

THE VILLAGE AT DISCOVERY PARK

SUBMITTAL 002

PRECAST RCB

☐	NO EXCEPTIONS NOTED
☐	RETURNED FOR CORRECTION
☒	EXCEPTIONS NOTED
☐	RECORD COPY

REVIEW DOES NOT RELIEVE CONTRACTOR
FROM RESPONSIBILITY FOR ERRORS OR
DEVIATIONS FROM CONTRACT
REQUIREMENTS

olsson

Arman Romanov

12/07/2023

-Notes provided throughout the document



Intrinsic Development
The Village at Discovery Park
ESS Job No. 1423119

Olsson - Civil Engineering
Engineer's Project
No. D21-04643

SUBMITTAL PACKAGE NO: 002

Date: October 23, 2023

To:

Olsson
1700 E. 123rd Street
Olathe, KS 66061
TEL: (913) 829-0078

From: Andy Svehla

Emery Sapp & Sons
140 Walnut Street, Ste. 101
Kansas City, MO 64106
TEL: (816) 221-3500
FAX: (816) 421-9333

Package Transmitted For: Approval	Package Sent Via: Email
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<u>Line</u>	<u>Qty</u>	<u>Item</u>	<u>Reference</u>	<u>Description</u>	<u>Status</u>
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1	1	Submittal		Precast RCB Shop Drawings	
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Due Date: November 6, 2023

CC:

Remarks:

Attached is the subject submittal, for approval.

If you have any questions, please contact Andy Svehla at andy.svehla@emerysapp.com or (573) 355-3551.

Signature:

Signature Date:

10/23/23

PROJECT QUANTITIES			
PIECE MARK	DESCRIPTION	QTY	WEIGHT
B1	6x5 BOX UPSTREAM TIE-IN SECTION	1	15,600 LB
B2	6x5 TYPICAL BOX SECTION	24	15,600 LB
HW1	6x5 HEADWALL SECTION	1	12,200 LB
B3	13x7 BOX UPSTREAM TIE-IN SECTION	1	40,400 LB
B4	13x7 BOX TYPICAL SECTION	97	40,400 LB
B5	13x7 BOX ACCESS MANHOLE SECTION	3	39,400 LB
B6	13x7 BOX UPSTREAM CIP TIE-IN SECTION	5	20,700 LB
B7	13x7 BOX DOWNSTREAM CIP TIE-IN SECTION	4	20,700 LB
B8	13x7 PIPE INLET BOX SECTION	1	39,700 LB
B9	13x7 PIPE INLET BOX SECTION	1	39,700 LB
B10	13x7 PIPE INLET BOX SECTION	1	39,700 LB

PLAN NOTES

- THIS PLAN IS BASED ON GRADING PLAN SHEET C310 BY OLSSON DATED 8/8/2023.
- THE UTILITIES AND STRUCTURES SHOWN ON THIS DRAWING ARE SHOWN AS PROVIDED BY THE ORIGINAL CONTRACT DOCUMENTS. CONTRACTOR TO FIELD VERIFY THE LOCATIONS OF ANY STRUCTURES OR UTILITIES THAT MAY CONFLICT WITH THE CONSTRUCTION OF THE WALL. CONTRACTOR TO CONTACT WITH ANY CONFLICTS HART CREEK ENGINEERING BEFORE PROCEEDING WITH CONSTRUCTION.

THE VILLAGE AT DISCOVERY PARK PRECAST BOX CULVERTS

- NOTES:
- DESIGN SPECIFICATIONS:
 - LOADING:
 - EARTH FILL:
 - CONCRETE:
 - REINFORCING:
- AASHTO LRFD
HL-93 TRUCK
5'-25' (6x5 BOX) / 7'-12' (13x7 BOX)
5000 PSI
ASTM A1064 / ASTM A615

HART CREEK

HARTCREEKENGINEERING.COM

HARTSBURG, MO 65039

573-289-8520

STATE OF MISSOURI

CHARLES ROBERT FARRIS

CHARLES FARRIS

NUMBER

PE-2011013734

PROFESSIONAL ENGINEER

10/23/2023

1 OVERALL PLAN
1" = 100'

SHEET INDEX	
GENERAL NOTES / OVERALL PLAN	PC1
6x5 BOX PLAN AND PROFILE	PC2
13x7 BOX PLAN AND PROFILE	PC3
13x7 BOX PLAN AND PROFILE	PC4
13x7 BOX PLAN AND PROFILE	PC5
PRECAST / CIP PLANS & DETAILS	PC6

PROJECT
THE VILLAGE AT DISCOVERY PARK
PRECAST BOX CULVERTS
LEE'S SUMMIT, MO
CLIENT
PRECISION PRECAST

REVISIONS	
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△	
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△	

DRAWN BY:	CRF
REVIEWED BY:	CRF
DATE:	10/23/2023
PROJECT NO:	23107

DRAWING NAME
COVER /
NOTES /
OVERALL PLN.

SHEET
PC1

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CREEK ENGINEERING, LLC

REVISIONS

DRAWING NAME
X5 BOX PLAN
& PROFILE

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CREEK ENGINEERING, LLC

2 6X5 BOX PROFILE
1" = 10'

PROJECT TI

REVISIONS

DRAWN BY:

REVIEWED

DATE: _____

PROJECT N

DRAWING NAME

13X7 BOX PLAN & PROFILE

SHEET

PC3

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CREEK ENGINEERING, LLC

PLAN NOTES

1. THIS PLAN & PROFILE IS BASED ON SHEETS C457 & C458 BY OLSSON DATED 9/8/2023.
2. THE UTILITIES AND STRUCTURES SHOWN ON THIS DRAWING ARE SHOWN AS PROVIDED BY THE ORIGINAL CONTRACT DOCUMENTS. CONTRACTOR TO FIELD VERIFY THE LOCATIONS OF ANY STRUCTURES OR UTILITIES THAT MAY CONFLICT WITH THE CONSTRUCTION OF THE WALL. CONTRACTOR TO CONTACT WITH ANY CONFLICTS HART CREEK ENGINEERING BEFORE PROCEEDING WITH CONSTRUCTION.



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STATE OF MISSOURI

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NUMBER

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PROFESSIONAL ENGINEER

10/23/2023

PROJECT

THE VILLAGE AT DISCOVERY PARK

PRECAST BOX CULVERTS

LEE'S SUMMIT, MO

CLIENT

PRECISION PRECAST

REVISIONS	
△	
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△	
△	
DRAWN BY: CRF	
REVIEWED BY: CRF	
DATE: 10/23/2023	
PROJECT NO: 23107	
DRAWING NAME	
13X7 BOX	
PLAN &	
PROFILE	
SHEET	
PC4	
COPYRIGHT 2023 BY HART CREEK ENGINEERING, LLC	

1 13X7 BOX PLAN (12+50 - 15+20)
1" = 10'

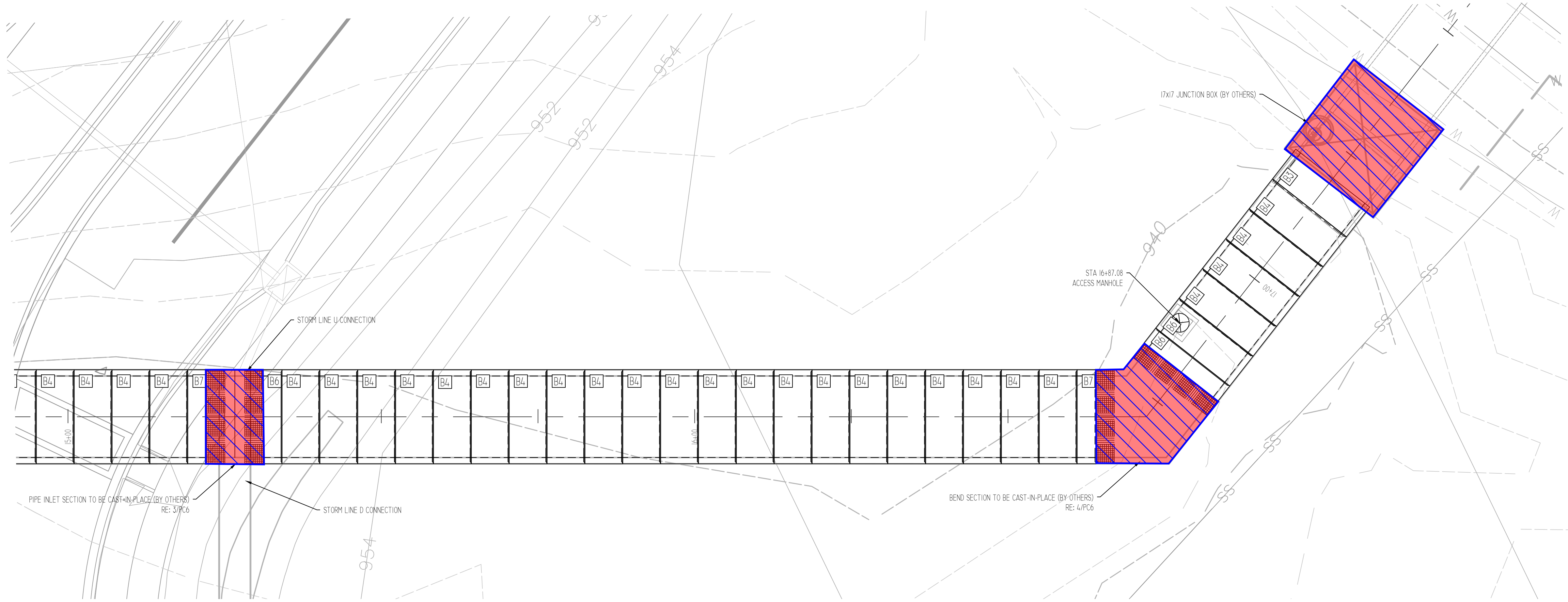
verify that structural analysis has been conducted for both parallel and perpendicular loads on these sections

2 13X7 BOX PROFILE (12+50 - 15+20)
1" = 10'

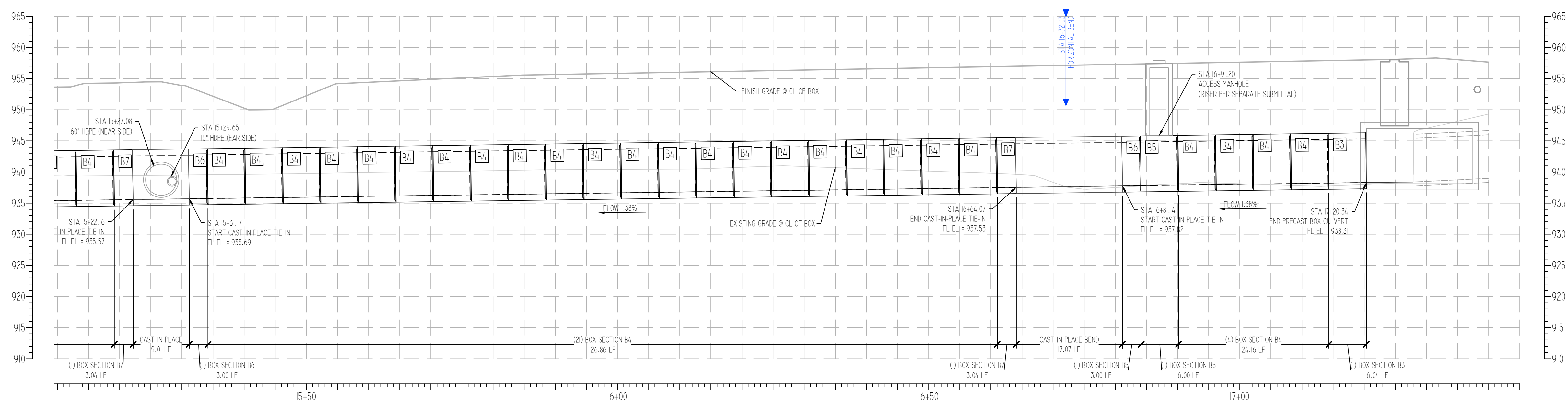
PLAN NOTES

1. THIS PLAN & PROFILE IS BASED ON SHEETS C457 & C458 BY OLSSON DATED 9/8/2023.

2. THE UTILITIES AND STRUCTURES SHOWN ON THIS DRAWING ARE SHOWN AS PROVIDED BY THE ORIGINAL CONTRACT DOCUMENTS. CONTRACTOR TO FIELD VERIFY THE LOCATIONS OF ANY STRUCTURES OR UTILITIES THAT MAY CONFLICT WITH THE CONSTRUCTION OF THE WALL. CONTRACTOR TO CONTACT WITH ANY CONFLICTS HART CREEK ENGINEERING BEFORE PROCEEDING WITH CONSTRUCTION.



1 13X7 BOX PLAN (15+20 - 17+30)
1" = 10'



2 13X7 BOX PROFILE (15+20 - 17+30)
1" = 10'

PROJECT
THE VILLAGE AT DISCOVERY PARK
PRECAST BOX CULVERTS
LEE'S SUMMIT, MO

CLIENT
PRECISION PRECAST

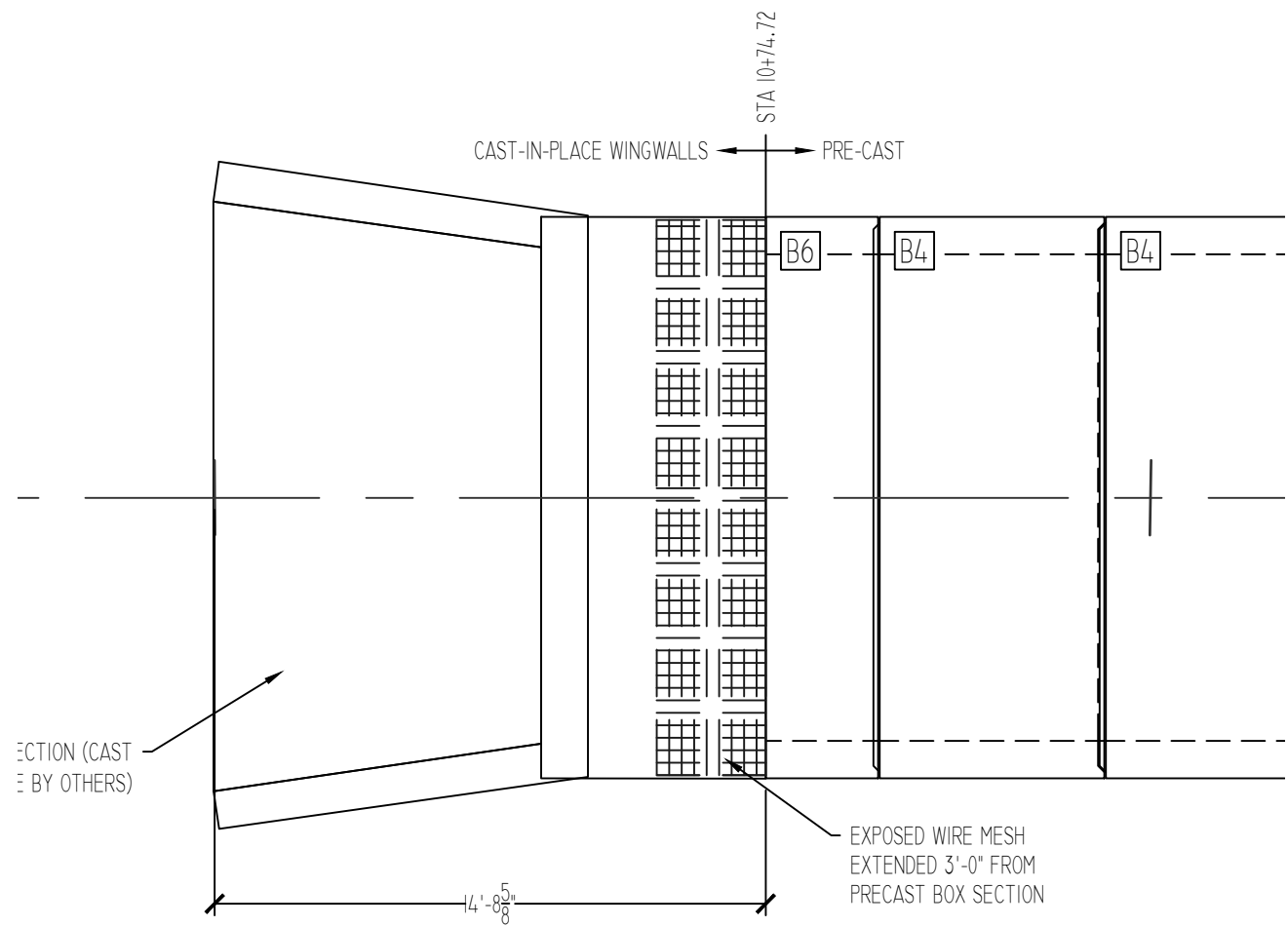
REVISIONS	
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DRAWN BY:	CRF
REVIEWED BY:	CRF
DATE:	10/23/2023
PROJECT NO:	23107

