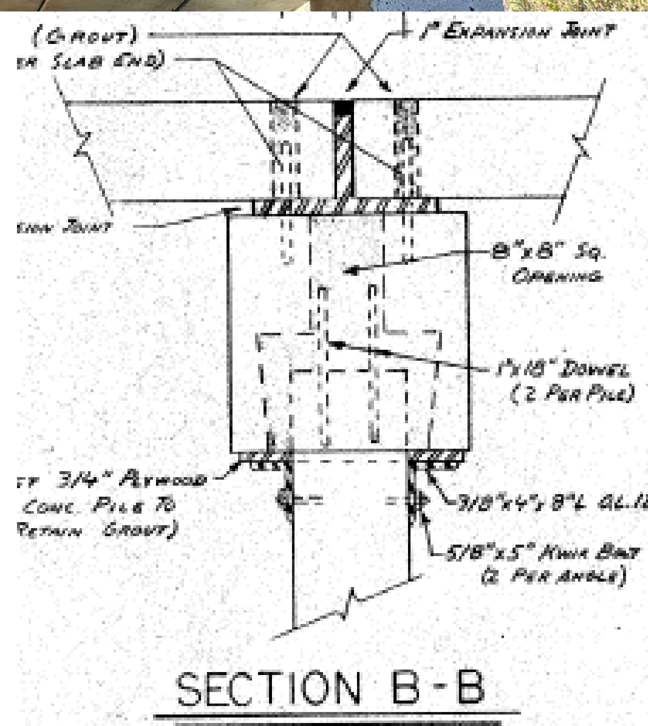
Open Pile Bent Types

Adams 169 – Precast Piles



Open Pile Bent Types

Jay 166 – Precast Piles



Open Pile Bent Types

Jay 159 – Timber Piles

Open Pile Bent Repairs

Jay 132 – Timber Piles

Open Pile Bent Types

Jay 15 – Steel Shell Piles

Replace Bridge

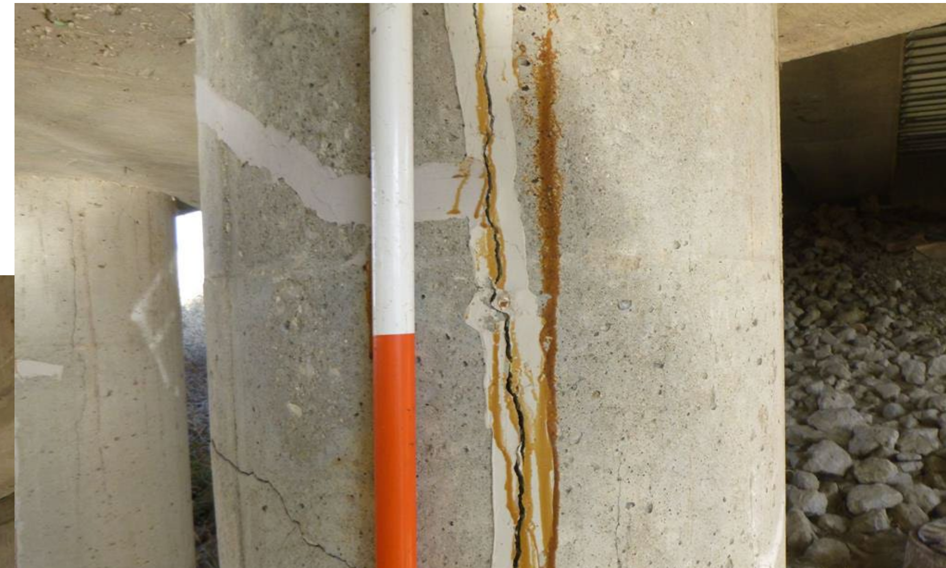
Monroe 46 – Steel H-Piles

Replace Bridge

SR 44 over Sugar Creek Overflow

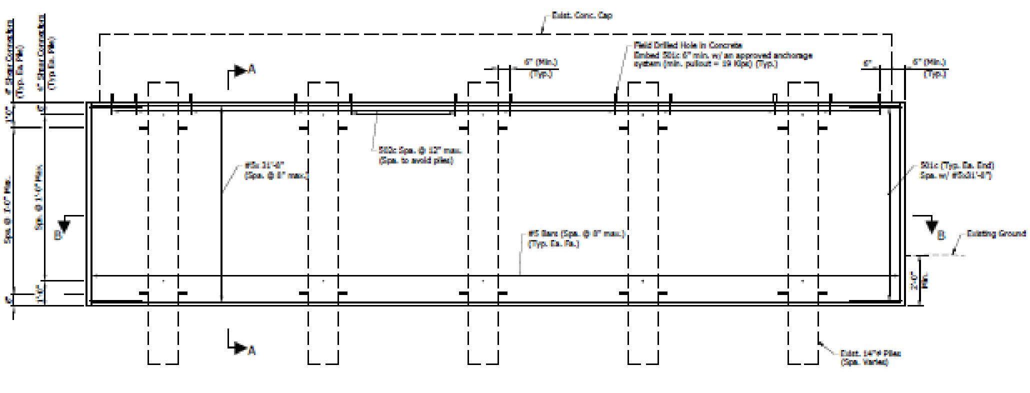
Repair – Epoxy Injection

Jay 501 - Pile Encasement

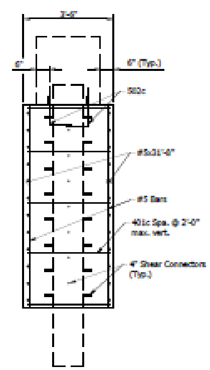


Repair vs Protection–Convert to Wall Pier vs FRP

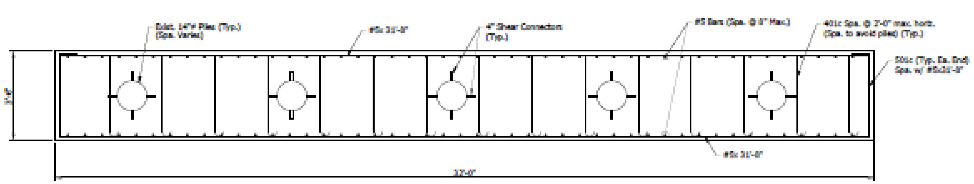
Madison 144



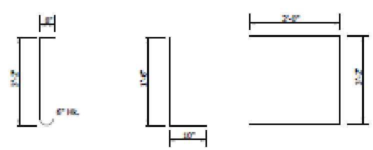
ELEVATION



SECTION A-A



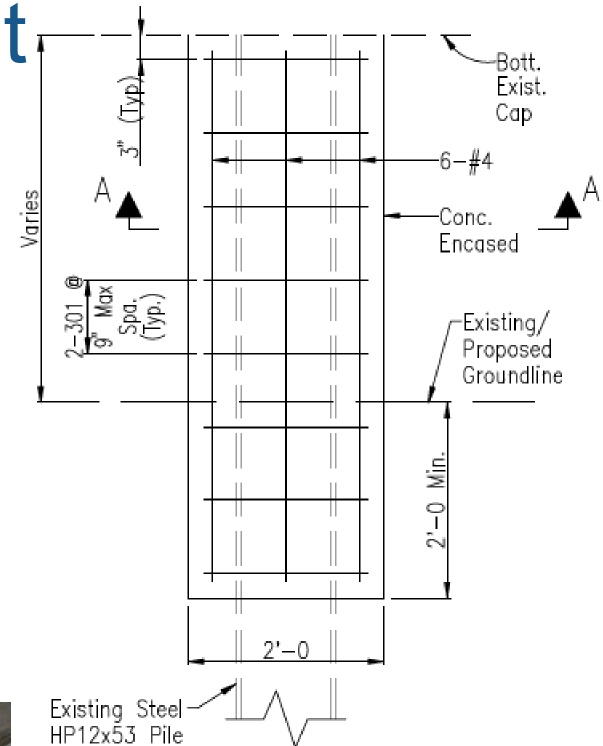
SECTION B-B



