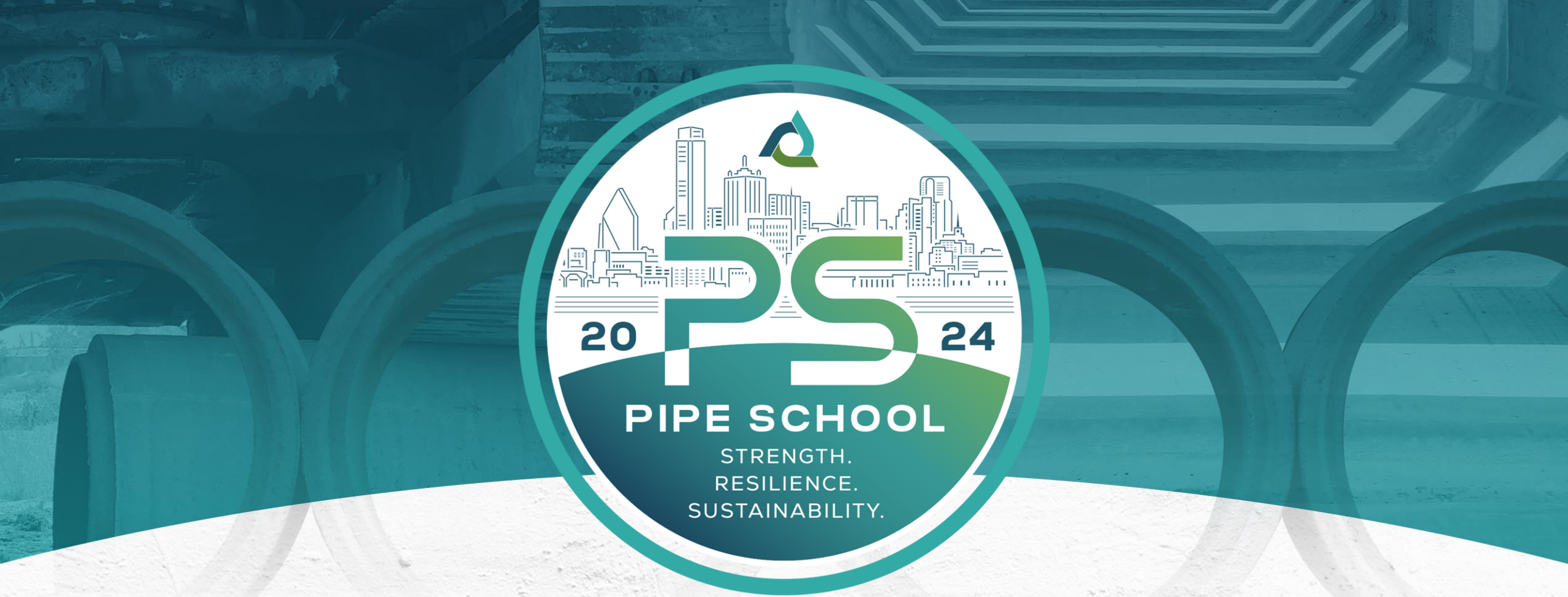


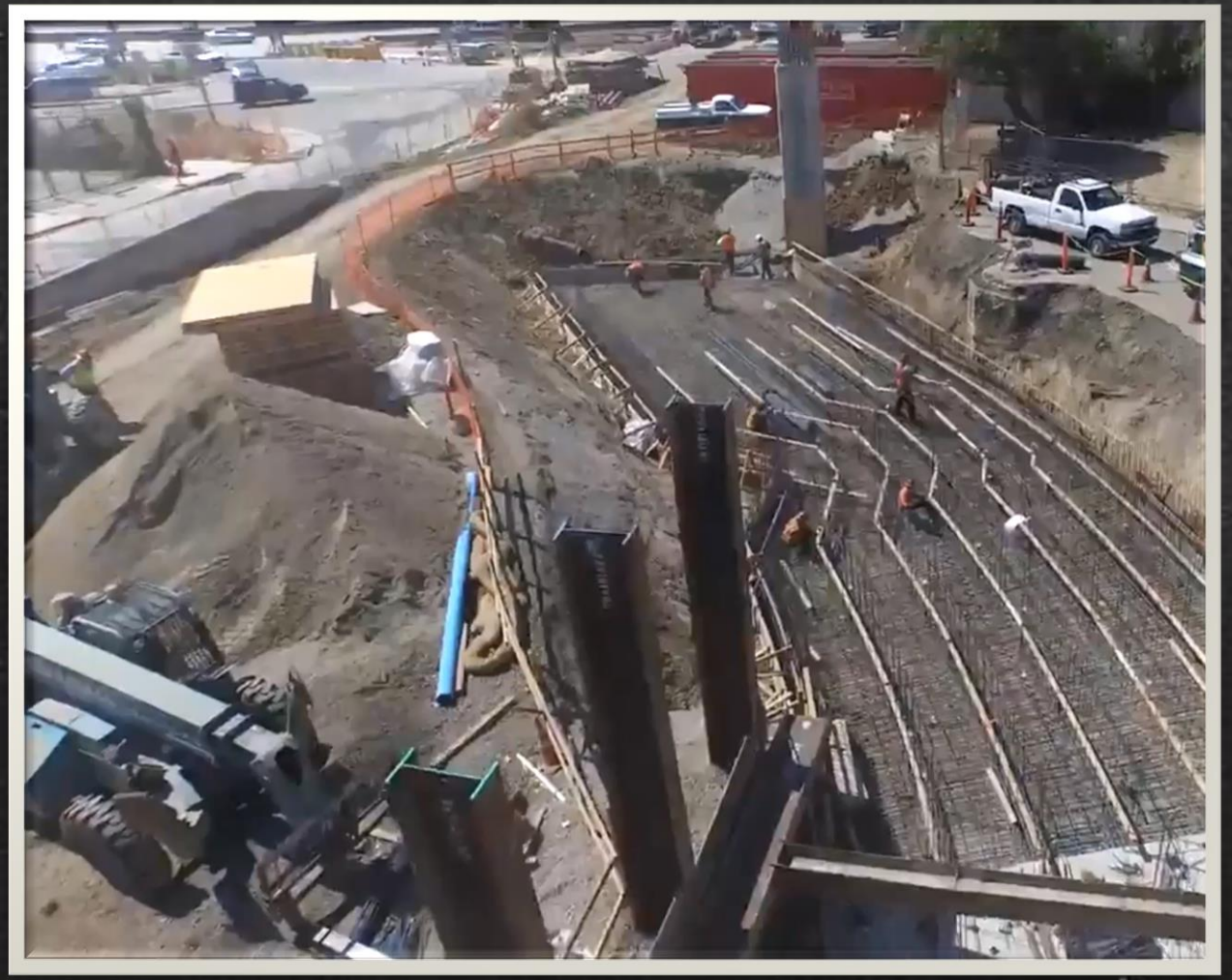
Installing Box Culverts and Creative Uses

Steve Smart - Technical Resource Engineer.

County Materials Corporation Maxwell, Indiana

Precast Structures:

Precast Vs Cast-in-Place



Precast Structures:

Precast Vs Cast-in-Place

Precast Structures:

Precast Vs Cast-in-Place

- Inspection
- Dimensions
- Reinforcement
- Climate
- Water/Cement Ratio

Precast Structures:

Precast Vs Cast-in-Place

- Agency approved in-plant Quality Control

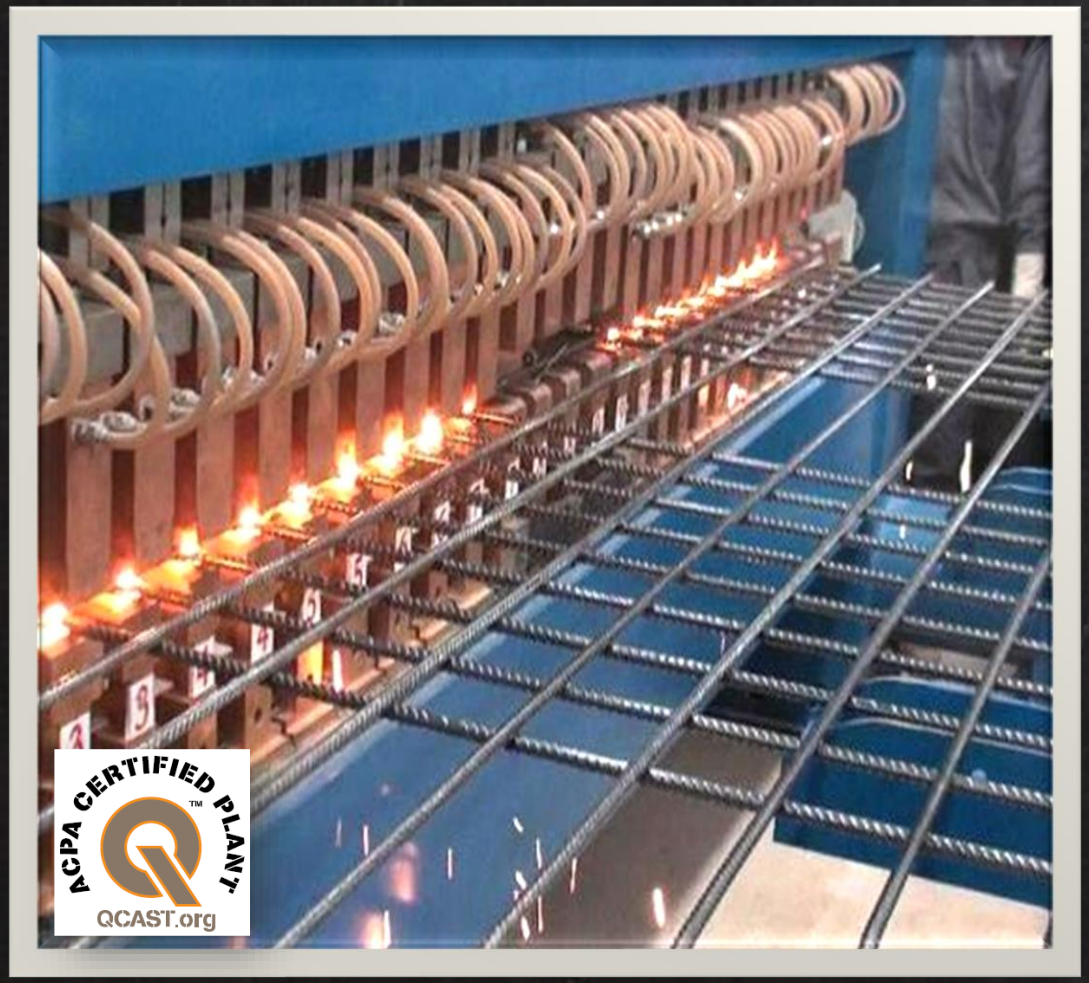
Precast Structures:

Precast Vs Cast-in-Place

- Consistent dimension tolerance

Precast Structures:

Precast Vs Cast-in-Place

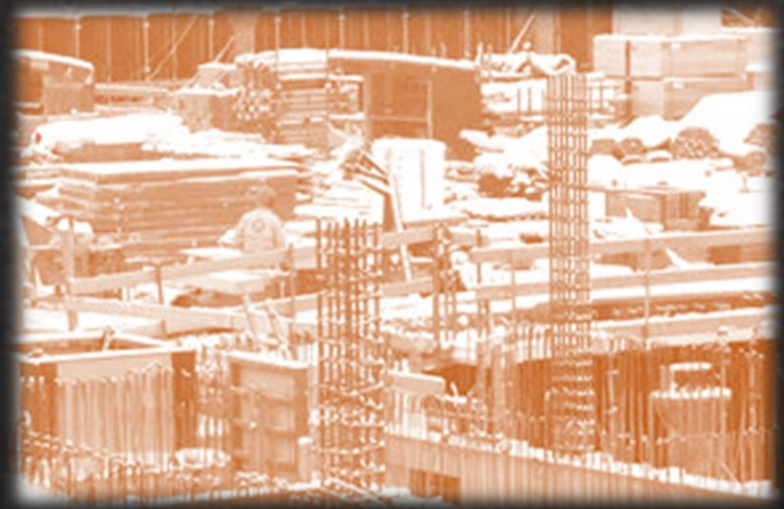


- Consistent engineered welded wire mesh – 65ksi min

Precast Structures:

Precast Vs Cast-in-Place

- Weather resilient construction



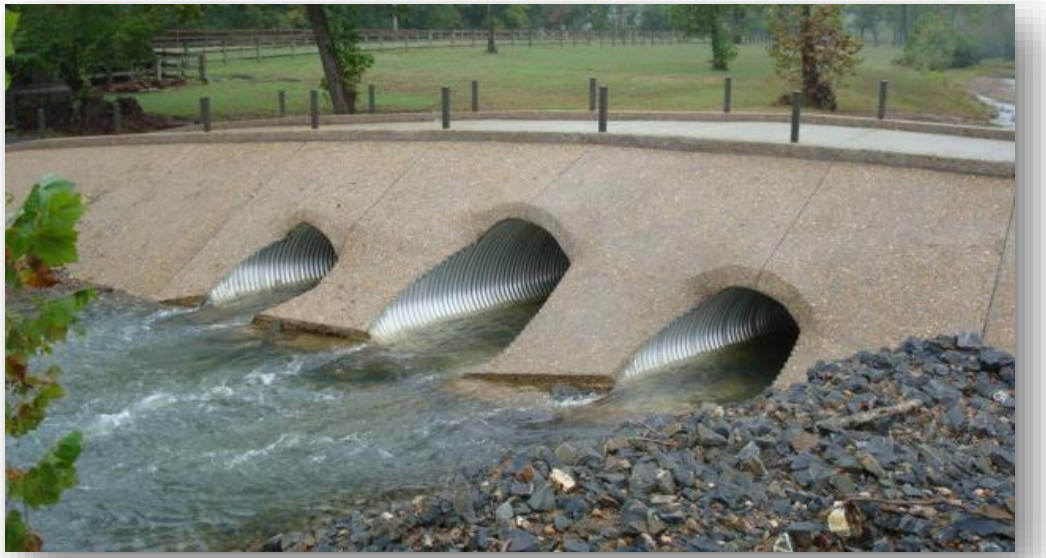
Precast Structures:

Precast Vs Cast-in-Place

- Consistent water/cement ratio

Why Box Culverts?

- Improved hydraulic capacity
- Accelerated Construction
- Minimal cover requirements
- Resiliency of precast infrastructure
- Elimination of weather sensitivity



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Why Box Culverts?