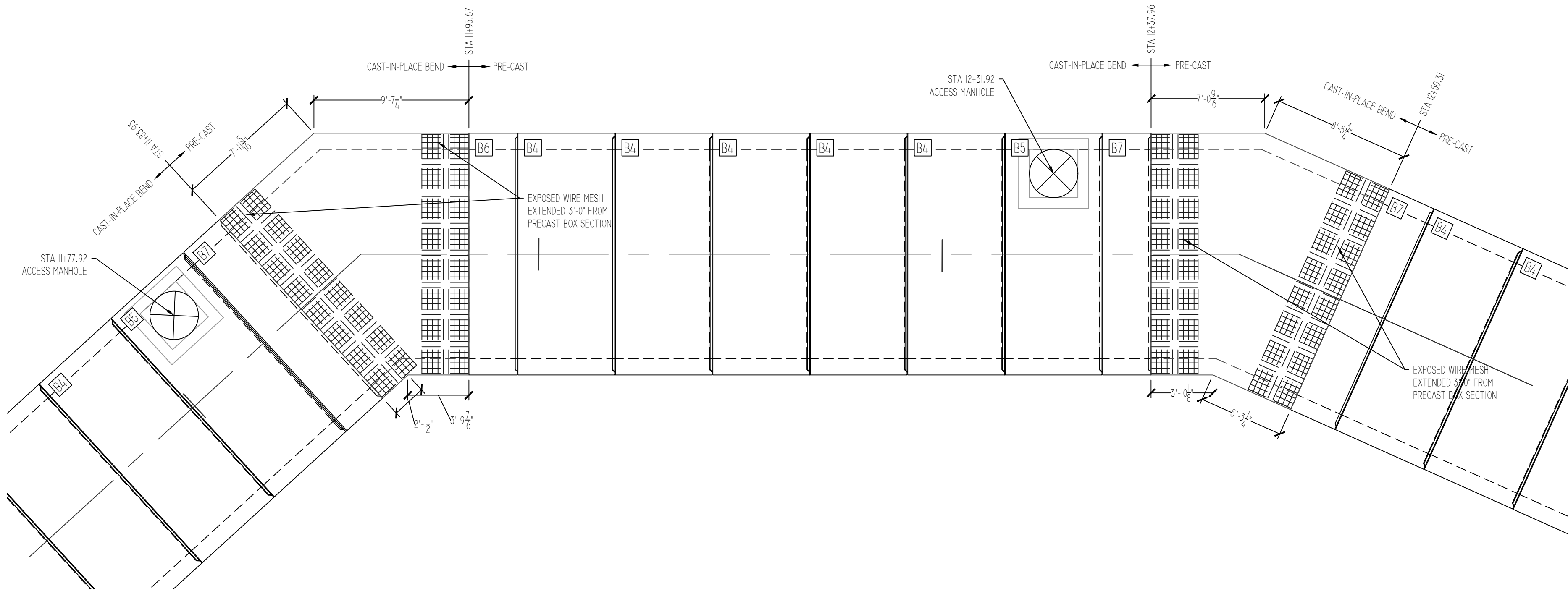
DRAWING NAME
13X7 BOX
PLAN &
PROFILE

SHEET
PC5

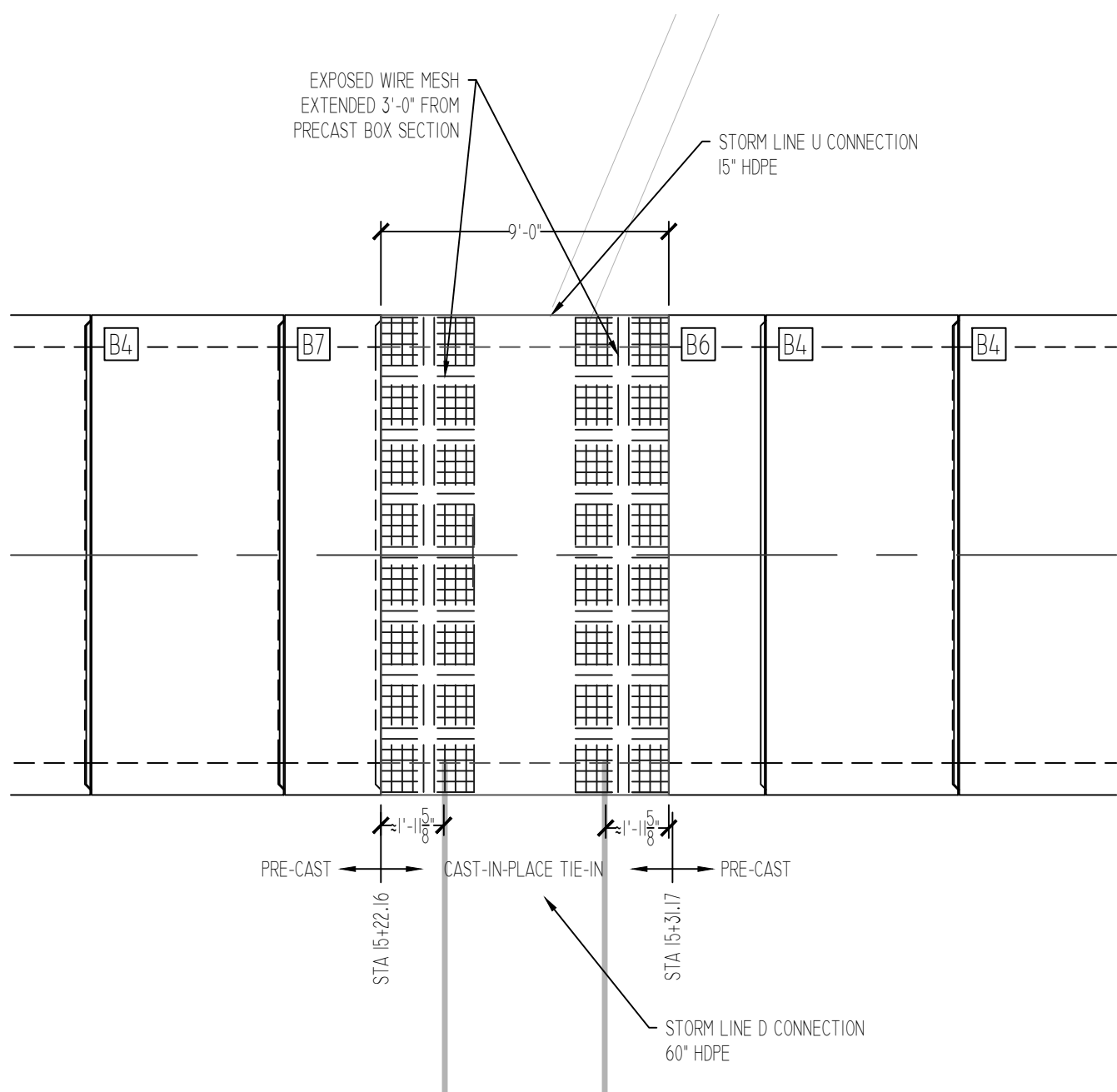
- PLAN NOTES
- THIS PLAN & PROFILE IS BASED ON SHEETS C457 & C458 BY OLSSON DATED 9/8/2023.
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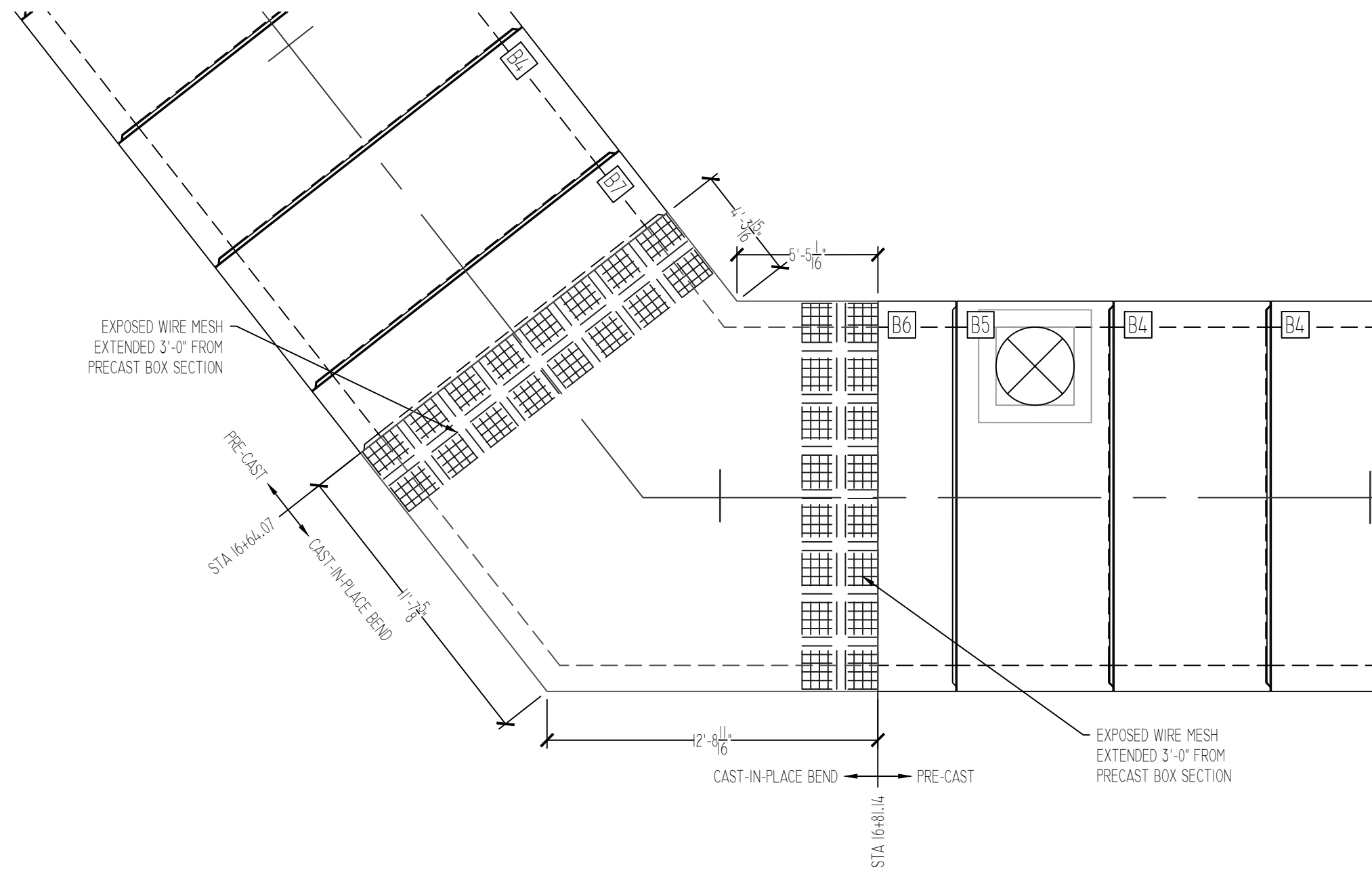
1 CAST-IN-PLACE TIE-IN @ 10+00
1" = 5'



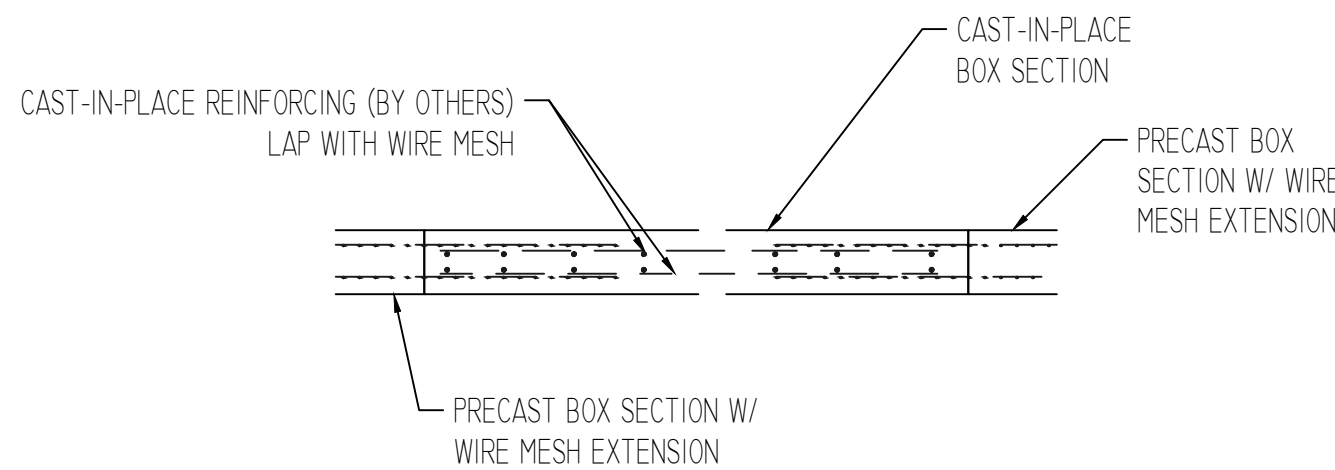
2 CAST-IN-PLACE BENDS @ 11+89 & 12+14
1" = 5'



3 CAST-IN-PLACE TIE-IN STORM LINE D
1" = 5'



4 CAST-IN-PLACE BEND @ 16+72
1" = 5'



5 PRECAST / CIP TRANSITION SECTION DETAIL

PROJECT
THE VILLAGE AT DISCOVERY PARK
PRECAST BOX CULVERTS
LEE'S SUMMIT, MO
CLIENT
PRECISION PRECAST

REVISIONS

- △
- △
- △
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- △
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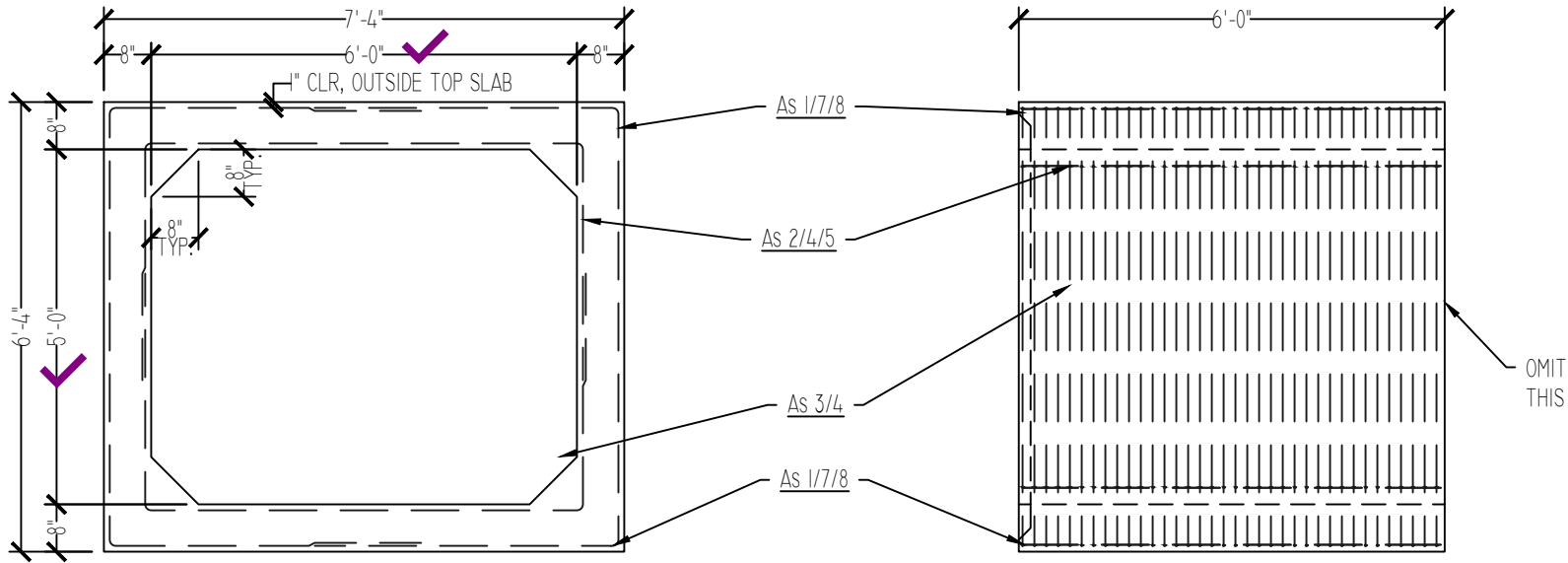
DRAWN BY: CRF
REVIEWED BY: CRF
DATE: 10/23/2023
PROJECT NO: 23107

DRAWING NAME
PRECAST / CIP PLANS & DETAILS

SHEET
PC6

PIECE: BI
QTY: 1
WEIGHT: 15,600 LB

- NOTES:
- | | |
|---------------------------|------------------------|
| 1. DESIGN SPECIFICATIONS: | AASHTO LRFD |
| 2. LOADING: | HL-93 TRUCK |
| 3. EARTH FILL: | 5'-25' |
| 4. CONCRETE: | 5000 PSI |
| 5. REINFORCING: | ASTM A1064 / ASTM A615 |

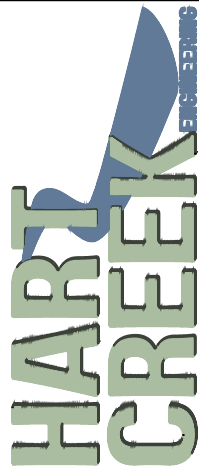


1 BOX SECTION
3/8" = 1'-0"

2 BOX SIDE
3/8" = 1'-0"

REINFORCING SCHEDULE		
SHEET	CIRCUMF. REINF.	LONG. REINF.
AS 1/7/8	D7.5 @ 4" O.C.	D4.0 @ 8" O.C.
AS 2/4/5	D6.4 / D7.7 @ 2" O.C.	D4.0 @ 8" O.C.
AS 3/4	D6.4 / D7.7 @ 2" O.C.	D4.0 @ 8" O.C.