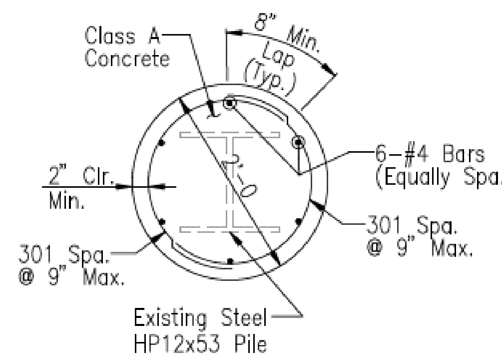
401c x 4'-4" 502c x 2'-4" 501c x 7'-2"

Protection – Concrete Encasement

Monroe 47



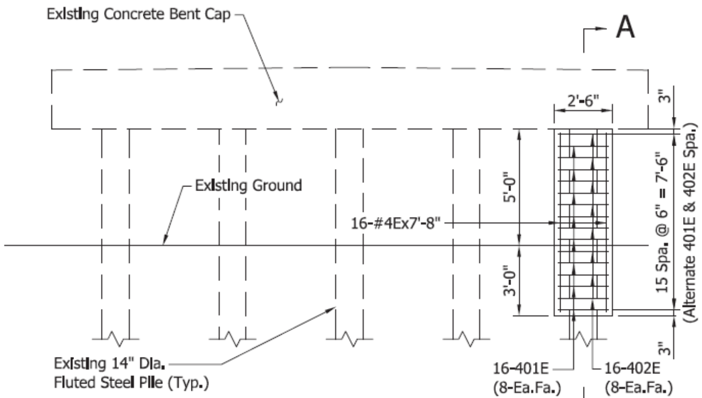
ELEVATION – TYPICAL
PILE ENCASEMENT
(No Scale)



SECTION A-A
(No Scale)

Protection – Concrete Encasement

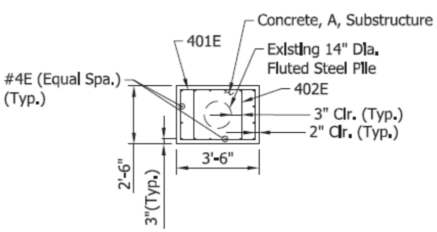
Newton 56



ELEVATION - BENT NO.3

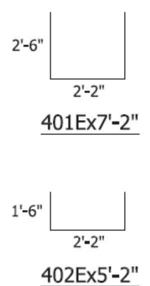
No Scale

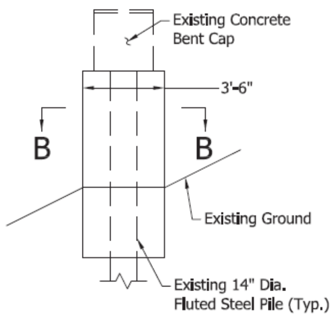
BILL OF MATERIALS			
BENT NO.3			
EPOXY COATED REINFORCING BARS			
SIZE or MARK	No. of BARS	LENGTH	WEIGHT (Lbs)
401E	16	7'-2"	
402E	16	5'-2"	
#4E	16	7'-8"	
Total #4E			214
Total Epoxy Coated Reinforcing Bars			214
CONCRETE			
Concrete, A, Substructure			2.3 Cys.
MISCELLANEOUS			
Excavation, Foundation, Unclassified			1 Cys.