Basic Box (C1577): 3x2 up to 12x12

Custom size

Multi-barre

Deep fill (up

Large Boxes

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RCB Installation Types

Embankment

Trench

Jacked

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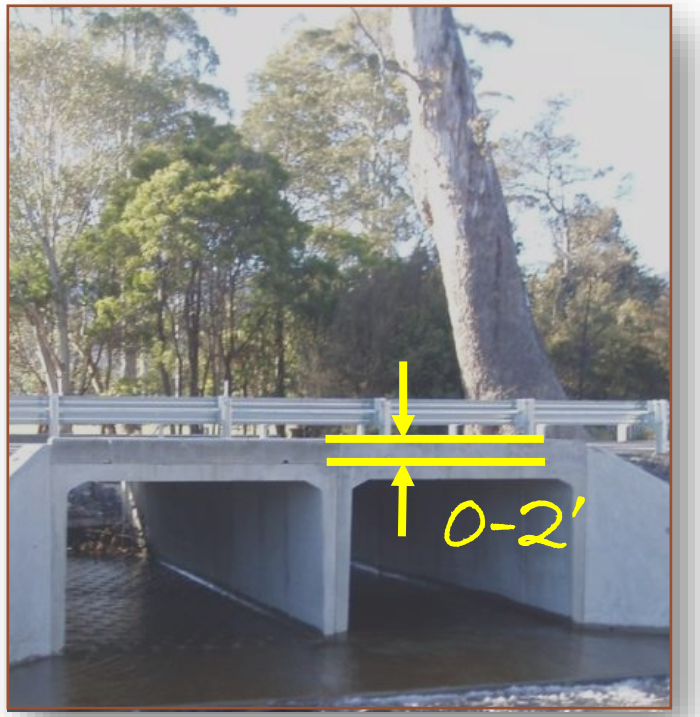
Cover: 0-2’



AASHTO: M273
ASTM: C850

Cover: 2’+

AASHTO M259
ASTM C789

ASTM: C1433 (1999)
LRFD → ASTM: **C1577 (2005)**

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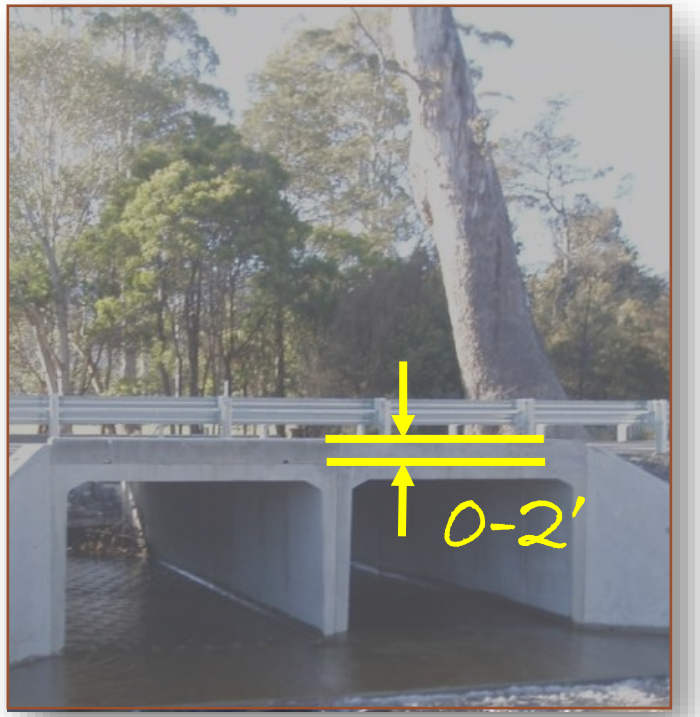
Cover: 0-2’



AASHTO: M273

ASTM: C850

Cover: 2’+

AASHTO M259

ASTM C789

2022

ASTM: C1433 (1999)

LRFD → ASTM: C1577 (2005)

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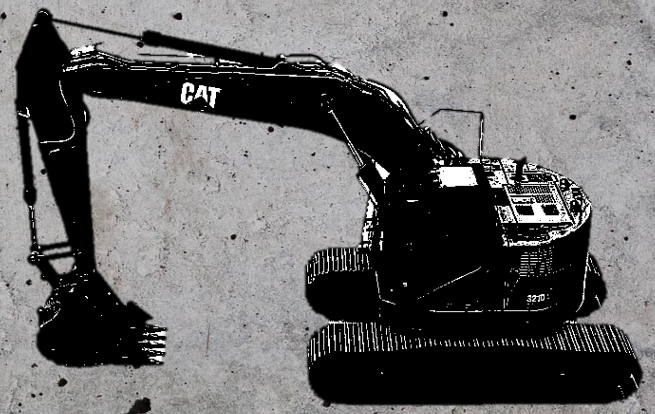
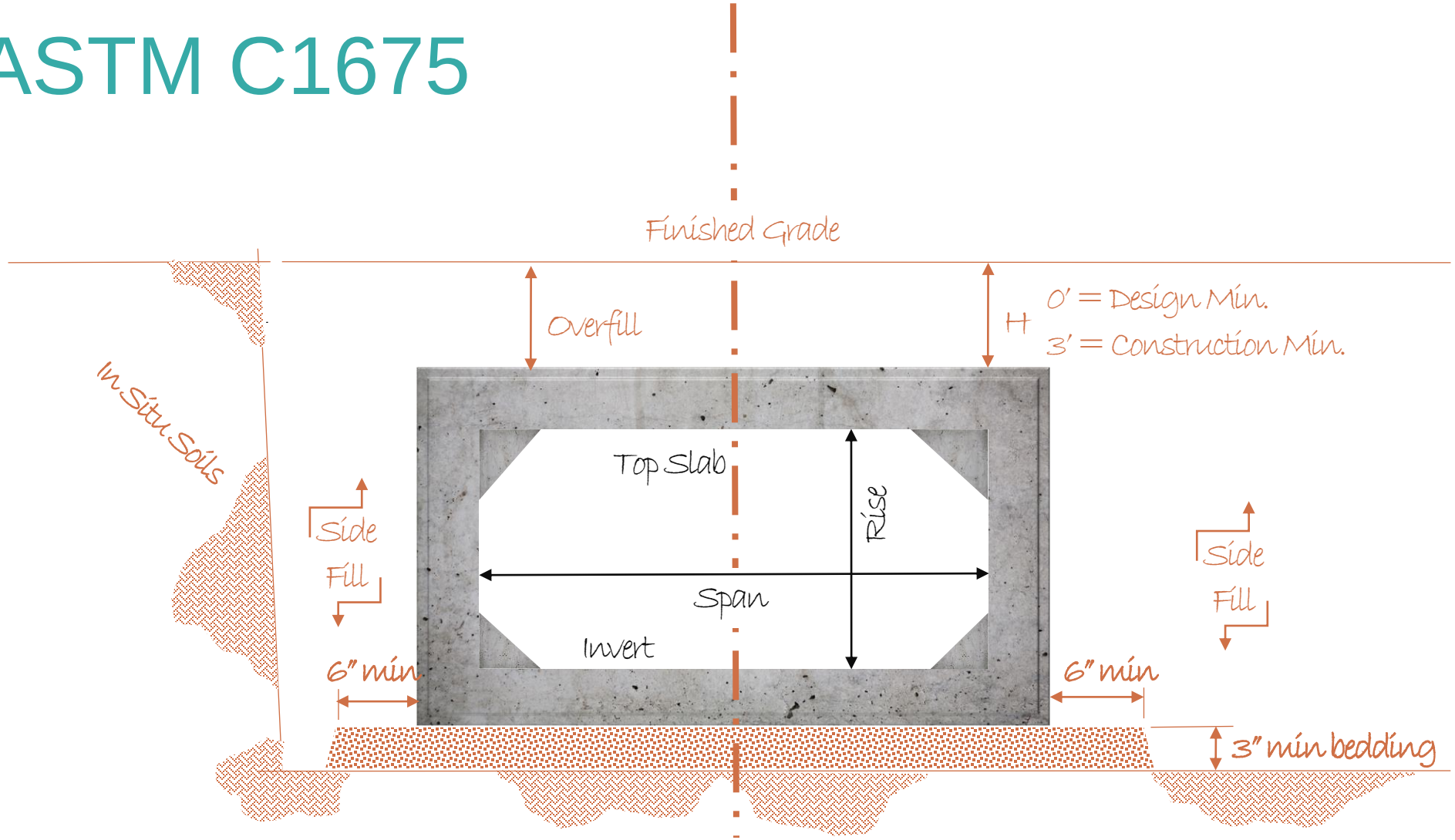
Installation



ASTM C1675



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Culvert Loading

Earth

Live

Construction

Surcharge Loads

Unless designed for construction loading, RCB backfill should be placed 3’ above top of box to accommodate construction loads.

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Installation Best Practices

Scheduling & Unloading = Project Efficiency

Divert drainage

Establish a good, level grade

- Use fine to medium material
- Leveling course should be 3” (min)

Installation Best Practices

- Install 1st & 2nd boxes accurately
- Place joint materials
- Properly align prior to pushing home
- Keep weight of box off bedding
- Pull home with winches or dozer

Handling:

Practice Caution!

Handle per manufacturers recommendations

Distribute load

This is the WRONG way to lift!!

Handling:

Lift – don’t drag

Use crane w/ stabilizers

Dewatering:

Control Surface & Ground Water

Maintain dry conditions during installation

Dewatering:

Maintain dry conditions during installation

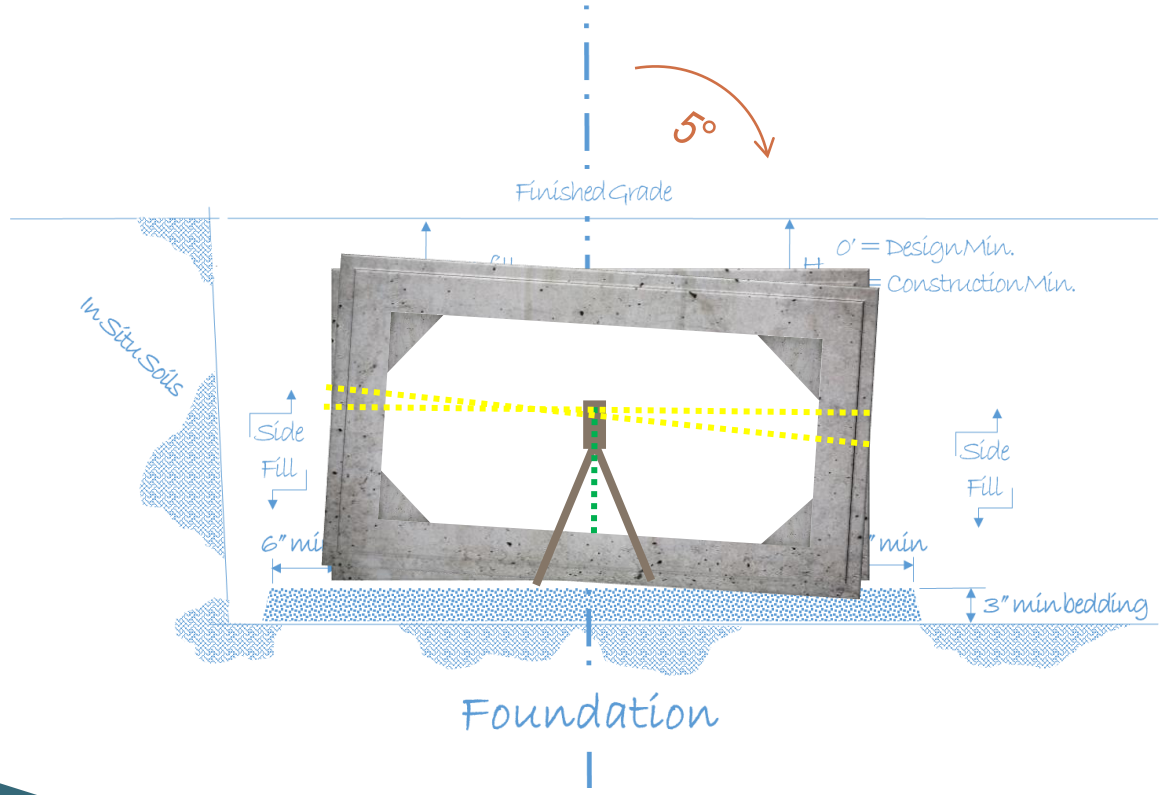
American Concrete Pipe Association

Bedding:

Check line and grade frequently and evenly

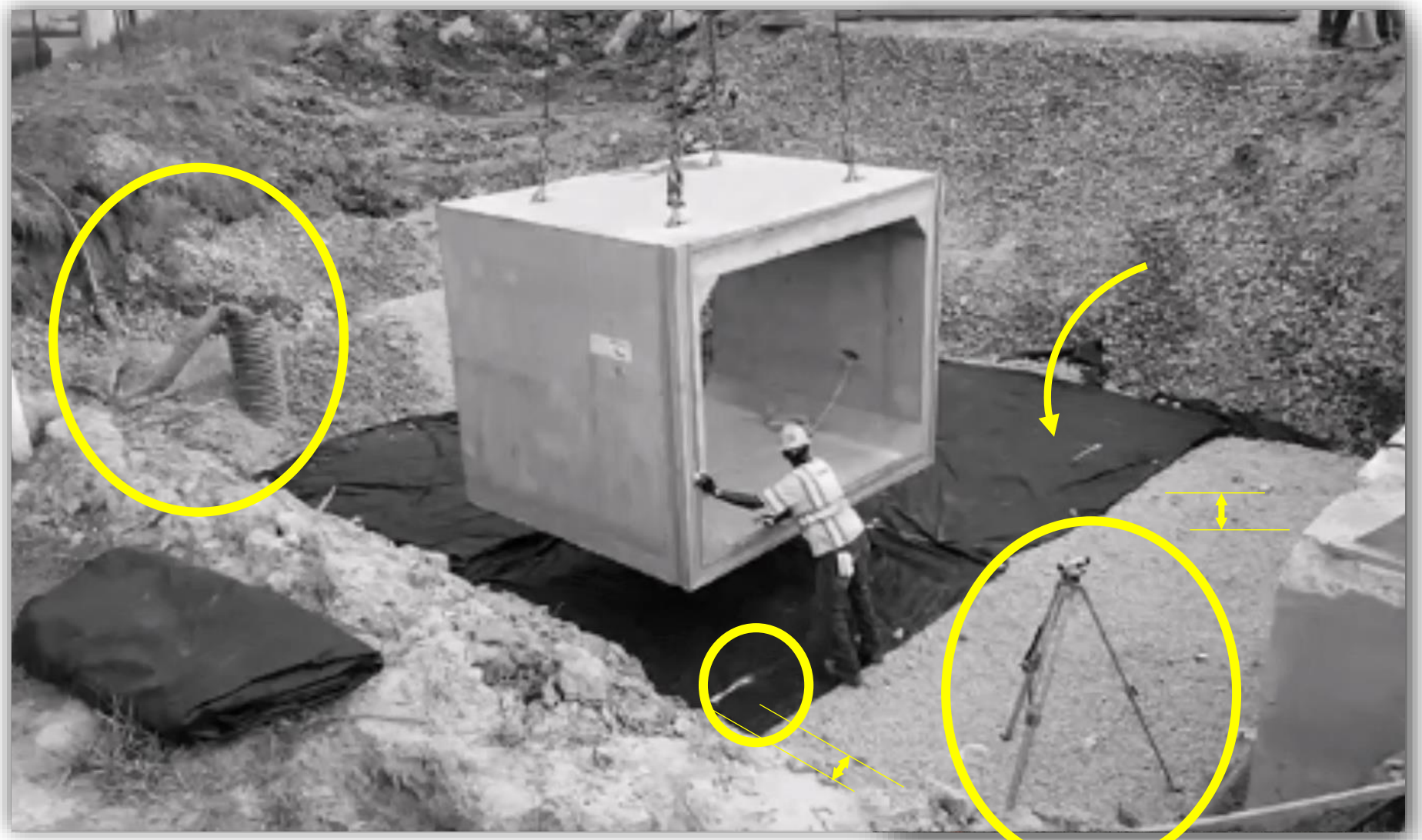
Bedding:

Check line and grade frequently and evenly



Bedding:

Bedding is key to a smooth installation!



