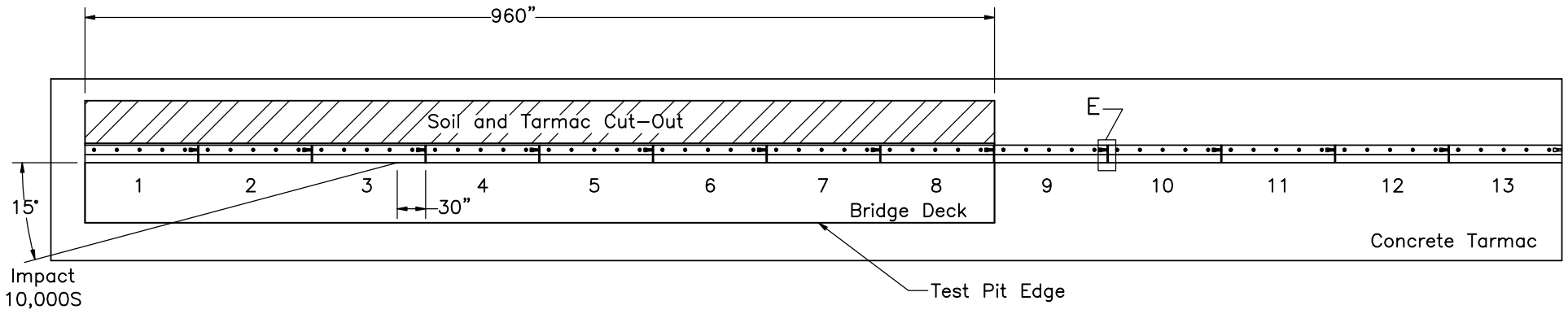
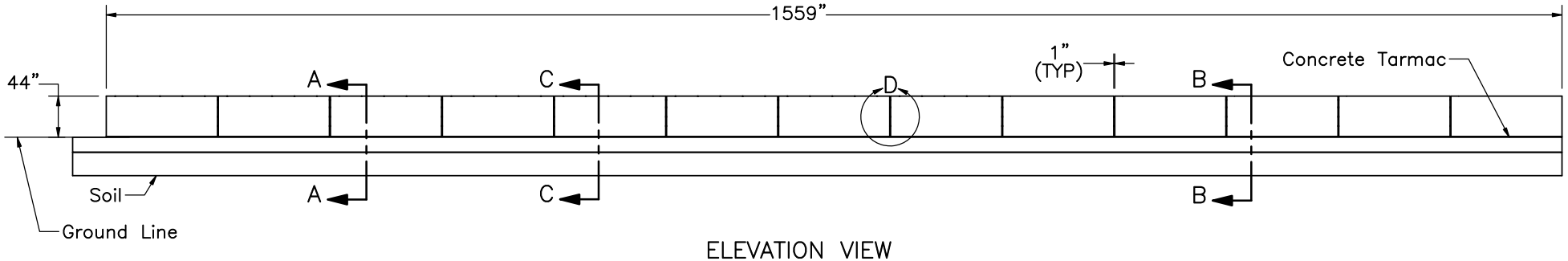


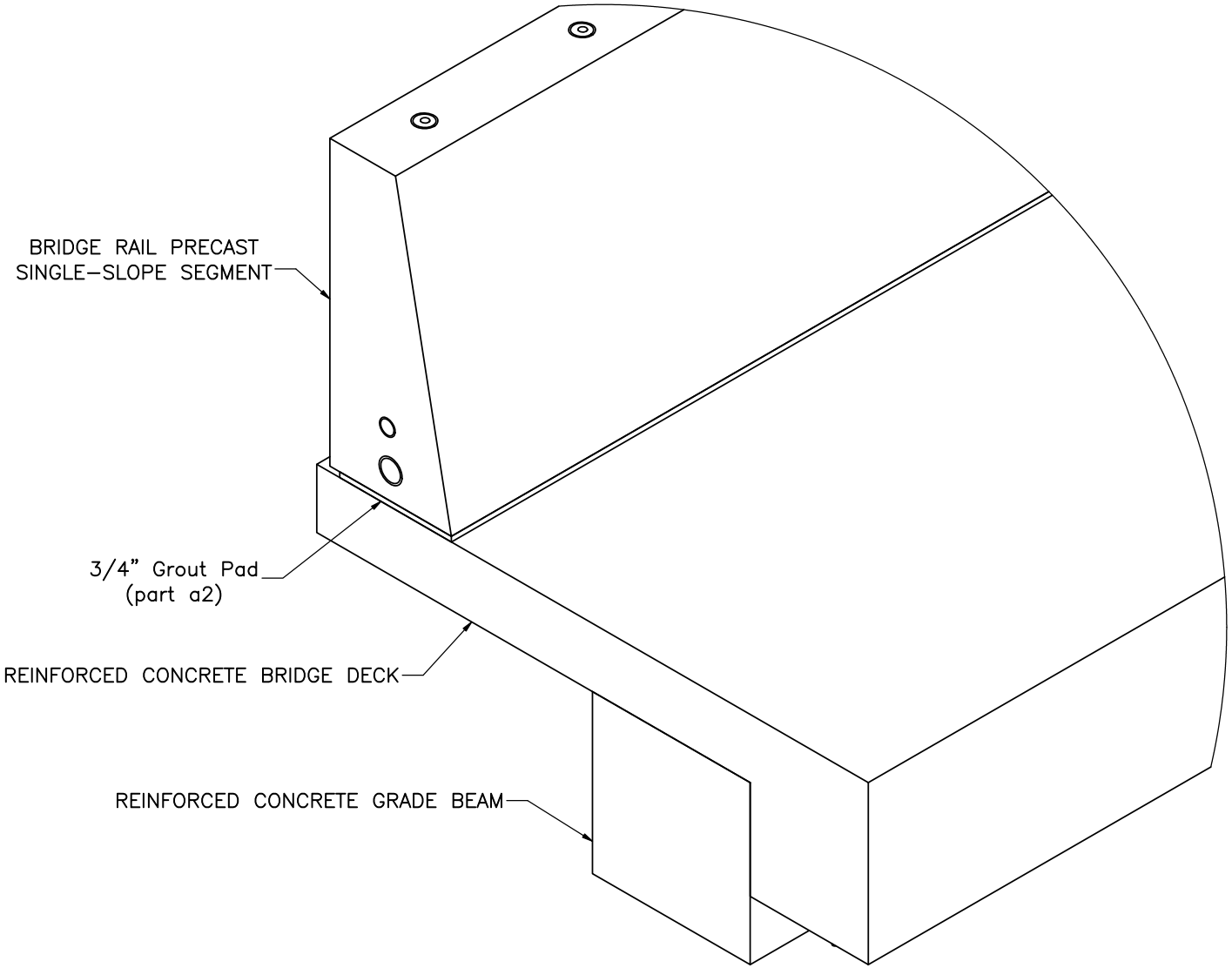
PLAN VIEW



ELEVATION VIEW

Notes: (1) Test no. ABCBRM-1 shall be performed according to test designation no. 4-12 using MASH 2016 criteria.
(2) The impact location is 30" upstream from the centerline of the joint between barriers nos. 3 and 4, which corresponds to the 3/4-span location.

MwRSF	Iowa Concrete Bridge Deck and Rail Test No. ABCBRM-1	SHEET: 1 of 21
	System Layout	DATE: 3/18/2024
Midwest Roadside Safety Facility		DRAWN BY: GHR/LJP/CJN/SBW/CAO
DWG. NAME. ABCBRM-1_R20	SCALE: 1:165 UNITS: in.	REV. BY: RKF/KAL



ISOMETRIC CROP VIEW

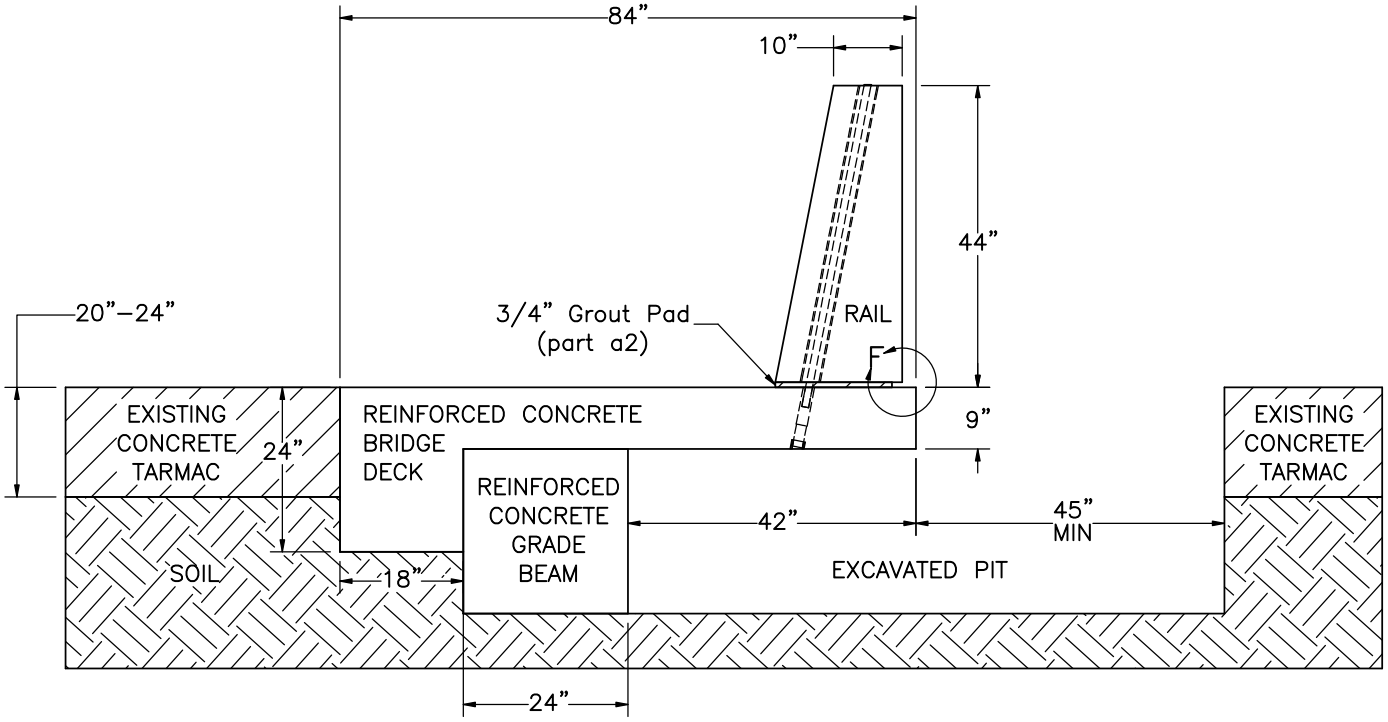
Midwest Roadside Safety Facility

Iowa Concrete Bridge Deck and Rail
Test No. ABCBRM–1

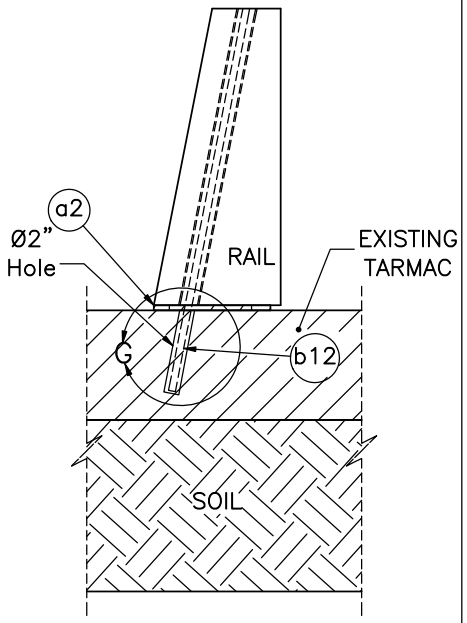
Isometric End View

DWG. NAME. ABCBRM–1_R20	SCALE: 1:18 UNITS: in.	REV. BY: RKF/KAL

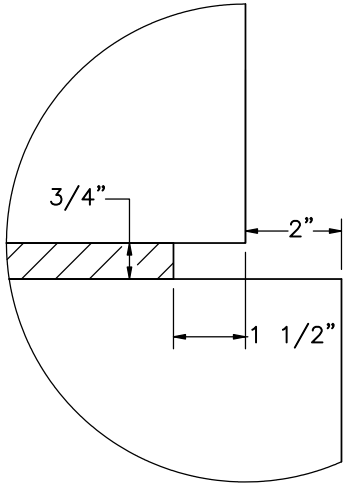
SHEET: 2 of 21
DATE: 3/18/2024
DRAWN BY: GHR/LJP/CJN/SBW/CAO



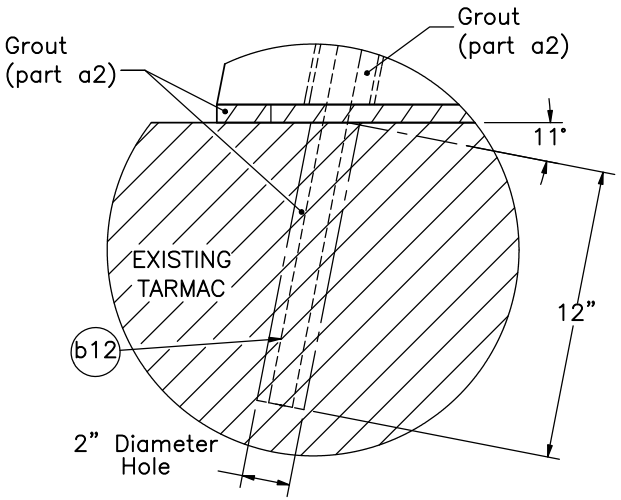
SECTION A–A
(Part c8 hidden from view)



SECTION B–B
(Part c8 hidden from view)