SECTION B-B

No Scale



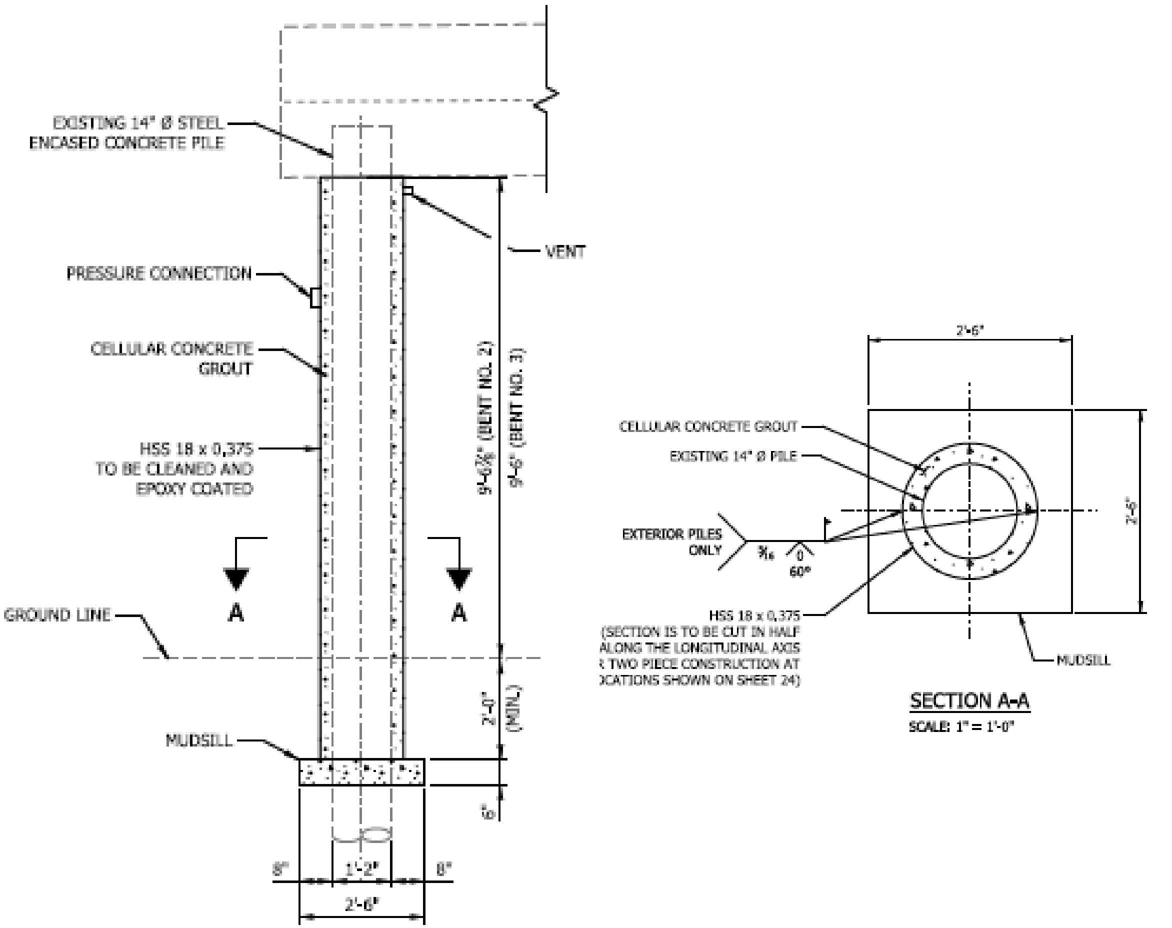


SECTION A-A

No Scale

Protection – Pile Jacket

US 20 over Pine Creek – Des 1500749



PROTECTIVE JACKET DETAIL

WESTBOUND ONLY, SEE SHEET 24 FOR LOCATIONS

SECTION A-A

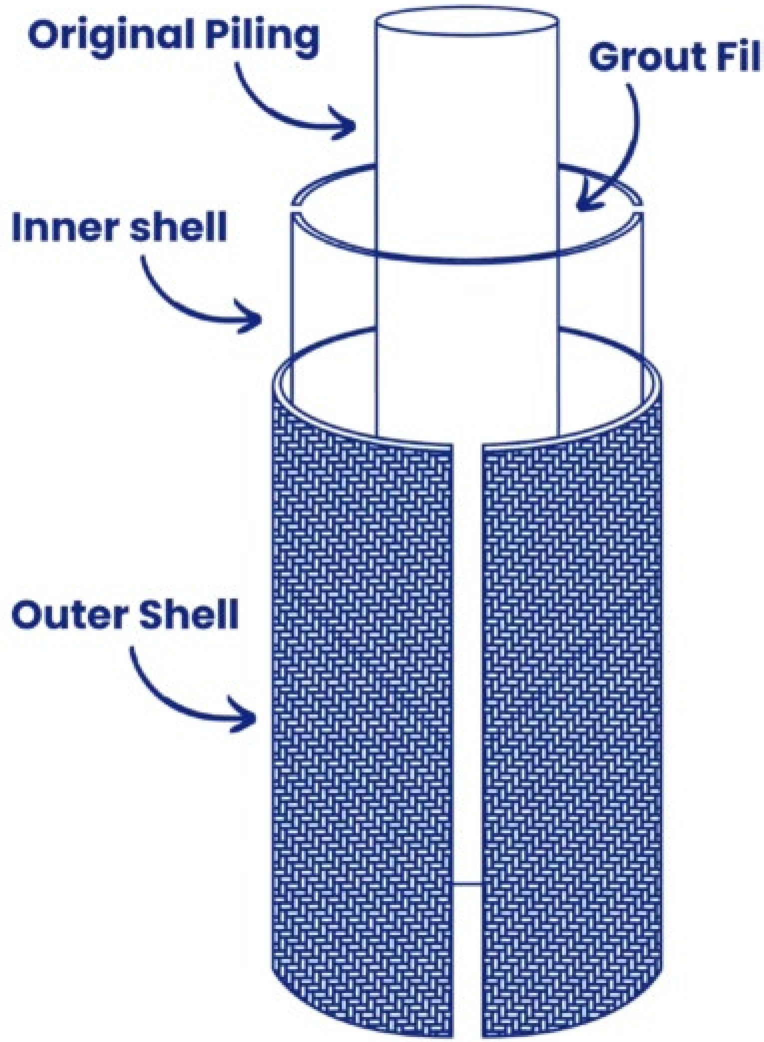
SCALE: 1" = 1'-0"

Protection - CarboShield

US 20 over Burns Ditch – Des 1702611

CarboShield

DOT agency uses CarboShield for rapid bridge repair with minimal underwater work



DOT agency uses CarboShield for rapid bridge repair with minimal underwater work

GENERAL CONTRACTOR
Rieth-Riley Construction Co., Inc.

OWNER
Indiana Dept. of Transportation

MATERIALS SUPPLIER
CarboShield Inc.

SYSTEM INSTALLER
Composite Construction, LLC

DATE OF COMPLETION:
September 2021

CarboShield Inc.
Project Data Sheet
CarboShield for rapid bridge repair with minimal underwater work
U.S. Highway 20
Portage, Indiana

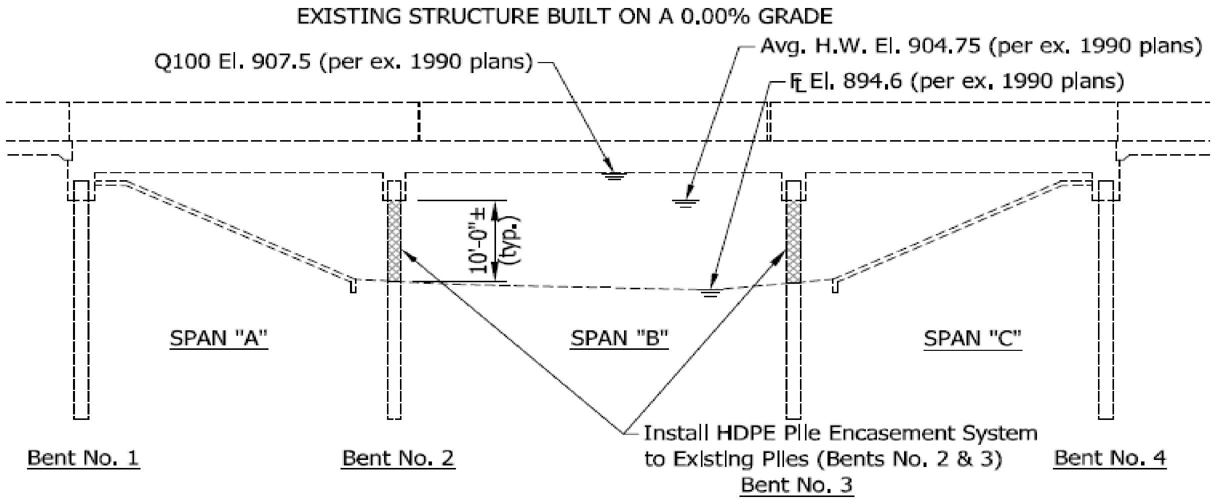
Protection - CarboShield

US 20 over Burns Ditch – Des 1702611

CarboShield pile encasement shells ready on the staging area underneath the INDOT U.S. 20 bridge being repaired.

Protection – HDPE Encasement

SR 3 over Pigeon River – Des 2000190



ELEVATION

HDPE PILE ENCASEMENT SYSTEM

Description

This work shall consist of preparing surfaces, disposing of waste residue, repairing piles, and furnishing and installing material and equipment to complete the installation of a field-applied pile protective covering using a multi-part system consisting of a waterproofing tape and a bolted high-density polyethylene, HDPE, outer cover, in accordance with 105.03.

Materials

Materials shall be supplied by:

Denso – SeaShield Series 2000HD
9710 Telge Road
Houston, TX 77095
www.densona.com

HDPE outer cover materials shall be manufactured from seamless virgin HDPE resin. Fasteners and all exposed hardware for the outer cover shall be either stainless steel or galvanized steel.

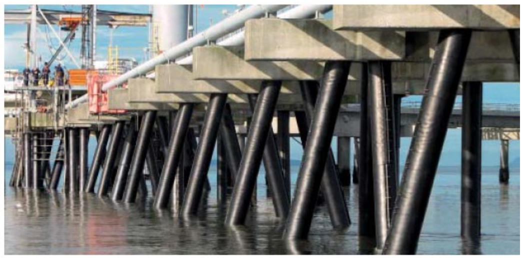
Materials shall be delivered to the project site in factory-sealed containers with the manufacturer's label intact and legible with the date of manufacture and shelf life. Products shall be stored in accordance with the manufacturer's recommendations and shall be protected from contact with moisture and direct exposure to sunlight until the time of installation.

The HDPE pile encasement system will be accepted by a type D certification in accordance with 916.