HARTCREEKENGINEERING.COM
HARTSBURG, MO 65039
573-289-8520

MO LICENSE E-2022018980

PROJECT DISCOVERY PARK PRECAST BOX CULVERTS	PROJECT NO:	23107
	CLIENT:PRECISION PRECAST	
	DRAWN / REVIEWD BY:	CRF
	DATE:	10/23/2023
DRAWING TITLE BOX B1 - 6x5 UPSTREAM TIE-IN BOX SECTION		
SHEET		B1

PIECE: B2
QTY: 24
WEIGHT: 15,600 LB

- NOTES:
1. DESIGN SPECIFICATIONS:

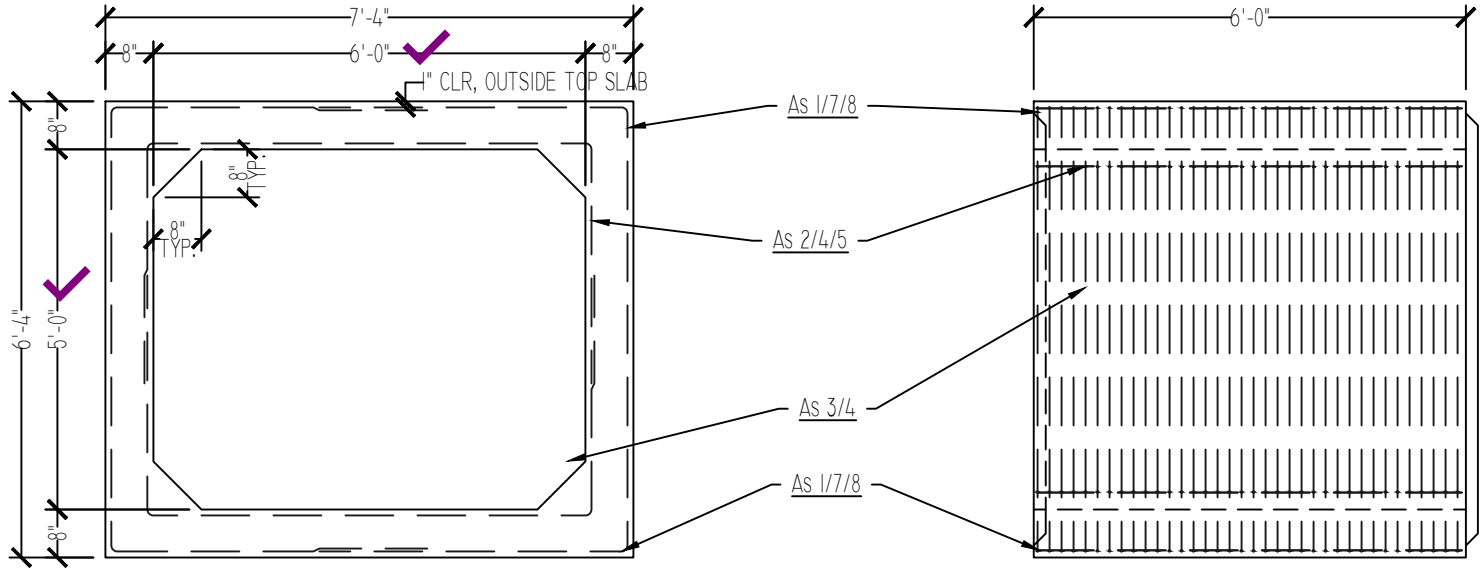
AASHTO LRFD
2. LOADING:

HL-93 TRUCK
3. EARTH FILL:

5'-25'
4. CONCRETE:

5000 PSI
5. REINFORCING:

ASTM A1064 / ASTM A615



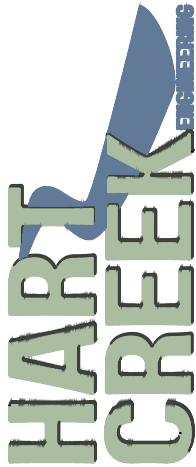
1 BOX SECTION
3/8" = 1'-0"

2 BOX SIDE
3/8" = 1'-0"

REINFORCING SCHEDULE		
SHEET	CIRCUMF. REINF.	LONG. REINF.
AS 1/7/8	D7.5 @ 4" O.C.	D4.0 @ 8" O.C.
AS 2/4/5	D6.4 / D7.7 @ 2" O.C.	D4.0 @ 8" O.C.
AS 3/4	D6.4 / D7.7 @ 2" O.C.	D4.0 @ 8" O.C.



10/23/2023



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HARTSBURG, MO 65039

573-289-8520

PROJECT NO: 23107

CLIENT:PRECISION PRECAST

DRAWN / REVIEWD BY: CRF

DATE: 10/23/2023

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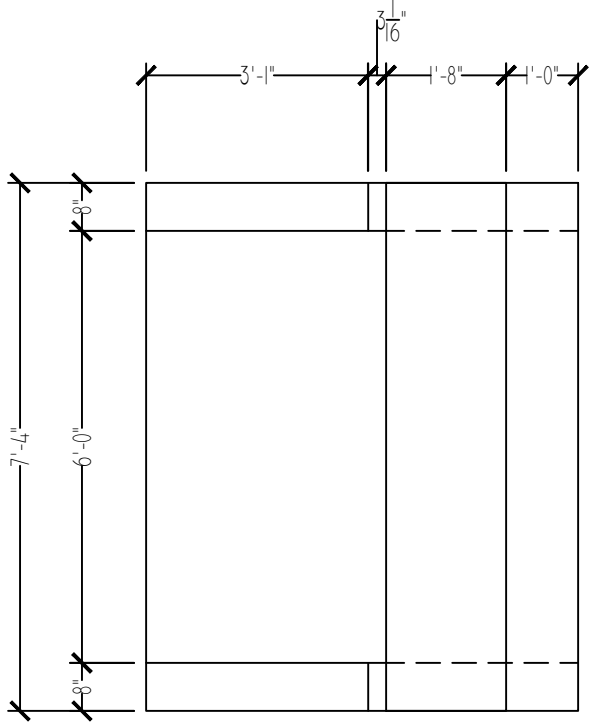
PROJECT
DISCOVERY PARK
PRECAST BOX CULVERTS

DRAWING TITLE
BOX B2 - 6x5 TYPICAL
BOX SECTION

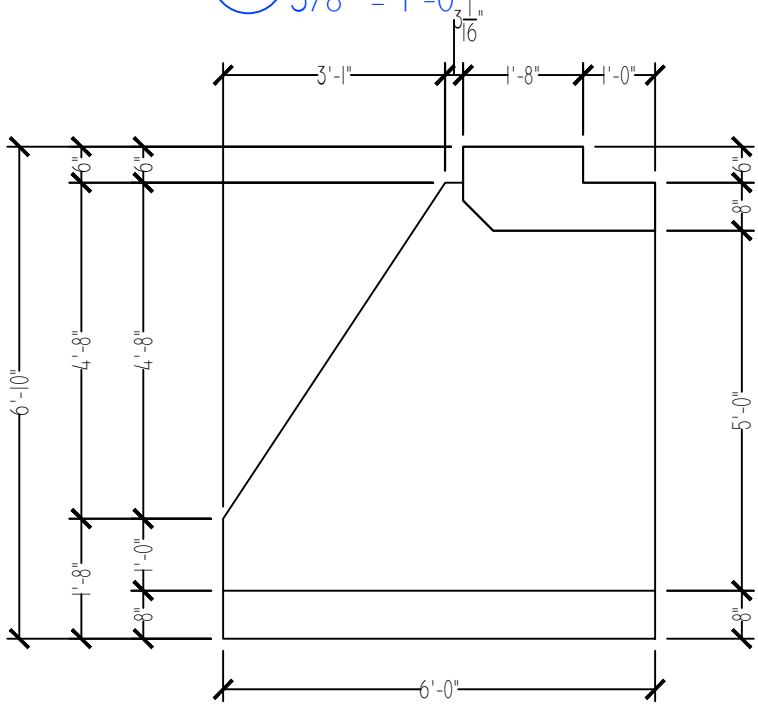
SHEET

B2

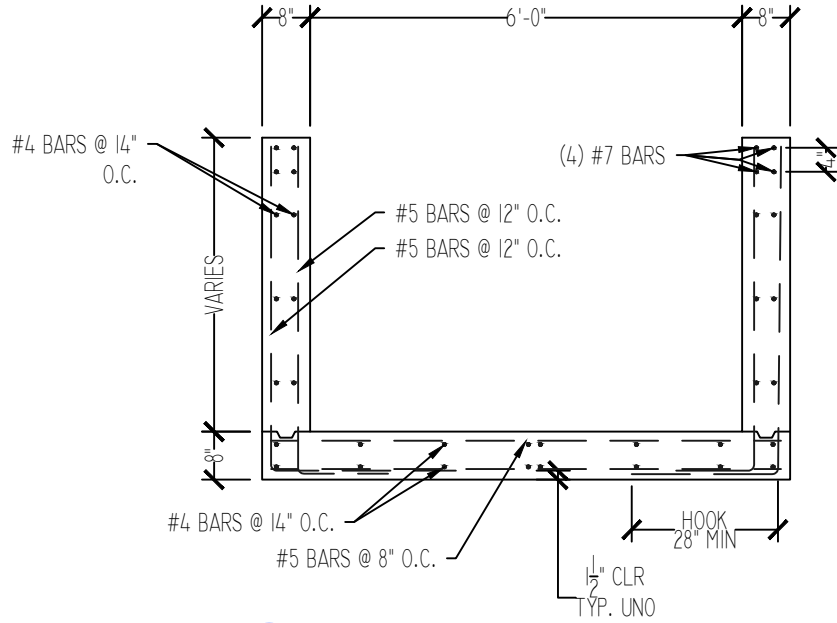
PIECE: HWI
QTY: 1
WEIGHT: 12,200 LB



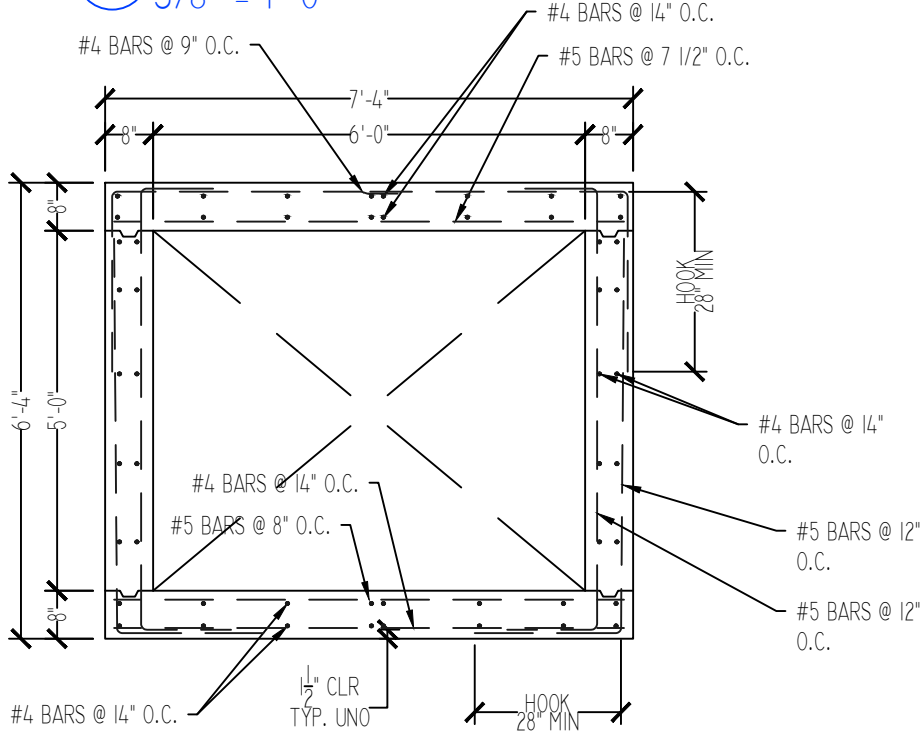
1 HEADWALL PLAN
3/8" = 1'-0"



3 HEADWALL ELEVATION
3/8" = 1'-0"

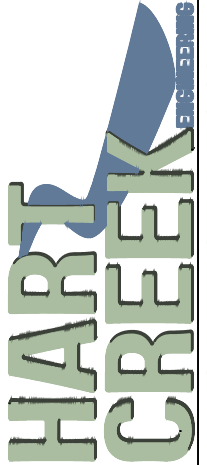
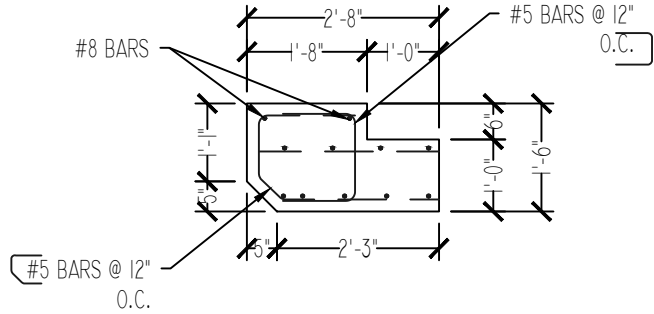


2 SECTION THROUGH WINGS
3/8" = 1'-0"



4 SECTION THROUGH BARREL
3/8" = 1'-0"

- NOTES:
- DESIGN SPECIFICATIONS: AASHTO LRFD
 - LOADING: HL-93 TRUCK
 - EARTH FILL: 5'-25'
 - CONCRETE: 5000 PSI
 - REINFORCING: ASTM A1064 / ASTM A615



HARTCREEKENGINEERING.COM
HARTSBURG, MO 65039
573-289-8520

MO LICENSE E-2022018980

PROJECT NO:	23107
CLIENT:PRECISION PRECAST	
DRAWN / REVIEWD BY:	CRF
DATE:	10/23/2023
PROJECT DISCOVERY PARK PRECAST BOX CULVERTS	
DRAWING TITLE HW1 - 6x5 HEADWALL SECTION	
SHEET	HW1

PIECE: B3
QTY: 1
WEIGHT: 40,400 LB

- NOTES:
1. DESIGN SPECIFICATIONS:

2. LOADING:

3. EARTH FILL:

4. CONCRETE:

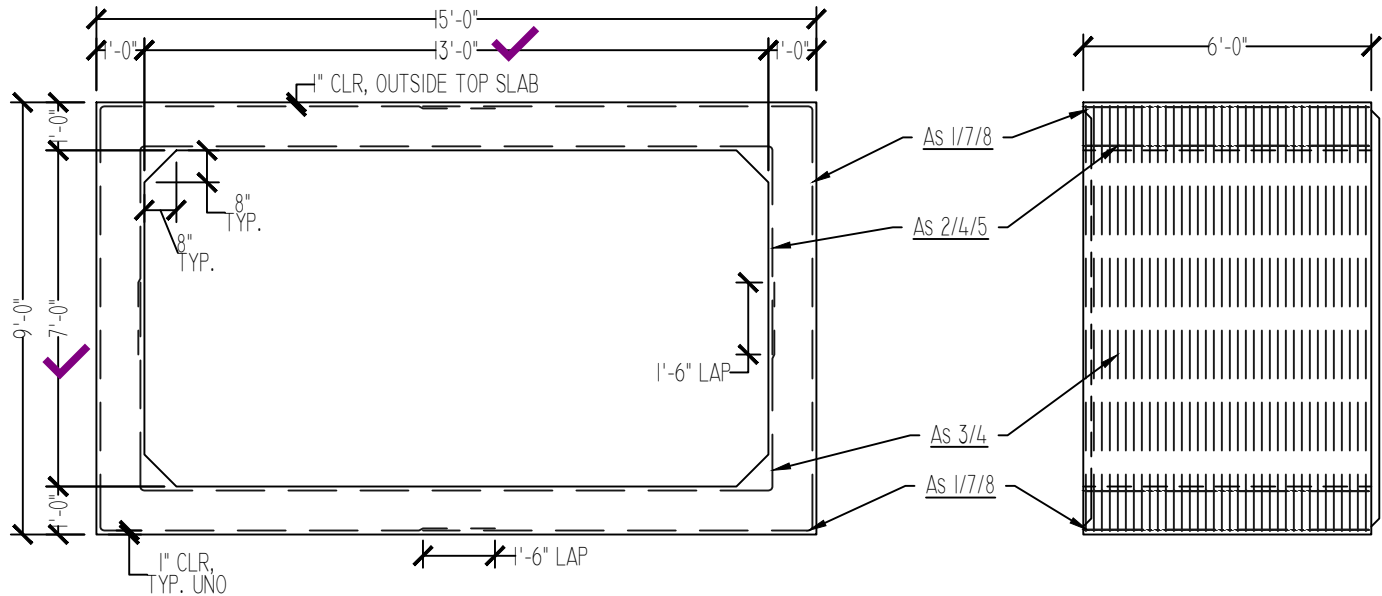
5. REINFORCING:
- AASHTO LRFD

HL-93 TRUCK

7'-12'

5000 PSI

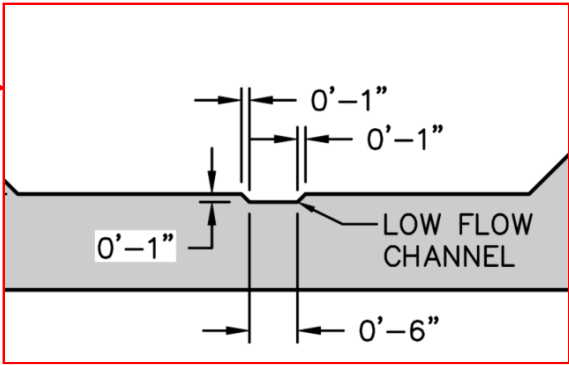
ASTM A1064 / ASTM A615



1 BOX SECTION
1/4" = 1'-0"

2 BOX SIDE
1/4" = 1'-0"

the city of Lee's Summit
requires us to provide a
low flow channel inside
7'x13' RCB



REINFORCING SCHEDULE		
SHEET	CIRCUMF. REINF.	LONG. REINF.
AS 1/7/8	D9.6 / D6.8 @ 2" O.C.	D4.0 @ 8" O.C.
AS 2/4/5	D9.6 / D10.8 @ 2" O.C.	D4.7 @ 8" O.C.
AS 3/4	D9.6 / D11.7 @ 2" O.C.	D4.7 @ 8" O.C.