DETAIL F
SCALE 1:4

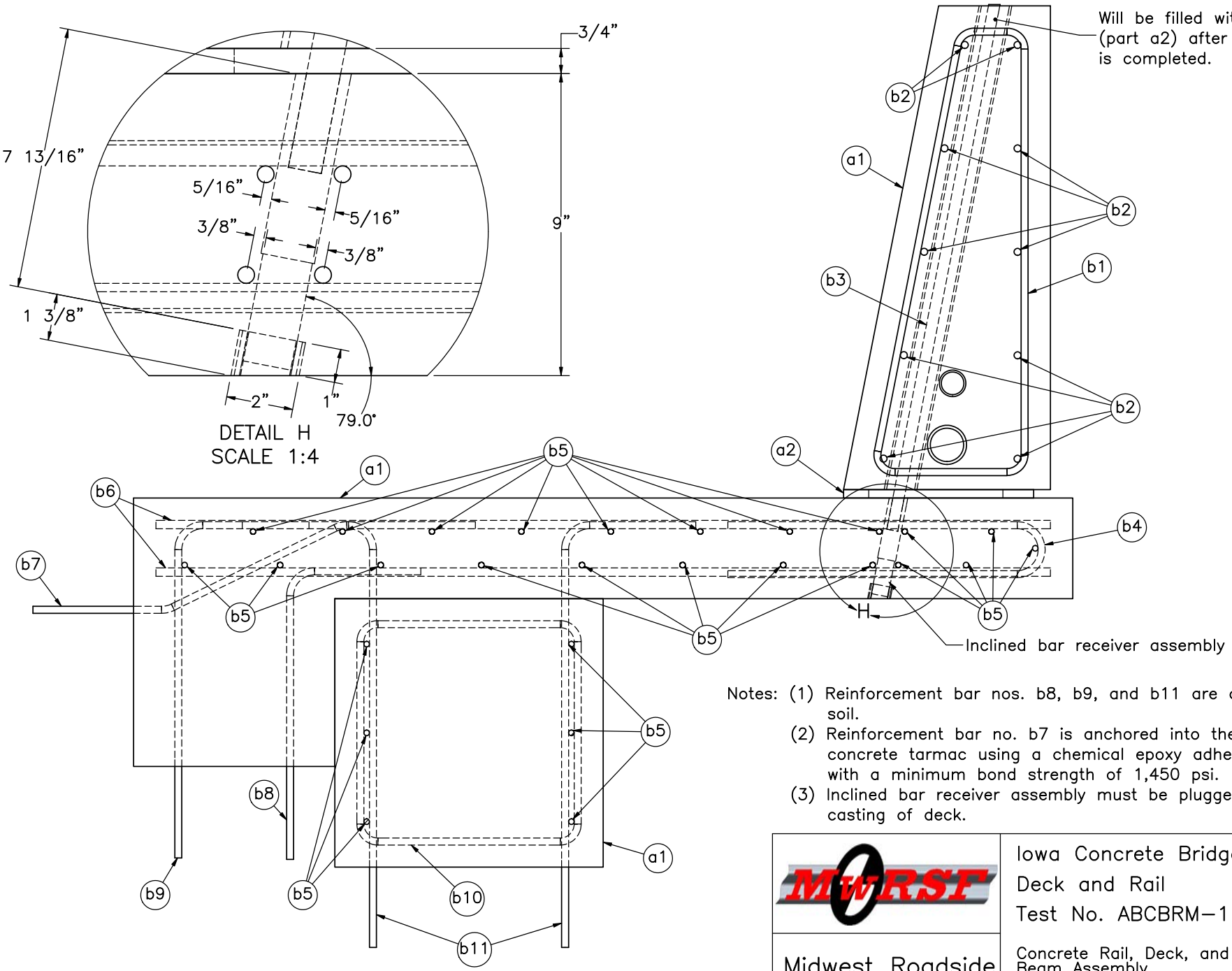


DETAIL G
SCALE 1:8

Notes:
(1) Reinforcement not shown for clarity in section A–A.
(2) Reinforcement bar no. b12 is shown in section B–B and is to be anchored into the existing tarmac with grout (part a2). Hole size selected to allow grout to flow down and around bar end in tarmac.
(3) Bridge deck shall have a broom finish under Grout Pad (part a2). Tarmac has no broom finish.
(4) Grout: All connections and interfaces should use a non–shrink grout with sufficient working time (30 min. or greater). The grout should gain at least 4000 psi in 8 hours with a 28 day strength of 8,000 psi.

MwRSF	Iowa Concrete Bridge Deck and Rail Test No. ABCBRM–1	SHEET: 3 of 21
	System Profile View	DATE: 3/18/2024
Midwest Roadside Safety Facility		DRAWN BY: GHR/LJP/CJN/SBW/CAO
DWG. NAME. ABCBRM–1_R20	SCALE: 1:28 UNITS: in.	REV. BY: RKF/KAL

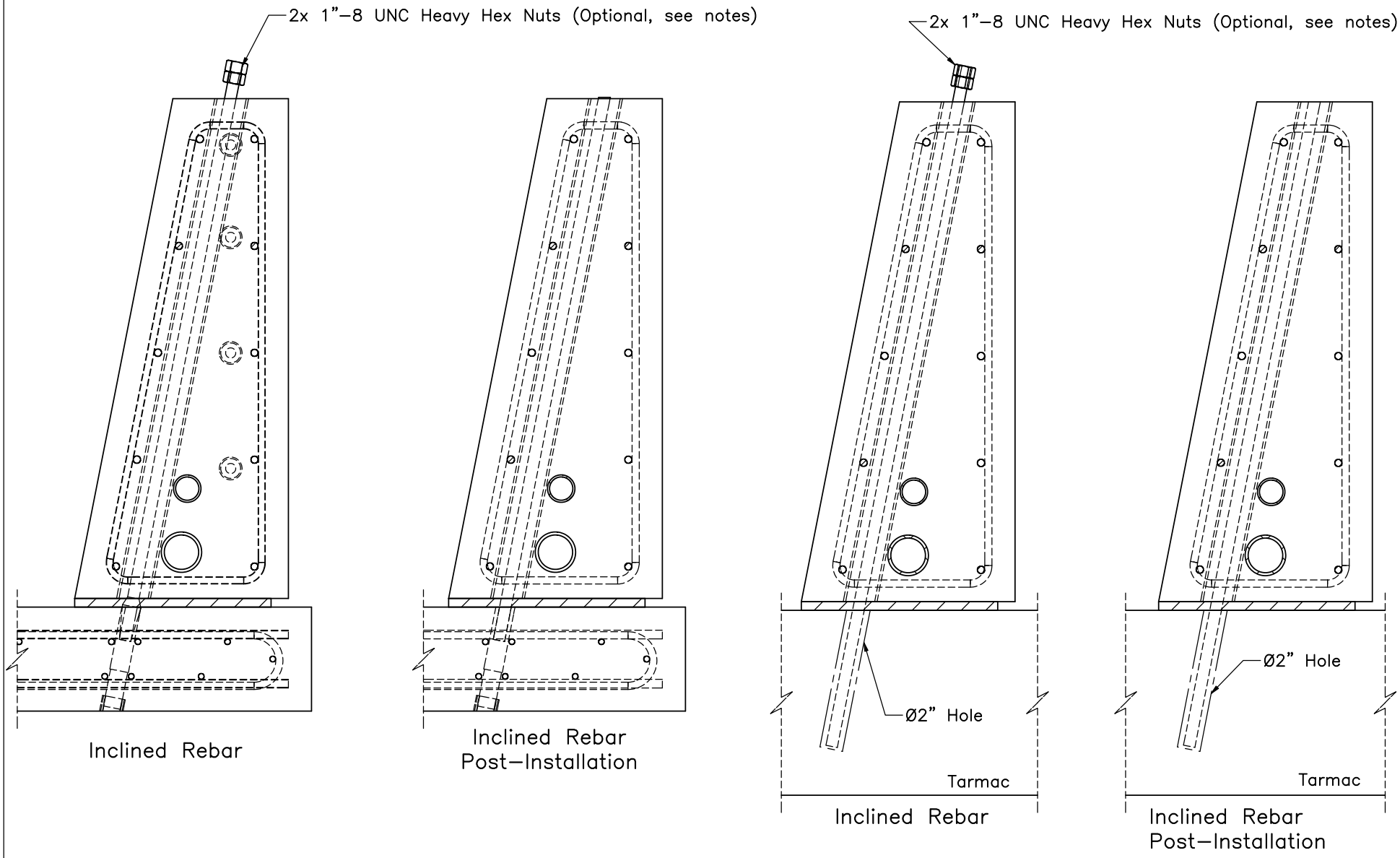
DETAIL H
SCALE 1:4



SECTION C–C

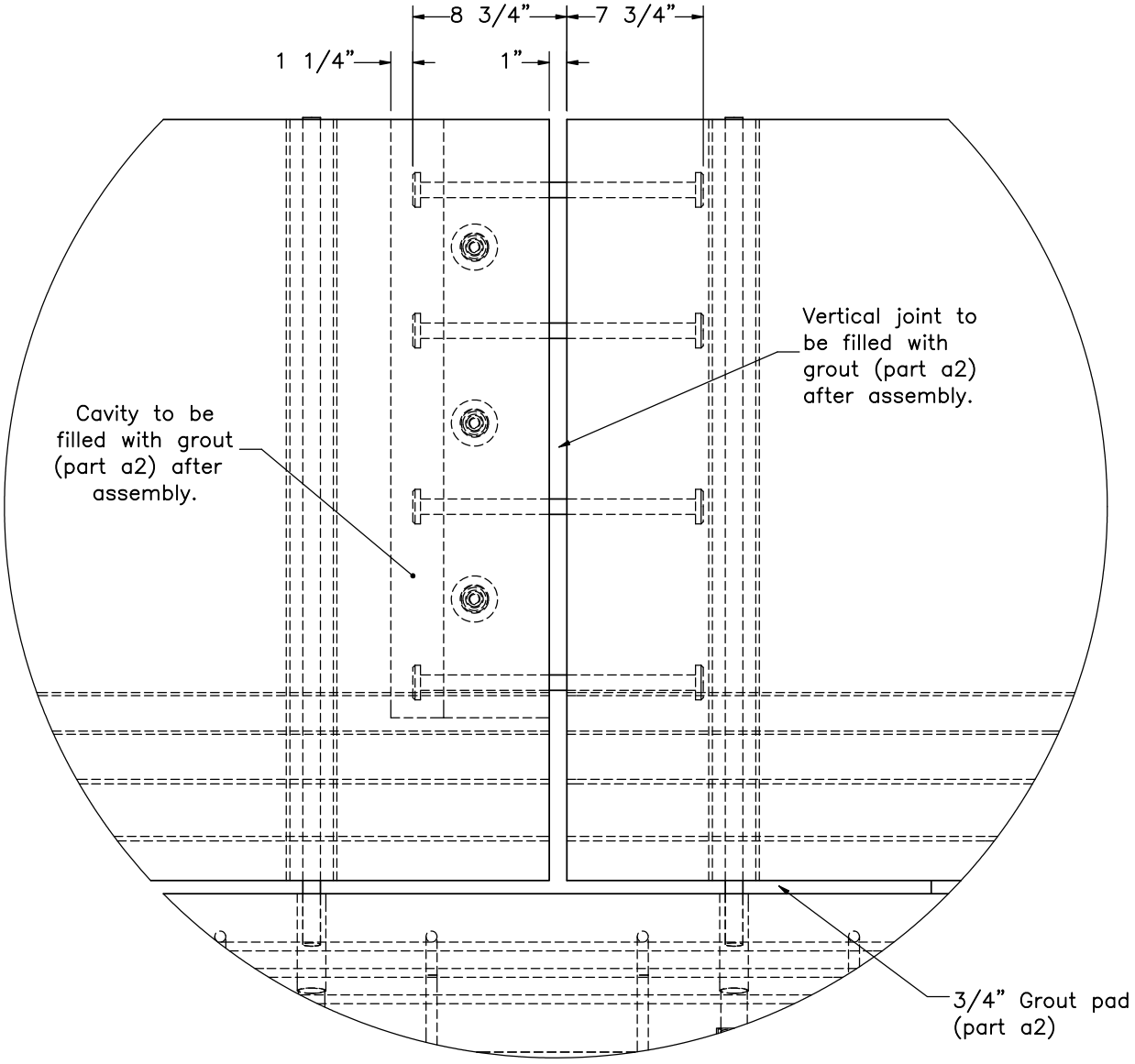
Notes: (1) Reinforcement bar nos. b8, b9, and b11 are driven into soil.
(2) Reinforcement bar no. b7 is anchored into the existing concrete tarmac using a chemical epoxy adhesive (Part d1) with a minimum bond strength of 1,450 psi.
(3) Inclined bar receiver assembly must be plugged during casting of deck.

MwRSF	Iowa Concrete Bridge Deck and Rail Test No. ABCBRM–1	SHEET: 4 of 21
		DATE: 3/18/2024
Midwest Roadside Safety Facility	Concrete Rail, Deck, and Box Beam Assembly	DRAWN BY: GHR/LJP/CJN/SBW/CAO
	DWG. NAME. ABCBRM–1_R20 / SCALE: 1:12 / UNITS: in.	REV. BY: RKF/KAL

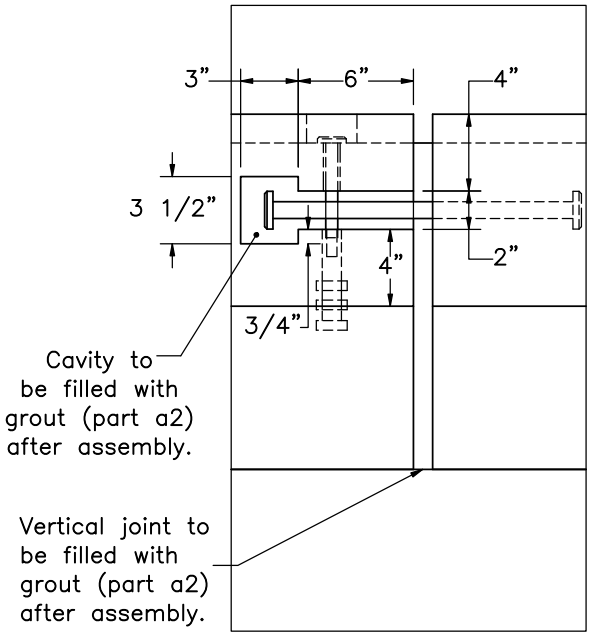


Notes: (1) Inclined rebar (Parts b3 and b12) is ordered long and cut flush with top of the barrier after installation.
(2) The rebar shall be installed using either a pipe wrench or double 1"–8 UNC nuts.