Protection – HDPE Encasement

Denso – Safeshield Series

SERIES 2000HD™



Steel and Concrete Pile Protection System

Heavy-duty pile protection system with marine grade petrolatum tape and an HDPE outercover secured with a bolted system. The system is ideal for environments where conditions are too severe for paint systems, epoxies and other conventional forms of protection.

SEASHIELD™
MARINE PROTECTION SYSTEMS

FULL LINE OF PILE PROTECTION SYSTEMS

PROTECTION FOR:
Steel Piles
Timber Piles
Concrete Piles
Pile Rehabilitation
Sheet Piles
Offshore
Pile Risers and more

Denso®

SERIES 100™

Steel, Concrete & Timber Pile Protection System

Pile protection system with a marine grade petrolatum tape and HDPE outercover secured with a strapping system. Seals out oxygen and water, effectively stopping corrosion on metal surfaces. The system also prevents spalling and corrosion of steel reinforcement in concrete piles.

SERIES 90™

Timber Pile Protection System

Provides timber pile protection against marine borer destruction and deterioration due to weathering using marine grade petrolatum tape and an outercover.

SERIES 70™

Durable Fiberglass Wrap System

A durable wrap system that is comprised of an inner layer of a marine grade petrolatum tape with a moisture cured resin impregnated tape outer layer that can accommodate new and hour-glassed timber piles and corrosion prevention of steel and concrete piles.

SERIES 400™

Non-Corrosive Structural Repair for Timber Piles

Structural repair system that doubles the strength of the original timber pile using Fiber-Form Jacket, C-GRID® 450 and SeaShield 510 UW Grout or SeaShield 550 Epoxy Grout.

Repair – Pile Medic

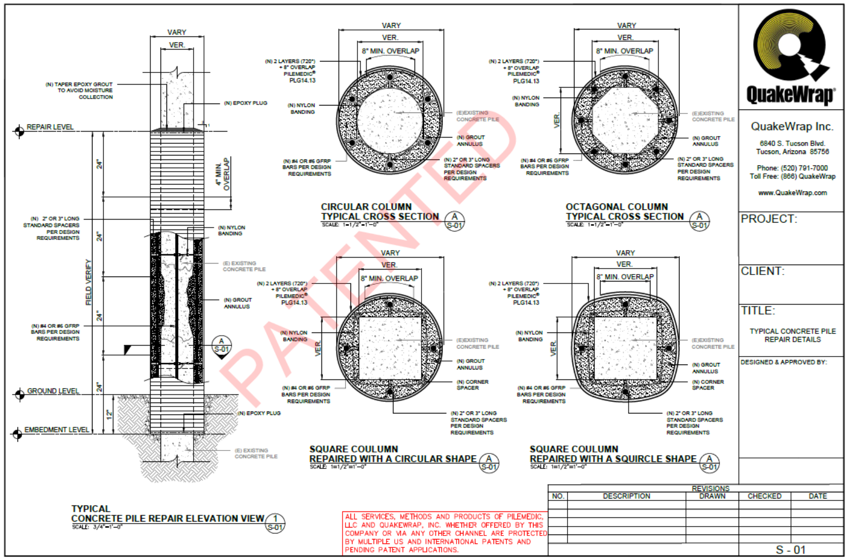
Pile Medic by QuakeWrap

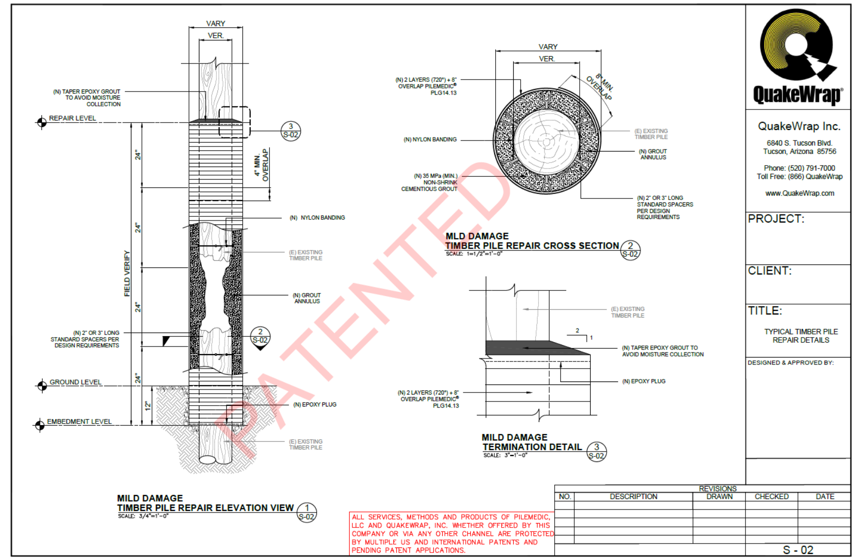
Rapid repair of piles and columns for bridges, piers, ports and more

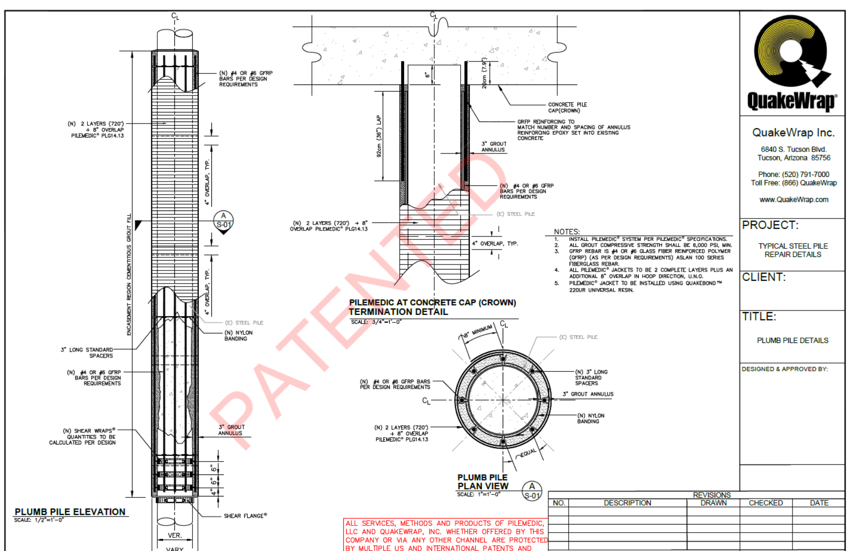
PileMedic+ By QuakeWrap, Inc.