Placement:

Ensure equipment is appropriate for weight & size of precast boxes

Placement:

Sequential marking helps proper placement on large/complex jobs

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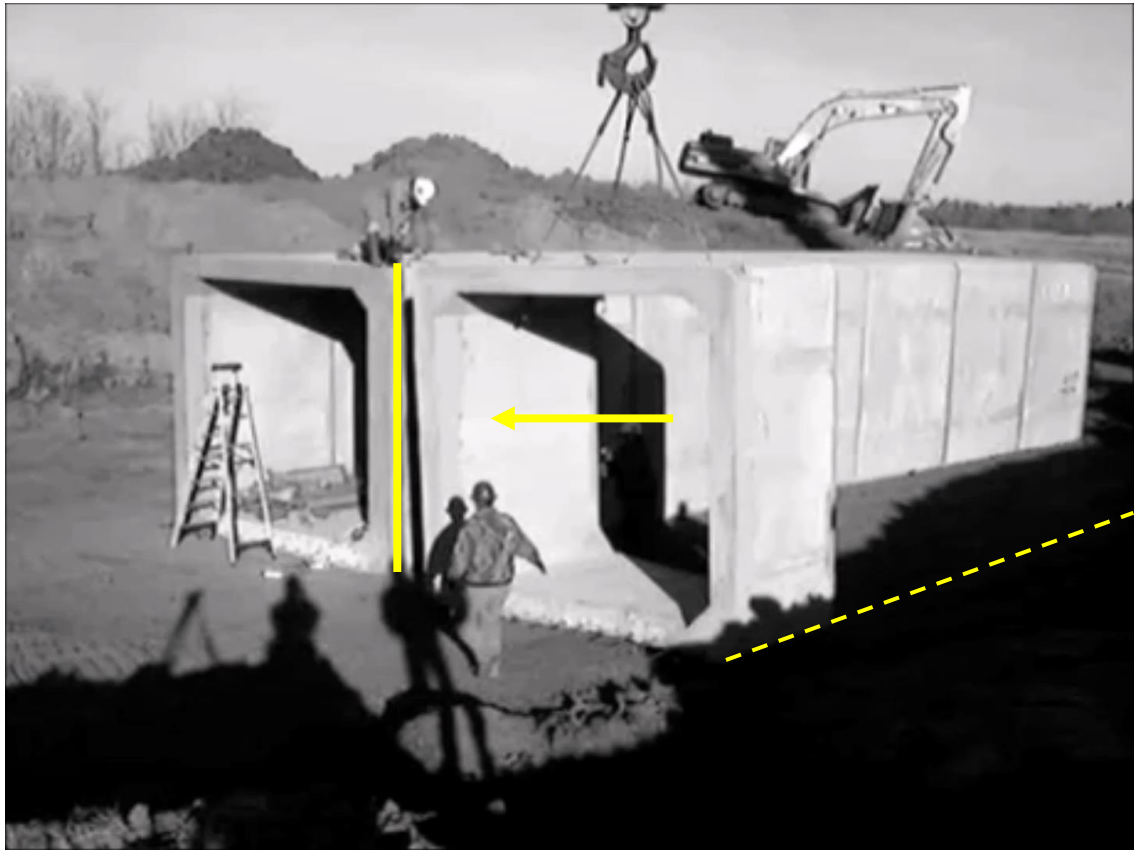
Placement:



1st RCB sets the stage

Take your time – get it right

More time on #1 – Smoother it goes

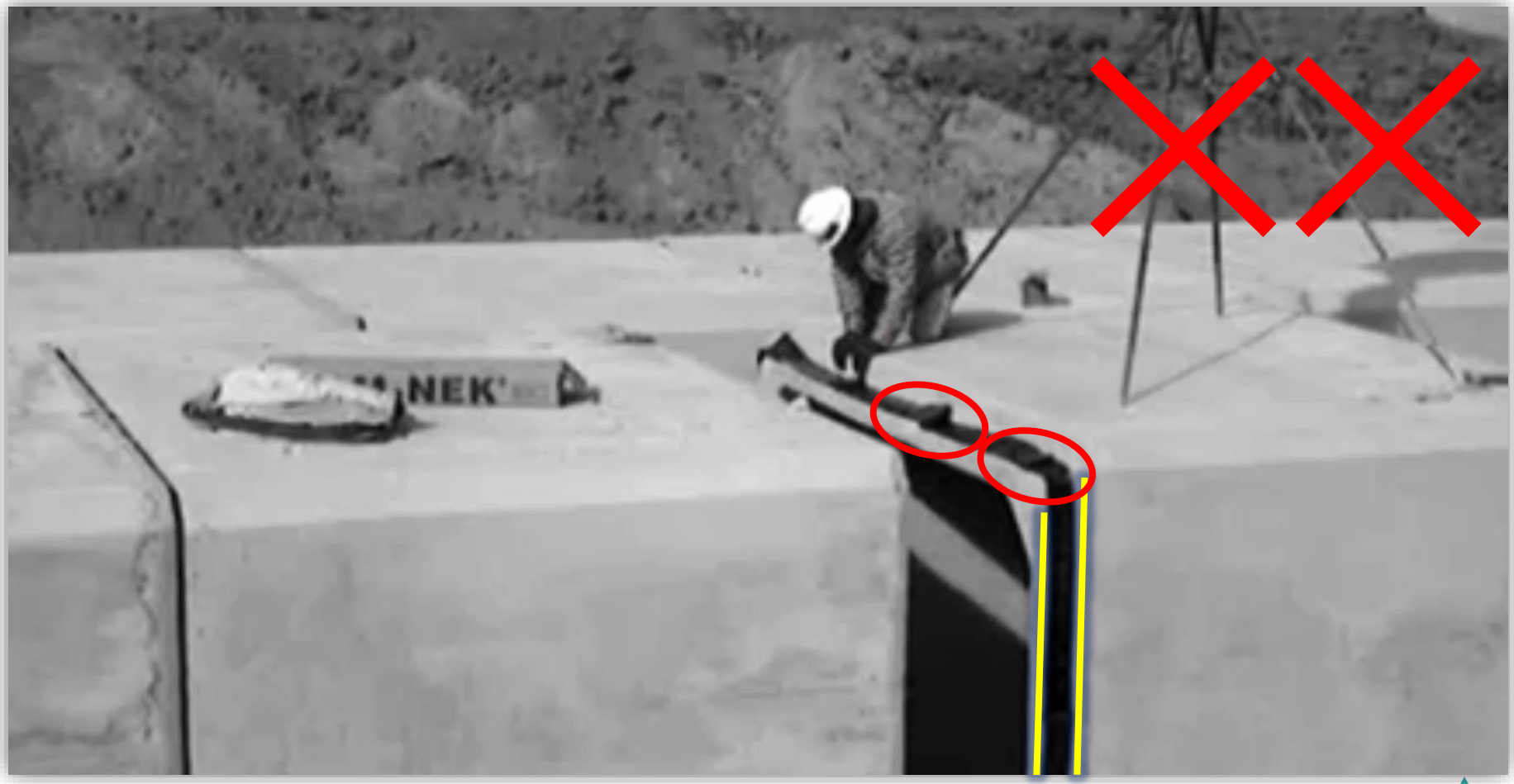
Joining:

Various joint materials are used in the market:

- Mastic
- Butyl Sealant
- Joint Wrap
- Gaskets

Joining:

Joint materials should be applied as recommended by manufacturer:



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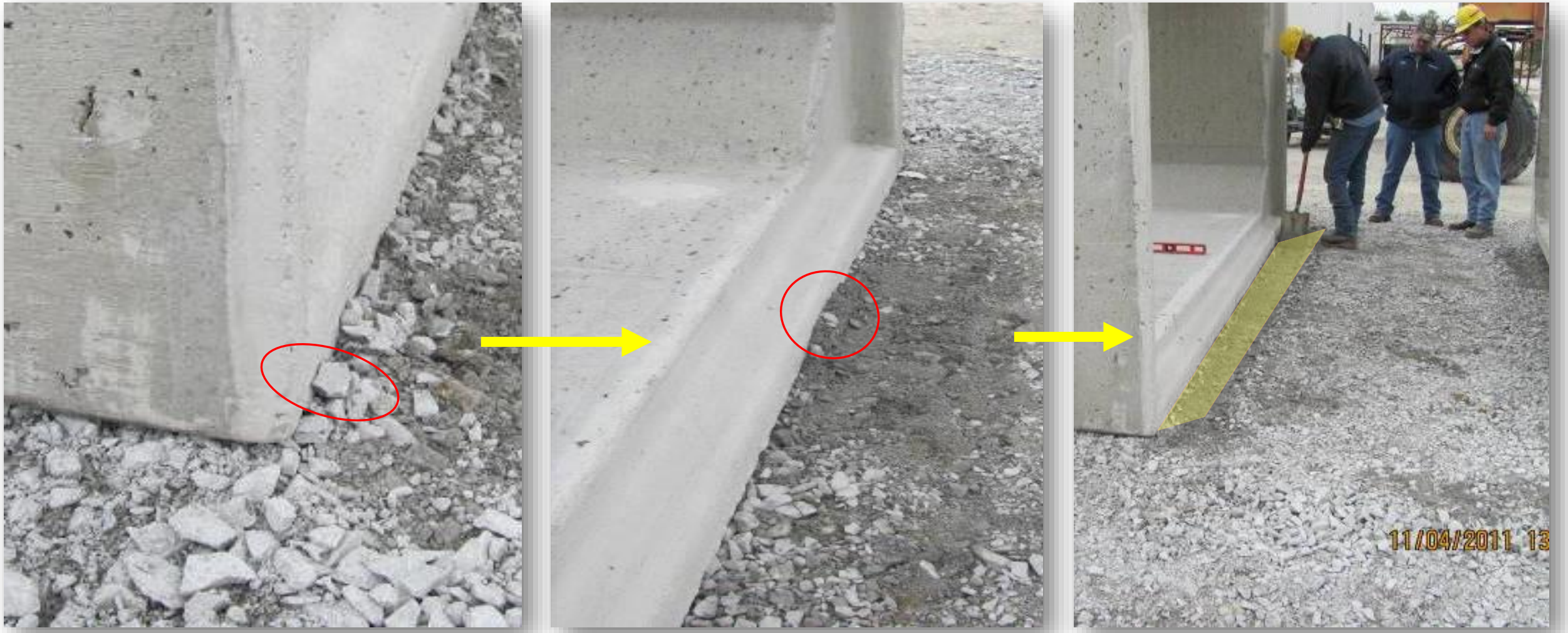
Joining:

Prevent bedding material entering the joint.

Smooth the bedding to improve homing the joint.



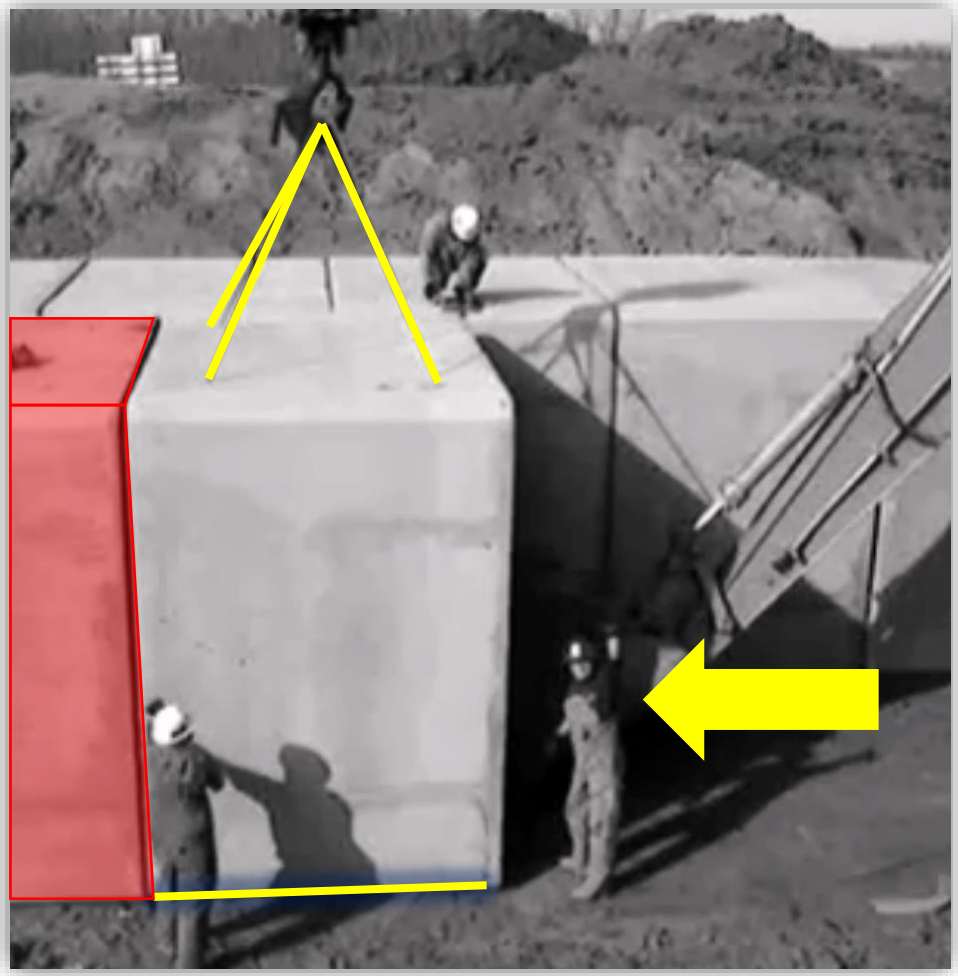
Joining:

Homing techniques driven by capabilities of crew, equipment & conditions.

American Concrete Pipe Association

Joining:

Homing techniques driven by capabilities of crew, equipment & conditions.



Joining:

Check alignment before pushing/pulling boxes home

Joining:

Commercial Pipe/Box Puller.

Joining:

Sometimes the best method is the simplest.

Final Backfill:

Minimize trench excavation

Compact backfill in lifts

Avoid large rolling compactors over the culvert

- **Avoid Construction loading with less than 3’ of cover!**

Successful First Installation:

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End Treatments:

Ends can be precast as well

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End Treatments:

120 feet of 16’ x 5’ box
Major Collector
CIP was $7,000 less than precast
Planned on 8 weeks for installation
Precast was installed in one weekend

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Specials:

Bends can save money & eliminate Junction Boxes

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Specials:

Manufacturers can customize any bend angle

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Multi Boxes:

Multicell vs Multibarrel

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Skewed Ends:

Skews are limited by size & geometry.