MwRSF	Iowa Concrete Bridge Deck and Rail Test No. ABCBRM–1	SHEET: 5 of 21
		DATE: 3/18/2024
Midwest Roadside Safety Facility	Inclined Rebar Installation Details	DRAWN BY: GHR/LJP/CJN/SBW/CAO
	DWG. NAME. ABCBRM–1_R20 / SCALE: 1:10 / UNITS: in.	REV. BY: RKF/KAL



DETAIL D



DETAIL E

Notes:
(1) Supporting rebar hidden in both detail views for clarity.
(2) Conduit (Parts c9 and c10) hidden in Detail E for clarity.
(3) It may be necessary to shim up concrete barrier segments with two permanent spacers per barrier, then seal the outer gap of grout pad and outer vertical joints, insert the inclined bars, install transverse ties, and place all grout (part a2) for pad, cavities, and joints.
(4) Grout: All connections and interfaces should use a non–shrink grout with sufficient working time (30 min. or greater). The grout should gain at least 4000 psi in 8 hours with a 28 day strength of 8,000 psi.

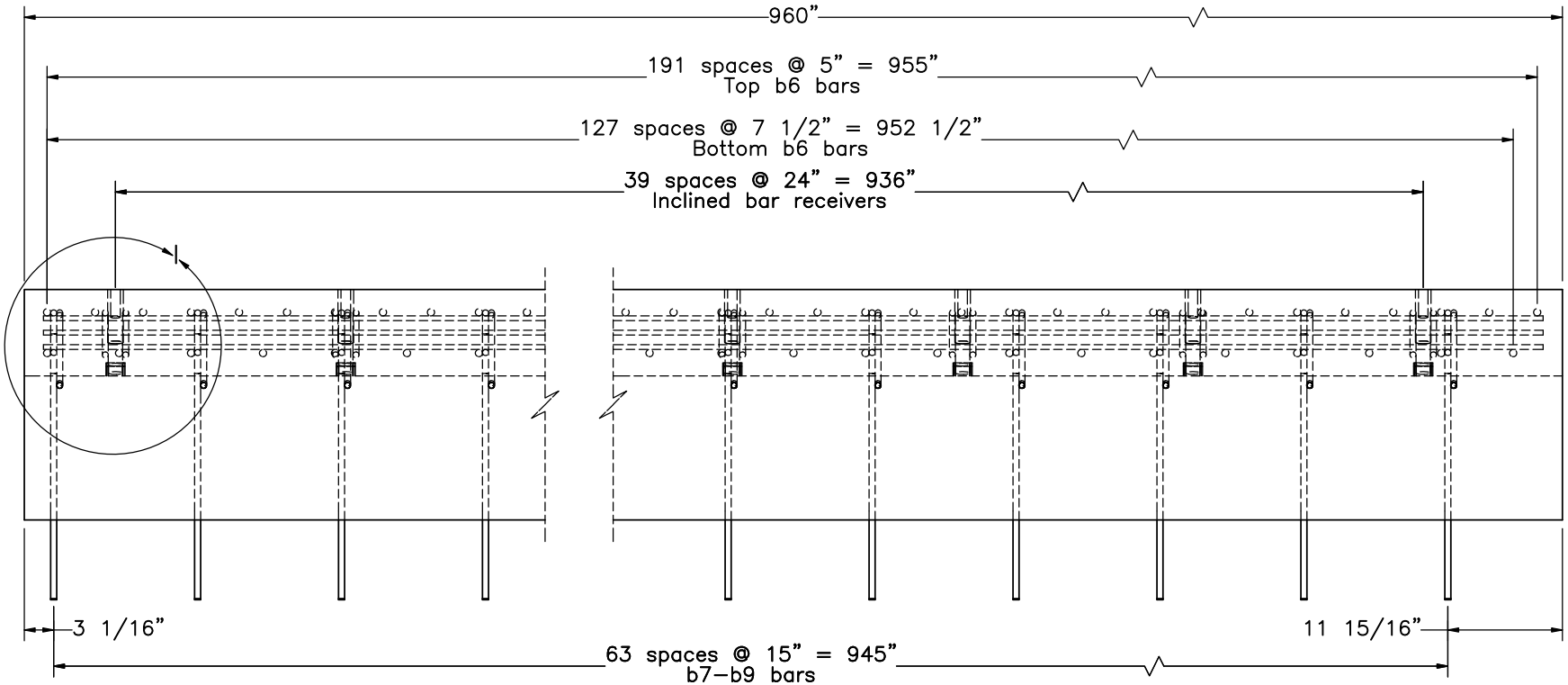
MwRSF

Midwest Roadside Safety Facility

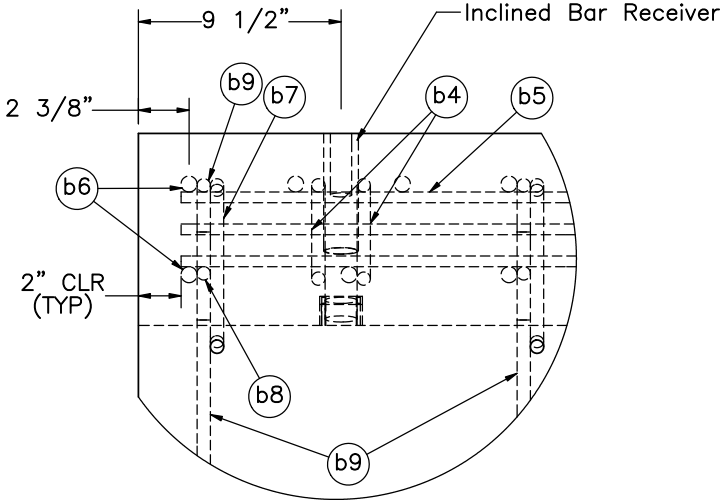
Iowa Concrete Bridge Deck and Rail
Test No. ABCBRM–1

Bridge Rail Connection Details

SHEET: 6 of 21		
DATE: 3/18/2024		
DRAWN BY: GHR/LJP/CJN/SBW/CAO		
DWG. NAME. ABCBRM–1_R20	SCALE: 1:10 UNITS: in.	REV. BY: RKF/KAL



ELEVATION VIEW

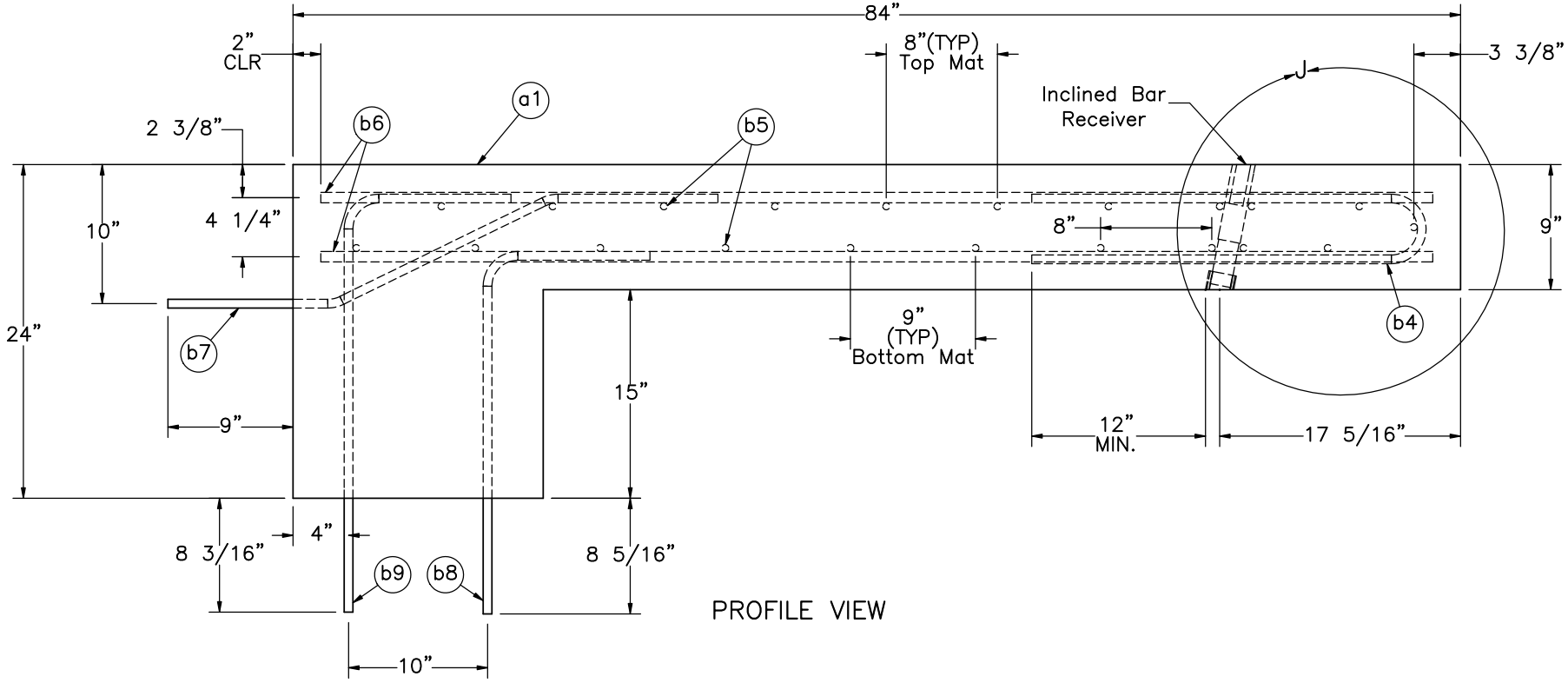


DETAIL I
SCALE 1:9

Notes: (1) Reinforcement bar nos. b7–b9 have a lateral spacing of 15" throughout the entire deck.
(2) Reinforcement bar no. b4 is placed tangent to both sides of the Inclined Bar Receivers throughout the entire deck.
(3) Inclined Bar Receivers must be placed as dimensioned. Reinforcement bar no. b6 may interfere and should be shifted accordingly.

Midwest Roadside Safety Facility	Iowa Concrete Bridge Deck and Rail Test No. ABCBRM–1 Bridge Deck Assembly	SHEET: 7 of 21 DATE: 3/18/2024 DRAWN BY: GHR/LJP/CJN/SBW/CAO
	DWG. NAME. ABCBRM–1_R20 / SCALE: 1:18 / UNITS: in.	REV. BY: RKF/KAL

Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
–	1	Concrete Bridge Deck Assembly	–	–	
a1	–	Concrete	Min. f'c = 4,000 psi	–	–
b4	80	#5 Bent Rebar, 58 5/8" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b5	21	#4 Rebar, 956" Total Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b6	320	#6 Rebar, 80" Total Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b7	64	#5 Bent Rebar, 41 5/16" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b8	64	#5 Bent Rebar, 36 1/2" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b9	64	#5 Bent Rebar, 40 1/2" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
–	40	Inclined Bar Receiver Assembly	–	–	–



PROFILE VIEW

Notes: (1) Reinforcement bar no. b7 is anchored into the existing concrete tarmac using a chemical epoxy adhesive with a minimum bond strength of 1,450 psi (Part d1).
(2) Open end of hairpin rebar (Part b4) must extend a minimum of 12" past inclined bar receivers.
(3) Plug top of Inclined Bar Receivers when casting concrete deck. Remove plugs to later install threaded inclined bars.

