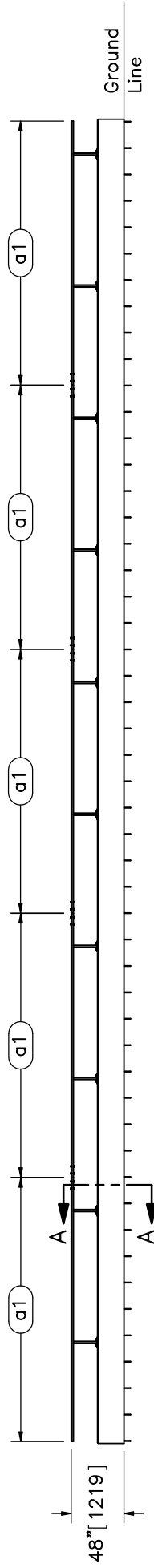



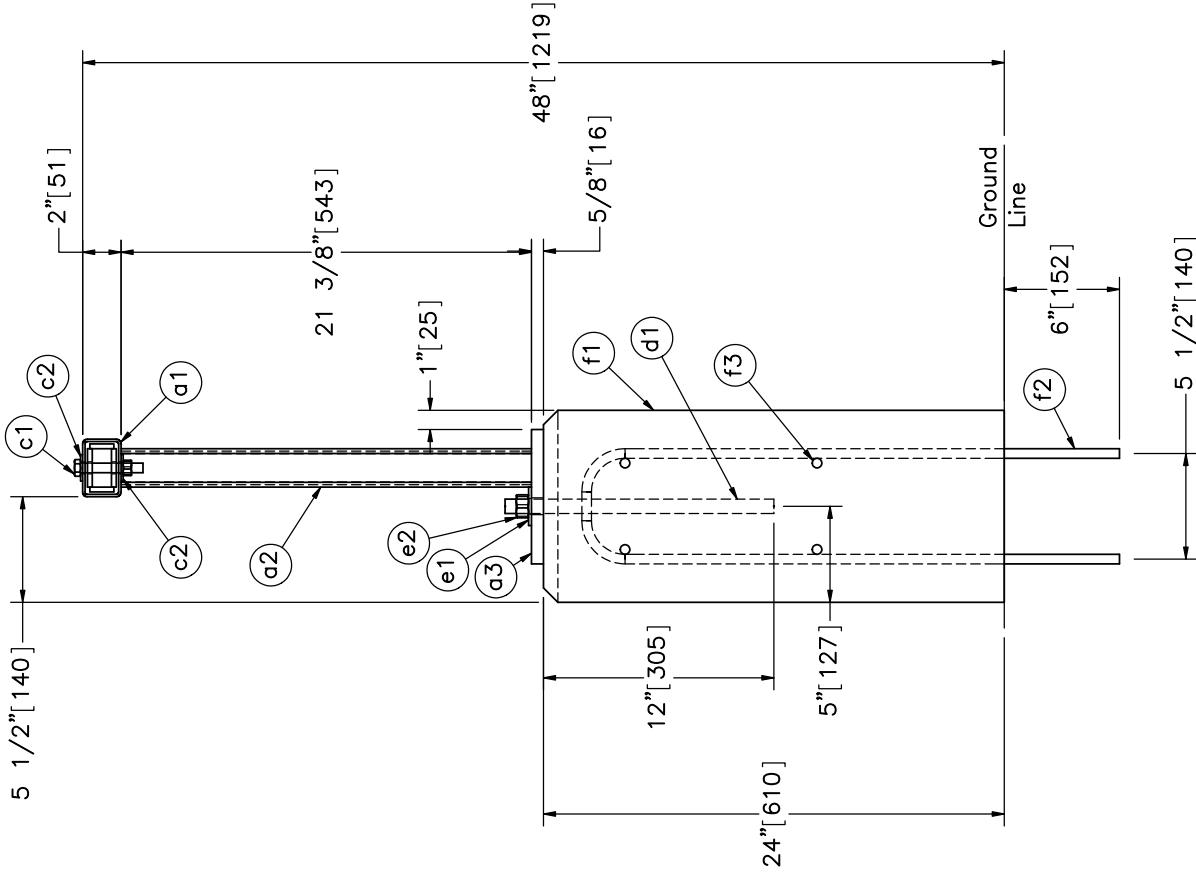
PLAN VIEW



ELEVATION VIEW


- Notes: (1) Test shall be performed according to test designation no. 2-11 using MASH 2016 criteria.  
 (2) The impact location is 45 5/8" [1,158] upstream of post no. 4.