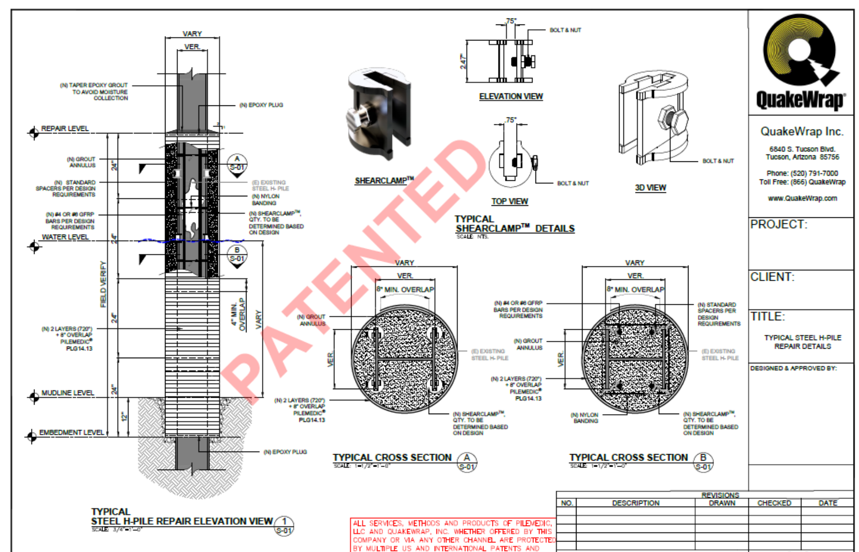
Repair – Pile Medic

QuakeWrap – Pile Medic Examples









Repair – Missouri DOT Standards

751.40.3.3 Steel HP Pile Maintenance and Repair

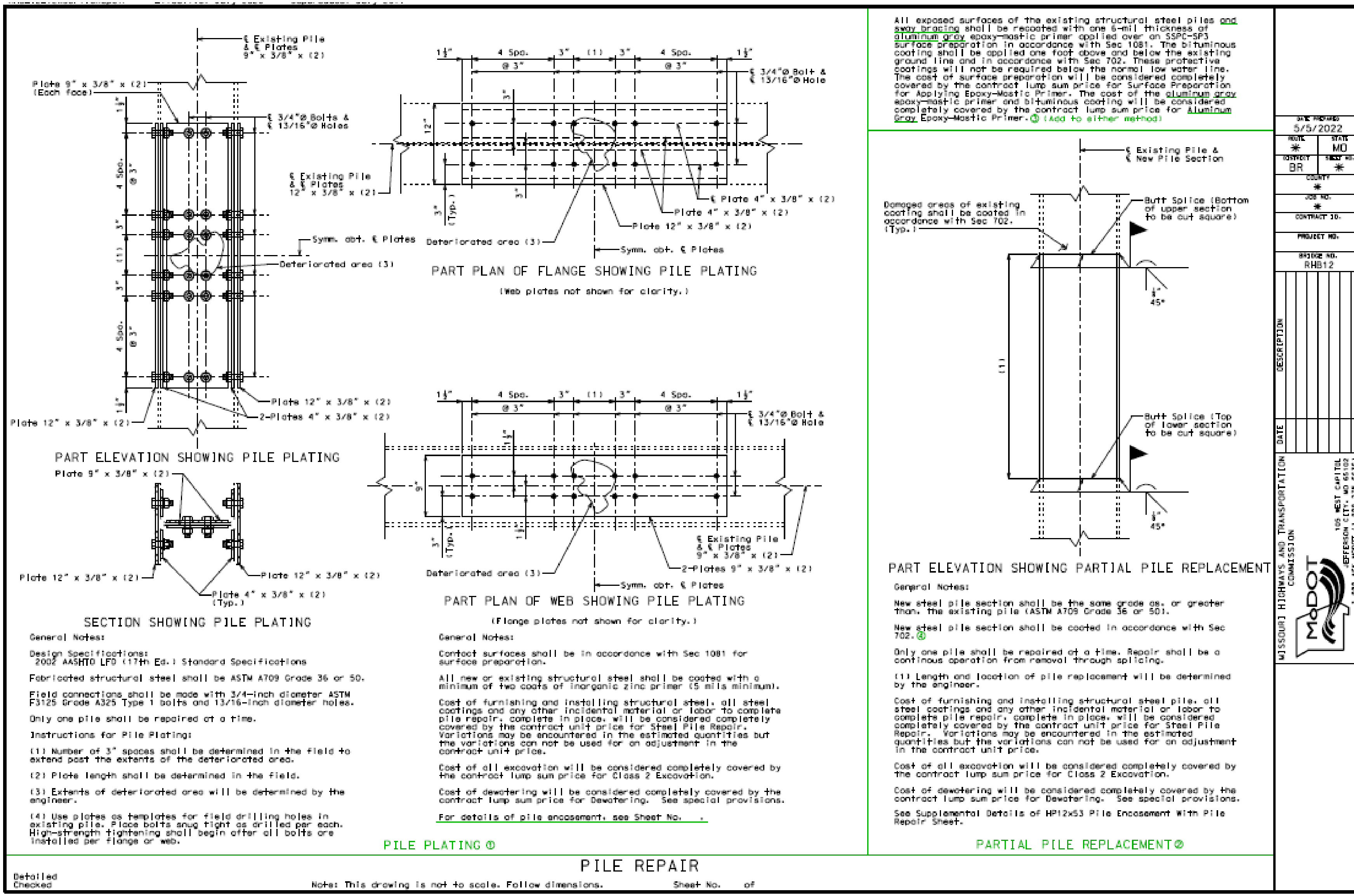
Maintenance/Repair Guidelines

Piles are primary structural members and are compressively loaded all the time which makes it important to safely inspect, maintain and repair them if necessary. Pile inspection will require an assessment of pile performance by looking for pile deterioration and measuring pile section loss in order to determine the level of pile maintenance/repair required. The following schedule may be used for selecting the level of maintenance/repair required:

Pile Percent Section Loss	Method*	Level
0% through 25%	Clean and recoat existing piles	Maintenance
>25% through 40%	Encasement of deteriorated section	Maintenance
>40% through 75% or holes in any element or local buckling of any element	Plating ** of deteriorated section OR replacement *** of section (splicing), AND encasement of the repaired section	Repair
>75%	Contact the Bridge Division	Repair
* Method may also include cleaning and recoating all exposed piles, and cleaning and recoating all remaining exposed pile sections after encasement and/or repair.		
** Plating can be for both flanges only, web only or both flanges and web. Overall symmetry of the pile cross-section shall be maintained when plating.		
*** Based on additional factors other than just the percent of pile section loss, a replacement pile section (splicing) may be considered. Minimizing or eliminating traffic loading, adding falsework or just having support conditions such as integral bents (where both the pile cap beam and the superstructure concrete diaphragm are connected by more than just dowel bars – see bridge plans) can help to determine the method of repair. A replacement pile section can be coated or galvanized. See Structural Project Manager.		