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Penetrations:

Penetration addressed in plant

Can be designed for field penetrations

Top, bottom & side penetrations

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Minimum Cover:

0’ cover:

Maximizes hydraulic capacity

Place road surface directly over boxes

American Concrete Pipe Association

Aesthetics:

Decorative stone end treatments

Foot bridges w/ decorative railings

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Final Review:

Properly sized lifting equipment

Tracked loader for homing

Alignment Marks

Dewatering

Line and Grade

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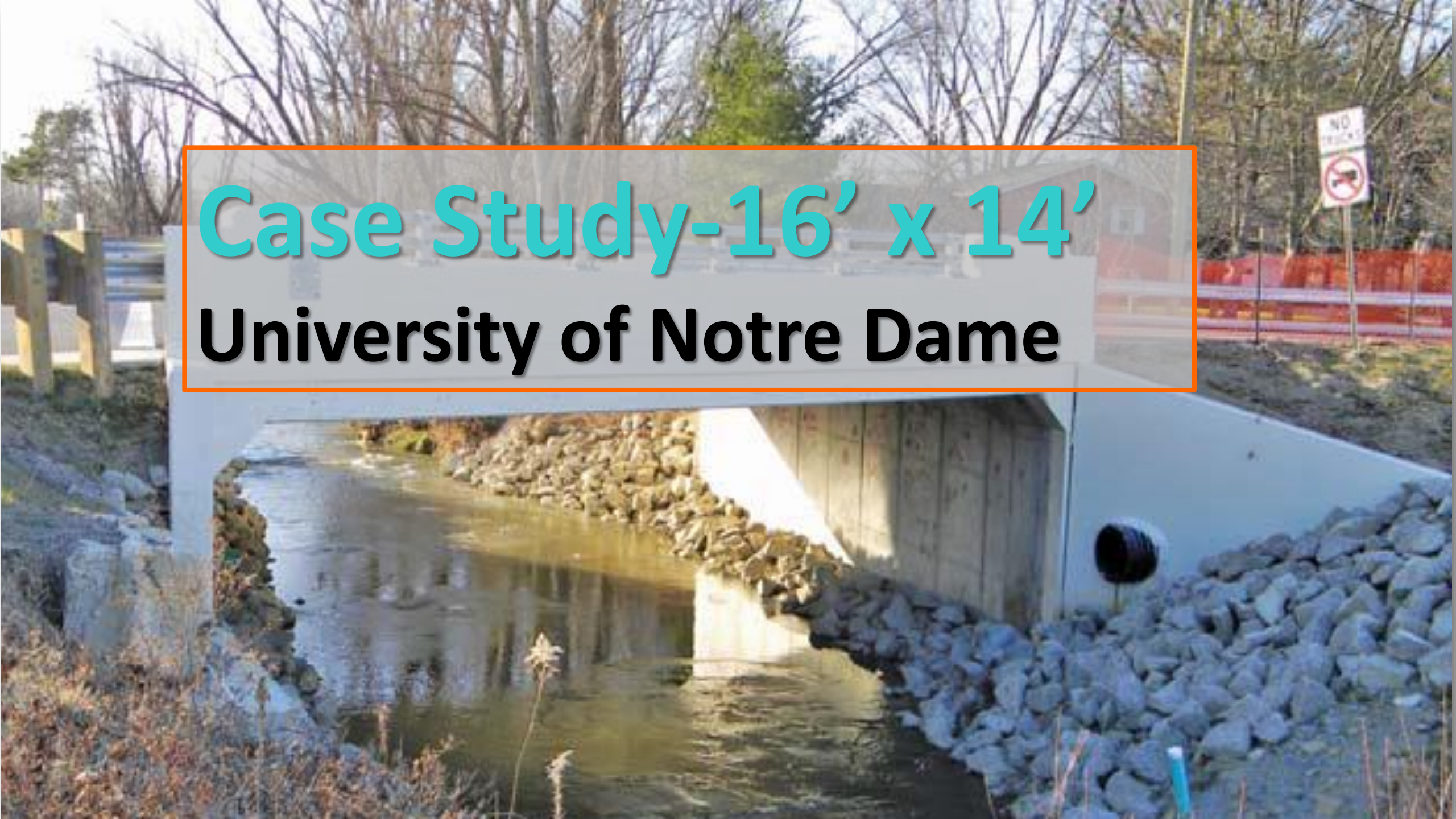
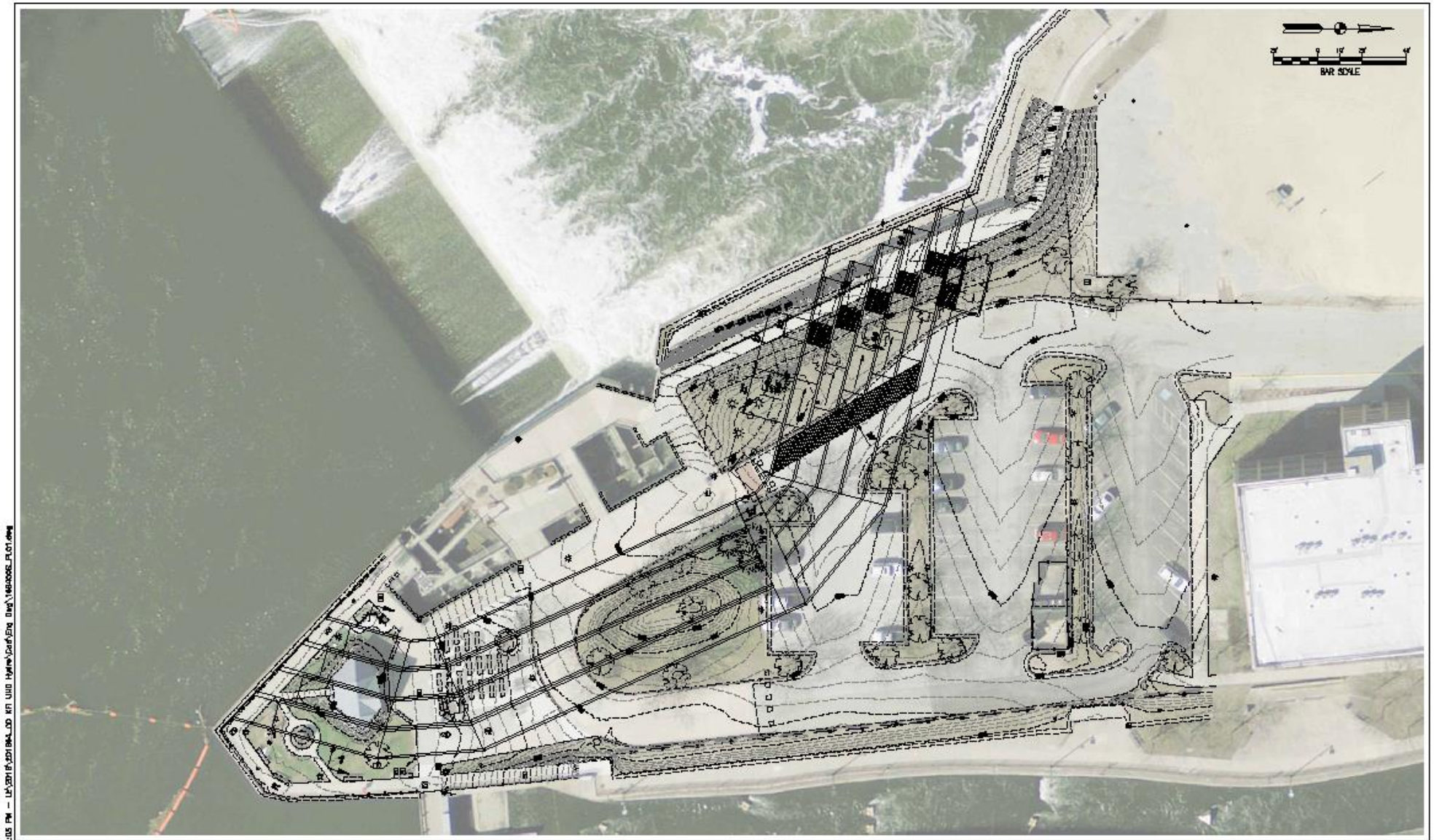


Case Study-16’ x 14’

University of Notre Dame



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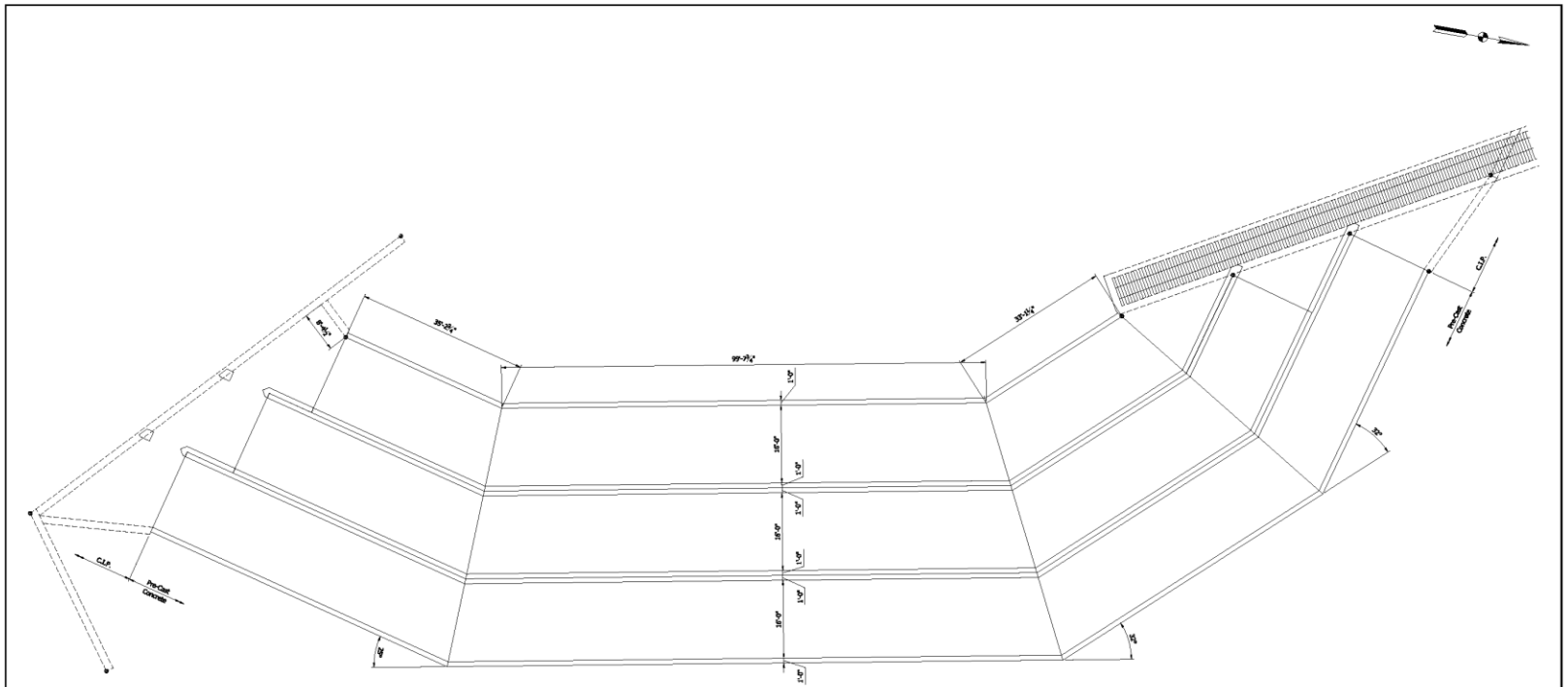

NOTES:

1. Precast box wall thicknesses are approximate and shall be designed by manufacturer.

PRECAST BOXES - GENERAL PLAN

Scale: 1/8" = 1'-0"

BAR SCALE

FOR REFERENCE ONLY
NOT FOR CONSTRUCTION

No.	Date	By	Revision
D	09-19-17	WMJ	75% REVIEW SET
C	09-08-17	WMJ	OWNER'S REVIEW
B	09-05-17	WMJ	OWNER'S REVIEW
A	09-0-17	WMJ	OWNER'S REVIEW

UNIVERSITY OF NOTRE DAME

Kerges-Faulconbridge,Inc.
Engineers
6/10 SOUTH MICHIGAN STREET
ST. PAUL, INDIANA 46785
Tel. (260) 749-2000
Fax (260) 214-8878
Email: kfi@kerges.com

LFA LAWSON-FISHER ASSOCIATES P.C.
3326 N. WASHINGTON AVENUE
SOUTH BEND, INDIANA 46601
PH. (574) 233-0167

Project Title: SOUTH BEND DAM
HYDROELECTRIC PROJECT
UNIVERSITY OF NOTRE DAME
SOUTH BEND, INDIANA

Sheet Title: PRECAST CONCRETE BOX
GENERAL PLAN

Date: 09-19-17
Drawn By: WJT
Checked By: RLH
Project No.: 16-280-00
CWGL Scale: As Noted
Sheet Size: 30x42

Revision Number:

Sheet Number: STR-4301

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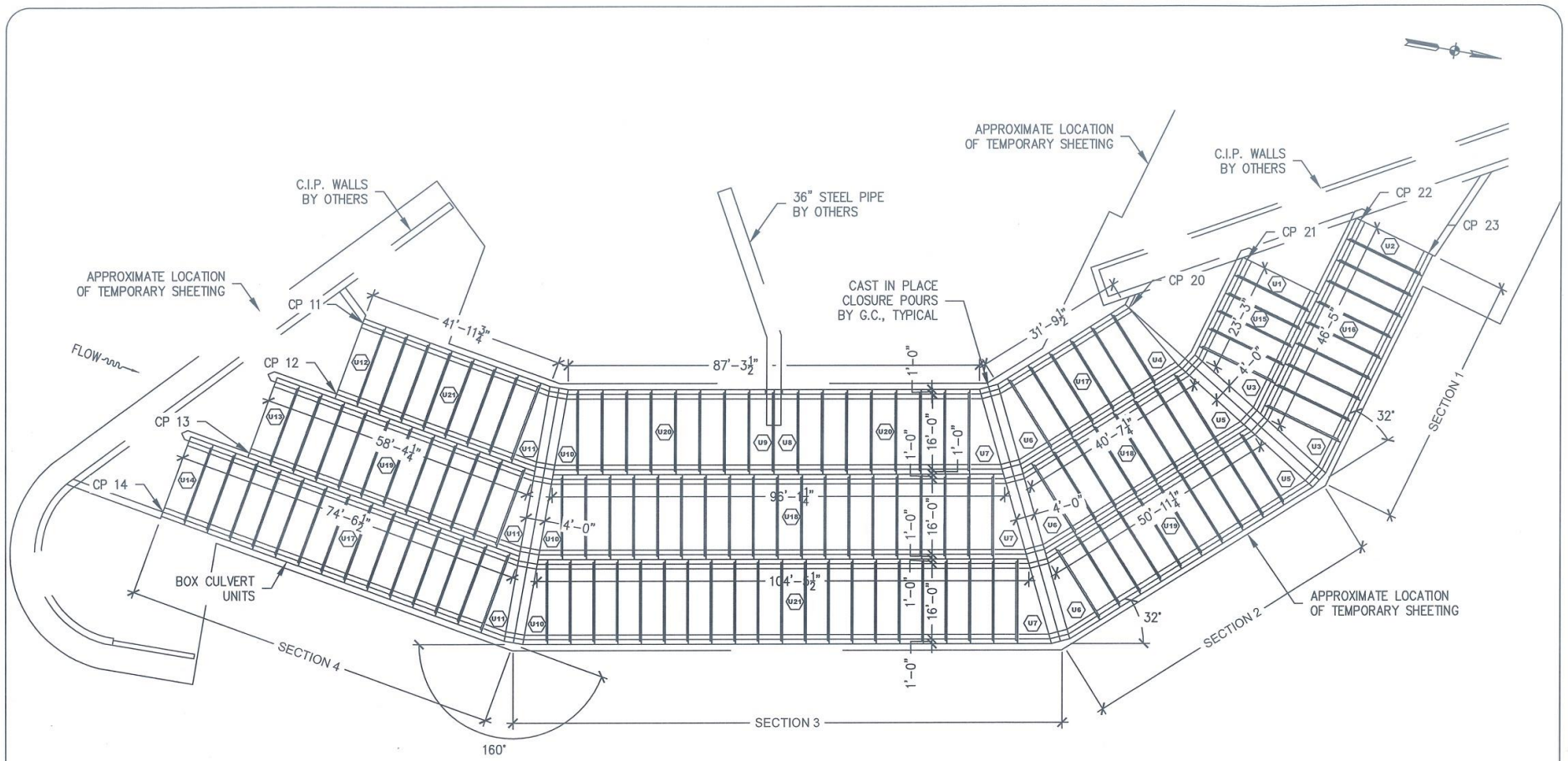

1/2 OVERALL STRUCTURE PLAN
1" = 20'-0"

Box span - 16'-0"
Box rise - 14'-0"

Date: 28 June 2018
Job no.: SPC-18-3015
Scale: 1"=20'-0"
Created by: ARW
Checked by: ZSS

HYDROELECTRIC PROJECT
UNIVERSITY OF NOTRE DAME
RIETH-RILEY CONSTRUCTION
St. Joseph County, Indiana

Overall Plan

S1.0

Sanders
Pre-Cast Concrete Systems, Inc.
6051 South Indianapolis Road
Whitestown, IN 46075-9527
(317) 769-5503 office
(317) 769-3712 fax
(800) 769-5503 toll free
www.sanderscompanies.com

Rieth-Riley Construction South Bend Group

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ALL CRANE RENTAL
800-232-4100
www.allcrane.com

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Case Study-19’ x11’

State Route 15 Grant Co.