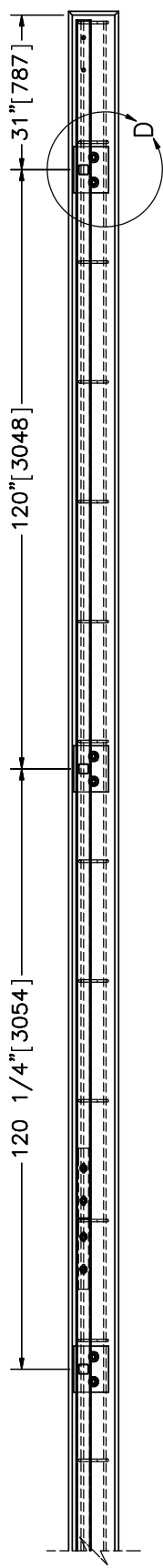
|   |                                      |                            |
|---|--------------------------------------|----------------------------|
|  | lowa Bicycle Rail<br>Test No. IBBR-1 | SHEET:<br>1 of 14          |
|   | System Layout                        | DATE:<br>05/22/2018        |
| Midwest Roadside<br>Safety Facility   | DWG. NAME:<br>IBBR-1_R5              | DRAWN BY:<br>JDU           |
|   | SCALE: 1:140<br>UNITS: in.[mm]       | REV. BY:<br>JEK/RWB/<br>CG |



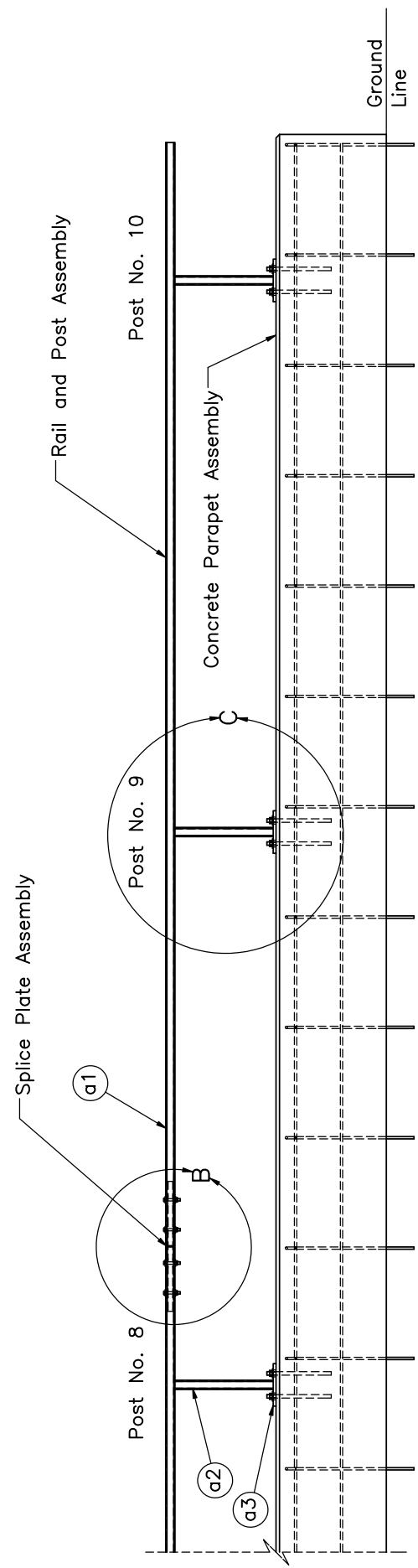
SECTION A-A

- Notes: (1) Reinforcement bar no. f2 is anchored into the existing tarmac with Hilti HIT-RE 500 V3 epoxy with a minimum bond strength of 1,560 psi [10.8 MPa].
- (2) Threaded rod (part d1) is anchored into the concrete barrier with Hilti HIT-RE 500 V3 epoxy with a minimum bond strength of 1,560 psi [10.8 MPa].

|   |  |   |
|---|--|---|
|  | Iowa Bicycle Rail<br>Test No. IBBR-1                           | SHEET:<br>2 of 14                         |
|   | System Cross Section<br><small>DWG. NAME:</small><br>IBBR-1_R5 | <small>DATE:</small><br>05/22/2018        |
| Midwest Roadside<br>Safety Facility   | <small>SCALE:</small> 1:10<br><small>UNITS:</small> in.[mm]    | <small>DRAWN BY:</small><br>JDU           |
|   |  | <small>REV. BY:</small><br>JEK/RWB/<br>CG |