10/23/2023

HARTCREEKENGINEERING.COM

HARTSBURG, MO 65039

573-289-8520

MO LICENSE E-2022018980

PROJECT NO: 23107

CLIENT:PRECISION PRECAST

DRAWN / REVIEWD BY: CRF

DATE: 10/23/2023

PROJECT
DISCOVERY PARK
PRECAST BOX CULVERTS

DRAWING TITLE
BOX B3 - 13x7 UPSTREAM
TIE-IN BOX SECTION

SHEET

B3

PIECE: B4
QTY: 97
WEIGHT: 40,400 LB

- NOTES:
1. DESIGN SPECIFICATIONS:

2. LOADING:

3. EARTH FILL:

4. CONCRETE:

5. REINFORCING:

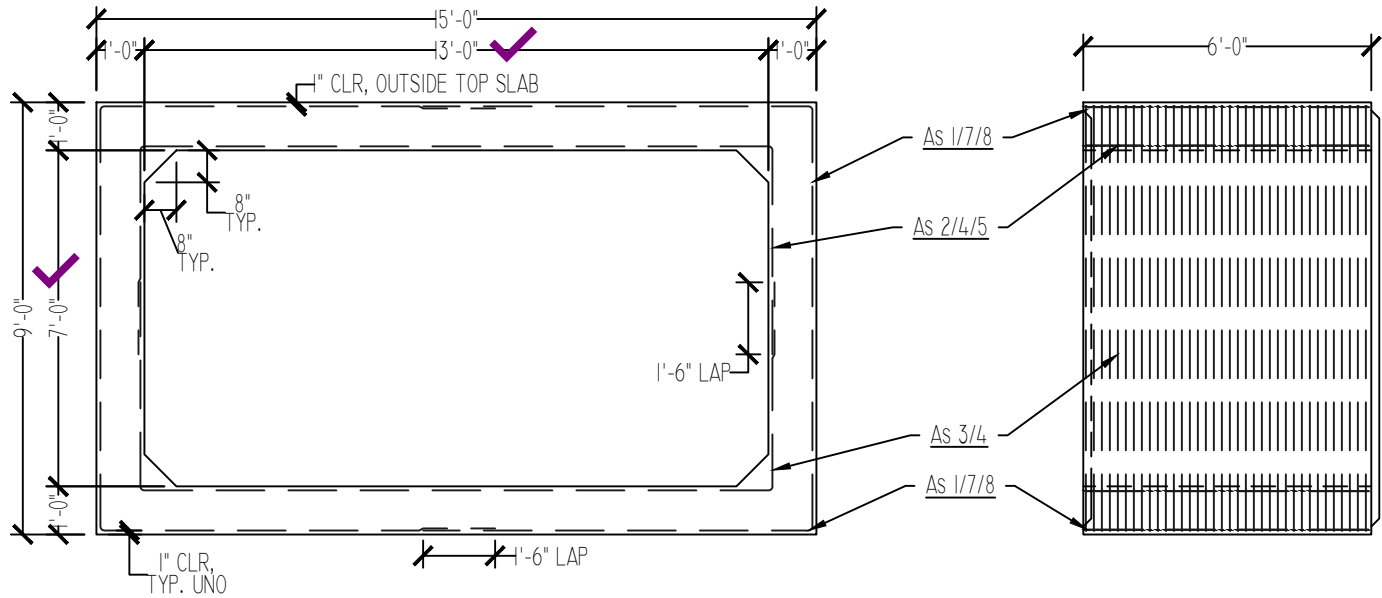
AASHTO LRFD

✓ HL-93 TRUCK

7'-12'

5000 PSI

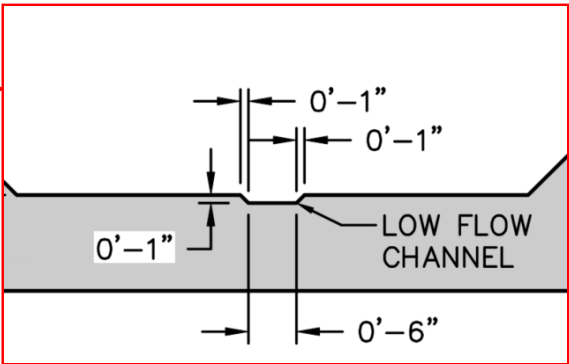
ASTM A1064 / ASTM A615



1 BOX SECTION
1/4" = 1'-0"

2 BOX SIDE
1/4" = 1'-0"

the city of Lee's Summit
requires us to provide a
low flow channel inside
7'x13' RCB



REINFORCING SCHEDULE		
SHEET	CIRCUMF. REINF.	LONG. REINF.
AS 1/7/8	D9.6 / D6.8 @ 2" O.C.	D4.0 @ 8" O.C.
AS 2/4/5	D9.6 / D10.8 @ 2" O.C.	D4.7 @ 8" O.C.
AS 3/4	D9.6 / D11.7 @ 2" O.C.	D4.7 @ 8" O.C.



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MO LICENSE E-2022018980

PROJECT DISCOVERY PARK
PRECAST BOX CULVERTS

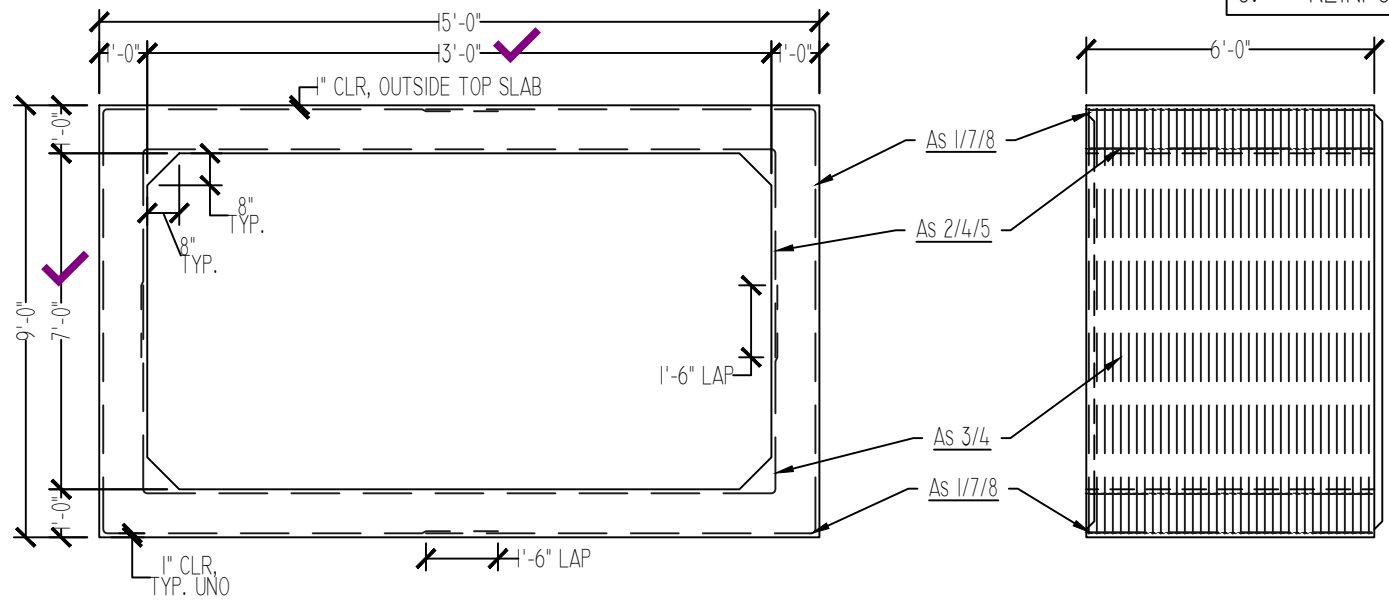
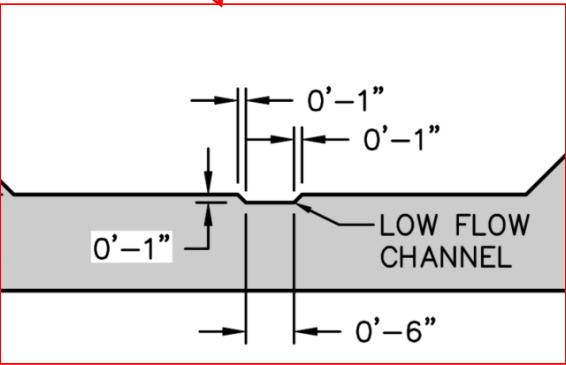
DRAWING TITLE
BOX B4 - TYPICAL 13x7
BOX SECTION

SHEET

B4

PIECE: B5
QTY: 3
WEIGHT: 39,400 LB

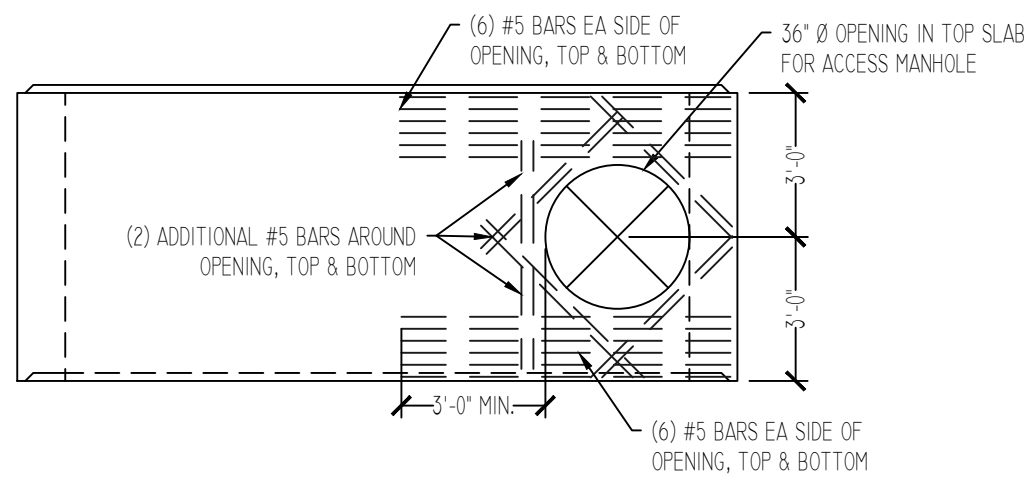
the city of Lee's Summit
requires us to provide a
low flow channel inside
7'x13' RCB



1 BOX SECTION
1/4" = 1'-0"

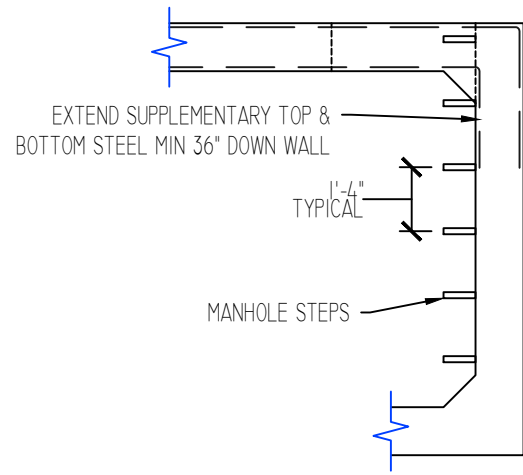
2 BOX SIDE
1/4" = 1'-0"

3 SECTION THROUGH ACCESS
1/4" = 1'-0"



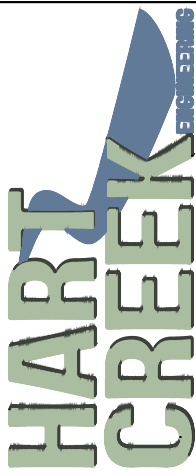
4 TOP PLAN
1/4" = 1'-0"

- NOTES:
- | | |
|---------------------------|------------------------|
| 1. DESIGN SPECIFICATIONS: | AASHTO LRFD |
| 2. LOADING: | ✓ HL-93 TRUCK |
| 3. EARTH FILL: | 7'-12' |
| 4. CONCRETE: | 5000 PSI |
| 5. REINFORCING: | ASTM A1064 / ASTM A615 |



REINFORCING SCHEDULE		
SHEET	CIRCUMF. REINF.	LONG. REINF.
AS 1/7/8	D9.6 / D6.8 @ 2" O.C.	D4.0 @ 8" O.C.
AS 2/4/5	D9.6 / D10.8 @ 2" O.C.	D4.7 @ 8" O.C.
AS 3/4	D9.6 / D11.7 @ 2" O.C.	D4.7 @ 8" O.C.





HARTCREEKENGINEERING.COM
HARTSBURG, MO 65039
573-289-8520
MO LICENSE E-2022018980

PROJECT NO:	23107
CLIENT:	PRECISION PRECAST
DRAWN / REVIEWD BY:	CRF
DATE:	10/23/2023

PROJECT
DISCOVERY PARK
PRECAST BOX CULVERTS

DRAWING TITLE
BOX B5 - 13x7 ACCESS
MANHOLE BOX SECTION

SHEET
B5

PIECE: B6
QTY: 5
WEIGHT: 20,700 LB

- NOTES:
1. DESIGN SPECIFICATIONS:

2. LOADING:

3. EARTH FILL:

4. CONCRETE:

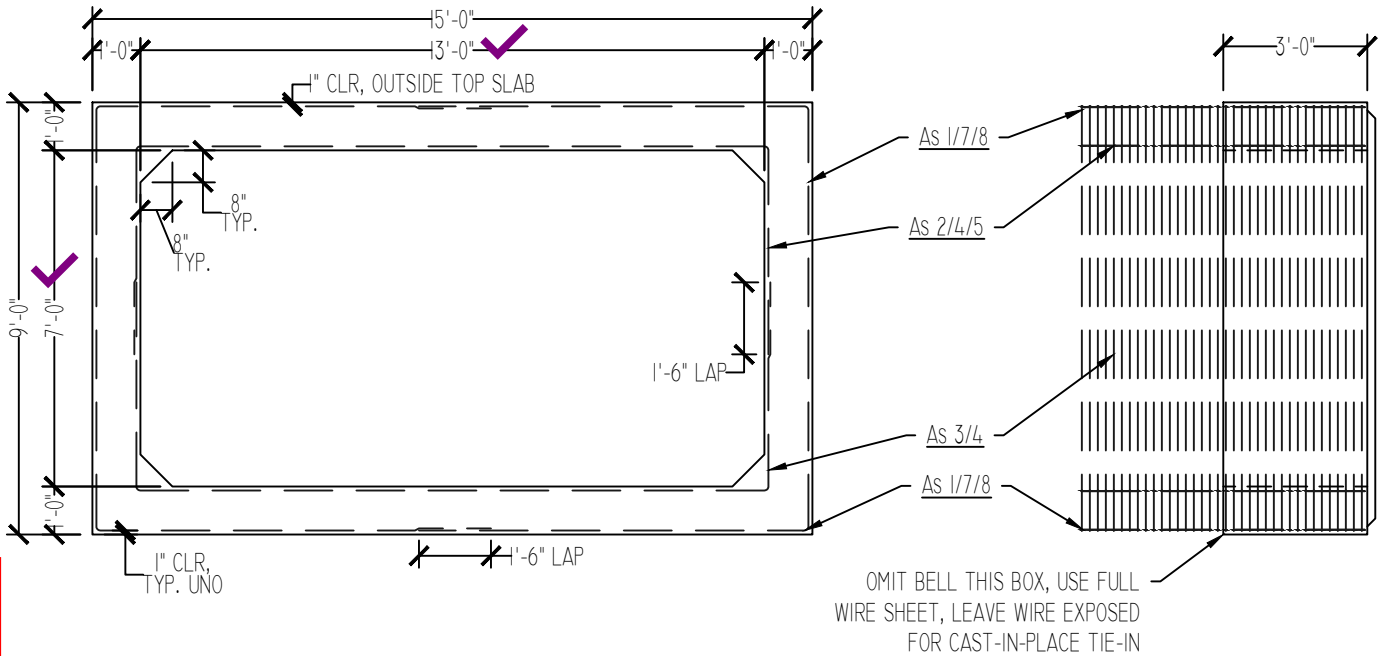
5. REINFORCING:
- AASHTO LRFD

HL-93 TRUCK

7'-12'

5000 PSI

ASTM A1064 / ASTM A615

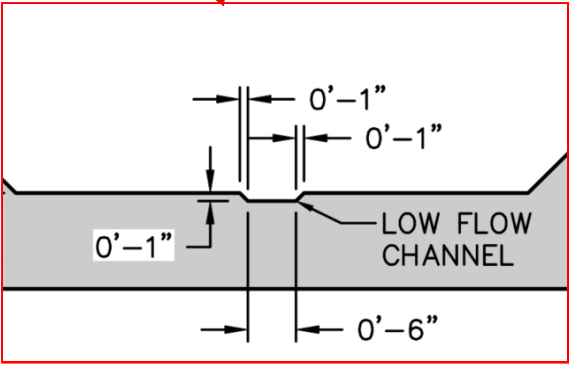


OMIT BELL THIS BOX, USE FULL WIRE SHEET, LEAVE WIRE EXPOSED FOR CAST-IN-PLACE TIE-IN

1 BOX SECTION
1/4" = 1'-0"

2 BOX SIDE
1/4" = 1'-0"

the city of Lee's Summit requires us to provide a low flow channel inside 7'x13' RCB



10/23/2023

REINFORCING SCHEDULE		
SHEET	CIRCUMF. REINF.	LONG. REINF.
AS 1/7/8	D9.6 / D6.8 @ 2" O.C.	D4.0 @ 8" O.C.
AS 2/4/5	D9.6 / D10.8 @ 2" O.C.	D4.7 @ 8" O.C.
AS 3/4	D9.6 / D11.7 @ 2" O.C.	D4.7 @ 8" O.C.