27’ Design Cover Height

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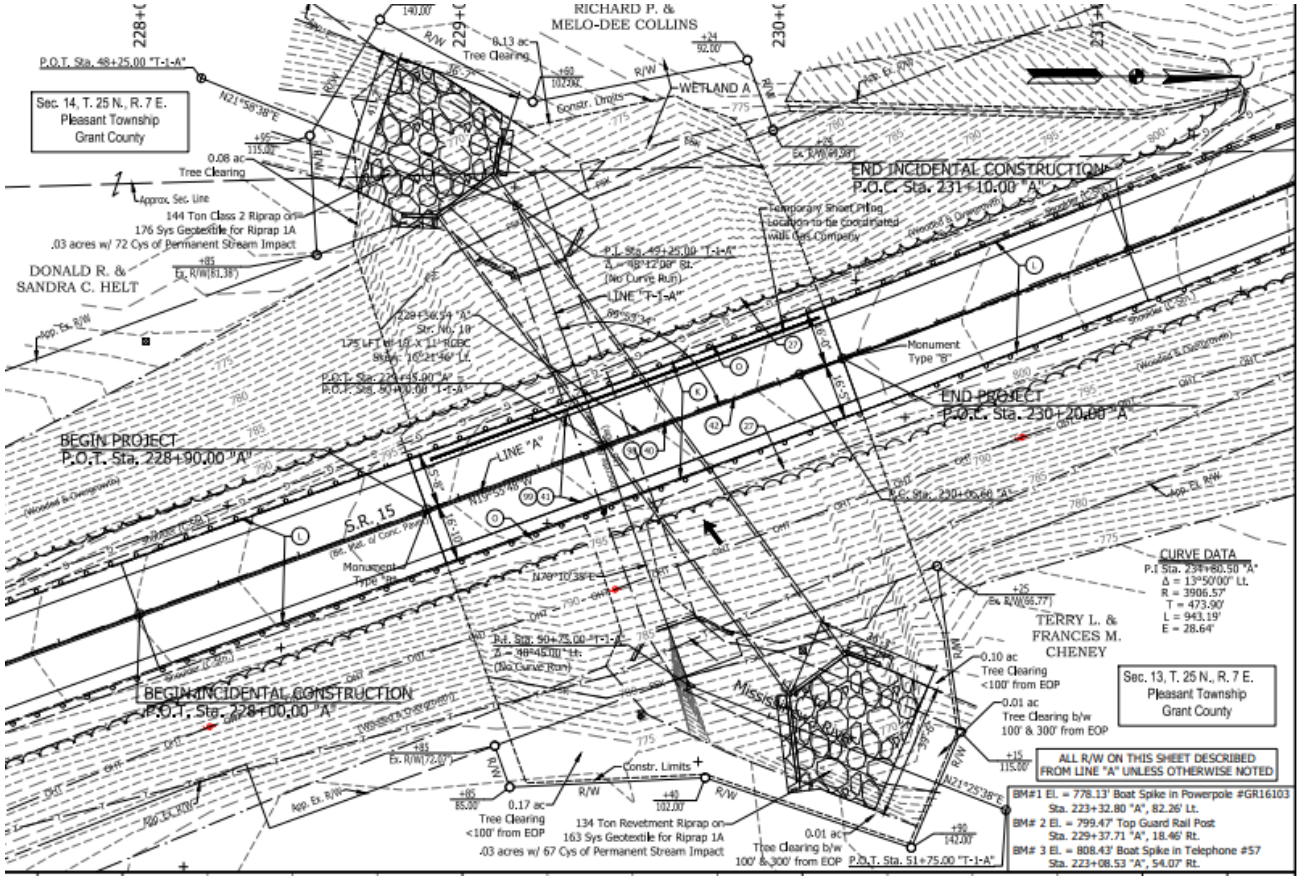
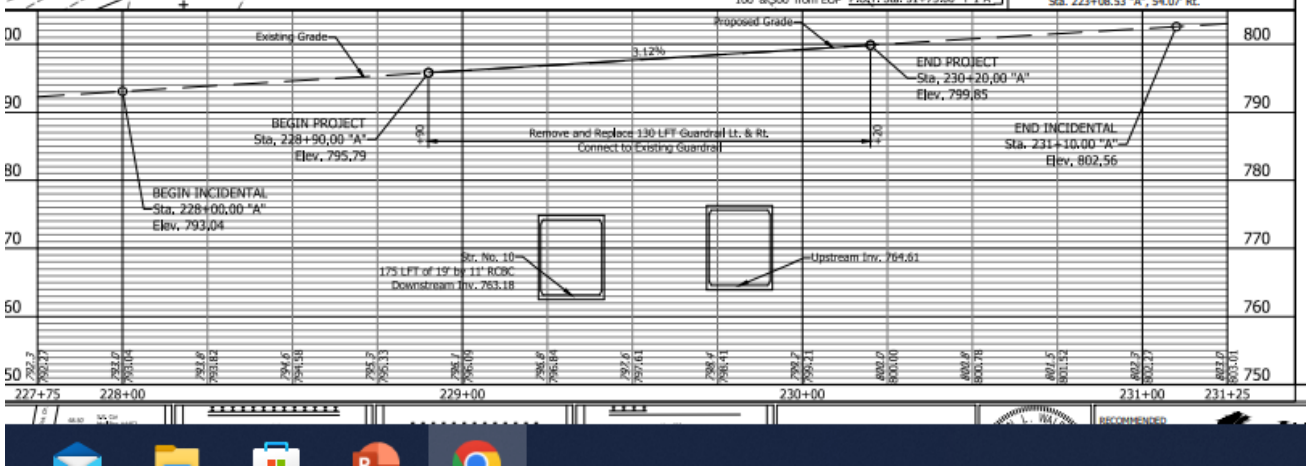
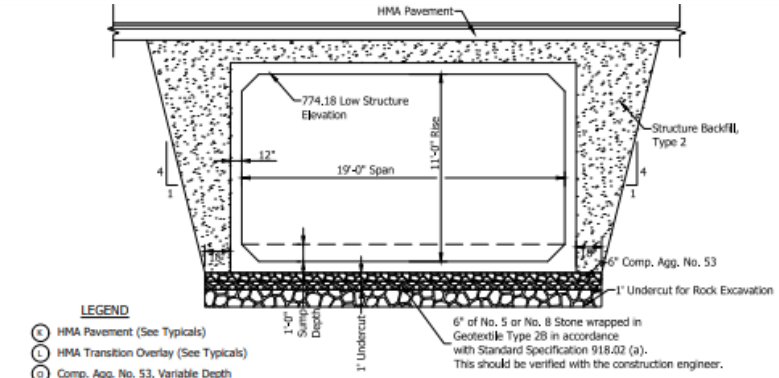
oncrete Pipe
ssociation







LEGEND

- (K) HMA Pavement (See Typicals)
- (L) HMA Transition Overlay (See Typicals)
- (Q) Comp. Agg. No. 53, Variable Depth
- (27) Mulched Seeding, R
- (40) Line, Paint, Yellow, Solid, 4"
- (41) Line, Paint, White, Solid, 4"
- (42) Line, Paint, Yellow, Broken, 4"
- (98) Milled HMA Corrugations, Sinusoidal
- (99) Milled HMA Corrugations, Conventional
- FSK Filter Sock

CROSS SECTION VIEW

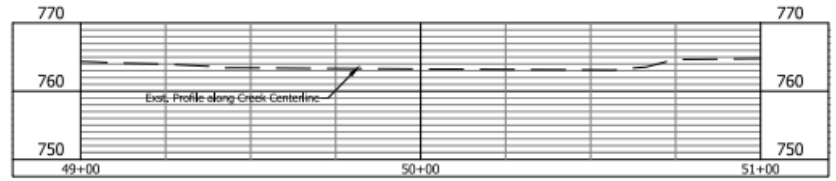
Scale: Not To Scale

HYDRAULIC DATA

ITEM	EXISTING STRUCTURE	PROPOSED STRUCTURE
DRAINAGE AREA	3.34 Sq. Mi.	3.34 Sq. Mi.
DESIGN DISCHARGE Q100	1,050 cfs	1,050 cfs
BACKWATER	4.26 ft	2.98 ft
MINIMAL LOW STRUCTURE ELEVATION	776.08'	776.08'
ROADWAY OVERFLOW	NO	NO
OUTLET VELOCITY Q50	NOT AVAILABLE	10.97 ft/sec
HEADWATER ELEVATION Q100	775.40'	774.12'

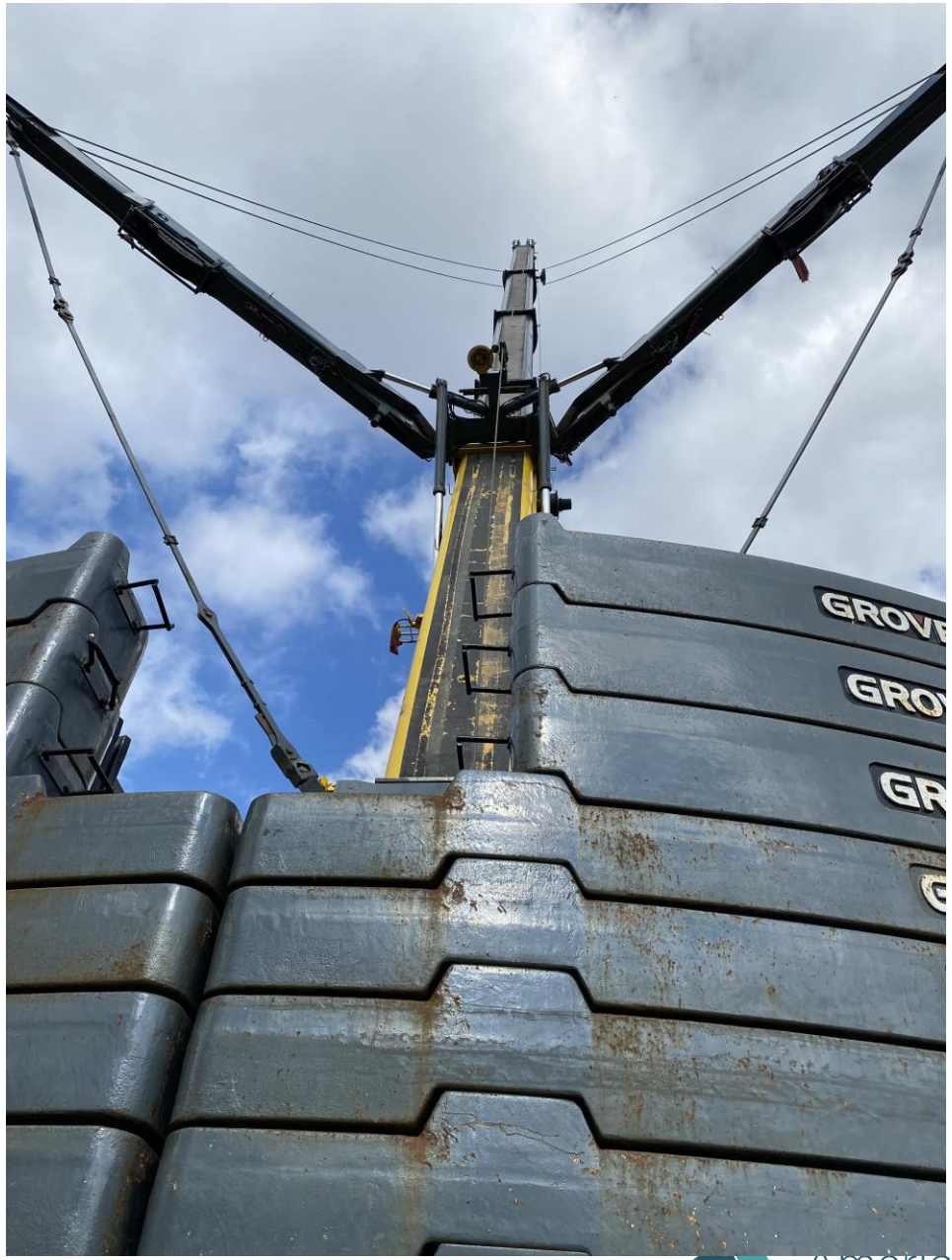
EXISTING STRUCTURE

Not to Scale



EXISTING PROFILE

1" = 20'



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Association

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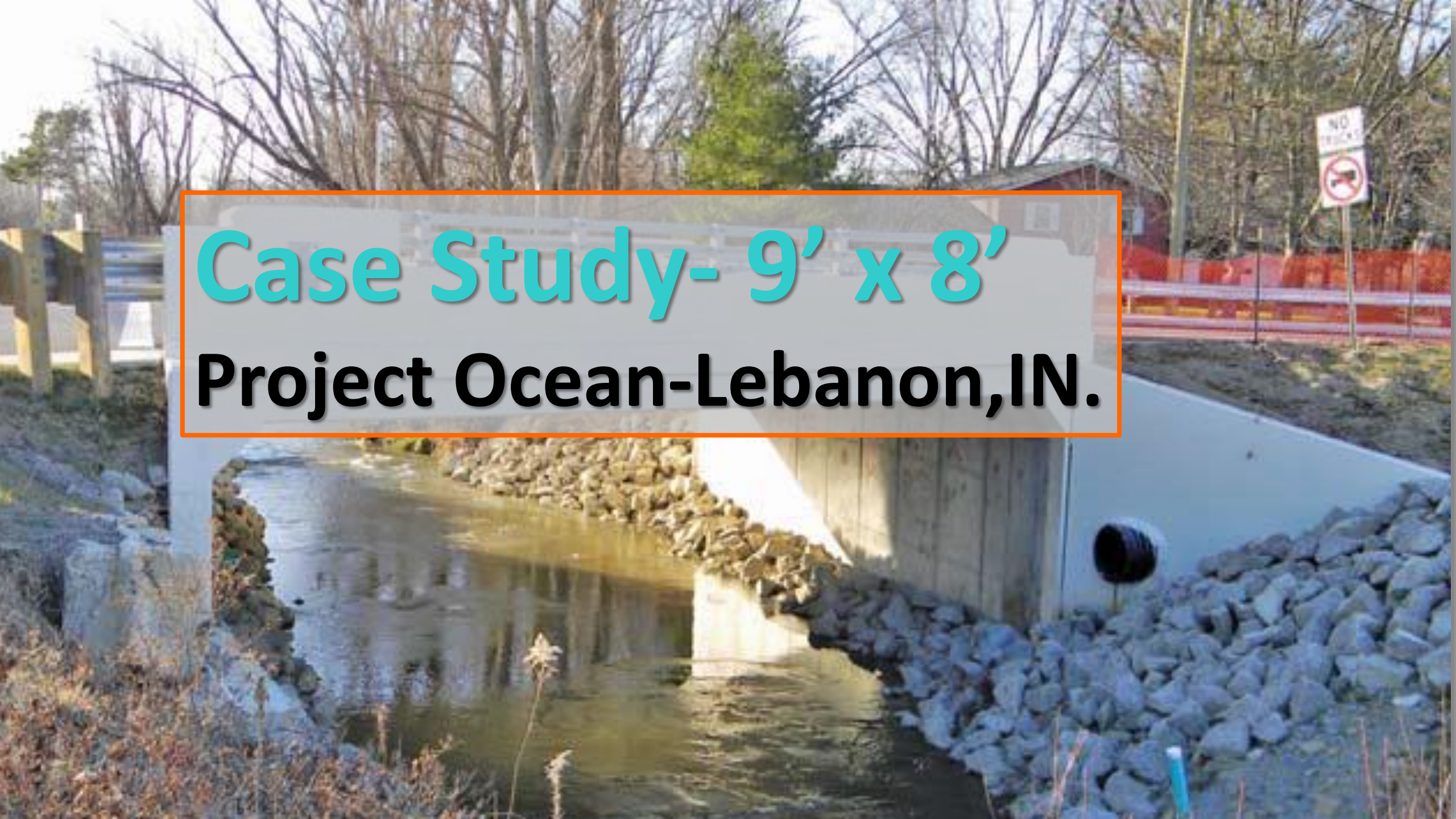
Association



Case Study- 9’ x 8’

Project Ocean-Lebanon,IN.