MwRSF

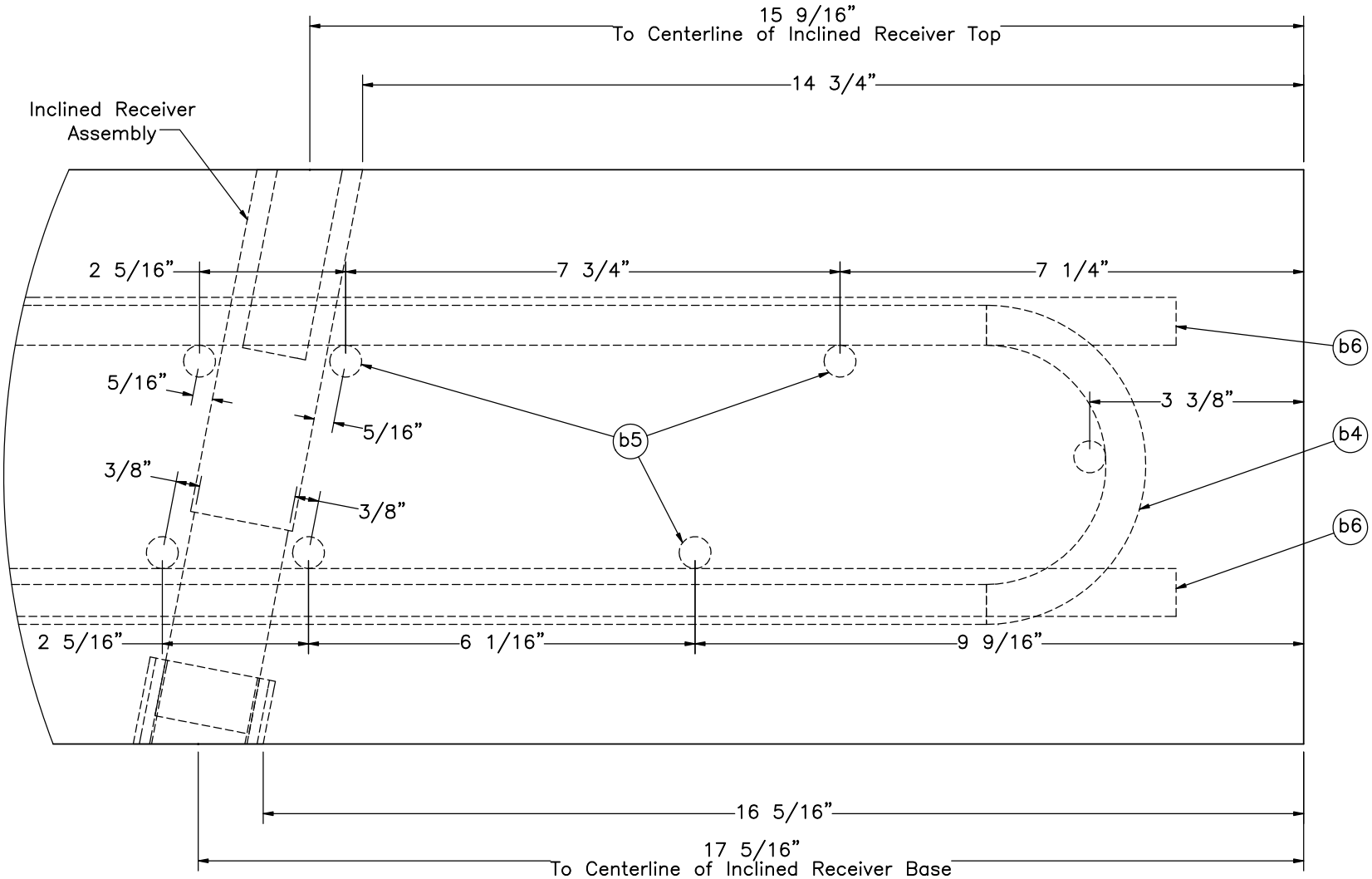
Midwest Roadside Safety Facility

Iowa Concrete Bridge Deck and Rail
Test No. ABCBRM–1

Bridge Deck Assembly

DWG. NAME. ABCBRM–1_R20	SCALE: 1:12 UNITS: in.	REV. BY: RKF/KAL

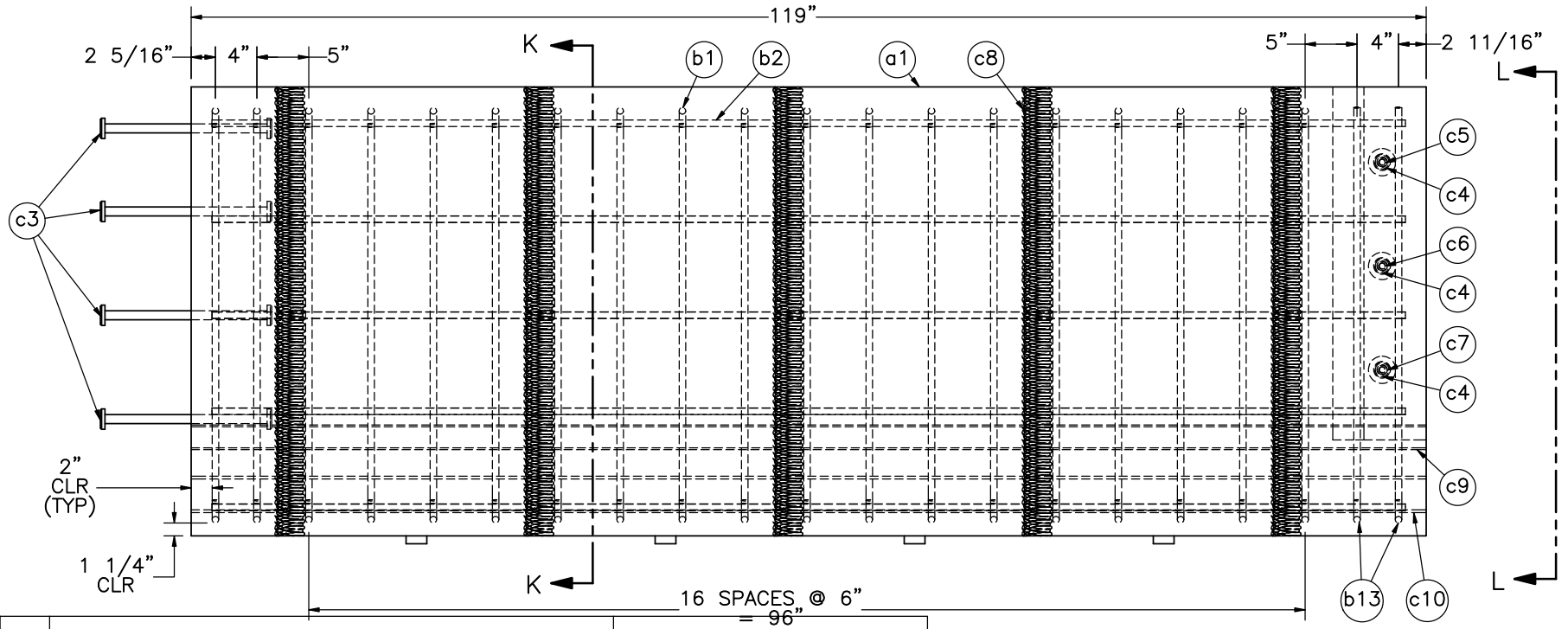
SHEET: 8 of 21
DATE: 3/18/2024
DRAWN BY: GHR/LJP/CJN/SBW/CAO



DETAIL J

Notes: (1) Plug top of Inclined Bar Receivers when casting concrete deck. Remove plugs to later install threaded inclined bars.

Midwest Roadside Safety Facility	Iowa Concrete Bridge Deck and Rail Test No. ABCBRM-1 Bridge Deck Details	SHEET: 9 of 21 DATE: 3/18/2024 DRAWN BY: GHR/LJP/CJN/SBW/CAO
DWG. NAME. ABCBRM-1_R20	SCALE: 2:5 UNITS: in.	REV. BY: RKF/KAL



ELEVATION VIEW

Item No.	QTY.	Description	Material Specification
–	13	Bridge Rail Assembly	–
a1	–	Concrete	Min. f'c = 4,000 psi (SEE NOTE 1)
b1	19	#5 Bent Rebar, 108" Total Unbent Length	ASTM A615 Gr. 60
b2	10	#5 Rebar, 115" Total Length	ASTM A615 Gr. 60
b13	2	#5 Bent Rebar, 92" Total Unbent Length	ASTM A615 Gr. 60
c3	4	7/8" Dia., 16 1/2" Long, Double–Headed Shear Tie, HRC 555 T–Head Both Ends	ASTM A970 & ASTM A706 Grade X
c4	3	5/8" Dia., 5 1/4" Long, 5/8"–11 UNC Male Transverse Tie, HRC 555 Series T–Head – One End, HRC 300M – One End	ASTM A970 & ASTM A706 Grade X
c5	1	5/8"–11 UNC Internally Threaded Transverse Receiving Tie, 1" Dia., 3 3/16" Long, Special #5 Head – One End, HRC 320 – One End	ASTM A706 and ASTM A615 Grade X
c6	1	5/8"–11 UNC Internally Threaded Transverse Receiving Tie, 1" Dia., 4 3/16" Long, Special #5 Head – One End, HRC 320 – One End	ASTM A706 and ASTM A615 Grade X
c7	1	5/8"–11 UNC Internally Threaded Transverse Receiving Tie, 1" Dia., 5 1/4" Long, Special #5 Headed – One End, HRC 320 – One End	ASTM A706 and ASTM A615 Grade X
c8	5	2 1/2" I.D., 2 5/8" O.D., 26–gauge 44 5/8" Long Corrugated Inclined Pipe or Post–Tensioning Pipe	ASTM A53 Corr. Pipe
c9	1	2" Dia. Conduit, 119" Long (4)	ASTM D3350, Min. SDR 13.5
c10	1	3" Dia. Conduit, 119" Long (5)	ASTM D3350, Min. SDR 13.5
d1	4	Steel Shim	–

Notes: (1) The two stirrups (part b13) on the downstream end shall be cut at the top to facilitate the use of the receiving slot.
(2) The farthest upstream bridge rail does not require Double–Headed Shear Ties (part c3).
(3) Clear cover shall be 2" minimum, except on the bottom of the barrier, where it shall be 1 1/4".
(4) I.D. = 2.002", O.D. = 2.375", Minimum Wall = 0.176".
(5) I.D. = 2.951", O.D. = 3.5", Minimum Wall = 0.259".
(6) When casting concrete barriers, a dowel shall be inserted into part no. c8 to prevent bending of material.

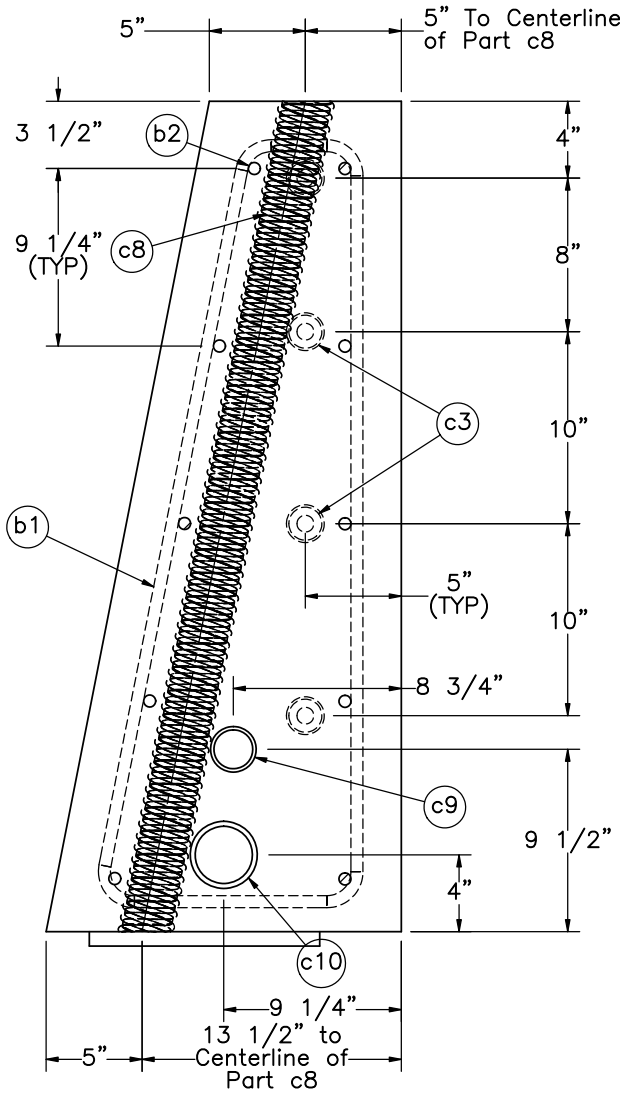
MwRSF

Midwest Roadside Safety Facility

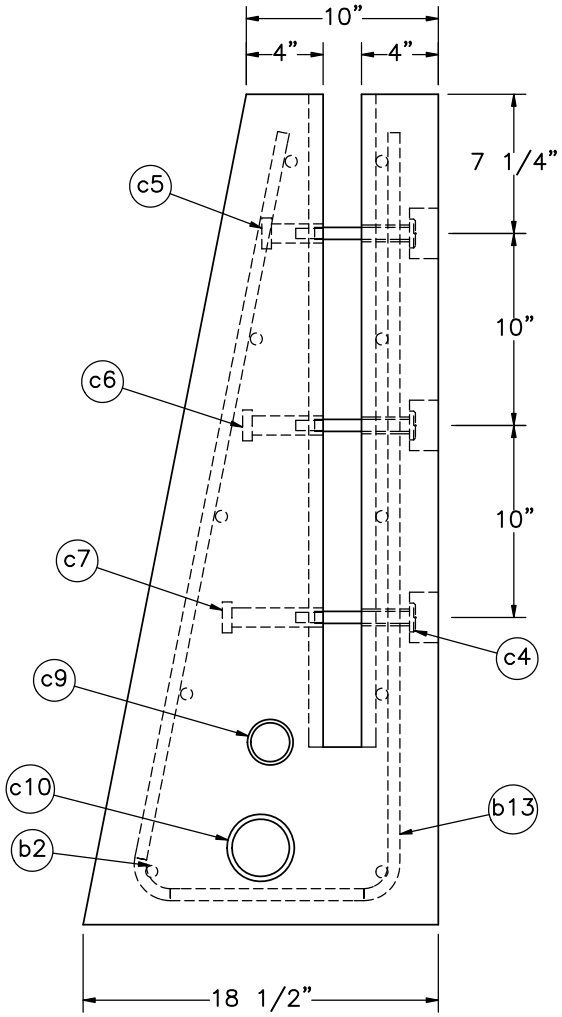
Iowa Concrete Bridge Deck and Rail
Test No. ABCBRM–1

Bridge Rail Segment Assembly

SHEET: 10 of 21
DATE: 3/18/2024
DRAWN BY: GHR/LJP/CJN/SBW/CAO
DWG. NAME. ABCBRM–1_R20
SCALE: 1:16
UNITS: in.
REV. BY: RKF/KAL