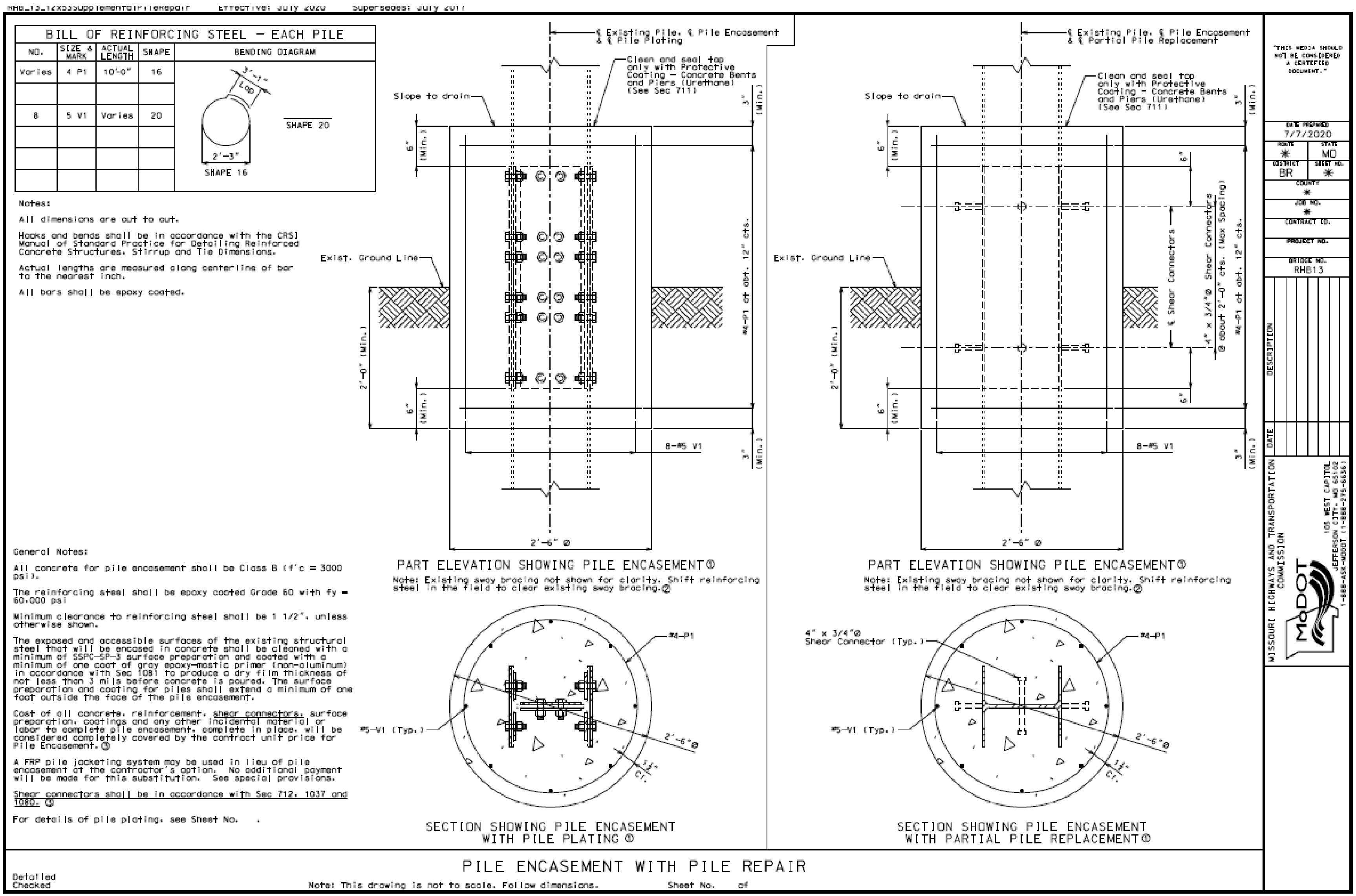
Repair – Missouri DOT Standards

Pile Plating or Partial Pile Replacement



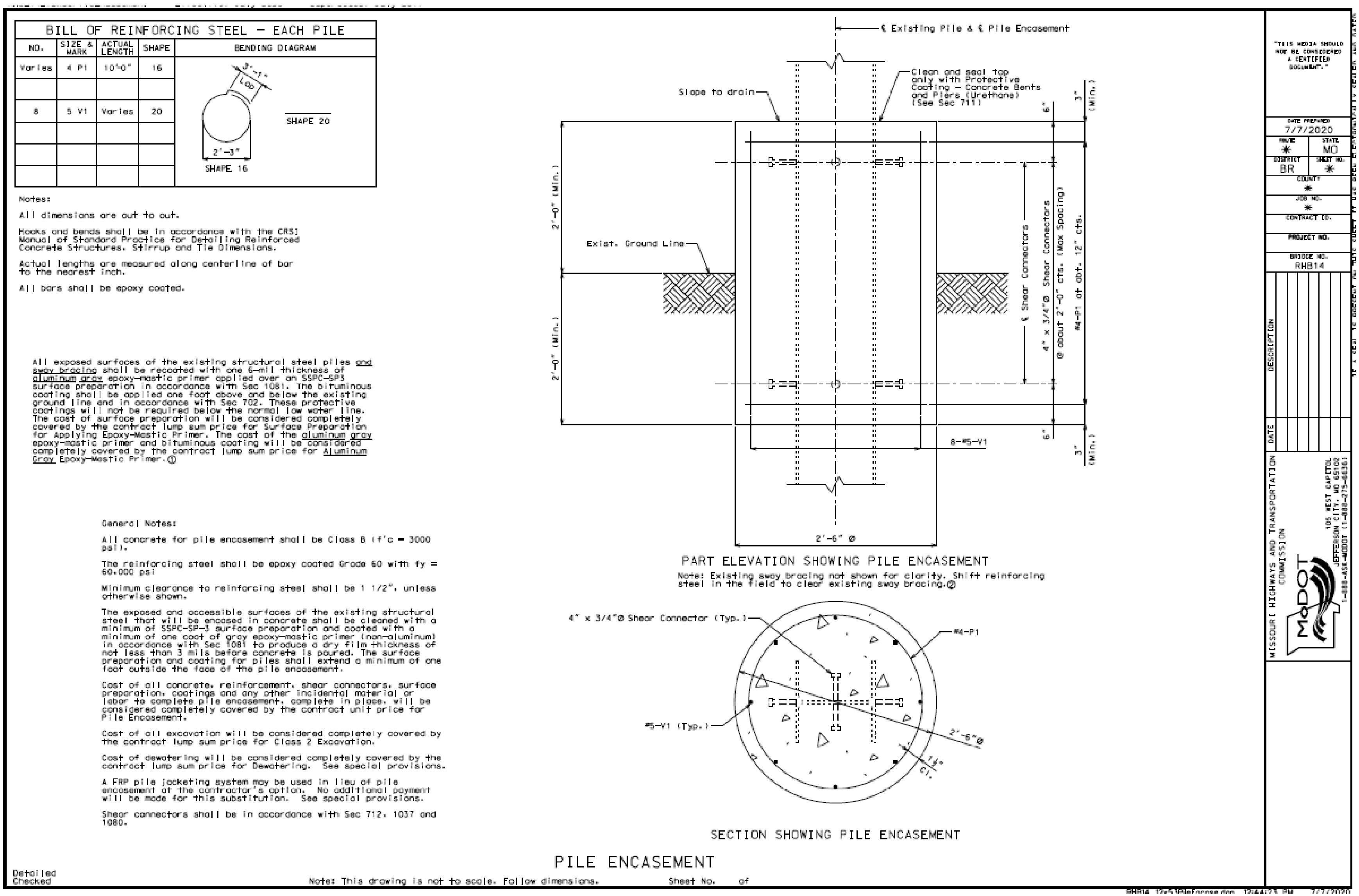
Repair – Missouri DOT Standards

Pile Encasement with Pile Repair



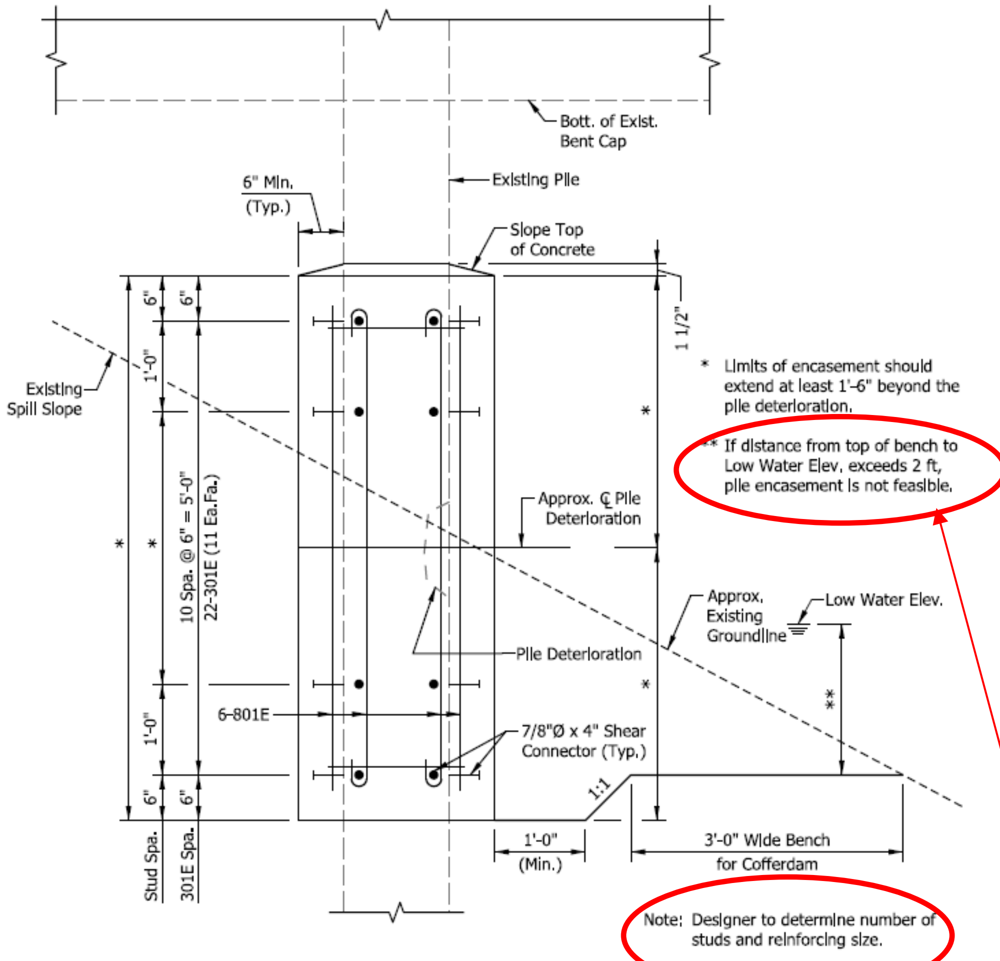
Repair – Missouri DOT Standards

Pile Encasement



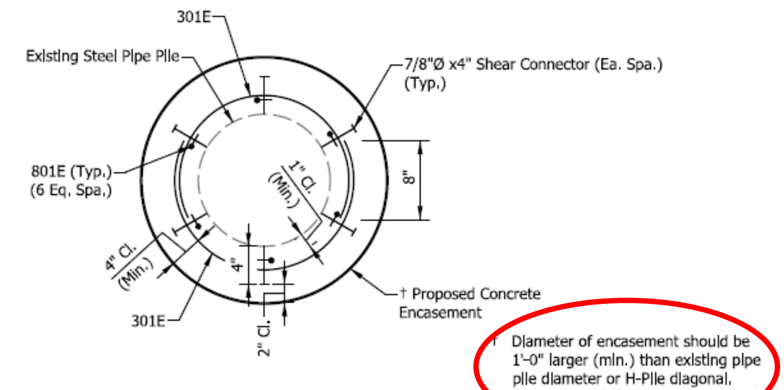
INDOT Bridge Design Aid (BDA)

Design Aid Figures

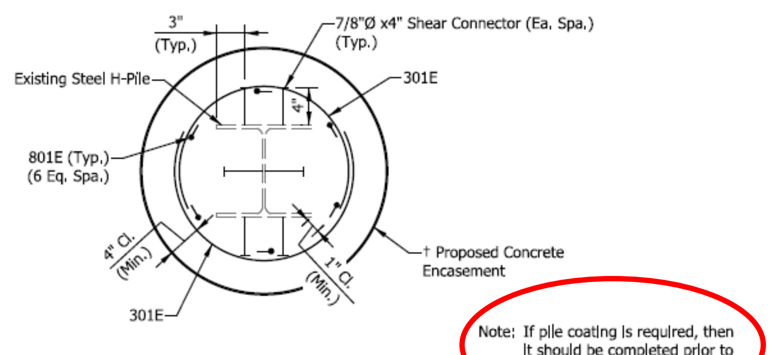


TYPICAL PILE ENCASEMENT DETAIL
Scale: 3/4" = 1'-0"

See Design Procedure