FCL BUILDERS

FCL Builders has reviewed for general conformance with design, contract documents and verification of products required, adjacent construction work and coordination of information. The review is cursory and in no way relieves the Subcontractor of responsibility for field dimensions, accuracy and compliance with the plans, specifications (manual) and code requirements. No work shall commence, or materials released for order without Architects/Engineer Review being issued.

[x] REVIEWED

[ ] REVIEWED AS NOTED

[ ] REJECTED, RESUBMIT

Project # SD Smith 18032
Date 4-3-19
By Walt Sabbath

Kevin Wyatt Architect

☐ APPROVED
☒ APPROVED AS CORRECTED
☐ REVISE AND RESUBMIT
☐ REJECTED

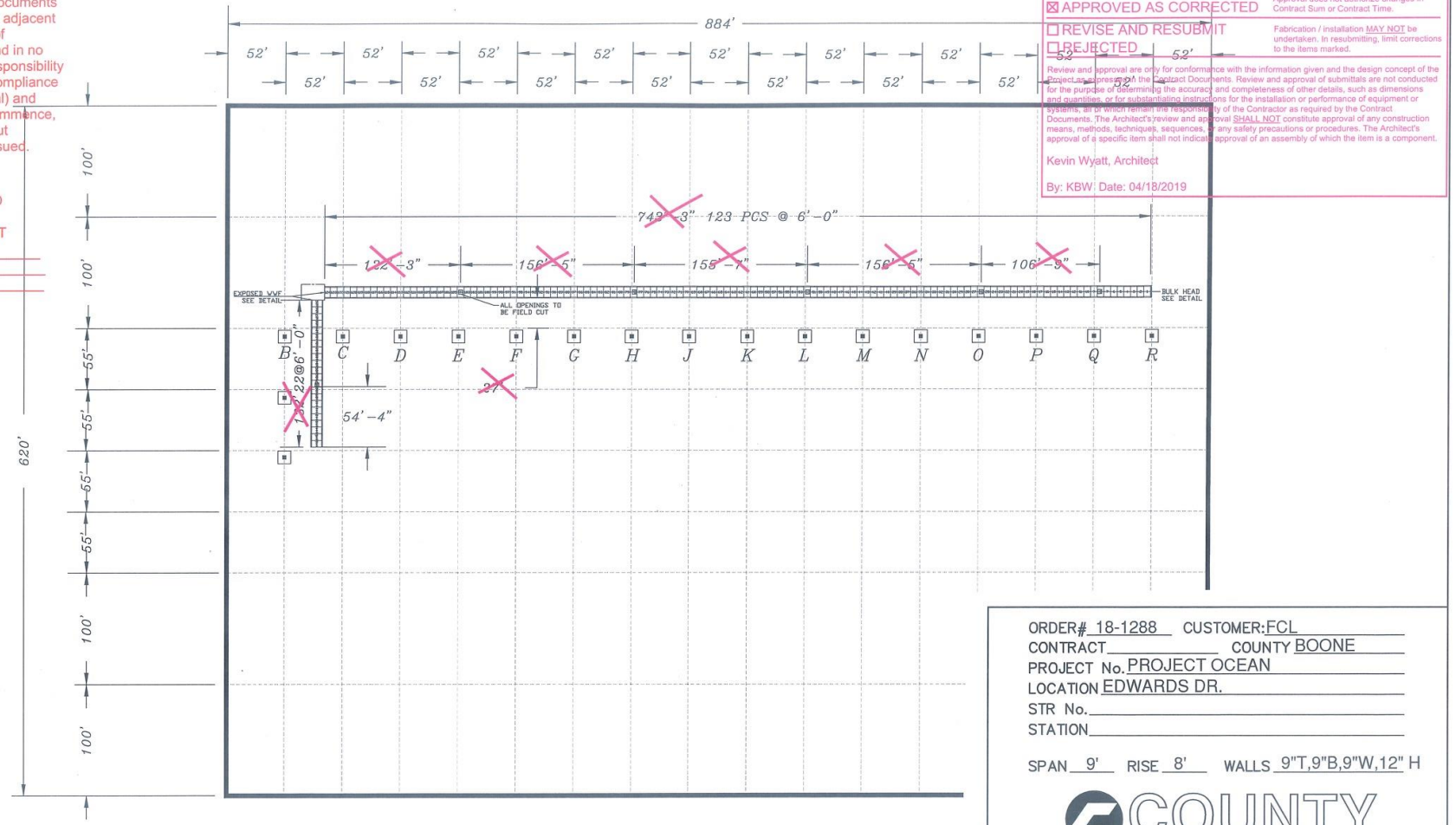
Fabrication / installation may be undertaken. Approval does not authorize changes in Contract Sum or Contract Time.

Fabrication / installation MAY NOT be undertaken. In resubmitting, limit corrections to the items marked.

Review and approval are only for conformance with the information given and the design concept of the Project as expressed in the Contract Documents. Review and approval of submittals are not conducted for the purpose of determining the accuracy and completeness of other details, such as dimensions and quantities, or for substantiating instructions for the installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review and approval SHALL NOT constitute approval of any construction means, methods, techniques, sequences, or any safety precautions or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

Kevin Wyatt, Architect

By: KBW Date: 04/18/2019



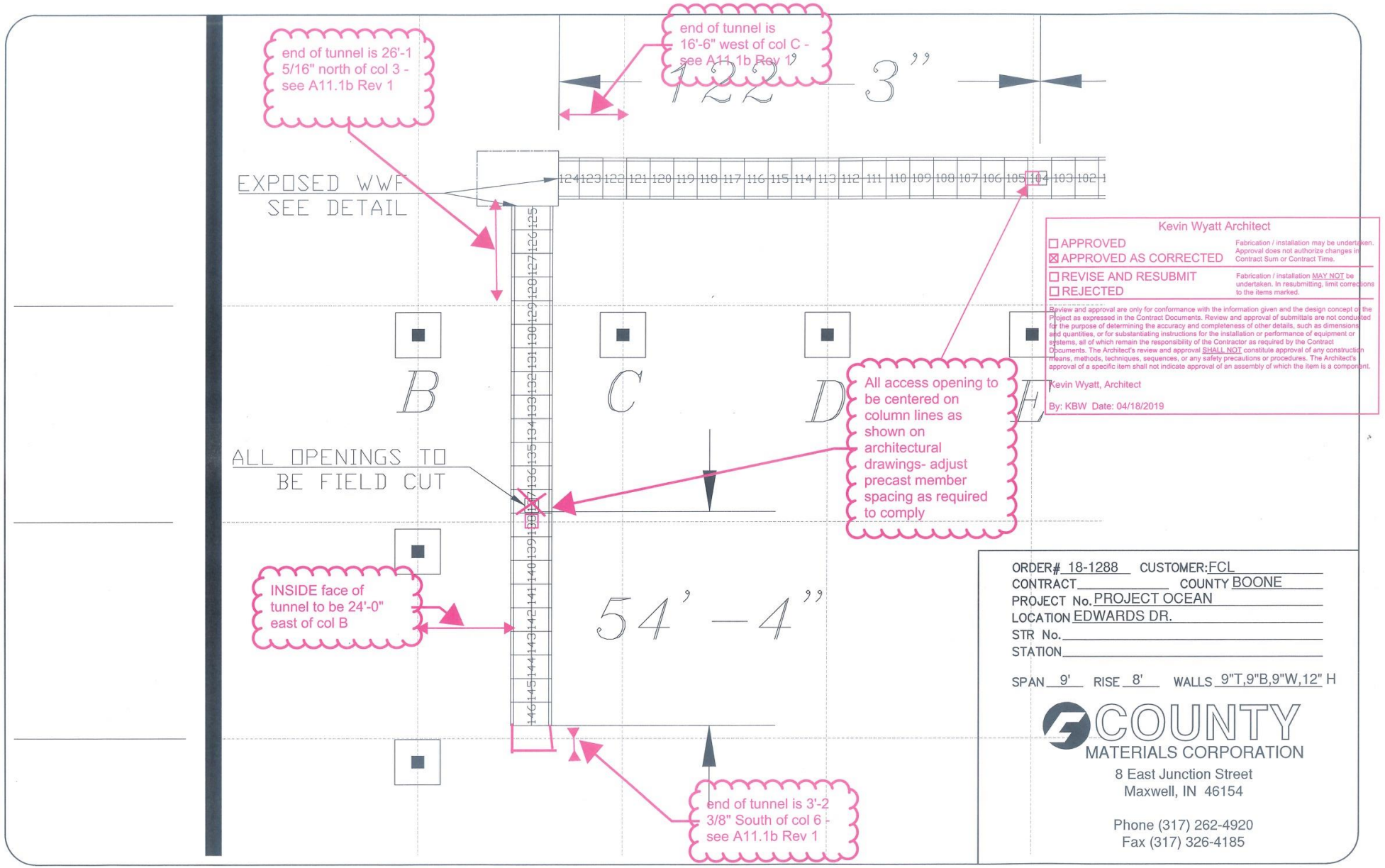
ORDER# 18-1288 CUSTOMER: FCL
CONTRACT ____ COUNTY BOONE
PROJECT No. PROJECT OCEAN
LOCATION EDWARDS DR.
STR No. ____
STATION ____

SPAN 9' RISE 8' WALLS 9"T,9"B,9"W,12" H

COUNTY MATERIALS CORPORATION
8 East Junction Street
Maxwell, IN 46154

Phone (317) 262-4920
Fax (317) 326-4185

American Concrete Pipe Association



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an
Concrete Pipe
Association