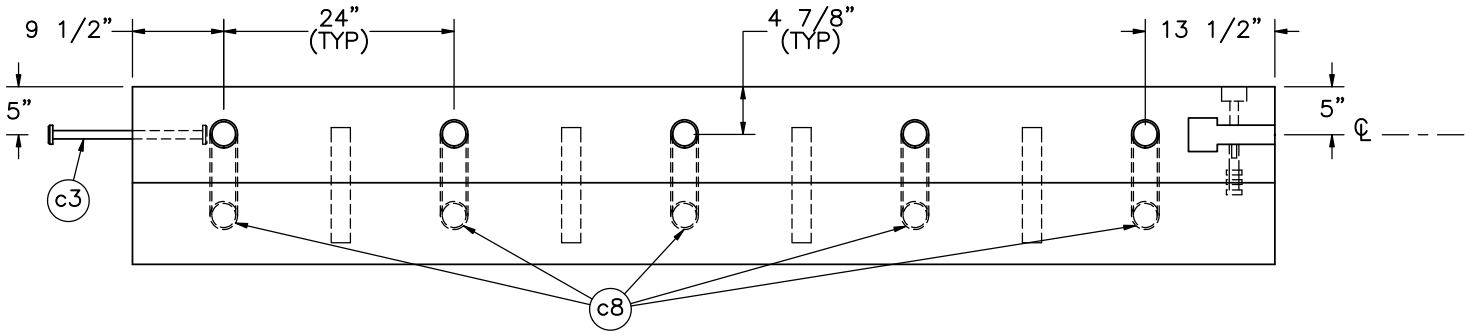
SECTION K–K



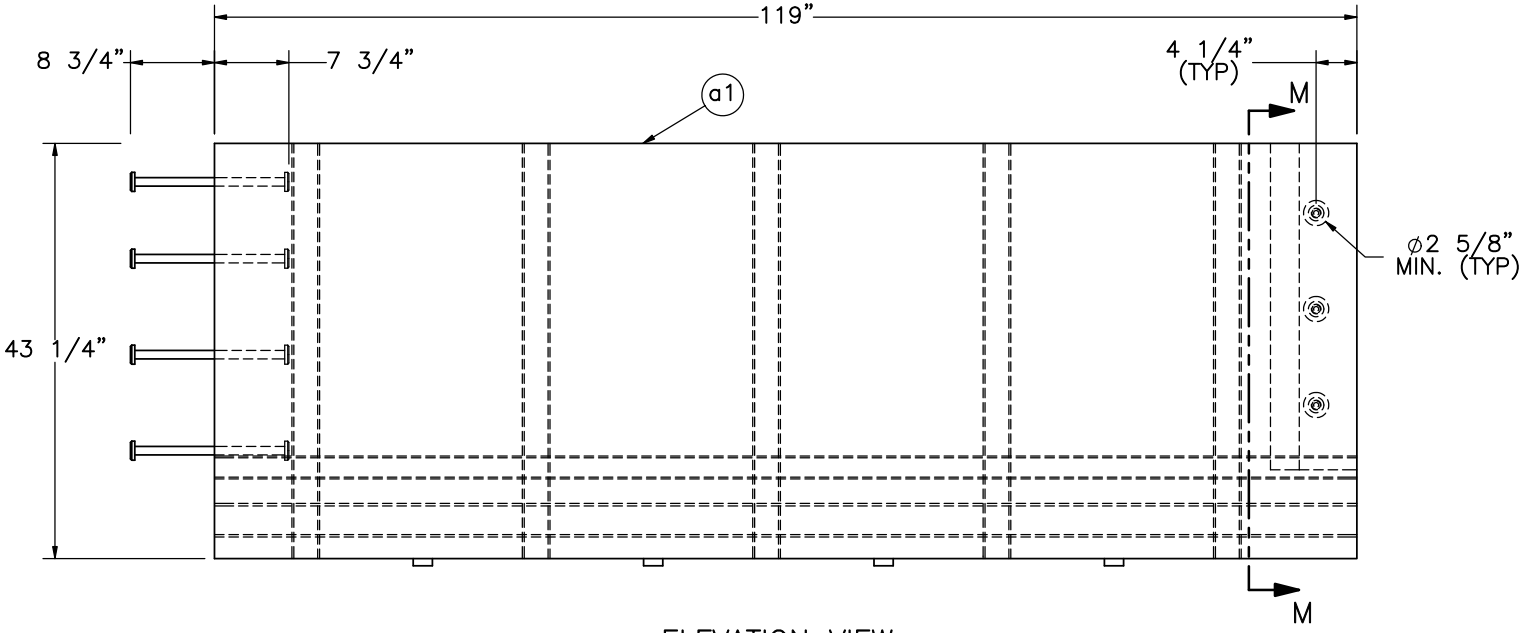
SECTION L–L

Note: (1) Part c8 and angled hole hidden in Section J–J for clarity.
(2) Parts c9 and c10 should be flush with part c8 at annotated height.

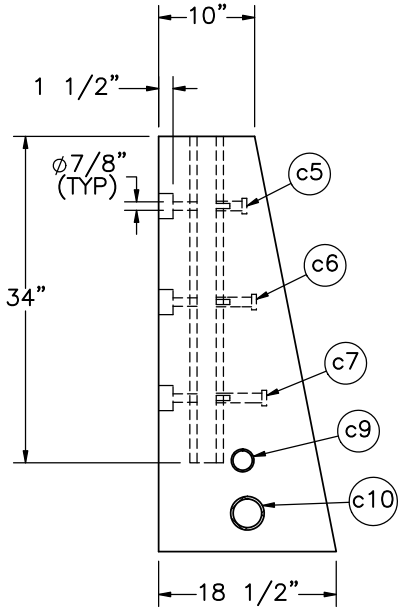
Midwest Roadside Safety Facility	Iowa Concrete Bridge Deck and Rail Test No. ABCBRM–1 Bridge Rail Details	SHEET: 11 of 21 DATE: 3/18/2024 DRAWN BY: GHR/LJP/CJN/SBW/CAO
DWG. NAME. ABCBRM–1_R20	SCALE: 1:10 UNITS: in.	REV. BY: RKF/KAL



PLAN VIEW



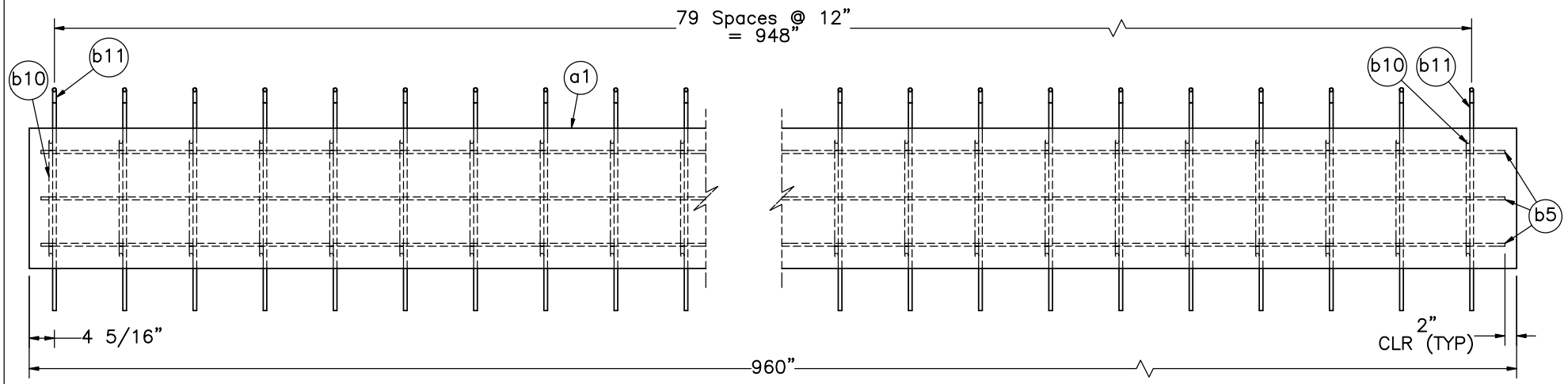
ELEVATION VIEW



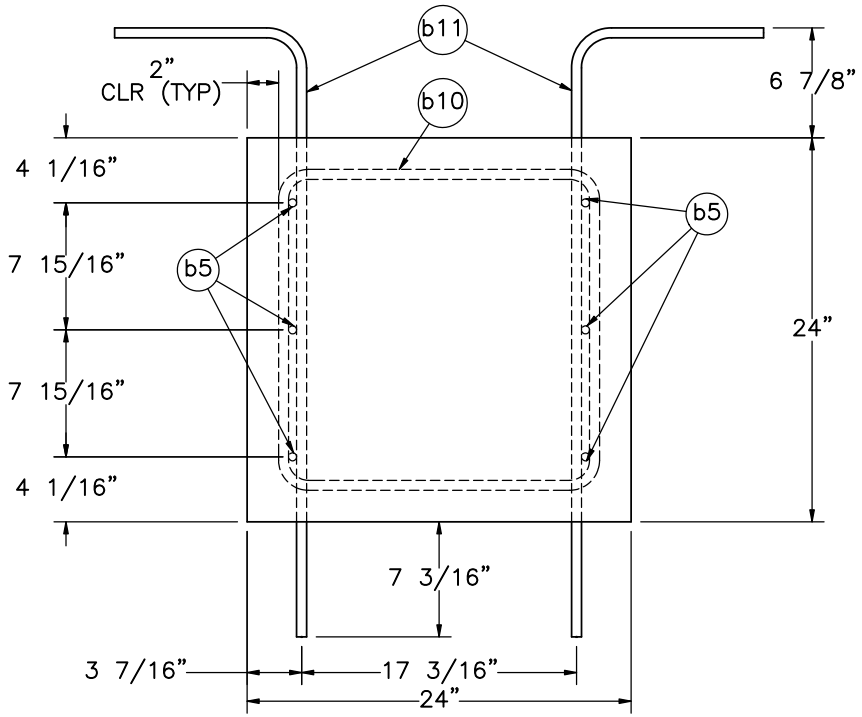
SECTION M–M

Notes: (1) Transverse receiving ties (parts c5–c7) shall be placed flush with slot cut–out when forming the barrier.
(2) Rebar hidden in views for clarity.
(3) Parts c9 and c10 hidden in plan view for clarity.

MwRSF	Iowa Concrete Bridge Deck and Rail Test No. ABCBRM–1	SHEET: 12 of 21
		DATE: 3/18/2024
	Bridge Rail Details	DRAWN BY: GHR/LJP/CJN/SBW/CAO
Midwest Roadside Safety Facility	DWG. NAME. ABCBRM–1_R20 / SCALE: 1:20 / UNITS: in.	REV. BY: RKF/KAL



ELEVATION VIEW



PROFILE VIEW
SCALE 1:12

Item No.	QTY.	Description	Material Specification	Treatment Specification
–	1	Concrete Grade Beam Assembly	–	–
a1	–	Concrete	Min. f'c = 4,000 psi	–
b5	6	#4 Rebar, 956" Total Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)
b10	80	#5 Bent Rebar, 87 1/16" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)
b11	160	#5 Bent Rebar, 48 1/2" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)

MwRSF

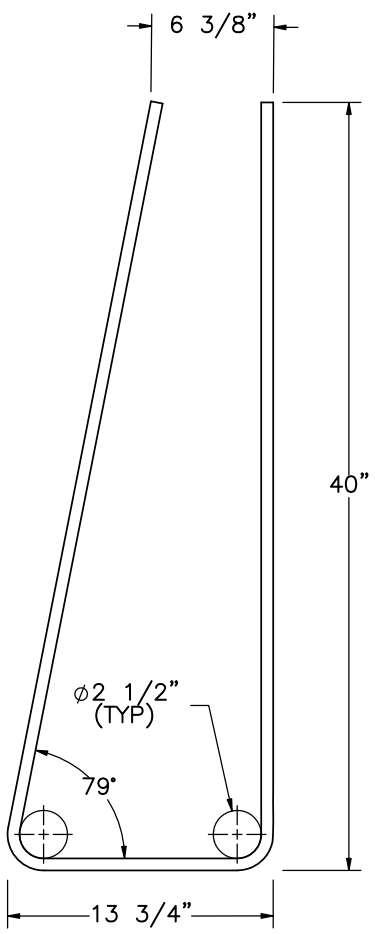
Midwest Roadside Safety Facility

Iowa Concrete Bridge Deck and Rail
Test No. ABCBRM-1

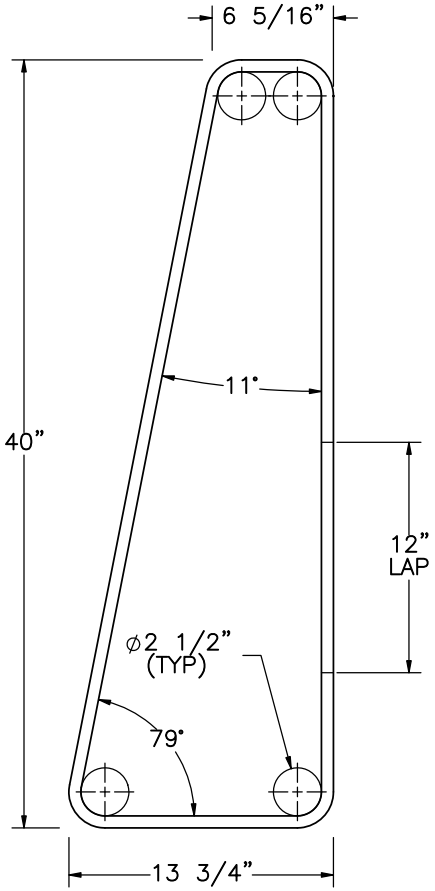
Concrete Grade Beam Assembly

SHEET: 13 of 21
DATE: 3/18/2024
DRAWN BY: GHR/LJP/CJN/SBW/CAO
REV. BY: RKF/KAL

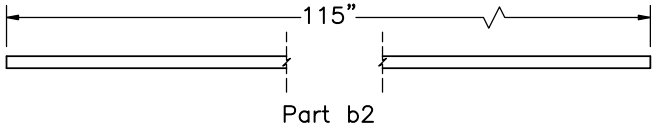
DWG. NAME. ABCBRM-1_R20
SCALE: 1:26
UNITS: in.