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HARTSBURG, MO 65039
573-289-8520

MO LICENSE E-2022018980

PROJECT NO: 23107

CLIENT: PRECISION PRECAST

DRAWN / REVIEWD BY: CRF

DATE: 10/23/2023

PROJECT
DISCOVERY PARK
PRECAST BOX CULVERTS

DRAWING TITLE
BOX B6 - 13x7 UPSTREAM
CIP TIE-IN BOX SECTION

SHEET

B6

PIECE: B7
QTY: 4
WEIGHT: 20,700 LB

- NOTES:
1. DESIGN SPECIFICATIONS:

2. LOADING:

3. EARTH FILL:

4. CONCRETE:

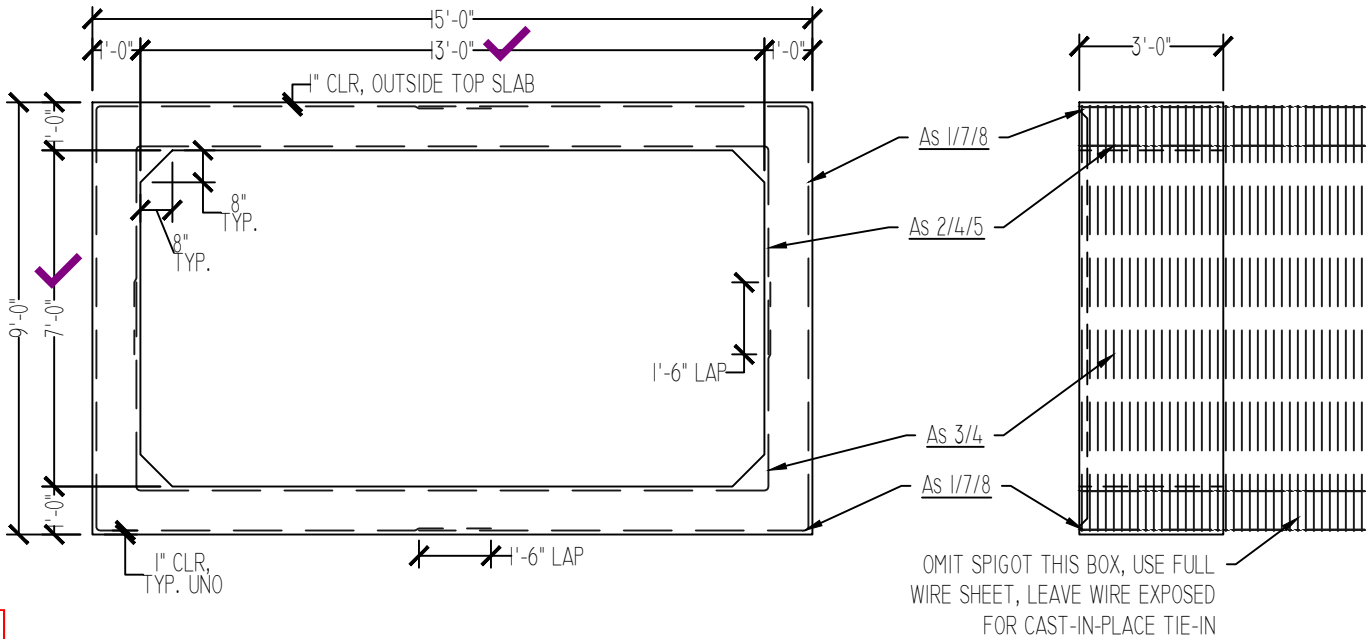
5. REINFORCING:
- AASHTO LRFD

HL-93 TRUCK

7'-12'

5000 PSI

ASTM A1064 / ASTM A615

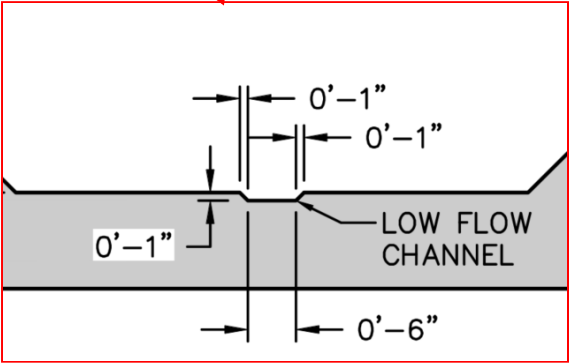


OMIT SPIGOT THIS BOX, USE FULL WIRE SHEET, LEAVE WIRE EXPOSED FOR CAST-IN-PLACE TIE-IN

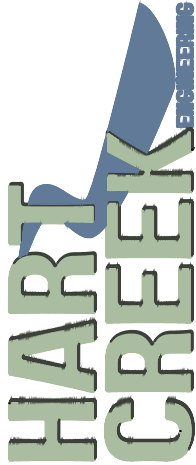
1 BOX SECTION
1/4" = 1'-0"

2 BOX SIDE
1/4" = 1'-0"

the city of Lee's Summit requires us to provide a low flow channel inside 7'x13' RCB



REINFORCING SCHEDULE		
SHEET	CIRCUMF. REINF.	LONG. REINF.
AS 1/7/8	D9.6 / D6.8 @ 2" O.C.	D4.0 @ 8" O.C.
AS 2/4/5	D9.6 / D10.8 @ 2" O.C.	D4.7 @ 8" O.C.
AS 3/4	D9.6 / D11.7 @ 2" O.C.	D4.7 @ 8" O.C.



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MO LICENSE E-2022018980

PROJECT NO:	23107
CLIENT:PRECISION PRECAST	
DRAWN / REVIEWD BY:	CRF
DATE:	10/23/2023
PROJECT DISCOVERY PARK PRECAST BOX CULVERTS	
DRAWING TITLE BOX B7 - 13x7 DNSTRM TIE-IN BOX SECTION	

SHEET

B7

PIECE: B8
QTY: 1
WEIGHT: 39,700 LB

- NOTES:
1. DESIGN SPECIFICATIONS:

2. LOADING:

3. EARTH FILL:

4. CONCRETE:

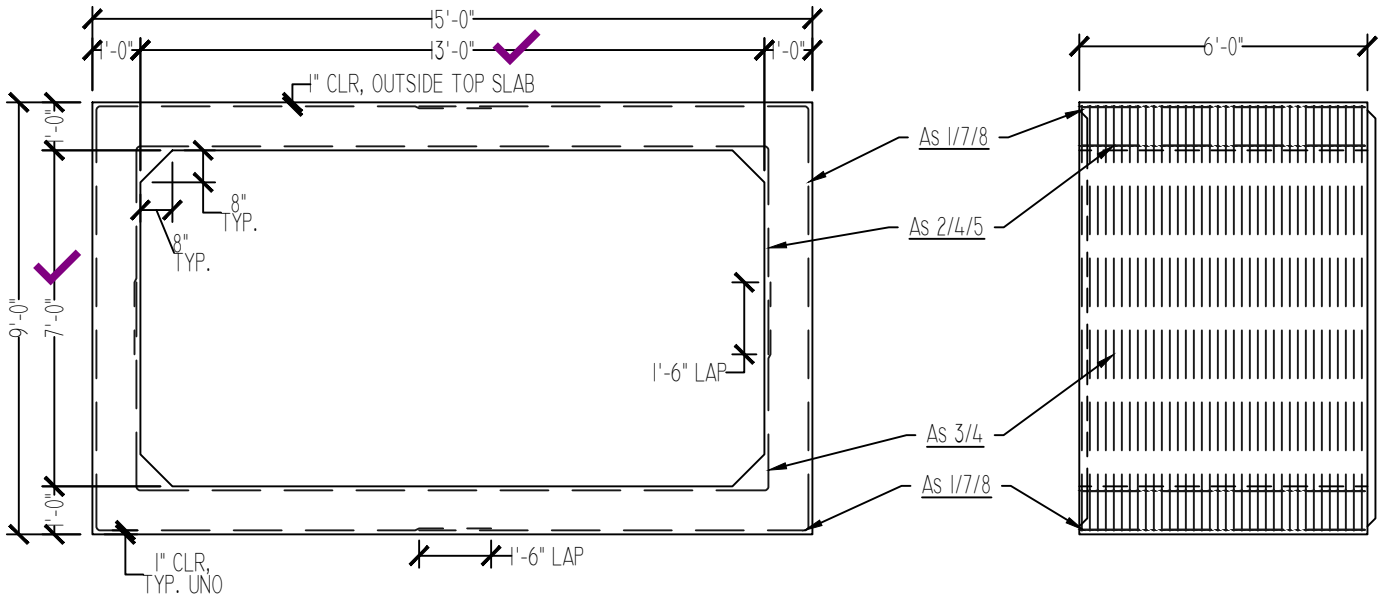
5. REINFORCING:
- AASHTO LRFD

HL-93 TRUCK

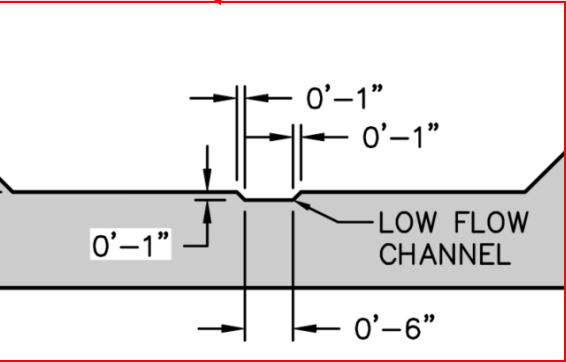
7'-12'

5000 PSI

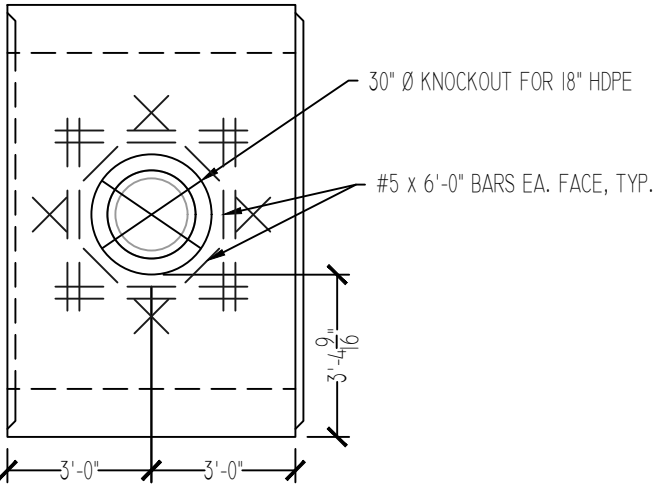
ASTM A1064 / ASTM A615



the city of Lee's Summit
requires us to provide a
low flow channel inside
7'x13' RCB



1 BOX SECTION
1/4" = 1'-0"



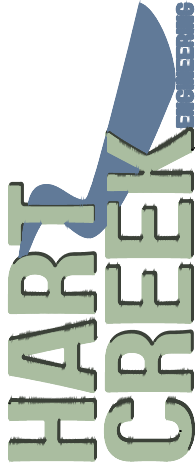
3 PIPE INLET DETAIL
1/4" = 1'-0"

2 BOX SIDE
1/4" = 1'-0"

REINFORCING SCHEDULE		
SHEET	CIRCUMF. REINF.	LONG. REINF.
AS 1/7/8	D9.6 / D6.8 @ 2" O.C.	D4.0 @ 8" O.C.
AS 2/4/5	D9.6 / D10.8 @ 2" O.C.	D4.7 @ 8" O.C.
AS 3/4	D9.6 / D11.7 @ 2" O.C.	D4.7 @ 8" O.C.



10/23/2023



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PROJECT NO: 23107

CLIENT:PRECISION PRECAST

DRAWN / REVIEWD BY: CRF

DATE: 10/23/2023

PROJECT
DISCOVERY PARK
PRECAST BOX CULVERTS

DRAWING TITLE
BOX B8 - 13x7 18" HDPE
INLET BOX SECTION

SHEET

B8

PIECE: B9
QTY: 1
WEIGHT: 39,700 LB

- NOTES:
1. DESIGN SPECIFICATIONS:

2. LOADING:

3. EARTH FILL:

4. CONCRETE:

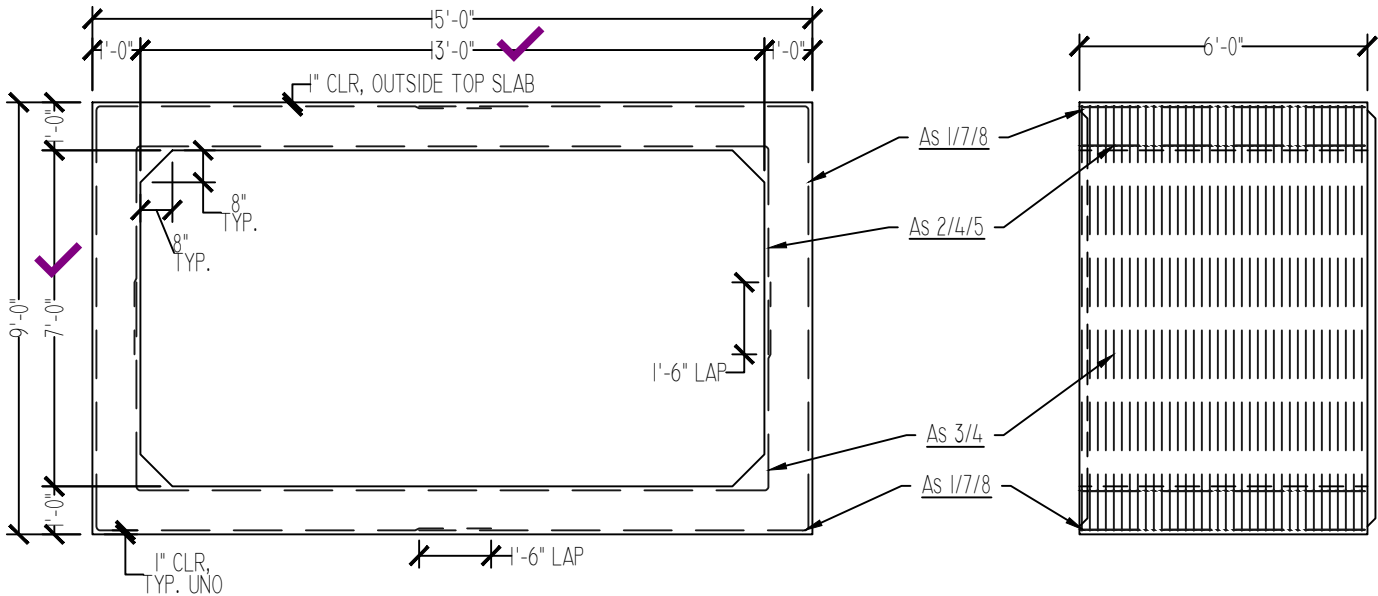
5. REINFORCING:
- AASHTO LRFD

✓ HL-93 TRUCK

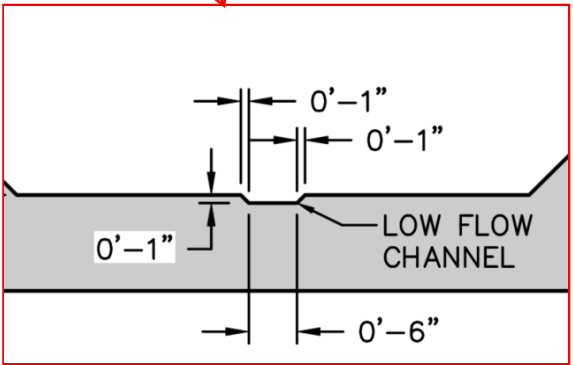
7'-12'

5000 PSI

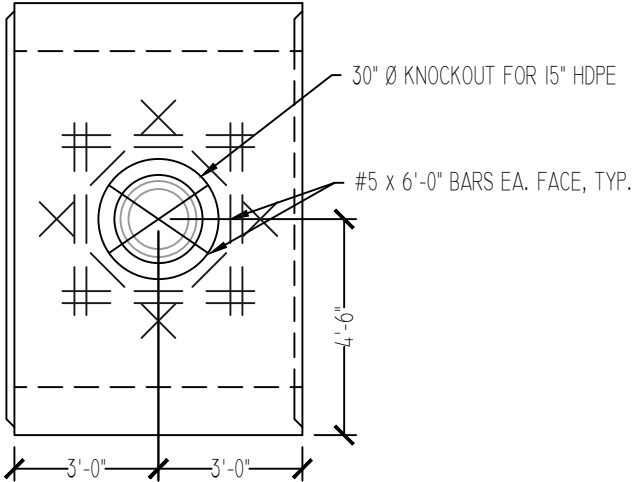
ASTM A1064 / ASTM A615



the city of Lee's Summit requires us to provide a low flow channel inside 7'x13' RCB



1 BOX SECTION
1/4" = 1'-0"



2 BOX SIDE
1/4" = 1'-0"

REINFORCING SCHEDULE		
SHEET	CIRCUMF. REINF.	LONG. REINF.
AS 1/7/8	D9.6 / D6.8 @ 2" O.C.	D4.0 @ 8" O.C.
AS 2/4/5	D9.6 / D10.8 @ 2" O.C.	D4.7 @ 8" O.C.
AS 3/4	D9.6 / D11.7 @ 2" O.C.	D4.7 @ 8" O.C.