SECTION SHELL PILE
Scale: 1" = 1'-0"



SECTION H-PILE
Scale: 1" = 1'-0"

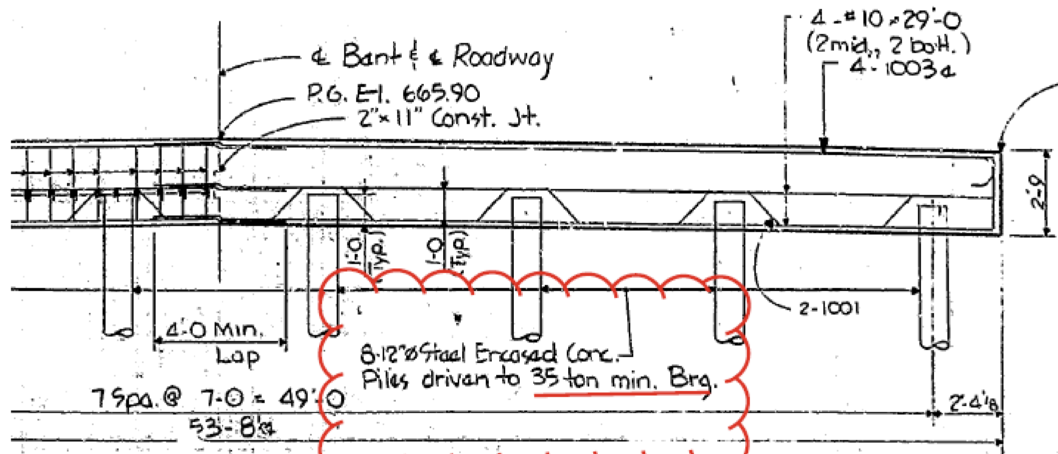
Bench for Sandbag Cofferdams

Design Considerations

Design Elements

- Verify on existing plans pile capacity (35 Ton Min. Brg.)
- Verify on existing plans pile gage to get thickness
- Convert to Ultimate Load
- Assume Max. Pile Factored Resistance
- Calculate Shear Stud Capacity
- Calculate Number of Studs req'd
- Calculate Spacing of Studs
- Calculate Size and Number rebar req'd
- Verify Stud and Rebar clearances