American Concrete Pipe Association

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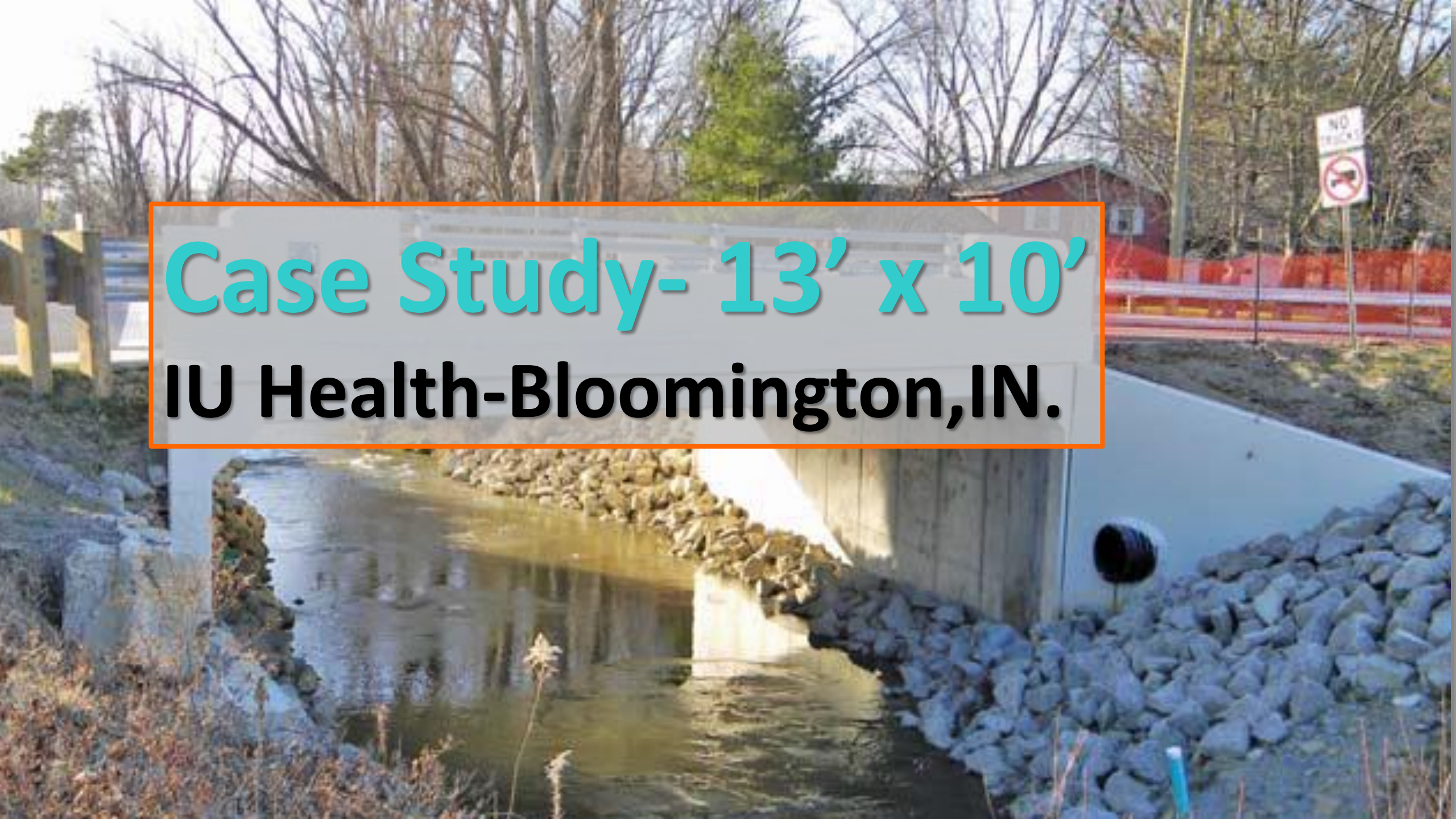
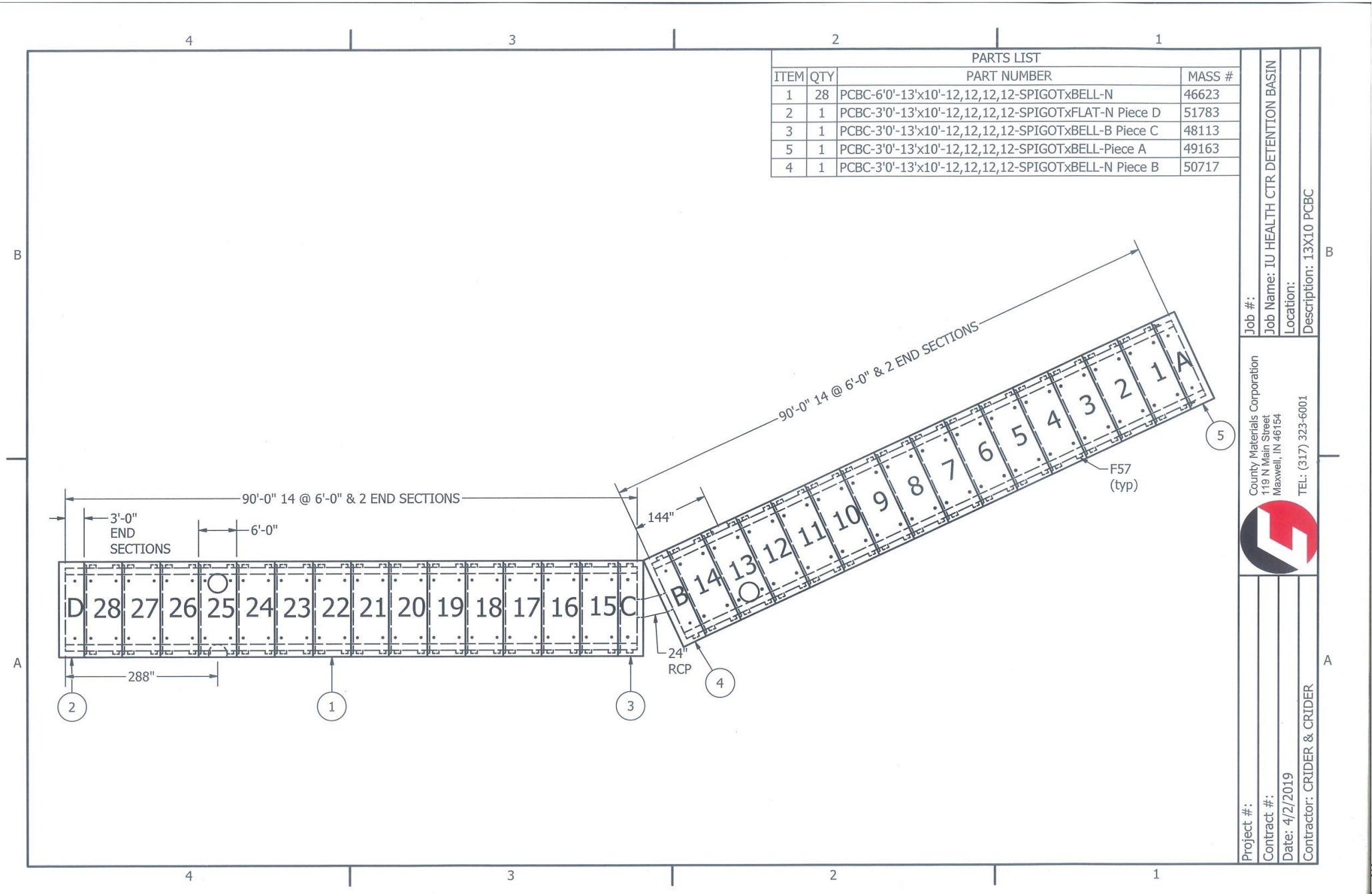
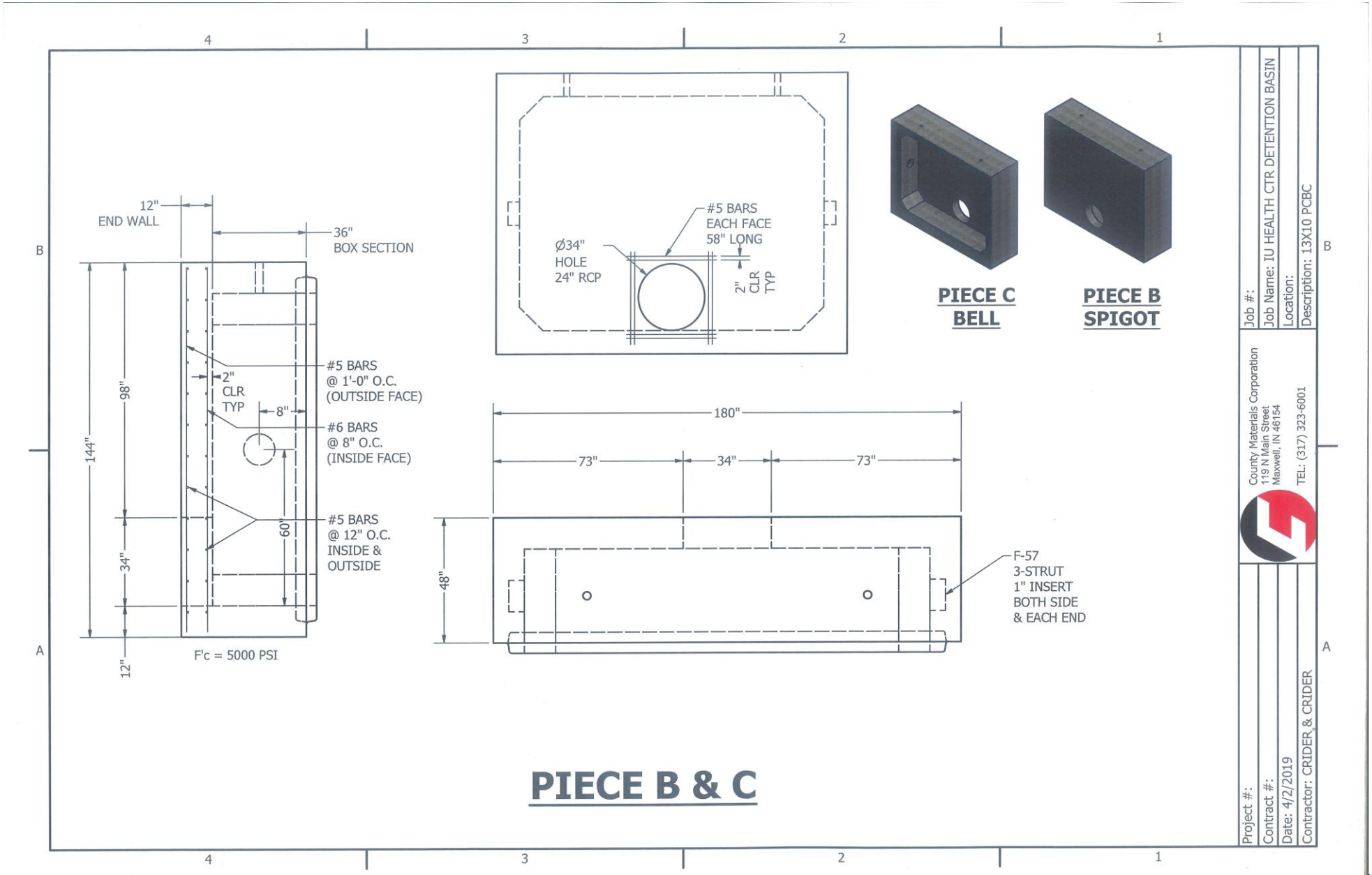


Case Study- 13’ x 10’

IU Health-Bloomington,IN.


PARTS LIST
ITEM | QTY | PART NUMBER | MASS #
1 | 28 | PCBC-6'0'-13'x10'-12,12,12,12-SPIGOTxBELL-N | 46623
2 | 1 | PCBC-3'0'-13'x10'-12,12,12,12-SPIGOTxFLAT-N Piece D | 51783
3 | 1 | PCBC-3'0'-13'x10'-12,12,12,12-SPIGOTxBELL-B Piece C | 48113
5 | 1 | PCBC-3'0'-13'x10'-12,12,12,12-SPIGOTxBELL-Piece A | 49163
4 | 1 | PCBC-3'0'-13'x10'-12,12,12,12-SPIGOTxBELL-N Piece B | 50717
90'-0" 14 @ 6'-0" & 2 END SECTIONS
3'-0" END SECTIONS
6'-0"
D 28 27 26 25 24 23 22 21 20 19 18 17 16 15 C
288"
144"
B 14 13 12 11 10 9 8 7 6 5 4 3 2 1 A
F57 (typ)
24" RCP
Job #:
Job Name: IU HEALTH CTR DETENTION BASIN
Location:
Description: 13X10 PCBC
County Materials Corporation
119 N Main Street
Maxwell, IN 46154
TEL: (317) 323-6001
Project #:
Contract #:
Date: 4/2/2019
Contractor: CRIDER & CRIDER



PIECE B & C

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Concrete Pipe
Association

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American Concrete Pipe Association

American Concrete Pipe Association

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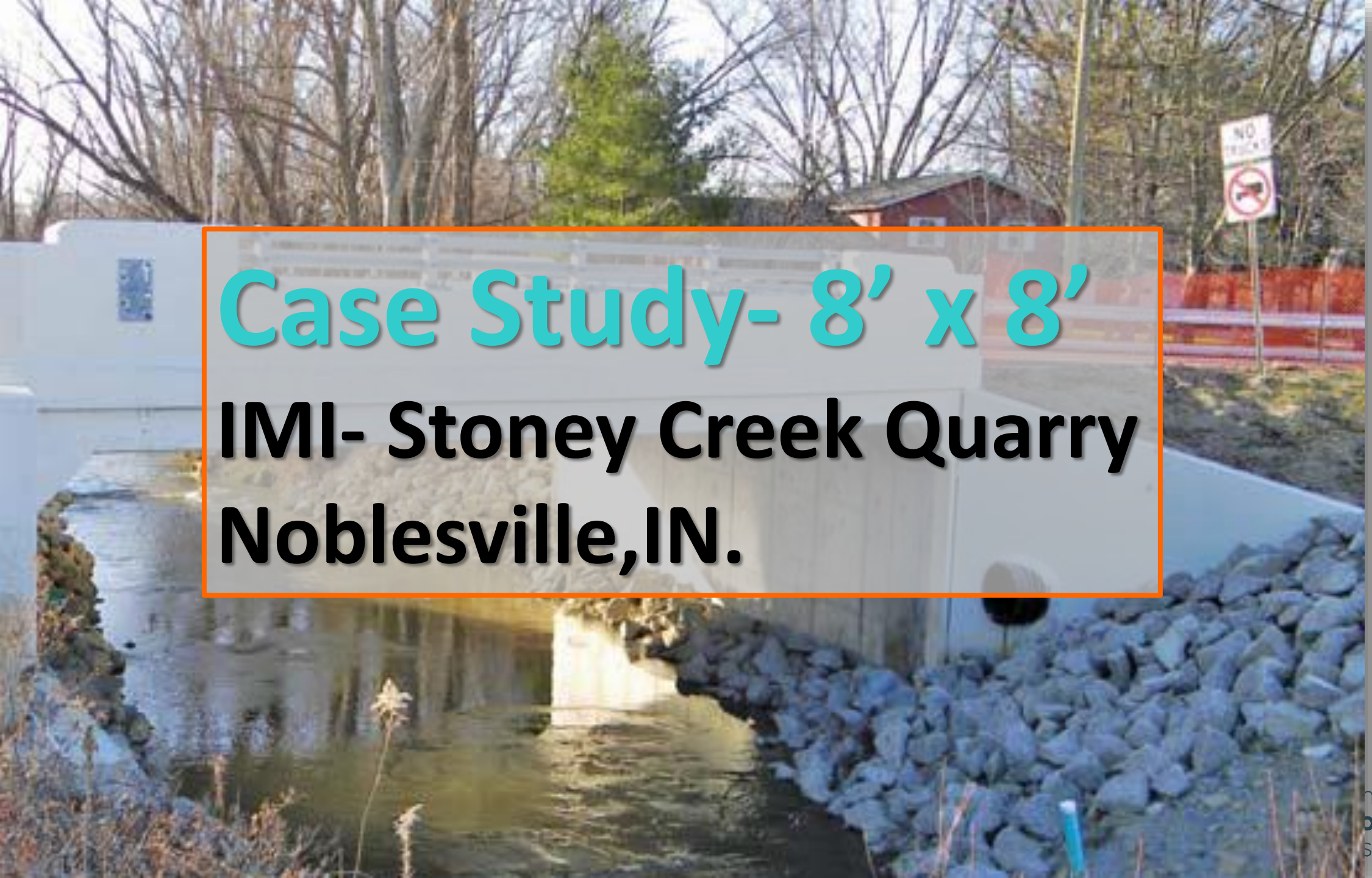

Case Study- 8’ x 8’

IMI- Stoney Creek Quarry Noblesville,IN.

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ssociation

PRECAST REINFORCED CONCRETE FOUR SIDED BOX STRUCTURE

COUNTY MATERIALS CORPORATION

INDEX OF SHEETS	
SHEET NUMBER	DESCRIPTION
1	TITLE AND INDEX OF SHEETS
2	STRUCTURE PLAN
3	CULVERT REINFORCEMENT
4-6	BOX CULVERT UNITS
7-8	DETAILS