3 PIPE INLET DETAIL
1/4" = 1'-0"



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PROJECT NO: 23107
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DATE: 10/23/2023
MO LICENSE E-2022018980

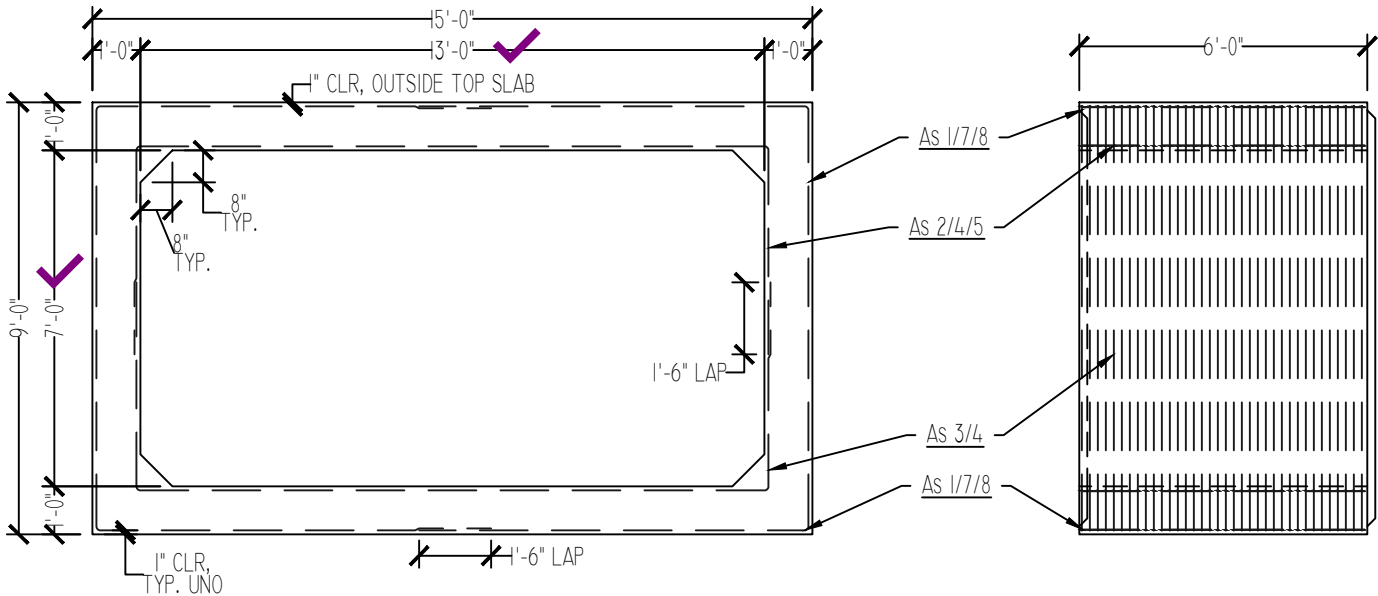
PROJECT
DISCOVERY PARK
PRECAST BOX CULVERTS

DRAWING TITLE
BOX B9 - 13x7 18" HDPE
INLET BOX SECTION

SHEET
B9

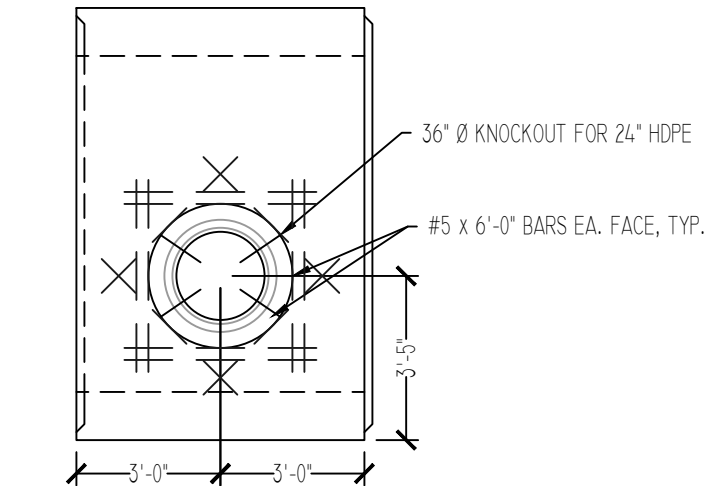
PIECE: B10
QTY: 1
WEIGHT: 39,700 LB

- NOTES:
- | | |
|---------------------------|------------------------|
| 1. DESIGN SPECIFICATIONS: | AASHTO LRFD |
| 2. LOADING: | ✓ HL-93 TRUCK |
| 3. EARTH FILL: | 7'-12' |
| 4. CONCRETE: | 5000 PSI |
| 5. REINFORCING: | ASTM A1064 / ASTM A615 |



1 BOX SECTION
1/4" = 1'-0"

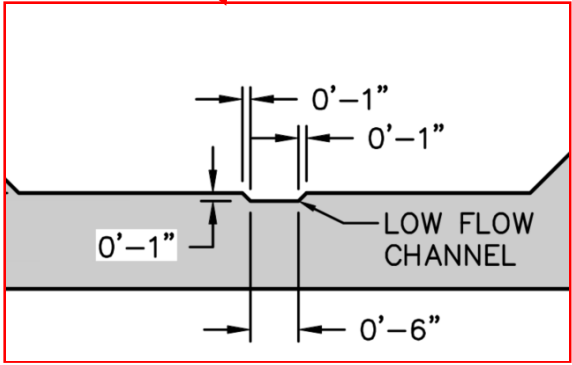
2 BOX SIDE
1/4" = 1'-0"

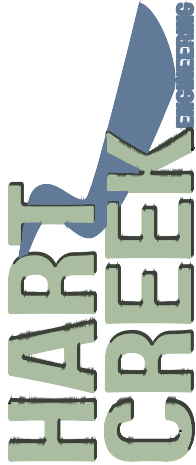


3 PIPE INLET DETAIL
1/4" = 1'-0"

REINFORCING SCHEDULE		
SHEET	CIRCUMF. REINF.	LONG. REINF.
AS 1/7/8	D9.6 / D6.8 @ 2" O.C.	D4.0 @ 8" O.C.
AS 2/4/5	D9.6 / D10.8 @ 2" O.C.	D4.7 @ 8" O.C.
AS 3/4	D9.6 / D11.7 @ 2" O.C.	D4.7 @ 8" O.C.

the city of Lee's Summit
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low flow channel
inside
7'x13' RCB





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573-289-8520

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PROJECT NO:	23107
CLIENT: PRECISION PRECAST	
DRAWN / REVIEWD BY:	CRF
DATE:	10/23/2023

PROJECT
DISCOVERY PARK
PRECAST BOX CULVERTS

DRAWING TITLE
BOX B10 - 13x7 24" HDPE
INLET BOX SECTION

SHEET
B10

Structural Calculations

For

The Village at Discovery Park 6X5 & 13x7 Box Culverts

Lee's Summit, MO

Client: Precision Precast
Date: October 23, 2023
Project No.: 23107



1218 E Cedar Tree Lane, Hartsburg, MO 65039

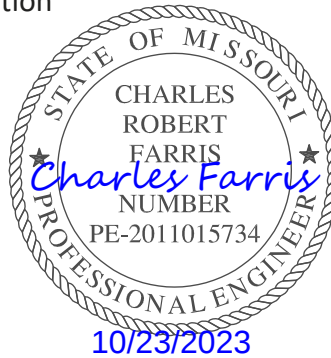
These calculations have been prepared by me or under my direct supervision. I am a registered Professional Engineer in good standing in the state of Missouri.

Missouri Certificate of Authority No. 2022018980



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Coversheet	1
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Box Calculations	4-9
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13x7 Boxes	
Box Calculations	13-18
Wire Information	19-22



These calculations have been prepared by me or under my direct supervision. I am a registered Professional Engineer in good standing in the state of Missouri.

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DESIGN CRITERIA

Design Codes: AASHTO LRFD Bridge Design Specifications
ASTM C1577 – Standard Specification for Concrete Monolithic Box Sections

Materials:

Concrete:

f'_c : 5000 psi (min, 28 day strength)

Unit Weight: 150 lb/ft³

Reinforcement

Grade: ASTM A1064 (Deformed)

Fy: 70,000 psi

Grade: ASTM A615

Fy: 60,000 psi

contractor/manufacture to
verify that mix design
conforms to these
requirements below

Loading:

Dead Loads:

Soil:

Unit Weight: 150 lb/ft³

Fill Height: 5'-25' (6x5 Box)

7'-12' (13x7 Box)

Water:

Unit Weight: 62.4 lb / ft³

Live Loads:

Wheel Load: HS-20 / HL-93 Truck

"Concrete for structures and structural components shall be KCMMB 4k or 5k mix; or MCIB 4,500 psi or 5,000 psi mix. Nominal aggregate shall be 1-inch or larger. Concrete used for soil stabilization, pipe cradles, filling, leveling courses and other similar purposes may use smaller nominal aggregate sizes of 1/2-inch, 3/4-inch."

Typical box section reinforcing per attached BOXCAR calculations.

Headwall dimensions and reinforcing per MoDOT Standard Drawings, section 703.

These calculations have been prepared by me or under my direct supervision. I am a registered Professional Engineer in good standing in the state of Missouri.

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BOXCAR Version 3.1

Job Description -Precision Precast-- 6x5, HL93 Loading, 5-25 ft. cover

GEOMETRY

Span	6. ft	Top Slab Thickness	8. in.
Rise	5. ft	Bottom Slab Thickness	8. in.
Min. Depth of Fill	5. ft	Sidewall Thickness	8. in.
Max. Depth of Fill	25. ft	Length of Precast	6. ft
Depth Increment	1. ft	Section	

HAUNCH DIMENSIONS

Top Vertical	8. in.	CONCRETE COVERS	
Top Horizontal	8. in.	Top Outside	1.00 in.
Bottom Vertical	8. in.	Bottom Outside	1.00 in.
Bottom Horizontal	8. in.	Sidewall Outside	1.00 in.
		Top Inside	1.00 in.
		Bottom Inside	1.00 in.
		Sidewall Inside	1.00 in.

MATERIAL PROPERTIES

Main Reinforcing Yield Stress	65000. psi
Total Service Stress Limit, % of Yield Stress	100 %
Design Concrete Strength	5000. psi
Concrete Density	150. pcf

DESIGN SPECIFICATION

AASHTO LRFD

REINFORCING DATA

	DIAMETER	SPACING
Top Slab Outside Face(AS7)	0.5 in.	4 in.
Bottom Slab Outside Face(AS8)	0.5 in.	4 in.
Sidewall Outside Face(AS1)	0.5 in.	4 in.
Top Slab Inside Face(AS2)	0.5 in.	4 in.
Bottom Slab Inside Face(AS3)	0.5 in.	4 in.
Sidewall Inside Face(AS4)	0.5 in.	4 in.

The diameters are used to estimate depth to tension reinforcing from compression face. They do not represent required reinforcing diameters.

SOIL LOAD DATA

Soil Density	120 pcf
Minimum Lateral Pressure Coefficient	0.25
Maximum Lateral Pressure Coefficient	0.50
Installation Type	Embankment/Compacted
Soil-Structure Interaction Factor varies with depth of fill	
(See reinforcing data for individual values)	

LIVE LOAD DATA

AASHTO - LRFD

HL-93 Loading

Live Load: 1

Live Load Type	HS-Series
Live Load Magnitude	20 tons
Footprint specification	by Code
Tire Footprint Length	10 in.
Tire Footprint Width	20 in.
Live Load Distribution Factor	1.15
Direction of Travel	Parallel to Span
Impact Factor	Variable - See Table
Lane Load	0 lb/ft

Job Description -Precision Precast-- 6x5, HL93 Loading, 5-25 ft. cover

Live Load: 2

Live Load Type	Interstate - Tandem
Live Load Magnitude	25 kips
Footprint specification	by Code
Tire Footprint Length	10 in.
Tire Footprint Width	20 in.
Live Load Distribution Factor	1.15
Direction of Travel	Parallel to Span
Impact Factor	Variable - See Table
Lane Load	0 lb/ft

SURCHARGE LOADS

Vertical Pressure	0.0 lb/sq. ft
Horiz. Pressure at Culvert Top	0.0 lb/sq. ft
Horiz. Pressure at Culvert Bottom	0.0 lb/sq. ft
Application Code	Additional Dead Load

FLUID LOADS

Depth of Fluid	5.0 ft
Fluid Density	62.5 pcf

LOAD COMBINATIONS

Load Factors:Std

	Self Weight	V. Earth	L. Earth	Water	Live
Max	1.25	1.30	1.35	1.00	1.75
Min	0.90	0.90	0.90	0.00	0.00

Load Modifiers:

	Self Weight	V. Earth	L. Earth	Water	Live
	1.00	1.05	1.05	1.00	1.00

Load Factor for Axial Thrust:
1.00

Number of Load Combinations:
4

Load Combinations: Std

Purpose	Self W	Earth	Lat E.	Fluid	V Live	AppVeh	Surch	V Sur	H Sur
MaxV/MaxH	Max	Max	Max	0.00	Max	Max	A	Max	Max
MaxV/MinH	Max	Max	Min	Max	Max	0.00	A	Max	0.00
MinV/MaxH	Min	Min	Max	0.00	0.00	Max	A	0.00	Max
Fatigue					0.00				

STRENGTH REDUCTION FACTORS

Flexure	1.00
Shear	0.90

Job Description -Precision Precast-- 6x5, HL93 Loading, 5-25 ft. cover

BOX CULVERT DESIGN SUMMARY SHEET

6.00 ft Span x 5.00 ft Rise

I N S T A L L A T I O N D A T A

Height of Fill Over Culvert,	Multiple Depths See Reinf. Data
Soil Unit Weight, pcf	120.
Minimum Lateral Soil Pressure Coefficient	0.250
Maximum Lateral Soil Pressure Coefficient	0.500
Soil-Structure Interaction Factor,	
	Multiple Depths See Reinf. Data
Installation Type	Embankment/Compacted

M A T E R I A L P R O P E R T I E S

Minimum Specified Reinforcing Yield Strength, ksi	65.00
Concrete - Specified Compressive Strength, ksi	5.00

G E O M E T R Y

Top Slab Thickness, in.	8.0
Side Wall Thickness, in.	8.0
Bottom Slab Thickness, in.	8.0
Top Horizontal Haunch Dimension, in.	8.0
Bottom Horizontal Haunch Dimension, in.	8.0
Top Vertical Haunch Dimension, in.	8.0
Bottom Vertical Haunch Dimension, in.	8.0
Concrete Cover Over Steel, in.	
Top Slab - Outside Face	1.00
Bottom Slab - Outside Face	1.00
Side Wall - Outside Face	1.00
Top Slab - Inside Face	1.00
Bottom Slab - Inside Face	1.00
Side Wall - Inside Face	1.00

Job Description -Precision Precast-- 6x5, HL93 Loading, 5-25 ft. cover

Height of Fill Over Culvert (ft)	SOIL-STRUCTURE INTERACTION AND IMPACT FACTORS	
	Soil-Structure Interaction Factor	Impact Factor
5.00	1.136	1.124
6.00	1.150	1.083
7.00	1.150	1.041
8.00	1.150	1.000
9.00	1.150	1.000
10.00	1.150	1.000
11.00	1.150	1.000
12.00	1.150	1.000
13.00	1.150	1.000
14.00	1.150	1.000
15.00	1.150	1.000
16.00	1.150	1.000
17.00	1.150	1.000
18.00	1.150	1.000
19.00	1.150	1.000
20.00	1.150	1.000
21.00	1.150	1.000
22.00	1.150	1.000
23.00	1.150	1.000
24.00	1.150	1.000
25.00	1.150	1.000

Job Description -Precision Precast-- 6x5, HL93 Loading, 5-25 ft. cover

R E I N F O R C E M E N T R E Q U I R E M E N T S

Height of Fill Over Culvert (ft)	REINFORCEMENT AREAS (in. ² /ft)					
	Transverse					
	Member / Location					
	out side AS1	in top AS2	in bott AS3	in side AS4	out top AS7	out bott AS8
5.00	0.192	0.192	0.192	0.192	0.192	0.192
6.00	0.192	0.192	0.192	0.192	0.192	0.192
7.00	0.192	0.192	0.192	0.192	0.192	0.192
8.00	0.192	0.192	0.192	0.192	0.192	0.192
9.00	0.192	0.192	0.193	0.192	0.192	0.192
10.00	0.192	0.195	0.205	0.192	0.192	0.192
11.00	0.192	0.209	0.218	0.192	0.192	0.192
12.00	0.192	0.222	0.231	0.192	0.192	0.192
13.00	0.192	0.236	0.245	0.192	0.192	0.192
14.00	0.192	0.250	0.259	0.192	0.192	0.192
15.00	0.192	0.264	0.273	0.192	0.192	0.192
16.00	0.192	0.278	0.287	0.192	0.192	0.192
17.00	0.192	0.292	0.302	0.192	0.192	0.192
18.00	0.192	0.307	0.316	0.192	0.192	0.192
19.00	0.192	0.321	0.331	0.192	0.192	0.192
20.00	0.192	0.336	0.345	0.192	0.192	0.192
21.00	0.193	0.351	0.360	0.192	0.192	0.192
22.00	0.201	0.365	0.375	0.192	0.192	0.192
23.00	0.209	0.380	0.390	0.192	0.192	0.192
24.00	0.217	0.396	0.405	0.192	0.192	0.192
25.00	0.225	0.411	0.421	0.192	0.192	0.192

Single Design Adequate for the Above Depths of Fill

0.225	0.411	0.421	0.192	0.192	0.192
-------	-------	-------	-------	-------	-------

** STIRRUP REINFORCING MAY BE REQUIRED - CHECK PRINTOUT BELOW **

Job Description -Precision Precast-- 6x5, HL93 Loading, 5-25 ft. cover

EXTENSION OF AS1 REINFORCEMENT INTO OUTSIDE
FACE OF TOP AND BOTTOM SLABS (in.)
measured from the bend point
see note 1

Height of Fill Over Culvert (ft)	Extension from Bend Point		Location of Zero Moment	
	Top Slab (Note 1)	Bottom Slab	Top Slab (Note 2)	Bottom Slab
5.00	0	0	23	23
6.00	0	0	23	23
7.00	0	0	22	22
8.00	0	0	22	22
9.00	0	0	22	22
10.00	0	0	22	22
11.00	0	0	22	22
12.00	0	0	22	22
13.00	0	0	22	22
14.00	0	0	22	22
15.00	0	0	22	22
16.00	0	0	22	22
17.00	0	0	22	22
18.00	0	0	22	22
19.00	0	0	22	22
20.00	0	0	22	22
21.00	0	0	22	22
22.00	0	0	22	22
23.00	0	0	22	22
24.00	0	0	22	22
25.00	0	0	22	22

Single Design Adequate for the Above Depths of Fill

0	0	23	23
---	---	----	----

Note 1: Sidewall outside face steel (AS1) must be bent at the corner and extended into the outside face of the top/bottom slab. The extension length assumes that the AS7 and AS8 reinforcing is provided. To obtain the total AS1 extension into the slabs, a tension lap splice length must be calculated and added to the extension lengths given above.

Note 2: Sidewall outside face steel (AS1) must be bent at the corner and extended into the outside face of the top/bottom slabs. AS7 and AS8 may be eliminated provided that the AS1 extends to the point of zero moment. Development lengths for the AS1 reinforcing must be added past the location of zero moment.

'---' indicates that negative moment may exist across the full width of the slab.