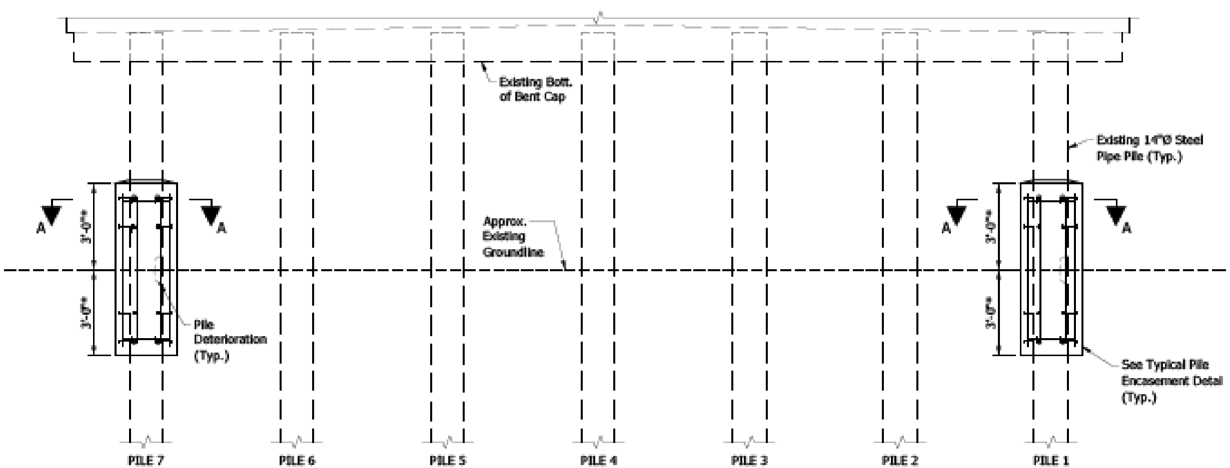
MISCELLANEOUS	
Railing Type 5A or C1	130 LFT
Surface Seal	3260 SFT
12-12" φ Steel Encased Concrete Piles (7Ga) @ 24' Bents #1 & #4	~~288~~ LFt
6-12" φ Steel Encased Concrete Piles (7Ga) @ 10' Bents #2 & #3	~~160~~ LFt
Total	~~448~~ LFt
16-12" φ Epoxy Coated Steel Encased Concrete Piles (7Ga) @ 19' Bents #2 & #3	~~304~~ LFT



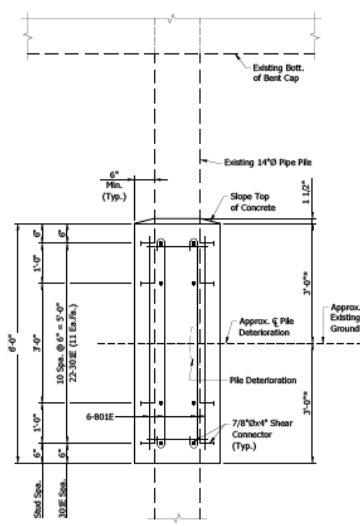
SECTION AT BENT #2 OR 3

BDA Example Project

SR 18 over Vanatta Ditch – Change Order



ELEVATION - BENT NO.3
Scale: 3/8" = 1'-0"

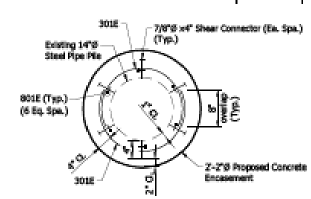


TYPICAL PILE ENCASEMENT DETAIL
Scale: 3/4" = 1'-0"

BILL OF MATERIALS

BENT REPAIR
BENT NO.3

EPOXY COATED REINFORCING BARS			
SIZE or MARK	of BARS	LENGTH	WEIGHT (Lbs)
801E	12	7'-2"	
Total #3E			230
301E	44	3'-1"	
Total #8E			51
Total Epoxy Coated Reinforcing Bars			281
CONCRETE			
Total Concrete, Class A in Substructure			1.2 Cys
Shear Connector, 7/8 in. Stud			48 Ea.



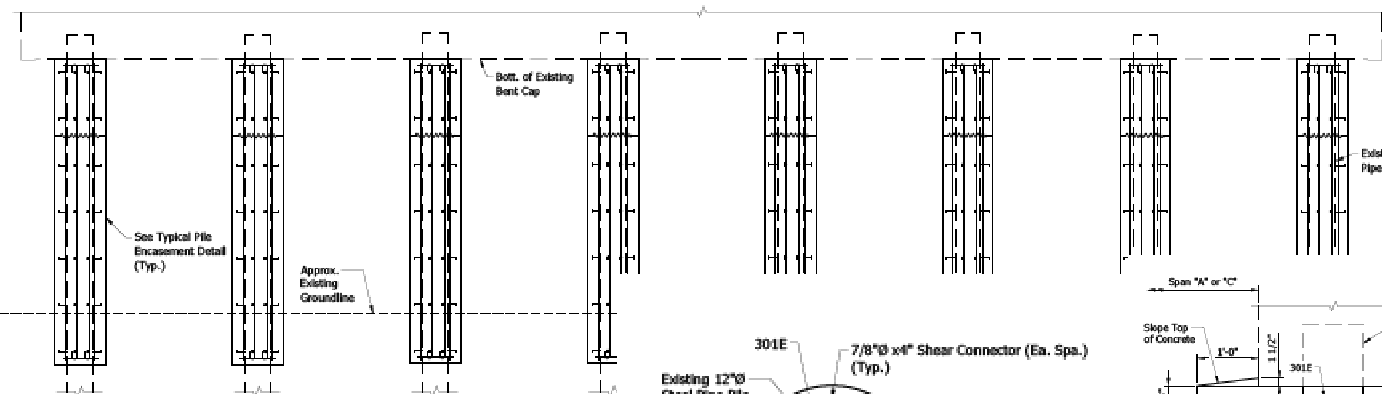
SECTION A-A
Scale: 1" = 1'-0"

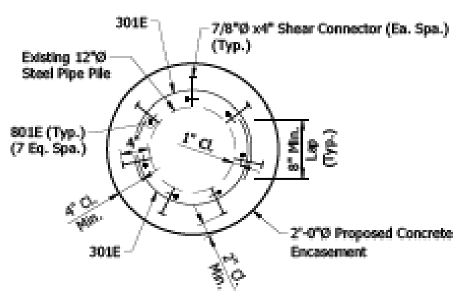
BDA Example Project

SR 18 over Vanatta Ditch - Completed

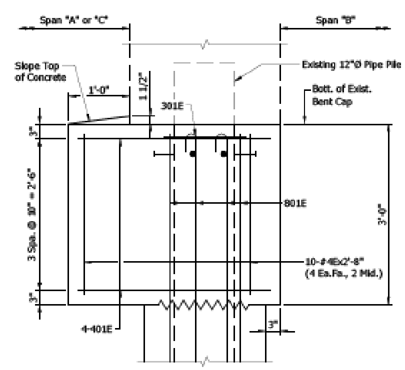
BDA Example Project

SR 28 over Goodwine – Change Order

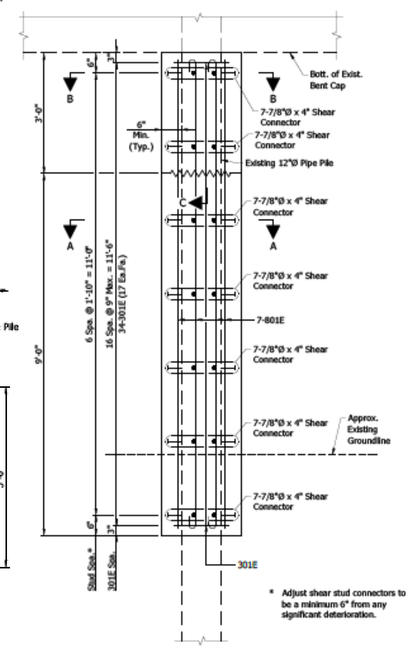




SECTION A-A
Scale: 1" = 1'-0"



SECTION C-C
Scale: 1" = 1'-0"



TYPICAL PILE ENCASEMENT DETAIL

BDA Example Project

SR 28 over Goodwine – Under Construction

Questions?

gai consultants®

INDIANA DEPARTMENT OF TRANSPORTATION INDOT slido

Audience Q&A

ⓘ Start presenting to display the audience questions on this slide.