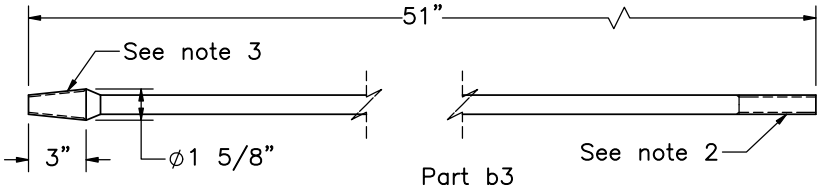
Part b13



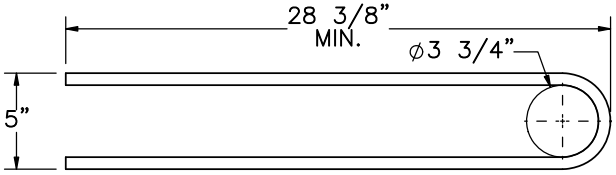
Part b1



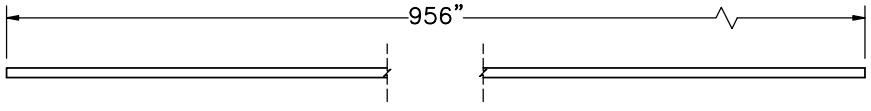
Part b2



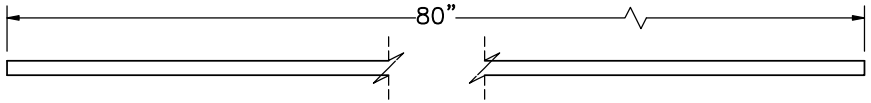
Part b3



Part b4



Part b5



Part b6

Notes: (1) Part b3 is cut at the barrier top after installation.
(2) If double nuts are used to help install and turn Part b3, top end shall be threaded with 1"–8 UNC x3".
(3) Part 3 shall have a threaded end that conforms to HRC 410 end splice specifications.

Bill of Bars					
Bar	QTY	Size	Total Length	Min. Lap Length	Material
b1	273	#5	108"	12"	ASTM A615 Gr. 60
b2	130	#5	115"	24"	ASTM A615 Gr. 60
b3	65	#8	51"	–	ASTM A615 Gr. 80
b4	80	#5	58 5/8"	–	ASTM A615 Gr. 60
b5	27	#4	956"	24"	ASTM A615 Gr. 60
b6	320	#6	80"	29"	ASTM A615 Gr. 60
b13	26	#5	92"	–	ASTM A615 Gr. 60

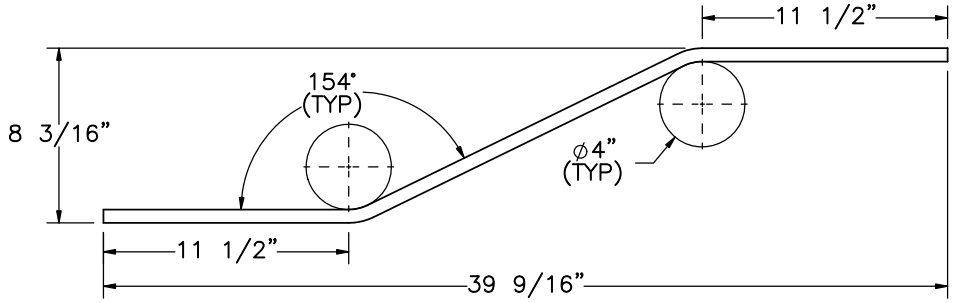
MwRSF

Midwest Roadside Safety Facility

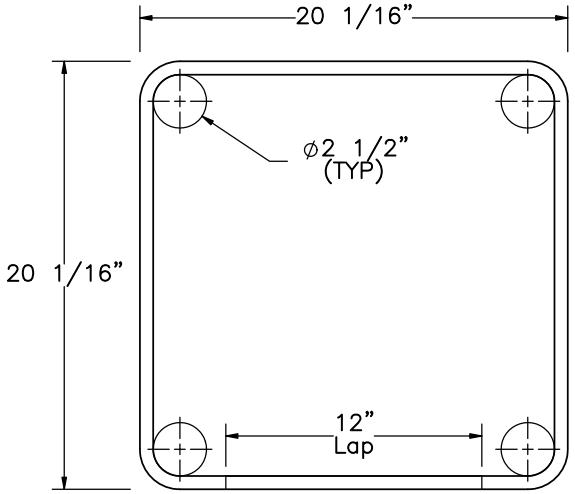
Iowa Concrete Bridge Deck and Rail
Test No. ABCBRM–1

System Rebar

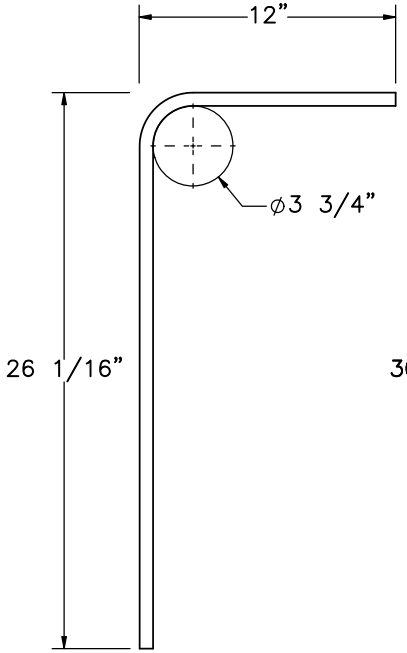
DWG. NAME. ABCBRM–1_R20	SCALE: 1:10	SHEET: 14 of 21	
	UNITS: in.	DATE: 3/18/2024	
		DRAWN BY: GHR/LJP/CJN/SBW/CAO	
		REV. BY: RKF/KAL	



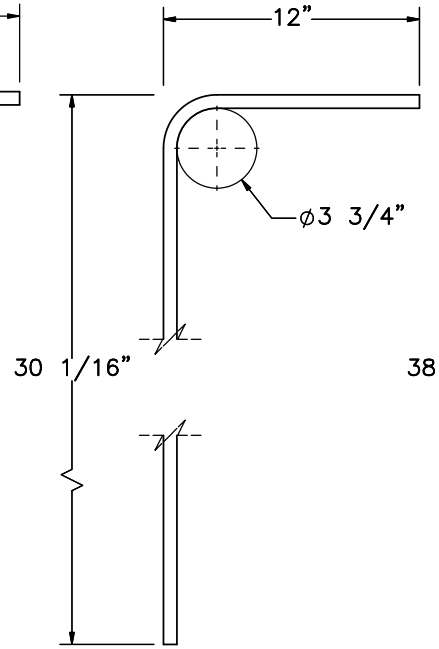
Part b7



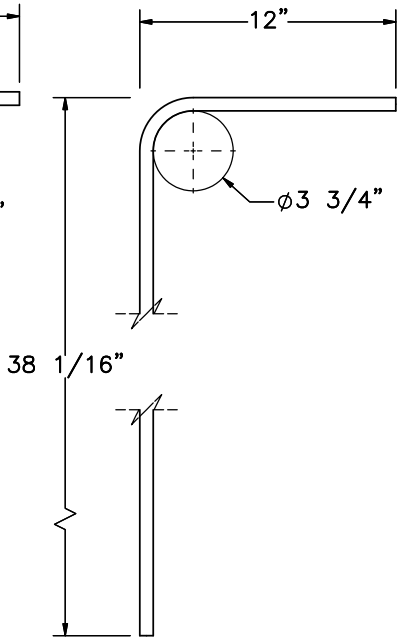
Part b10



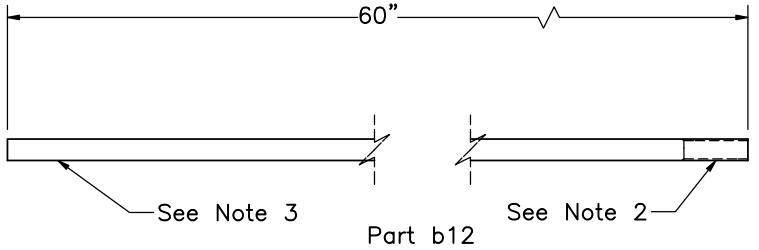
Part b8



Part b9



Part b11



Part b12

Notes: (1) Part b12 is cut at the barrier top after installation.
(2) If double nuts are used to help install and turn Part b12, one end shall be threaded with 1–8" UNC threads.
(3) End installed into drilled/cored hole placed within concrete tarmac.

Bill of Bars

Bar	QTY	Size	Total Length	Min. Lap Length	Material
b7	64	#5	41 5/16"	–	ASTM A615 Gr. 60
b8	64	#5	36 1/2"	–	ASTM A615 Gr. 60
b9	64	#5	40 1/2"	–	ASTM A615 Gr. 60
b10	80	#5	87 1/16"	12"	ASTM A615 Gr. 60
b11	160	#5	48 1/2"	–	ASTM A615 Gr. 60
b12	20	#8	60"	–	ASTM A615 Gr. 80

MwRSF

Midwest Roadside Safety Facility

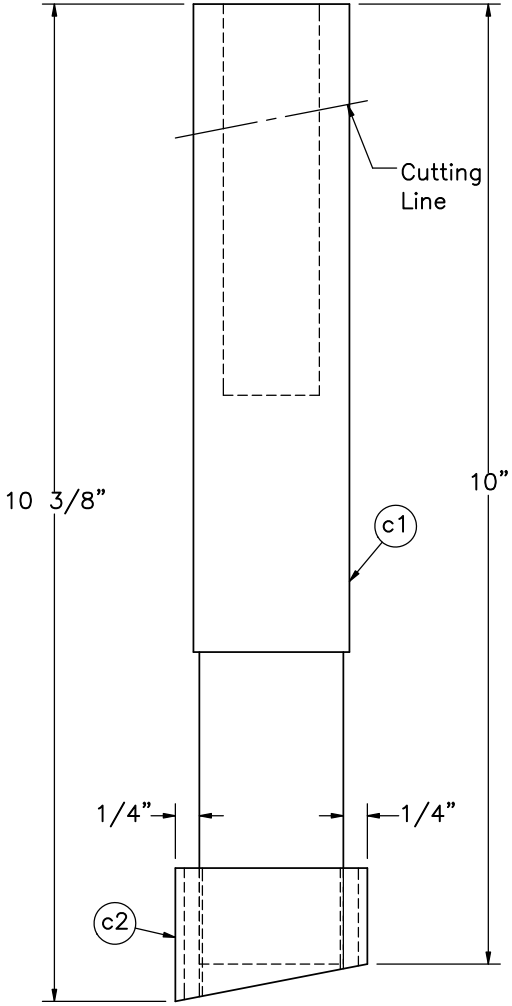
Iowa Concrete Bridge Deck and Rail
Test No. ABCBRM–1

System Rebar

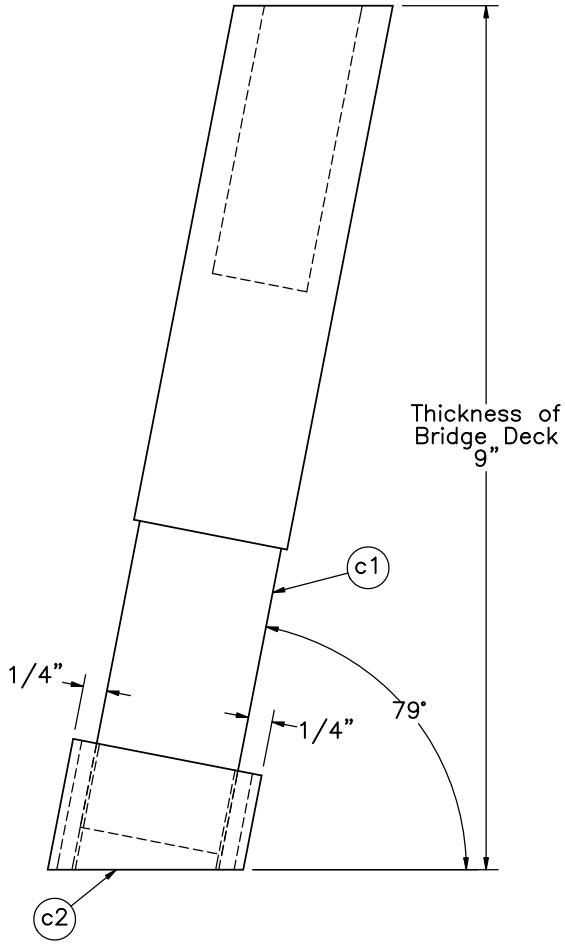
DWG. NAME. ABCBRM–1_R20

SCALE: 1:9
UNITS: in.

SHEET: 15 of 21
DATE: 3/18/2024
DRAWN BY: GHR/LJP/CJN/SBW/CAO
REV. BY: RKF/KAL



PROFILE VIEW
(Pre–Installation)



PROFILE VIEW
(Post–Installation)

Notes: (1) Plans are preliminary and subject to change.
(2) Fabrication details to connect c1 to c2 are to be determined by the manufacturer of the specialty hardware.
(3) Assembly will be cut after installation to be flush with the top of the bridge deck.