***** Stirrups are not required *****



LIBERTY
ENGINEERED WIRE PRODUCTS

Welded Wire Proposal

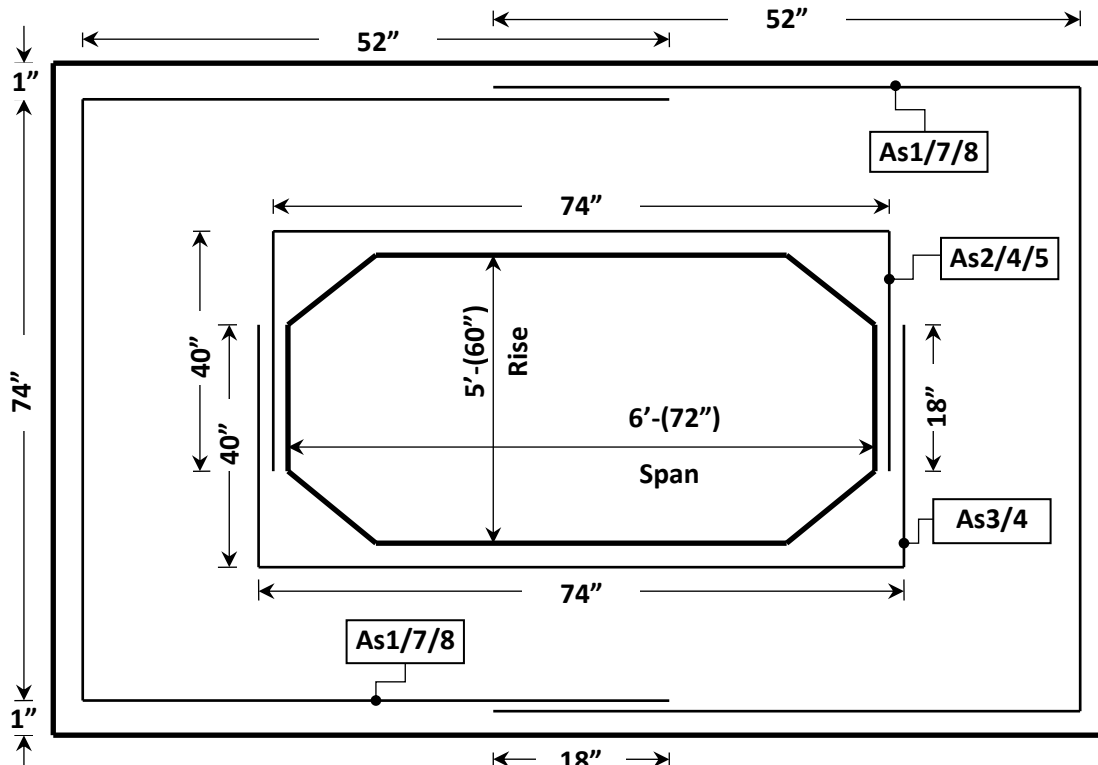
Comments: 1" Clear cover on all surfaces.
 'M' Dimension = 18", min.

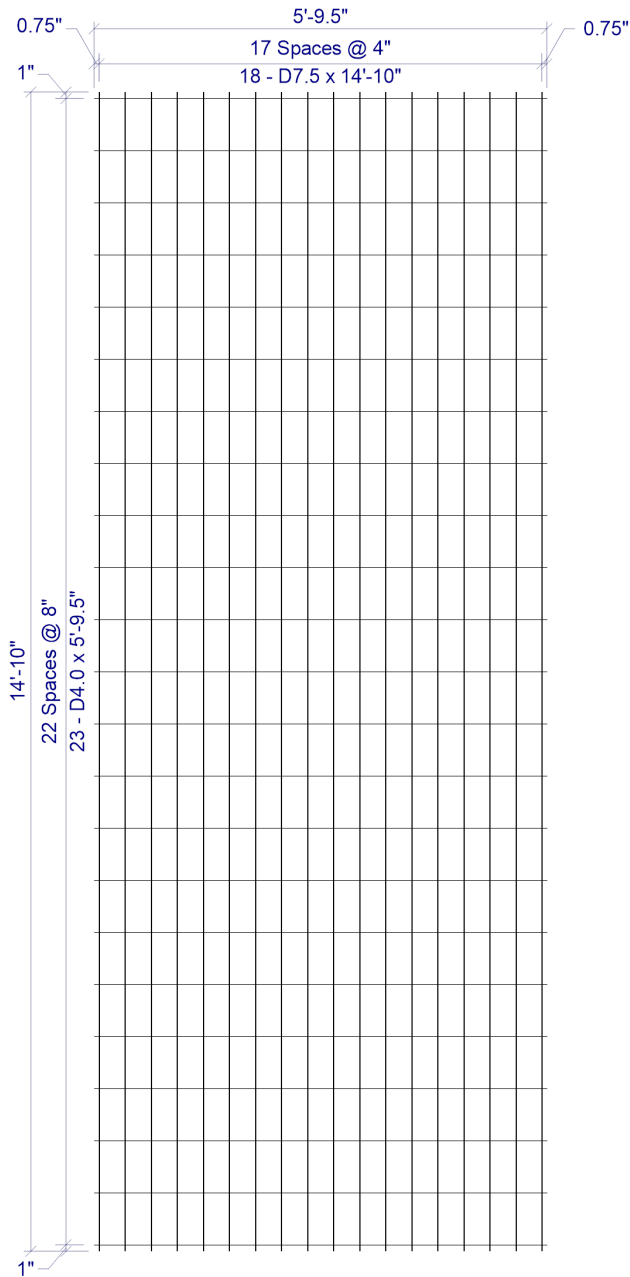
Date: 10/11/23
Customer Name: Precision Precast
Ship To: Columbia, MO
Project Name: WWR 6x5' Discovery Park
P.O. #: _____
Description: 6x5 Box Culvert
Qty.: 27 Pcs. @ 6' (162 LF)
Loading/Design Spec.: HL-93 Loading (Boxcar)
Earth Cover: 5-25'
Top Slab: 8"
Side Wall: 8"
Conc. Strength: 5,000 psi
Bot. Slab: 8"
Haunch: 8" x 8"

As#	Area Required	Area Obtained	Qty.	Space	W-No.	Width	O'Hang	Length	Weight	Comments
1/7/8	.225/.192/.192	.225/.225/.225	54	4x8	D7.5 + D4.0	68"	¾ + ¾	14'-10" (1,1)	86.2	
2/4	.411/.192	.423/.192	27	2x8V	D6.4/D7.7 + D4.0	68"	¾ + ¾	12'-10"/6'-2" (1,1)	94.3	SWOH = 5"
				8V = 1" EOH, 1@4", 18@8", 1@4", 1" EOH						
3/4	.421/.192	.423/.192	27	2x8V	D6.4/D7.7 + D4.0	68"	¾ + ¾	12'-10"/6'-2" (1,1)	94.3	SWOH = 5"
				8V = 1" EOH, 1@4", 18@8", 1@4", 1" EOH						

Price: _____

Total Weight: 9,747.0 LB.





4 x 8 D7.5 / D4.0 (GRADE 70) 68(+0.75, +0.75) x 14'-10" (1, 1)

SHEET DESIGN



LIBERTY
ENGINEERED WIRE PRODUCTS

CUSTOMER Precision Precast

PROJECT Precision Precast 231011 - 6x5 Box Culvert - DWGS

LOCATION Columbia, MO

DATE 10-11-2023 MARK NUMBER As1/7/8

L.W.SPACE 4"

C.W.SPACE 8"

L.W.1 SIZE D7.5

L.W.2 SIZE N/A

C.W.SIZE D4.0

WIDTH 5'-9.5"

LENGTH 14'-10"

OH.LEFT 0.75"

OH.RIGHT 0.75"

OH.TOP 1"

OH.BOTTOM 1"

YIELD 70,000psi

BENT -

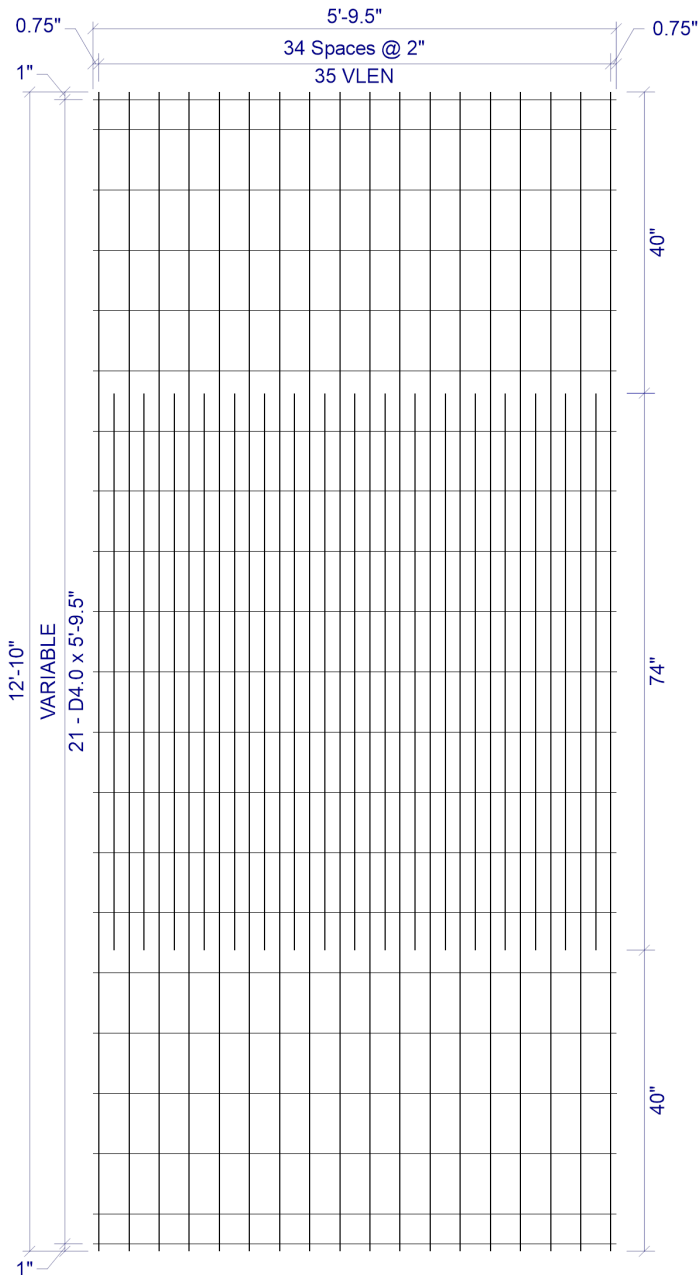
CUT -

ROLL -

W I R E S	LINE WIRE 1	LINE WIRE 2	CROSS WIRE
NO. PER SHEET	18	N/A	23
SIZE	D7.5	N/A	D4.0
LENGTH	14'-10"	-	5'-9.5"
W.T./SHEET	68.08#	-	18.12#
SHEET W.T.	86.2#		
QUANTITY	54		
SUB TOTAL WEIGHT			
TOTAL WEIGHT			
S.F./SHEET			
LBS/CSF			
Ast/LF			
ST.DENSITY			

SPECIAL REMARKS:

APPROVED _____



2 x VAR D6.4 / D7.7 / D4.0 (GRADE 70) 68"(+0.75", +0.75") x VLEN(1", 1")
 VLEN = ALTERNATING LENGTH 6'-2" & 12'-10" WITH 12'-10" @ LHS & RHS
 VAR = 1" OH, 1@4", 18@8", 1@4", 1" OH

SHEET DESIGN



LIBERTY
ENGINEERED WIRE PRODUCTS

CUSTOMER Precision Precast

PROJECT Precision Precast 231011 - 6x5 Box Culvert - DWGS

LOCATION Columbia, MO

DATE 10-11-2023 MARK NUMBER As2/4 & As3/4

L.W.SPACE 2"

C.W.SPACE VAR

L.W.1 SIZE D6.4

L.W.2 SIZE D7.7

C.W.SIZE D4.0

WIDTH 5'-9.5"

LENGTH 12'-10"

OH.LEFT 0.75"

OH.RIGHT 0.75"

OH.TOP 1"

OH.BOTTOM 1"

YIELD 70,000psi

BENT -

CUT -

ROLL -

W I R E S	LINE WIRE 1	LINE WIRE 2	CROSS WIRE
NO. PER SHEET	18	17	21
SIZE	D6.4	D7.7	D4.0
LENGTH	12'-10"	6'-2"	5'-9.5"
W.T./SHEET	50.27#	27.45#	16.54#
SHEET W.T.	94.3#		
QUANTITY	54		
SUB TOTAL WEIGHT			
TOTAL WEIGHT			
S.F./SHEET			
LBS/CSF			
Ast/LF			
ST.DENSITY			

SPECIAL REMARKS:

Interior short wire OH at top = 5"
 Interior short wire OH at bottom = 5"

APPROVED _____

RJS 7/31/2023

BOXCAR

Version 3.1 for Windows
15 September 2010

A Computer Program for the Structural Design of Reinforced Concrete Box Culverts

Developed by

Simpson Gumpertz & Heger Inc.
in cooperation with

The Federal Highway Administration
and
The American Concrete Pipe Association

The successful application and use of this software product is dependent on the application of skilled engineering judgment and is the responsibility of the user. The user must select input values suitable to his specific installation. The information presented in the computer output is for review, interpretation, application and approval by a qualified engineer.