IMI - STONEY CREEK QUARRY

SR 38/32

NOBLESVILLE, IN

TOMMY NICHOLSON REGISTERED No. PE 11120281 STATE OF INDIANA PROFESSIONAL ENGINEER

DECEMBER 20, 2018

DATE	ISSUE / REVISIONS
12-XX-2018	ISSUED FOR CONSTRUCTION

RECOMMENDED FOR APPROVAL: _____ DESIGN ENGINEER DATE

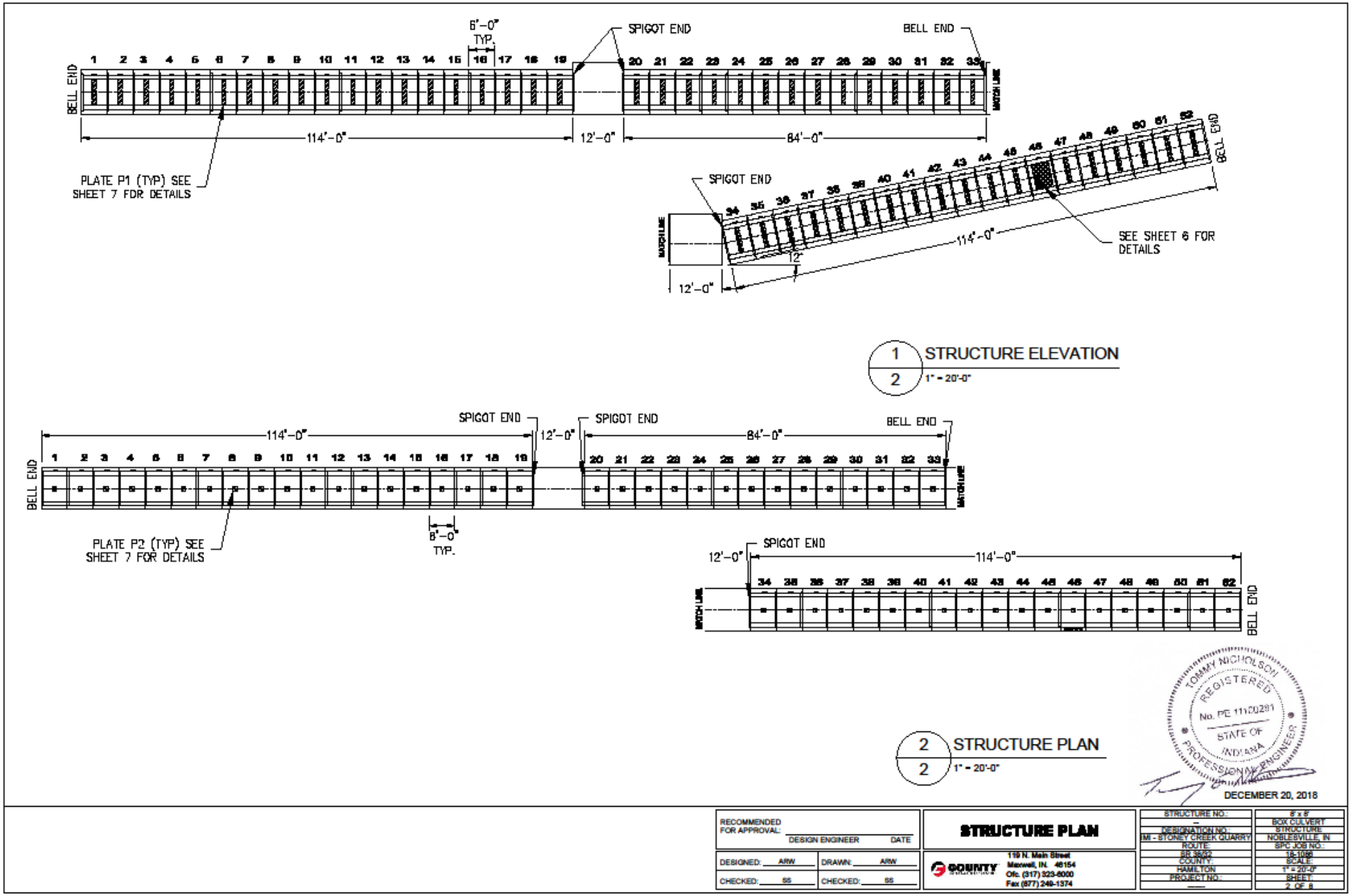
DESIGNED: ARW DRAWN: ARW

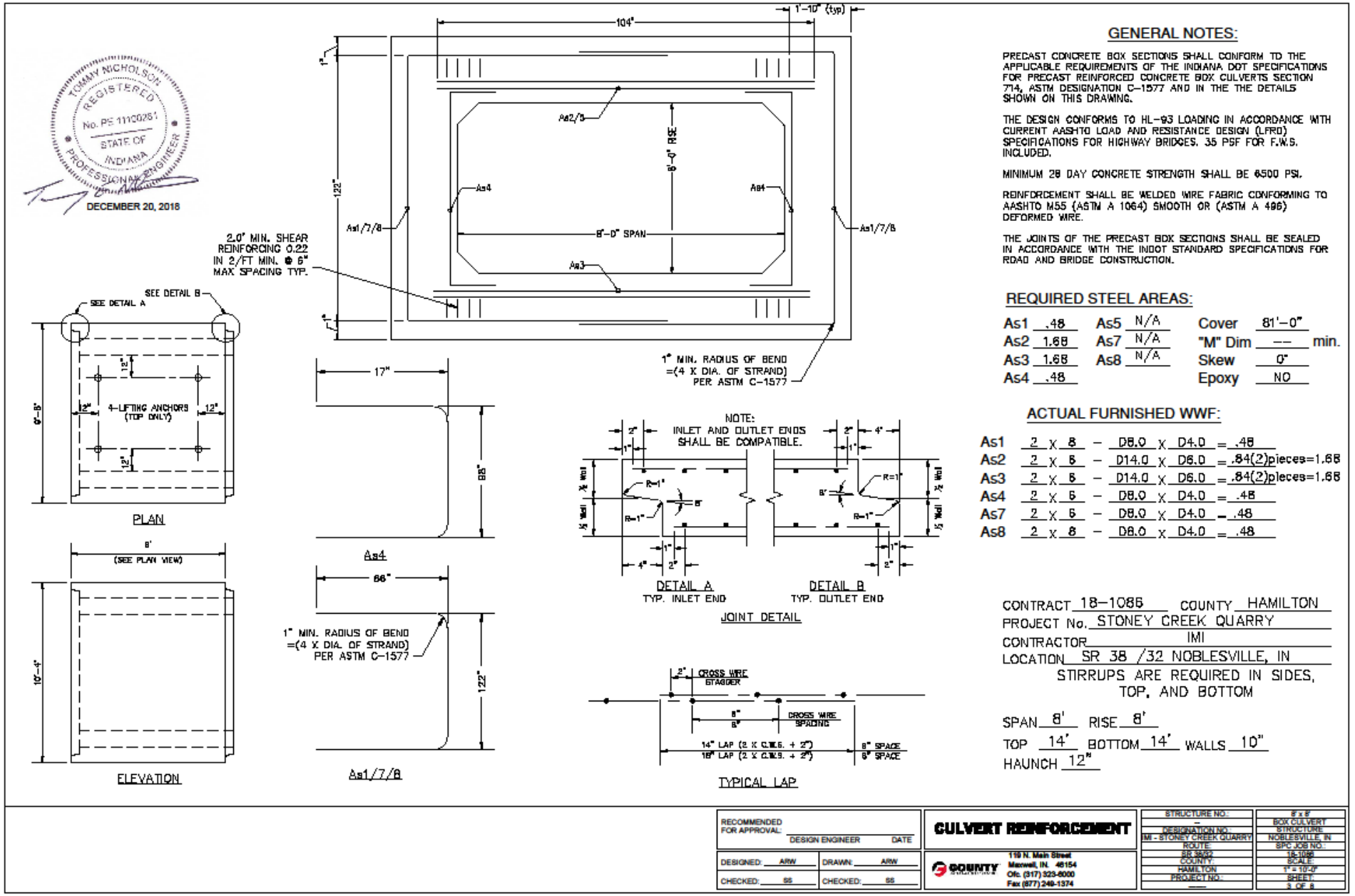
CHECKED: SS CHECKED: SS

TITLE AND INDEX OF SHEETS

COUNTY MATERIALS CORPORATION
119 N. Main Street
Maxwell, IN. 46154
Ofc. (317) 323-6000
Fax (877) 249-1374

STRUCTURE NO.:	8' x 8'
–	BOX CULVERT
DESIGNATION NO.:	STRUCTURE
IMI - STONEY CREEK QUARRY	NOBLESVILLE, IN
ROUTE:	SPC JOB NO.:
SR 38/32	18-1088
COUNTY:	SCALE:
HAMILTON	1" = 10'-0"
PROJECT NO.:	SHEET:
—	1 OF 8





GENERAL NOTES:

PRECAST CONCRETE BOX SECTIONS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF THE INDIANA DOT SPECIFICATIONS FOR PRECAST REINFORCED CONCRETE BOX CULVERTS SECTION 714, ASTM DESIGNATION C-1577 AND IN THE THE DETAILS SHOWN ON THIS DRAWING.

THE DESIGN CONFORMS TO HL-93 LOADING IN ACCORDANCE WITH CURRENT AASHTO LOAD AND RESISTANCE DESIGN (LFRD) SPECIFICATIONS FOR HIGHWAY BRIDGES. 35 PSF FOR F.W.S. INCLUDED.

MINIMUM 28 DAY CONCRETE STRENGTH SHALL BE 6500 PSI.

REINFORCEMENT SHALL BE WELDED WIRE FABRIC CONFORMING TO AASHTO M55 (ASTM A 1064) SMOOTH OR (ASTM A 496) DEFORMED WIRE.

THE JOINTS OF THE PRECAST BOX SECTIONS SHALL BE SEALED IN ACCORDANCE WITH THE INDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.

REQUIRED STEEL AREAS:

As1	.48	As5	N/A	Cover	81'-0"
As2	1.68	As7	N/A	"M" Dim	--- min.
As3	1.68	As8	N/A	Skew	0°
As4	.48			Epoxy	NO

ACTUAL FURNISHED WWF:

As1	2	X 8	- D8.0	X D4.0	= .48	
As2	2	X 6	- D14.0	X D6.0	= .84(2)pieces	=1.68
As3	2	X 6	- D14.0	X D6.0	= .84(2)pieces	=1.68
As4	2	X 6	- D8.0	X D4.0	= .48	
As7	2	X 6	- D8.0	X D4.0	= .48	
As8	2	X 8	- D8.0	X D4.0	= .48	

CONTRACT 18-1086 COUNTY HAMILTON
PROJECT No. STONEY CREEK QUARRY
CONTRACTOR IMI
LOCATION SR 38 /32 NOBLESVILLE, IN
STIRRUPS ARE REQUIRED IN SIDES, TOP, AND BOTTOM

SPAN 8' RISE 8'
TOP 14" BOTTOM 14" WALLS 10"
HAUNCH 12"

RECOMMENDED FOR APPROVAL: DESIGN ENGINEER DATE	CULVERT REINFORCEMENT	STRUCTURE NO.: -	8' x 8' BOX CULVERT
DESIGNED: ARW DRAWN: ARW	COUNTY 119 N. Main Street Maxwell, IN. 46154 Ofc. (317) 323-6000 Fax (877) 249-1374	DESIGNATION NO.: IMI - STONEY CREEK QUARRY	STRUCTURE: NOBLESVILLE, IN
CHECKED: SS CHECKED: SS		ROUTE: SR 38/32	SPC JOB NO.: 18-1086
		COUNTY: HAMILTON	SCALE: 1" = 10'-0"
		PROJECT NO.: ---	SHEET: 3 OF 8

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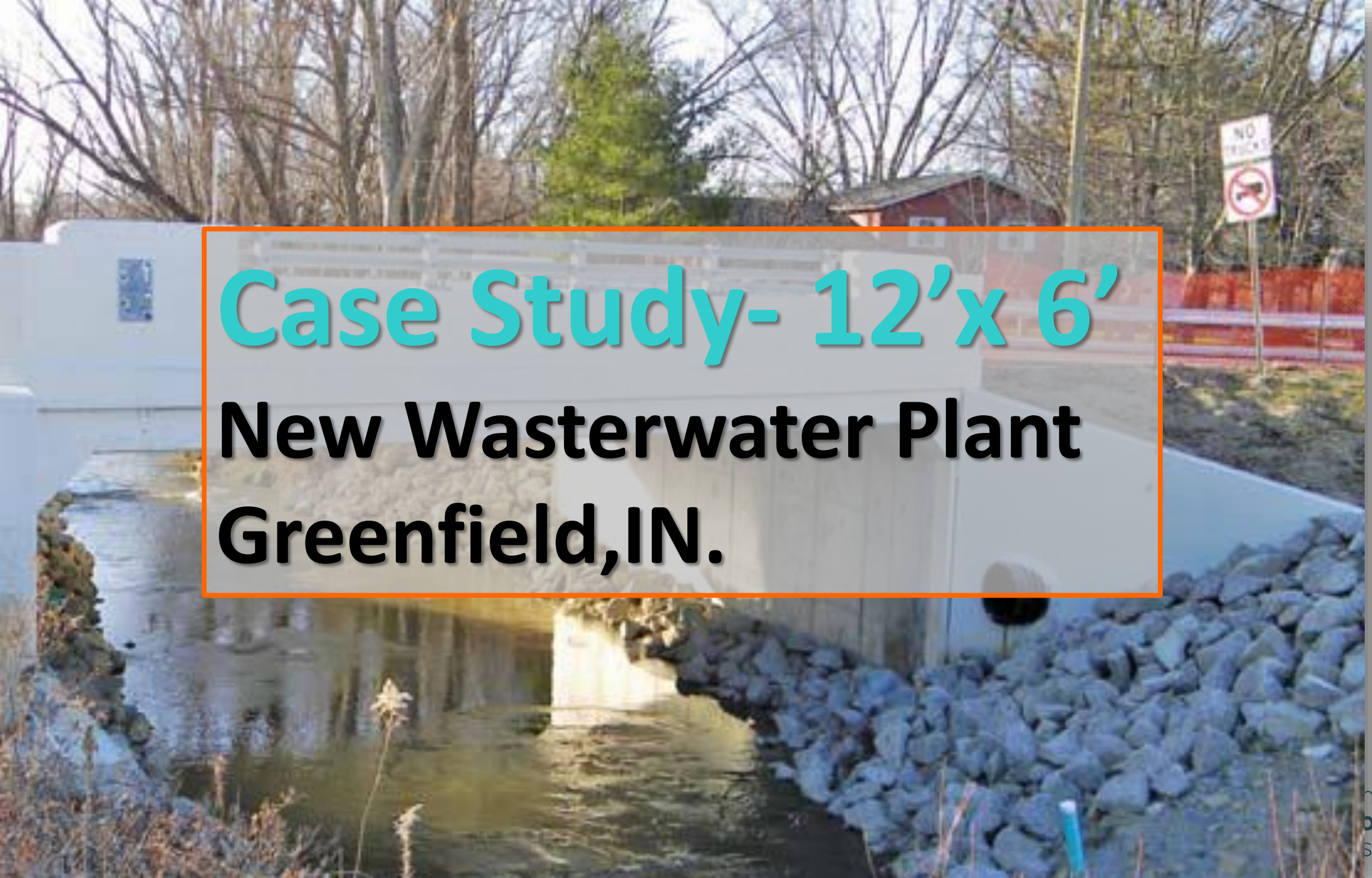

Case Study- 12’x 6’

New Wasterwater Plant Greenfield,IN.

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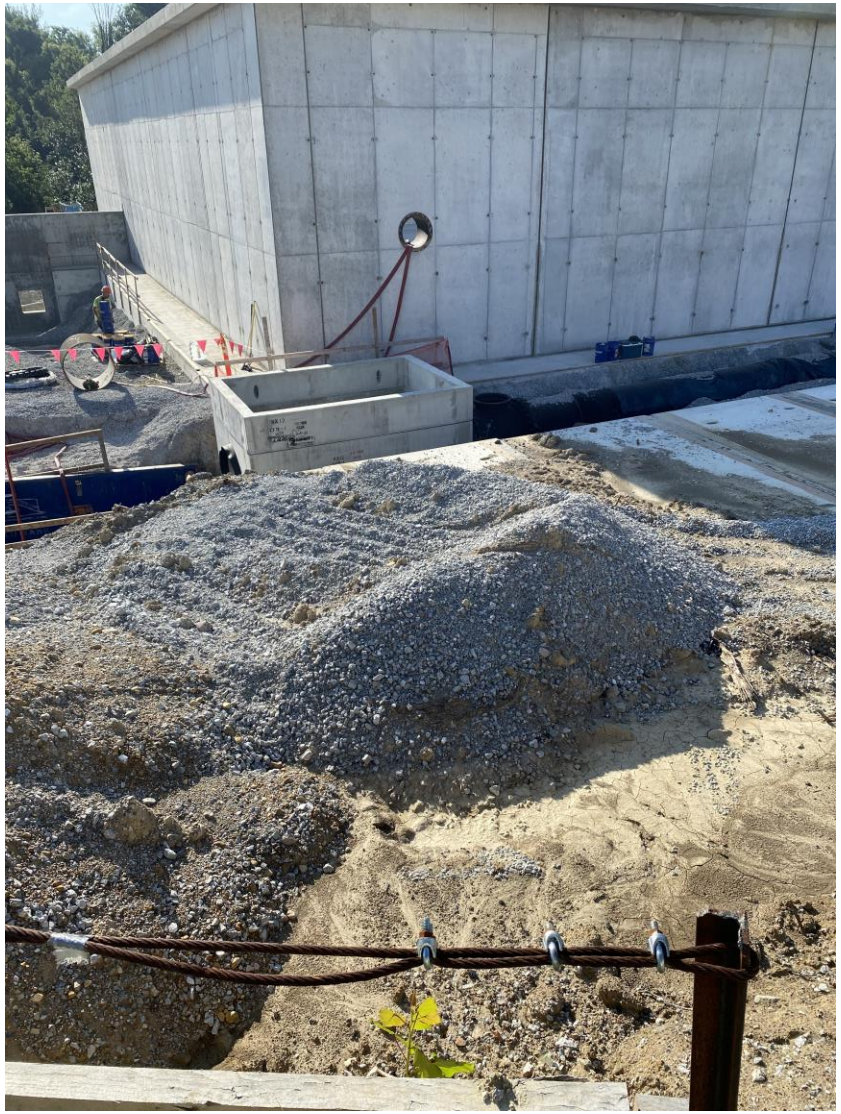

American Concrete Pipe Association

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Concrete Pipe
Association

Thank You!

Steve Smart

Steve.smart@countymaterials.com

ACPA

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