Item No.	QTY.	Description	Material Specification	Treatment Specification
–	40	Inclined Bar Receiver Assembly	–	–
c1	1	1 5/8" Dia., 9 1/16" Long, 1"–8 UNC x 2" Internally Threaded Tube	Stainless Steel – (TBD)	–
c2	1	Inclined Bar Receiver Assembly	Stainless Steel – (TBD)	–

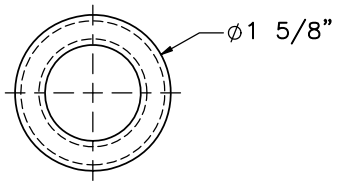
Midwest Roadside Safety Facility

Iowa Concrete Bridge Deck and Rail
Test No. ABCBRM–1

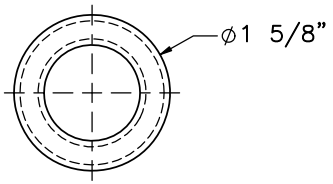
Inclined Bar Receiver Assembly and Components

DWG. NAME. ABCBRM–1_R20
SCALE: 1:2
UNITS: in.

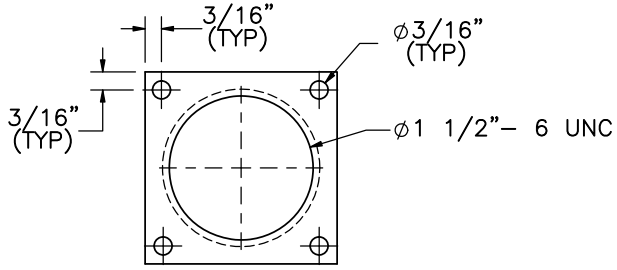
SHEET: 16 of 21
DATE: 3/18/2024
DRAWN BY: GHR/LJP/CJN/SBW/CAO
REV. BY: RKF/KAL



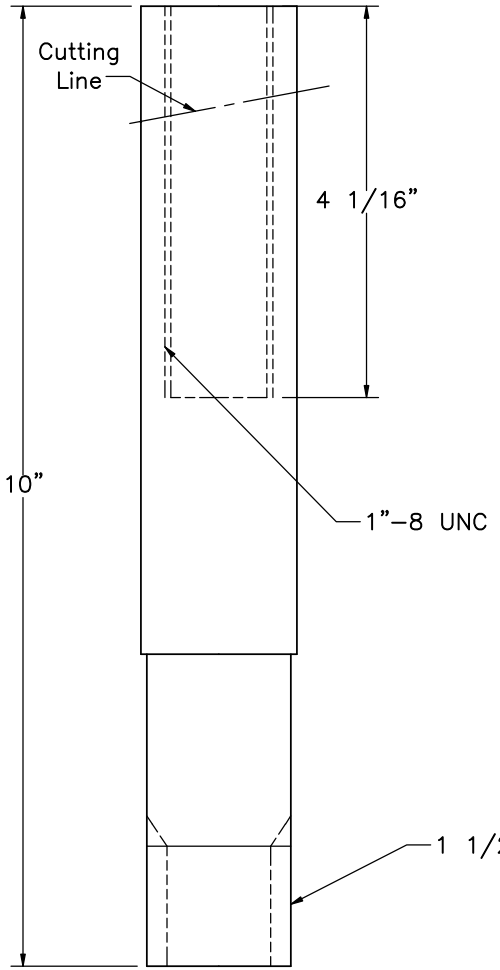
PLAN VIEW



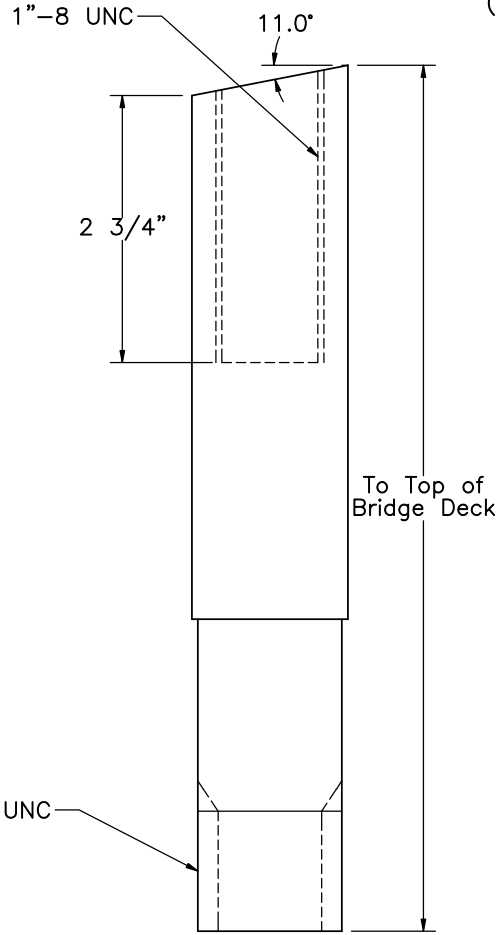
PLAN VIEW



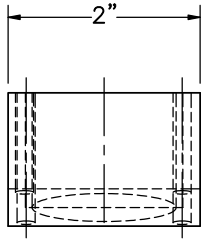
PLAN VIEW



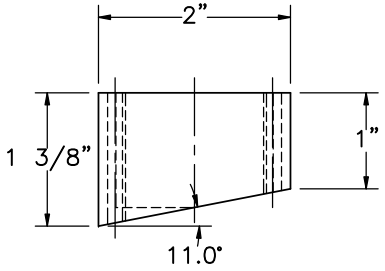
PROFILE VIEW
(Pre–Installation)



PROFILE VIEW
(Post–Installation)



ELEVATION VIEW



PROFILE VIEW

Part c2

Part c1

Notes: (1) Parts are preliminary and subject to change.
(2) After installation the top of part c1 will be cut flush with the top of the bridge rail.

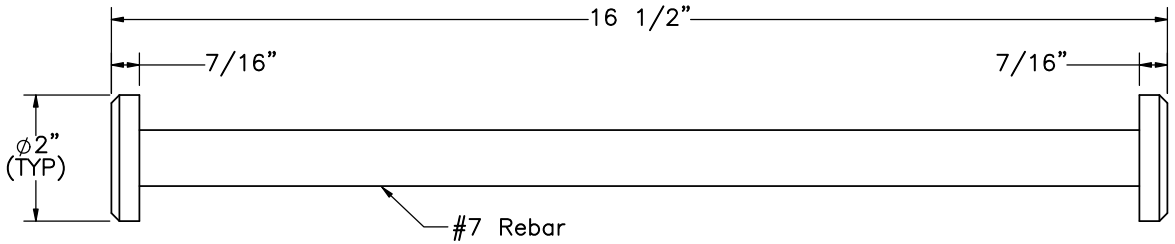
Midwest Roadside Safety Facility

Iowa Concrete Bridge Deck and Rail
Test No. ABCBRM–1

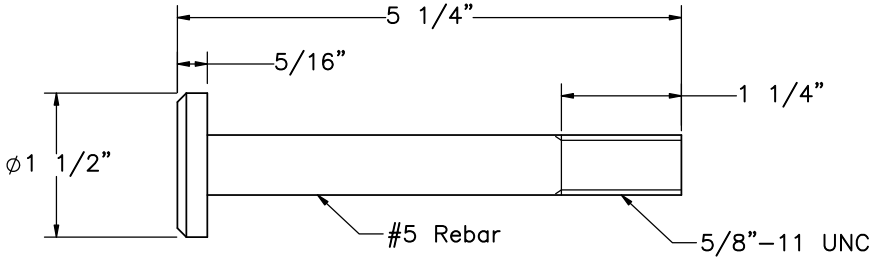
Inclined Bar Slicer Component Details

DWG. NAME. ABCBRM–1_R20	SCALE: 1:2 UNITS: in.	REV. BY: RKF/KAL

SHEET: 17 of 21
DATE: 3/18/2024
DRAWN BY: GHR/LJP/CJN/SBW/CAO

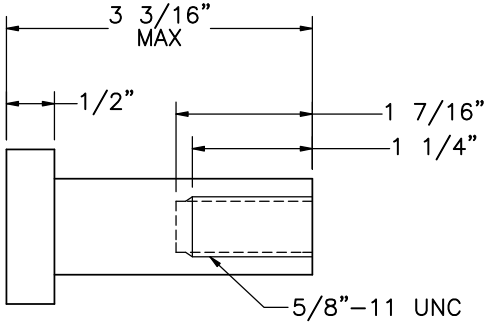


Part c3
SCALE 1:3

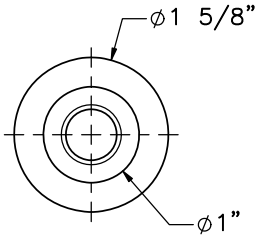


Part c4

Midwest Roadside Safety Facility	Iowa Concrete Bridge Deck and Rail Test No. ABCBRM–1 Double–headed Shear Tie and Transverse Tie Details	SHEET: 18 of 21 DATE: 3/18/2024 DRAWN BY: GHR/LJP/CJN/SBW/CAO
	DWG. NAME. ABCBRM–1_R20 / SCALE: 1:2 / UNITS: in.	REV. BY: RKF/KAL

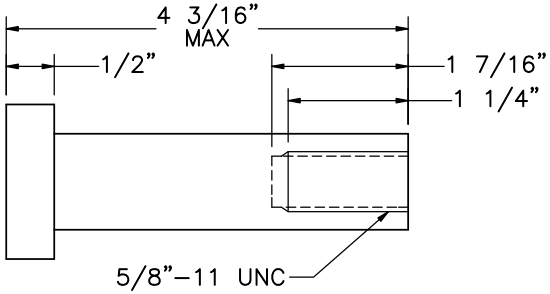


ELEVATION VIEW

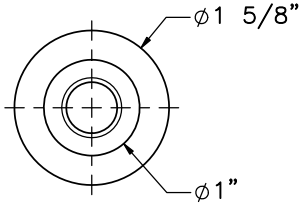


PROFILE VIEW

Part c5

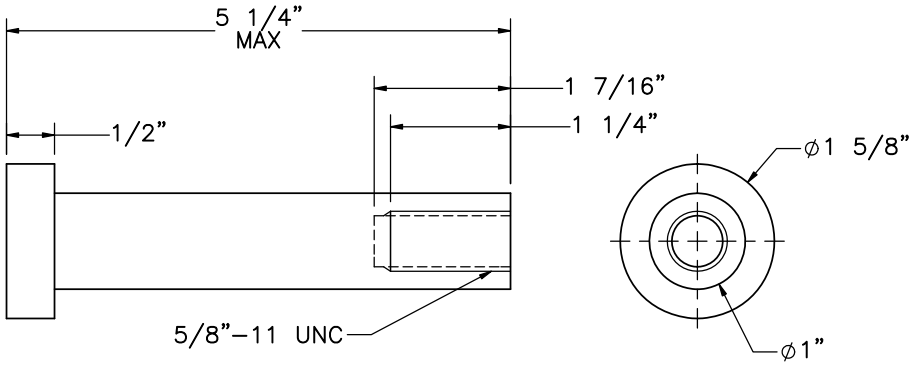


ELEVATION VIEW



PROFILE VIEW

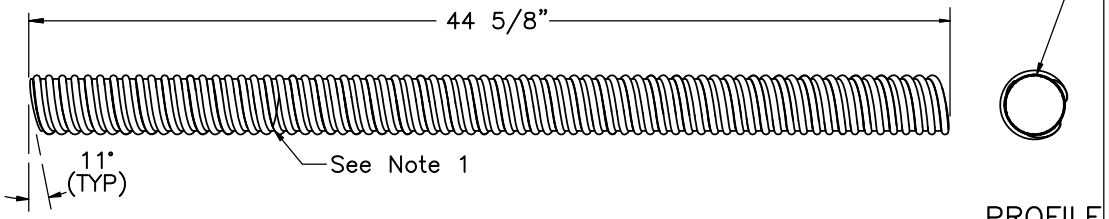
Part c6



ELEVATION VIEW

PROFILE VIEW

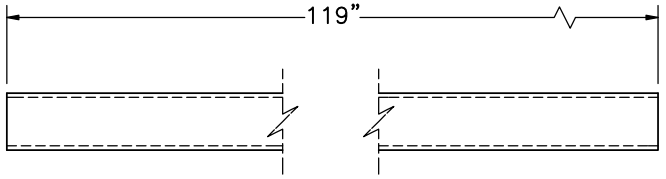
Part c7



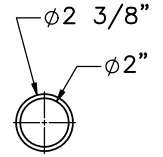
ELEVATION VIEW

PROFILE VIEW

Part c8
SCALE 1:8

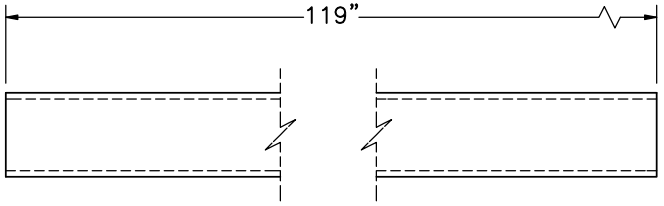


ELEVATION VIEW

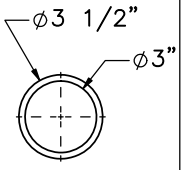


PROFILE VIEW

Part c9
SCALE 1:8



ELEVATION VIEW



PROFILE VIEW

Part c10
SCALE 1:8

Notes: (1) When casting concrete barriers, a dowl shall be inserted into part no. c8 to prevent bending of material.