PLAN VIEW

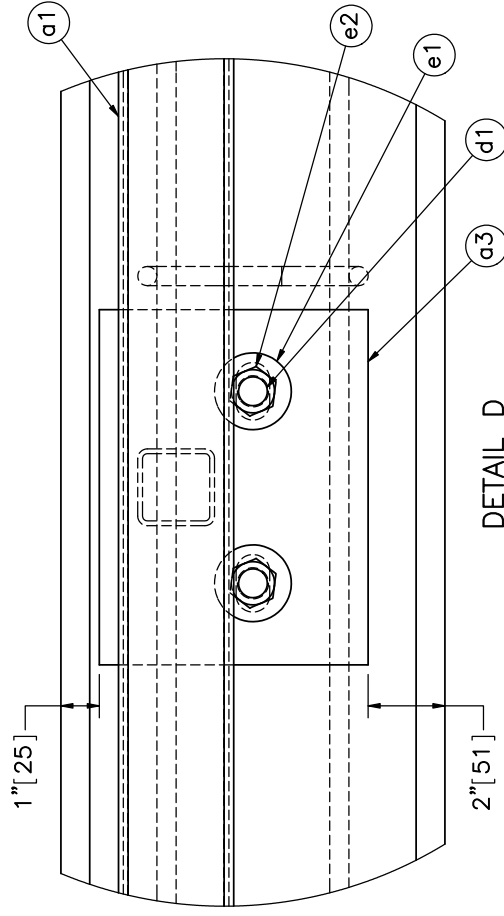
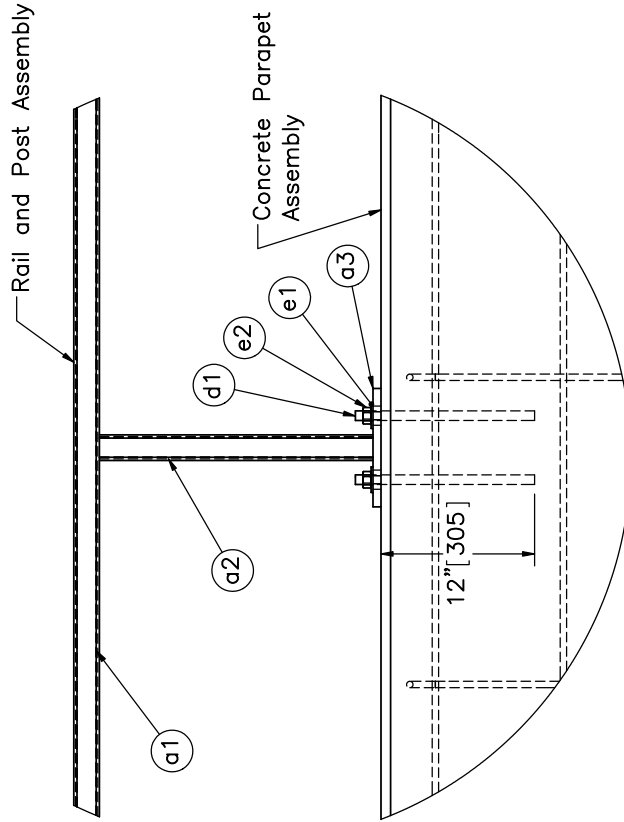
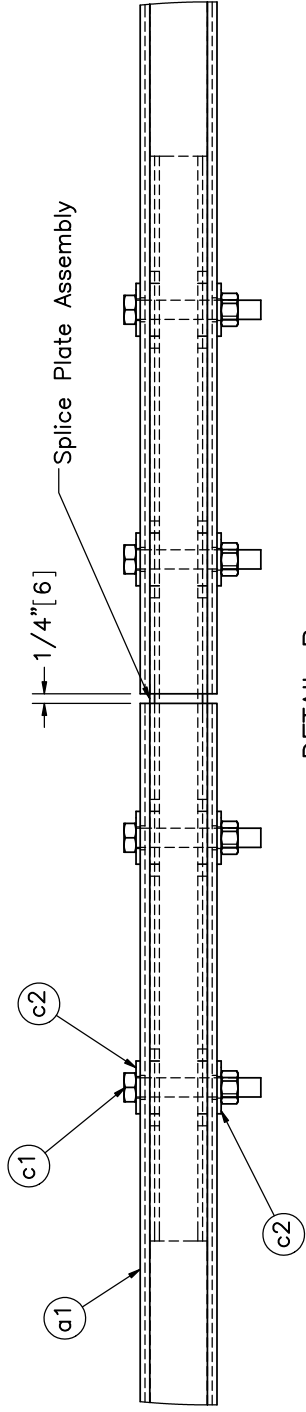