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```
Date: 07-31-2023
Time: 11:10:12
Filename - 13x7x6 Precision-
```

Discovery Park

[illegible]

Filename - 13x7x6 Precision-Discovery Park
Job Description - 13x7 w/7'-12' Fill & HL93 LL

--
GEOMETRY

Span	13. ft		Top Slab Thickness	12. in.
Rise	7. ft		Bottom Slab Thickness	12. in.
Min. Depth of Fill	7. ft		Sidewall Thickness	12. in.
Max. Depth of Fill	12. ft		Length of Precast	6. ft
Depth Increment	1. ft		Section	

--
HAUNCH DIMENSIONS | CONCRETE COVERS

Top Vertical	8. in.		Top Outside	1.00 in.
Top Horizontal	8. in.		Bottom Outside	1.00 in.
Bottom Vertical	8. in.		Sidewall Outside	1.00 in.
Bottom Horizontal	8. in.		Top Inside	1.00 in.
			Bottom Inside	1.00 in.
			Sidewall Inside	1.00 in.

--
MATERIAL PROPERTIES

Main Reinforcing Yield Stress	65000. psi
Total Service Stress Limit, % of Yield Stress	100 %
Design Concrete Strength	5000. psi
Concrete Density	150. pcf

--
DESIGN SPECIFICATION

AASHTO LRFD

--
REINFORCING DATA

	DIAMETER	SPACING
Top Slab Outside Face(AS7)	0.65 in.	4 in.
Bottom Slab Outside Face(AS8)	0.65 in.	4 in.
Sidewall Outside Face(AS1)	0.65 in.	4 in.
Top Slab Inside Face(AS2)	0.65 in.	4 in.
Bottom Slab Inside Face(AS3)	0.65 in.	4 in.
Sidewall Inside Face(AS4)	0.65 in.	4 in.

The diameters are used to estimate depth to tension reinforcing from compression face. They do not represent required reinforcing diameters.

--
SOIL LOAD DATA

Soil Density	120 pcf
Minimum Lateral Pressure Coefficient	0.25
Maximum Lateral Pressure Coefficient	0.50
Installation Type	Embankment/Compacted
Soil-Structure Interaction Factor varies with depth of fill	
(See reinforcing data for individual values)	

--
LIVE LOAD DATA

AASHTO - LRFD
HL-93 Loading

Live Load: 1

Live Load Type	HS-Series
Live Load Magnitude	20 tons
Footprint specification	by Code
Tire Footprint Length	10 in.
Tire Footprint Width	20 in.
Live Load Distribution Factor	1.15
Direction of Travel	Parallel to Span
Impact Factor	Variable - See Table
Lane Load	0 lb/ft

Live Load: 2

Live Load Type	Interstate - Tandem
Live Load Magnitude	25 kips
Footprint specification	by Code
Tire Footprint Length	10 in.
Tire Footprint Width	20 in.
Live Load Distribution Factor	1.15
Direction of Travel	Parallel to Span
Impact Factor	Variable - See Table
Lane Load	0 lb/ft

--
SURCHARGE LOADS

Vertical Pressure	0.0 lb/sq. ft
Horiz. Pressure at Culvert Top	0.0 lb/sq. ft
Horiz. Pressure at Culvert Bottom	0.0 lb/sq. ft
Application Code	Additional Dead Load

--
FLUID LOADS

Depth of Fluid	7.0 ft
Fluid Density	62.5 pcf

--
LOAD COMBINATIONS

Load Factors:Std

	Self Weight	V. Earth	L. Earth	Water	Live
Max	1.25	1.30	1.35	1.00	1.75
Min	0.90	0.90	0.90	0.00	0.00

Load Modifiers:

	Self Weight	V. Earth	L. Earth	Water	Live
	1.00	1.05	1.05	1.00	1.00

Load Factor for Axial Thrust:

1.00

Number of Load Combinations:

4

Load Combinations: Std

Purpose	Self	W Earth	Lat E.	Fluid	V Live	AppVeh	Surch	V Sur	H
Sur									
MaxV/MaxH	Max	Max	Max	0.00	Max	Max	A	Max	Max
MaxV/MinH	Max	Max	Min	Max	Max	0.00	A	Max	0.00
MinV/MaxH	Min	Min	Max	0.00	0.00	Max	A	0.00	Max
Fatigue					0.00				

--

STRENGTH REDUCTION FACTORS

--

Flexure	1.00
Shear	0.90

x

BOX CULVERT DESIGN SUMMARY SHEET

13.00 ft Span x 7.00 ft Rise

I N S T A L L A T I O N D A T A

Height of Fill Over Culvert,	Multiple Depths See Reinf. Data
Soil Unit Weight, pcf	120.
Minimum Lateral Soil Pressure Coefficient	0.250
Maximum Lateral Soil Pressure Coefficient	0.500
Soil-Structure Interaction Factor,	
	Multiple Depths See Reinf. Data
Installation Type	Embankment/Compacted

M A T E R I A L P R O P E R T I E S

Minimum Specified Reinforcing Yield Strength, ksi	65.00
Concrete - Specified Compressive Strength, ksi	5.00

G E O M E T R Y

Top Slab Thickness, in.	12.0
Side Wall Thickness, in.	12.0
Bottom Slab Thickness, in.	12.0
Top Horizontal Haunch Dimension, in.	8.0
Bottom Horizontal Haunch Dimension, in.	8.0
Top Vertical Haunch Dimension, in.	8.0
Bottom Vertical Haunch Dimension, in.	8.0
Concrete Cover Over Steel, in.	
Top Slab - Outside Face	1.00
Bottom Slab - Outside Face	1.00
Side Wall - Outside Face	1.00
Top Slab - Inside Face	1.00
Bottom Slab - Inside Face	1.00
Side Wall - Inside Face	1.00

Height of Fill Over Culvert (ft)	SOIL-STRUCTURE INTERACTION AND IMPACT FACTORS	

	Soil-Structure Interaction Factor	Impact Factor

7.00	1.093	1.041
8.00	1.107	1.000
9.00	1.120	1.000
10.00	1.133	1.000
11.00	1.147	1.000
12.00	1.150	1.000

X
R E I N F O R C E M E N T R E Q U I R E M E N T S

Height of Fill Over Culvert (ft)	REINFORCEMENT AREAS (in. ² /ft)					

	Transverse					

	Member / Location					

	out side AS1	in top AS2	in bott AS3	in side AS4	out top AS7	out bott AS8

7.00	0.359	0.444	0.464	0.288	0.288	0.288
8.00	0.378	0.467	0.490	0.288	0.288	0.288
9.00	0.404	0.499	0.525	0.288	0.288	0.288
10.00	0.431	0.534	0.560	0.288	0.288	0.288
11.00	0.462	0.575	0.601	0.288	0.288	0.288
12.00	0.491	0.612	0.639	0.288	0.288	0.288

Single Design Adequate for the Above Depths of Fill

	0.491	0.612	0.639	0.288	0.288	0.288

** STIRRUP REINFORCING MAY BE REQUIRED - CHECK PRINTOUT BELOW **

EXTENSION OF AS1 REINFORCEMENT INTO OUTSIDE
FACE OF TOP AND BOTTOM SLABS (in.)
measured from the bend point
see note 1

Height of Fill Over Culvert (ft)	-----			
	Extension from Bend Point		Location of Zero Moment	
	Top Slab	Bottom Slab	Top Slab	Bottom Slab
	(Note 1)		(Note 2)	
-----	-----			
7.00	0	0	34	39
8.00	0	0	34	39
9.00	0	0	34	39

10.00	0	0	34	34
11.00	0	0	34	34
12.00	0	0	34	34

Single Design Adequate for the Above Depths of Fill

	0	0	34	39

Note 1: Sidewall outside face steel (AS1) must be bent at the corner and extended into the outside face of the top/bottom slab. The extension length assumes that the AS7 and AS8 reinforcing is provided. To obtain the total AS1 extension into the slabs, a tension lap splice length must be calculated and added to the extension lengths given above.

Note 2: Sidewall outside face steel (AS1) must be bent at the corner and extended into the outside face of the top/bottom slabs. AS7 and AS8 may be eliminated provided that the AS1 extends to the point of zero moment. Development lengths for the AS1 reinforcing must be added past the location of zero moment.

'---' indicates that negative moment may exist across the full width of the slab.

***** Stirrups are not required *****

Date: 7/31/2023
 Customer Name: Precision Precast
 Ship To: Columbia, MO
 Project Name: WWR 13x7' Discovery Park
 P.O. #:
 Description: 13x7 Box Culvert
 Qty.: 120-Bxs @ 6'
 Loading/Design Spec.: ASTM/HL93/Boxcar
 Earth Cover: 7'-12' Conc. Strength: 5000 psi
 Top Slab: 12" Bot. Slab: 12"
 Side Wall: 12" Haunch: 8"

Comments: "M" = 18" Minimum

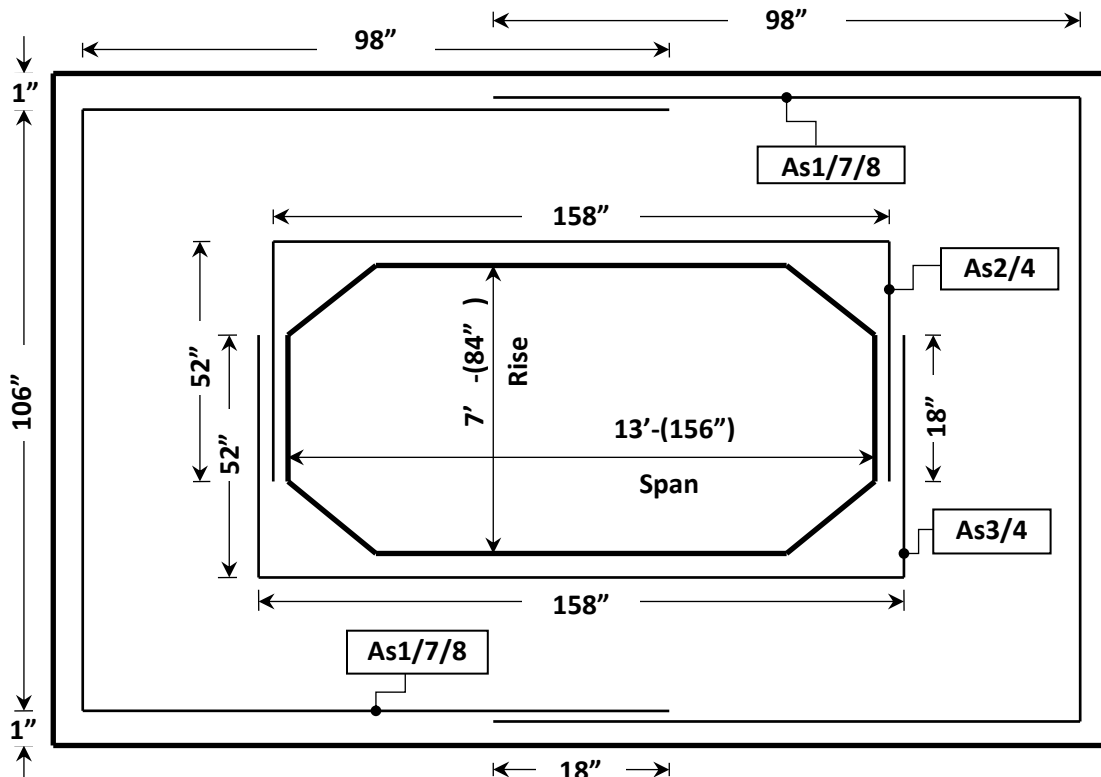
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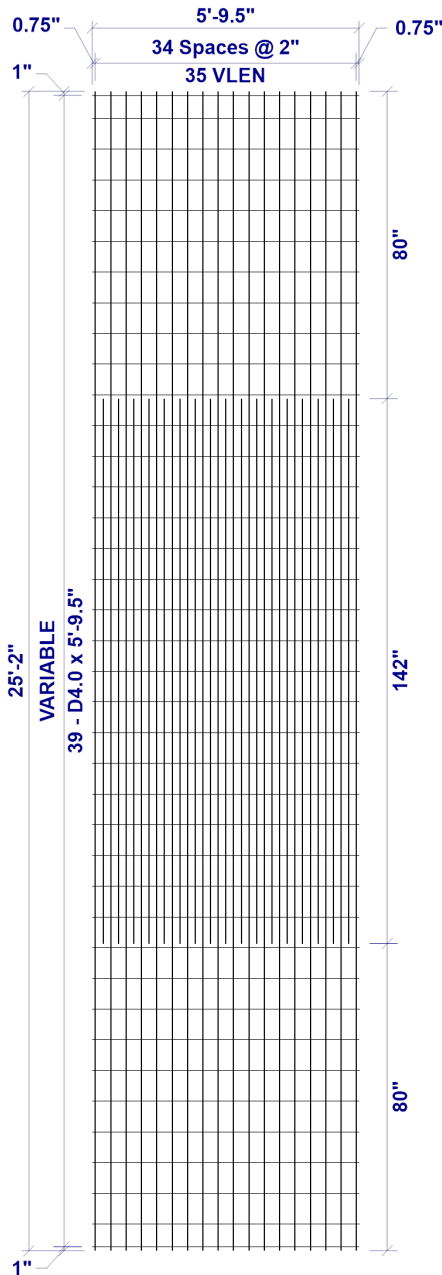
As#	Area Required	Area Obtained	Qty.	Spacing	D-No.	Width	O'Hang	Length	Weight	Comments
1/7/8	.491/.288/.288	.492/.288/.288	240	2x8V	D9.6/D6.8 + D4	68"	¾" + ¾"	25'-2"/11'-10" (1,1)	225.1	
2/4	.612/.288	.612/.288	120	2x8V	D9.6/D10.8 + D4.7	68"	¾" + ¾"	21'-10"/13'-2" (1,1)	241.9	
3/4	.639/.288	.639/.288	120	2x8V	D9.6/D11.7 + D4.7	68"	¾" + ¾"	21'-10"/13'-2" (1,1)	248.8	
					As1/7/8 8V = 1"eoh-6"-36@8"-6"-1"eoh					
					As2/4 & As3/4 8V = 1"eoh-6"-31@8"-6"-1"eoh					

112,908

Price:

Total Weight: LBS.





2 x VAR D9.6 / D6.8 / D4.0 (GRADE 70) 68"(+0.75", +0.75") x VLEN(1", 1")

VLEN = ALTERNATING LENGTH 11'-10" & 25'-2" WITH 25'-2" @ LHS & RHS

VAR = 1" OH, 1@6", 36@8", 1@6", 1" OH

SHEET DESIGN



LIBERTY
ENGINEERED WIRE PRODUCTS

CUSTOMER Precision Precast

PROJECT 13x7x6 RCB 7-12F 120-Bxs HL93 Boxcar

LOCATION Columbia, MO

DATE 07-31-2023 MARK NUMBER As1/7/8

L.W.SPACE 2"

C.W.SPACE VAR

L.W.1 SIZE D9.6

L.W.2 SIZE D6.8

C.W.SIZE D4.0

WIDTH 5'-9.5"

LENGTH 25'-2"

OH.LEFT 0.75"

OH.RIGHT 0.75"

OH.TOP 1"

OH.BOTTOM 1"

YIELD 70,000psi

BENT -

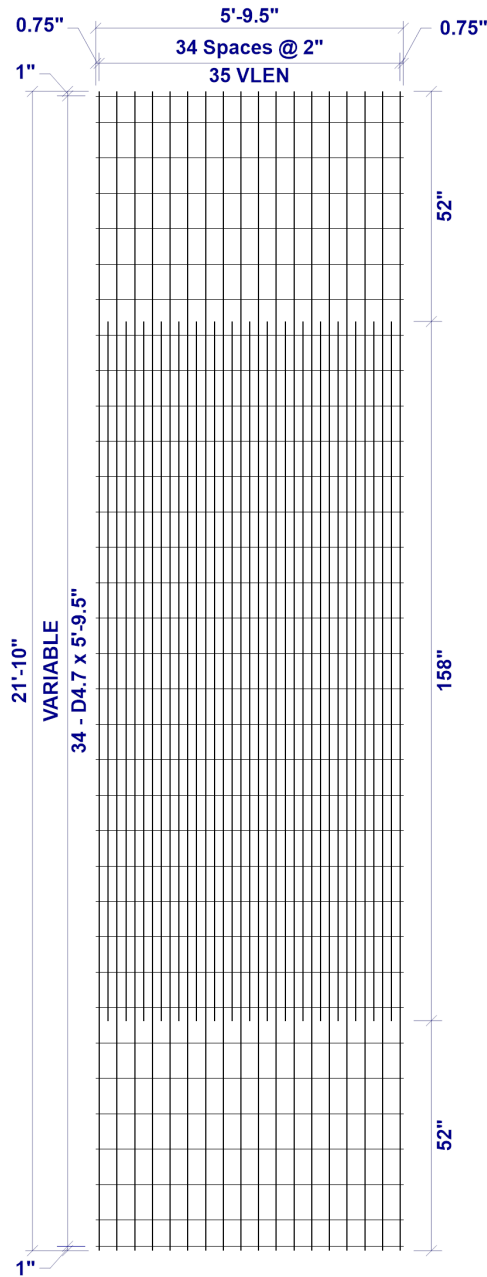
CUT -

ROLL -

W I R E S	LINE WIRE 1	LINE WIRE 2	CROSS WIRE
NO. PER SHEET	18	17	39
SIZE	D9.6	D6.8	D4.0
LENGTH	25'-2"	11'-10"	5'-9.5"
W.T./SHEET	147.86#	46.51#	30.72#
SHEET W.T.	225.1#		
QUANTITY	240		
SUB TOTAL WEIGHT	35486.20#	11162.33#	7372.56#
TOTAL WEIGHT	54,021.10#		
S.F./SHEET	145.7569		
LBS/CSF	154.43#		
Ast/LF	0.58 in ²	0.41 in ²	VAR
ST.DENSITY	0.2833333 lbs/in ³		

SPECIAL REMARKS:
Interior EOH's = 7" + 7"

APPROVED _____



2 x VAR D9.6 / D10.8 / D4.7 (GRADE 70) 68"(+0.75", +0.75") x VLEN(1", 1")
 VLEN = ALTERNATING LENGTH 13'-2" & 21'-10" WITH 21'-10" @ LHS & RHS
 VAR = 1" OH, 1@6", 31@8", 1@6", 1" OH

SHEET DESIGN



LIBERTY
ENGINEERED WIRE PRODUCTS

CUSTOMER Precision Precast

PROJECT 13x7x6 RCB 7-12F 120-Bxs HL93 Boxcar

LOCATION Columbia, MO

DATE 07-31-2023 MARK NUMBER As2/4

L.W.SPACE 2"

C.W.SPACE VAR

L.W.1 SIZE D9.6

L.W.2 SIZE D10.8

C.W.SIZE D4.7

WIDTH 5'-9.5"

LENGTH 21'-10"

OH.LEFT 0.75"

OH.RIGHT 0.75"

OH.TOP 1"

OH.BOTTOM 1"

YIELD 70,000psi

BENT -

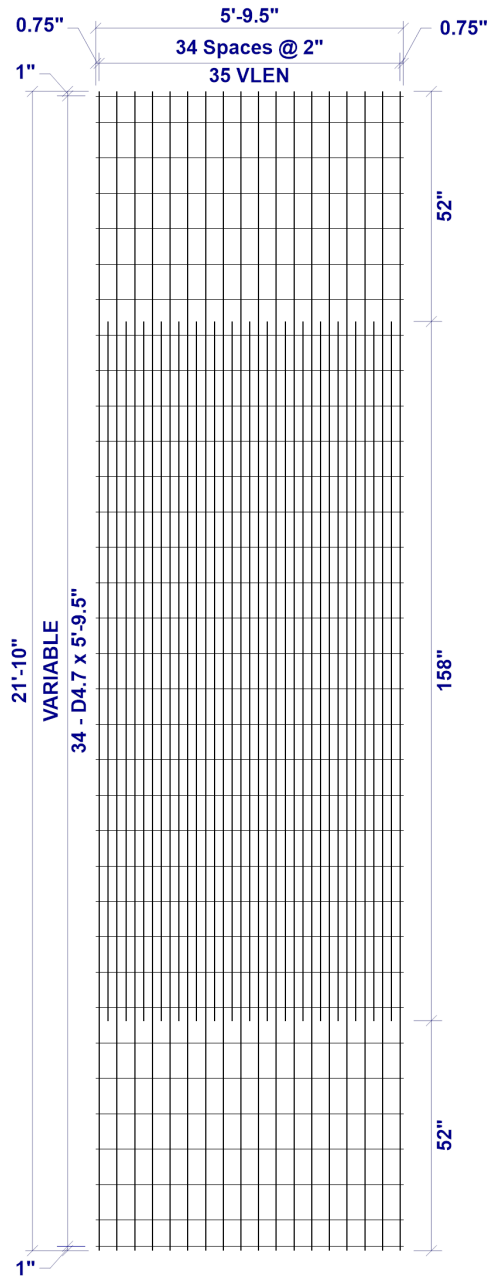
CUT -

ROLL -

W I R E S	LINE WIRE 1	LINE WIRE 2	CROSS WIRE
NO. PER SHEET	18	17	34
SIZE	D9.6	D10.8	D4.7
LENGTH	21'-10"	13'-2"	5'-9.5"
W.T./SHEET	128.28#	82.19#	31.47#
SHEET W.T.	241.9#		
QUANTITY	120		
SUB TOTAL WEIGHT	15393.02#	9862.99#	3776.07#
TOTAL WEIGHT	29,032.09#		
S.F./SHEET	126.4514		
LBS/CSF	191.33#		
Ast/LF	0.58 in ²	0.65 in ²	VAR
ST.DENSITY	0.2833333 lbs/in ³		

SPECIAL REMARKS:
Interior EOH's = 3" + 3"

APPROVED _____



2 x VAR D9.6 / D11.7 / D4.7 (GRADE 70) 68"(+0.75", +0.75") x VLEN(1", 1")
 VLEN = ALTERNATING LENGTH 13'-2" & 21'-10" WITH 21'-10" @ LHS & RHS
 VAR = 1" OH, 1@6", 31@8", 1@6", 1" OH

SHEET DESIGN



LIBERTY
ENGINEERED WIRE PRODUCTS

CUSTOMER Precision Precast

PROJECT 13x7x6 RCB 7-12F 120-Bxs HL93 Boxcar

LOCATION Columbia, MO

DATE 07-31-2023 MARK NUMBER As3/4

L.W.SPACE 2"

C.W.SPACE VAR

L.W.1 SIZE D9.6

L.W.2 SIZE D11.7

C.W.SIZE D4.7

WIDTH 5'-9.5"

LENGTH 21'-10"

OH.LEFT 0.75"

OH.RIGHT 0.75"

OH.TOP 1"

OH.BOTTOM 1"

YIELD 70,000psi

BENT -

CUT -

ROLL -

W I R E S	LINE WIRE 1	LINE WIRE 2	CROSS WIRE
NO. PER SHEET	18	17	34
SIZE	D9.6	D11.7	D4.7
LENGTH	21'-10"	13'-2"	5'-9.5"
W.T./SHEET	128.28#	89.04#	31.47#
SHEET W.T.	248.8#		
QUANTITY	120		
SUB TOTAL WEIGHT	15393.02#	10684.91#	3776.07#
TOTAL WEIGHT	29,854.00#		
S.F./SHEET	126.4514		
LBS/CSF	196.74#		
Ast/LF	0.58 in ²	0.70 in ²	VAR
ST.DENSITY	0.2833333 lbs/in ³		

SPECIAL REMARKS:
Interior EOH's = 3" + 3"

APPROVED _____