Midwest Roadside Safety Facility

Iowa Concrete Bridge Deck and Rail
Test No. ABCBRM–1

Bridge Rail Hardware

DWG. NAME. ABCBRM–1_R20	SCALE: 1:2 UNITS: in.	REV. BY: RKF/KAL

SHEET: 19 of 21
DATE: 3/18/2024
DRAWN BY: GHR/LJP/CJN/SBW/CAO

Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
a1	–	Concrete	Min. f'c = 4,000 psi (SEE NOTE 1)	–	–
a2	–	Grout	Min. 8–hour f'c = 4,000 psi; Min. 28–day f'c = 8,000 psi (SEE NOTE 2)	–	–
b1	247	#5 Bent Rebar, 108" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b2	130	#5 Rebar, 115" Total Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b3	40	#8 Rebar with 1"–8 UNC x 3" section, 51" Long, HRC – one end, threaded – one end (SEE NOTE 3)	ASTM A615 Gr. 80	–	–
b4	80	#5 Bent Rebar, 58 5/8" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b5	27	#4 Rebar, 956" Total Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b6	320	#6 Rebar, 80" Total Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b7	64	#5 Bent Rebar, 41 5/16" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b8	64	#5 Bent Rebar, 36 1/2" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b9	64	#5 Bent Rebar, 40 1/2" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b10	80	#5 Bent Rebar, 87 1/16" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b11	160	#5 Bent Rebar, 48 1/2" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
b12	25	#8 Rebar with 1"–8 UNC x 12" section, 60" Long, threaded – one end (SEE NOTE 3)	ASTM A615 Gr. 80	–	–
b13	26	#5 Bent Rebar, 92" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–

Notes:
(1) NE 47BD/1PF4000 concrete mix was used for testing purposes, but any concrete mix that meets the f'c can be used.
(2) Grout: All connections and interfaces should use a non–shrink grout with sufficient working time (30 min. or greater). The grout should gain at least 4000 psi in 8 hours with a 28 day strength of 8,000 psi.
(3) If double nuts are used to install parts b3 and b12 the top end of both shall be threaded with 1–8" UNC threads.

Midwest Roadside Safety Facility

Iowa Concrete Bridge Deck and Rail Test No. ABCBRM–1

Bill of Materials

SHEET: 20 of 21
DATE: 3/18/2024
DRAWN BY: GHR/LJP/CJN/SBW/CAO
REV. BY: RKF/KAL
DWG. NAME. ABCBRM–1_R20
SCALE: None
UNITS: in.

Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
c1	40	1 5/8" Dia., 9 1/16" Long, 1"–8 UNC x 2" Internally Threaded Tube	Stainless Steel – (TBD)	–	–
c2	40	2"x2"x1 3/8" Base Plate	Stainless Steel – (TBD)	–	–
c3	48	7/8" Dia., 16 1/2" Long, Double–Headed Shear Tie, HRC 555 T–Head Both Ends	ASTM A970 & ASTM A706 Grade X	(TBD)	–
c4	39	5/8" Dia., 5 1/4" Long, 5/8"–11 UNC Male Transverse Tie, HRC 555 Series T–Head – One End, HRC 300M – One End	ASTM A970 & ASTM A706 Grade X	(TBD)	–
c5	13	5/8"–11 UNC Internally Threaded Transverse Receiving Tie, 1" Dia., 3 3/16" Long, Special #5 Head – One End, HRC 320 – One End	ASTM A706 and ASTM A615 Grade X	–	–
c6	13	5/8"–11 UNC Internally Threaded Transverse Receiving Tie, 1" Dia., 4 3/16" Long, Special #5 Head – One End, HRC 320 – One End	ASTM A706 and ASTM A615 Grade X	–	–
c7	13	5/8"–11 UNC Internally Threaded Transverse Receiving Tie, 1" Dia., 5 1/4" Long, Special #5 Headed – One End, HRC 320 – One End	ASTM A706 and ASTM A615 Grade X	–	–
c8	65	2 1/2" ID, 44 5/8" Long Corrugated Inclined Pipe	ASTM A53 Corr. Pipe	–	–
c9	13	2" Dia. Conduit, 119" Long	ASTM D3350, Min. SDR 13.5	–	–
c10	13	3" Dia. Conduit, 119" Long	ASTM D3350, Min. SDR 13.5	–	–
–	2**	1"–8 UNC Heavy Hex Nut	ASTM A563A or equivalent	ASTM A153	FNX24b

Note: ** Hex nuts not required if inclined rebar is tightened using a pipe wrench.

Midwest Roadside Safety Facility

Iowa Concrete Bridge Deck and Rail Test No. ABCBRM–1

Bill of Materials, Cont.

SHEET: 21 of 21

DATE: 3/18/2024

DRAWN BY: GHR/LJP/CJN/SBW/CAO

DWG. NAME. ABCBRM–1_R20

SCALE: None

UNITS: in.

REV. BY: RKF/KAL

System: ISU ABC Bridge Rail

Drawing: ABCBRM−1

Revision History

REV.	DATE OF ISSUE	PAGE	NATURE OF CHANGES	REVIEWER	REVISED BY
0	3/1/2021	–	Created from ABCBR−1 using the inclined bar spacing from ABCBR−2.	–	GHR
1	3/24/2021	–	Drawing name changed to ABCBRM−1.	RKF	LJP
		1	Edited notes 1 and 2. Re−labeled views to be in order.		
		2	Edited labels.		
		3	Edited labels. Edited note 3. Showed inclined bar in section A.		
		4	Added hatching to grout pad. Edited note 2. Added note 3.		
		5	Moved this sheet up since it shows detail views from sheet 1.		
		6	Edited spacing dimensions.		
		7	Edited note 1.		
		8	Made assembly BOM smaller. Deleted plan view. Increased scale of elevation view. Moved and flipped direction of section J. Fixed typo in note 2.		
		9	Flipped section J for consistency with section I.		
		10	Fixed typo in note 1. Added dimension.		
		11	Showed b3 bars.		
		14	Rotated view of assembly to show actual orientation and added part labels.		
		BOM	Matl: b3 and b12		
2	3/26/2021	7	Removed NE mix from BOM	KAL	CJN
		11	Removed NE mix from BOM		
		BOM	Added note stating what NE mix was used during testing.		
3	4/29/2021	1	Added Ground Line to Elevation View	RKF	GHR
		3,4,7	Added Part # (d1) to epoxy notes.		
		9	Added Balloon for Part c8 to Section I−I		
		15	Added thread size to Part c4.		
		BOM	Split BOM into 2 pages. Added Parts b1, b5, b6, b13, c4 back to BOM. Added thread sizes to threaded rebar and reciever descriptions.		
		2	Edited grout pad note.		

System: ISU ABC Bridge Rail
Drawing: ABCBRM–1

Revision History

4	5/12/2021	3	Edited grout pad note, added hole details to section B, edited hole details in detail G, added note 4, edited note 2, hid part c8 for clarity.	RKF	SBW
		4	Added additional detail view to show inclined bar receiver assembly, fixed sheet scale.		
		5	Added note to details D and E on vertical join grout fill, added note 3 on concrete shims, removed line between barriers for clarity.		
		7	Added dimensions to inclined bar receiver, fixed sheet scale.		
5	5/13/2021	1	Changed impact loaction to 30" DS of joint centerline. Edited note 2.	RKF	LJP
		3	Edited note 4. Edited grout dimension in detail G.		
		4	Edited notes 1 and 2.		
		5	Edited note 3.		
		6	Edited notes 2 and 3.		
		7	Edited 1 and 3.		
6	7/16/2021	3	Removed top of barrier–inclined rebar dimension. Removed note 4.	RKF	GHR
		5	Added sheet to show inclined rebar before and after being cut flush after installation.		
		7	Removed inclined rebar socket–top of bridge deck dimension.		
		13,14	Added notes on threading and extra length for the installation of inclined rebar. Increased the length of Parts b3 & b12 in the bill of bars.		
		15	Increased inclined bar receiver tube (part c1) length so that the total assembly length is 9".		
		BOM	Added nuts for inclined rebar installation. Updated inclined rebar and receiver tube lengths.		
7	7/26/2021	5	Corrected rebar location.	RKF	GHR
		13,14	Clarified inclined rebar lengths before being cut.		
		20	Added extra Bill of Materials for external components. Note: sheet placed after revision history to separate it from the drawing set.		
		3	Edited notation to detail G.		

System: ISU ABC Bridge Rail

Drawing: ABCBRM−1

Revision History

8	11/15/2021	4,5,8	Added 3 b5 bars to model, shifted location of othr b5 bars, and edited relevant dimensions.	RKF	SBW
		8	Changed quantity for part b5.		
		13	Changed quantity for part b5.		
		15	Changed dimensions on part c2.		
		BOM	Changed quantity for part b5.		
9	11/29/2021	15	Centered part c1 on c2 in assbembly, changed length on part c1 to maintain a 9" height on assembly. Added note	RKF	SBW
10	12/10/2021	15	Added pre−installation profile view. Moved parts c1 and c2 to page 16.	RKF	SBW
		16	Added new page to detail inclined bar assembly parts.		
11	12/14/2021	4	Moved dimensions in Detail H.	RKF	GHR
		5	Added before/after installation rebar views for the non−bridge rail section.		
		14	Added note on possible threads on both ends of b12.		
		BOM	Updated pre−cut lengths for b3 and b12.		
12	1/19/2022	3	Updated hole notes for Section B−B and Detail G.	RKF	GHR
		5	Showed pre−drilled hole in the tarmac.		
		BoM	Updated material spec for parts b3 and b12.		
		Rev. History	Corrected reviewer from "RFK" to "RKF" for R4, R5, R8, R9, R10, R11		
		Supple. BOM	Updated material spec for parts b3 and b12. Corrected reviewer from "RFK" to "RKF"		
13	1/20/2022	13,14	Updated material spec for parts b3 and b12.	RKF	GHR
14	6/9/2022	9	Updated description and material specs on part nos. c3, c4, c5, c6, and c7.	RKF	SBW
		13	Updated part b3, updated note 2, added note 3.		
		14	Updated part b12, updated note 2.		
		BOM	Updated description on part nos. b3, b12, c3, c4, c5, c6, and c7. Updated material specs on part nos. c3, c4, c5, c6, c7 and c8.		
		Supple. BOM	Updated description on part nos. b12, c3, c4, c5, c6, and c7. Updated material specs on part nos. c3, c4, c5, c6, and c7.		

System: ISU ABC Bridge Rail

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Revision History

15	7/20/2022	8	Added detail view of deck end. Edited dims of deck end.	RKF	SBW
		9	Added page to detail deck end.		
		11	Edited dims of corregated tube for clarity. Added dims to detail top and bottom lengths.		
		16	Changed assembly to reflect provided parts.		
		17	Changed parts to reflect provided parts.		
		19	Changed part nos. c5 and c6 to reflect provided parts.		
		BOM	Changed part descriptions of part nos c1, c2, c5, and c6.		
16	7/28/2022	5	Adjusted location of inclined rebar to match install location.	RKF	SBW
		10	Edited description of parts c3, c4, c5, c6, c7, and c8. Added notes concerning parts c9 and c10. Added notes 4−6.		
		11	Changed centerline location of part c8.		
		12	Added centerine notation to plan view.		
		15	Added note 3.		
		16	Adjusted length to 9" of assembly.		
		19	Changed OD of part c8, added note on dowl.		
		21	Edited description of parts c3, c4, c5, c6, c7, and c8.		
17	8/3/2022	3	Fixed typo.	RKF	CAO
		10	Fixed typos clarified language in note 6.		
		14	Fixed typo in note 3.		
		17	Fixed typo in note 2.		
		19	Fixed typor and clarified language in note 6.		
18	1/23/2023	3	Added grout specification note 4	RKF	CAO
		6	Added grout specification note 4		
		17	Updated page detail since it was previously unspecified		
		Supple. BOM	Added "see note" 3 details for parts b3, and b12. Added note 3 to be consistent with note changes in BOM.		
		BOM	Updated grout (part a2) material spec details, added "see note" 1, 2, 3 details for parts a1, a2, b3, and b12. Added note 2 and 3.		
		−	Revised document name to R18 to be consistent with revision history.		

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Revision History

19	2/20/2023	BOM	Removed part d1.	RKF	SBW
20	3/18/2024	3	Updated drawing annotations.	KAL	MM

Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
b3	40	#8 Rebar with 1"–8 UNC x 3" section, 51" Long, HRC – one end, threaded – one end (SEE NOTE 3)	ASTM A615 Gr. 80	–	–
b12	25	#8 Rebar with 1"–8 UNC x 12" section, 60" Long, threaded – one end (SEE NOTE 3)	ASTM A615 Gr. 80	–	–
c1	40	1 5/8" Dia., 9 1/16" Long, 1"–8 UNC x 2" Internally Threaded Tube	Stainless Steel – (TBD)	–	–
c2	40	Inclined Bar Receiver Assembly	Stainless Steel – (TBD)	–	–
c3	48	7/8" Dia., 16 1/2" Long, Double–Headed Shear Tie, HRC 555 T–Head Both Ends	ASTM A970 & ASTM A706 Grade X	(TBD)	–
c4	39	5/8" Dia., 5 1/4" Long, 5/8"–11 UNC Male Transverse Tie, HRC 555 Series T–Head – One End, HRC 300M – One End	ASTM A970 & ASTM A706 Grade X	(TBD)	–
c5	13	5/8"–11 UNC Internally Threaded Transverse Receiving Tie, 1" Dia., 3 3/16" Long, Special #5 Head – One End, HRC 320 – One End	ASTM A706 and ASTM A615 Grade X	–	–
c6	13	5/8"–11 UNC Internally Threaded Transverse Receiving Tie, 1" Dia., 4 3/16" Long, Special #5 Head – One End, HRC 320 – One End	ASTM A706 and ASTM A615 Grade X	–	–
c7	13	5/8"–11 UNC Internally Threaded Transverse Receiving Tie, 1" Dia., 5 1/4" Long, Special #5 Headed – One End, HRC 320 – One End	ASTM A706 and ASTM A615 Grade X	–	–

Notes: (3) If double nuts are used to install parts b3 and b12 the top end of both shall be threaded with 1–8" UNC threads.

Midwest Roadside Safety Facility

Iowa Concrete Bridge Deck and Rail
Test No. ABCBRM–1
Supplemental Bill of Materials

SHEET: – of –
DATE: 3/18/2024
DRAWN BY: GHR/LJP/CJN/SBW/CAO
REV. BY: RKF/KAL
DWG. NAME. Supplimental BOM_R20
SCALE: None
UNITS: in.