ELEVATION VIEW



Midwest Roadside Safety Facility

|                                      |                     |                                      |                            |
|--------------------------------------|---------------------|--------------------------------------|----------------------------|
| SHEET:<br>3 of 14                    | DATE:<br>05/22/2018 | DRAWN BY:<br>JDU                     | REV. BY:<br>JEK/RWB/<br>CG |
|                                      |                     |                                      |                            |
| Iowa Bicycle Rail<br>Test No. IBBR-1 |                     | Rail and Concrete Parapet<br>Details |                            |
| DWG. NAME:<br>IBBR-1_R5              |                     |                                      |                            |



DETAIL C  
SCALE 1:15

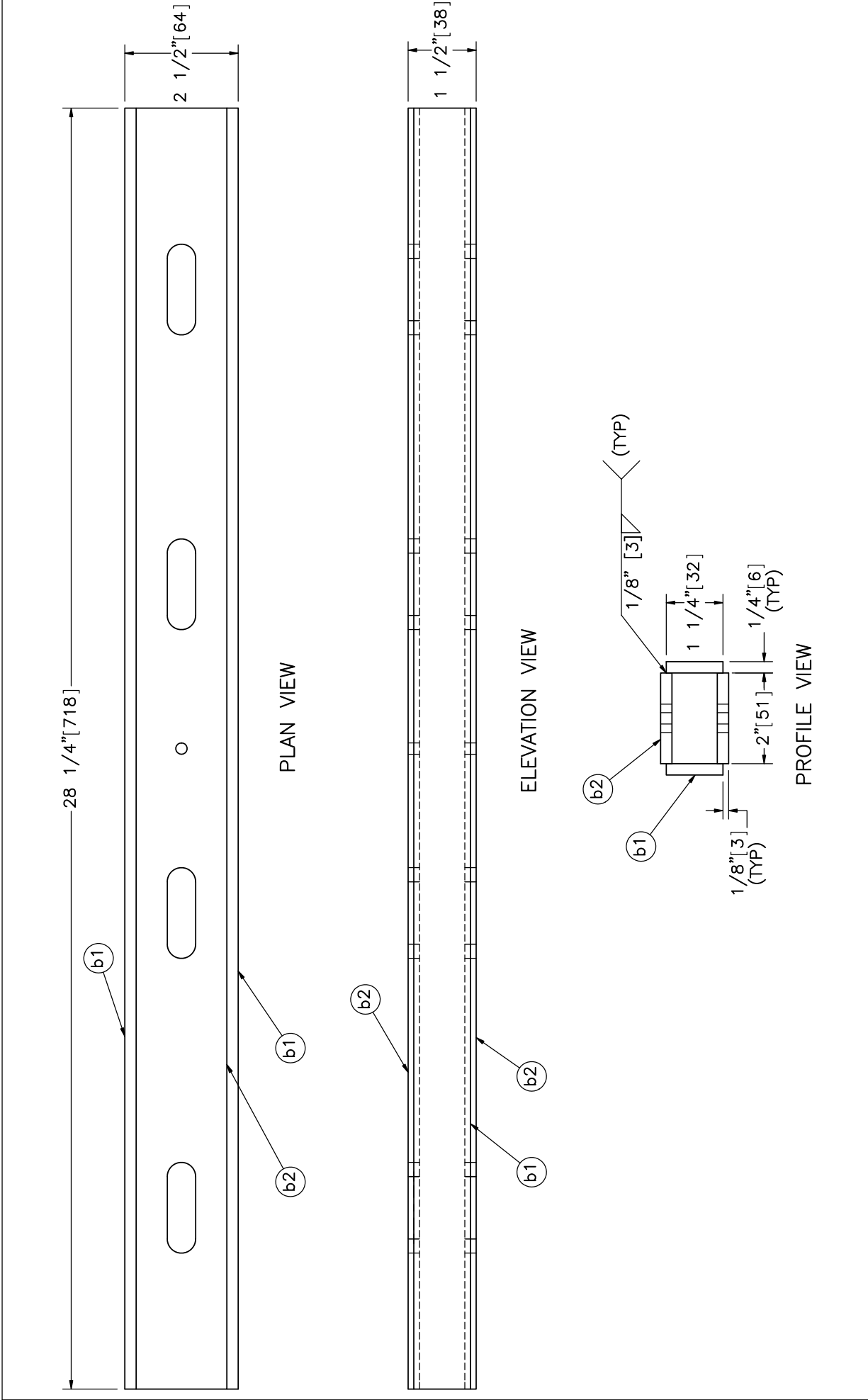


Midwest Roadside Safety Facility

Iowa Bicycle Rail  
Test No. IBBR-1

Rail and Concrete Parapet  
Details  
DWG. NAME: IBBR-1\_R5  
SCALE: 1:5  
UNITS: in./mm

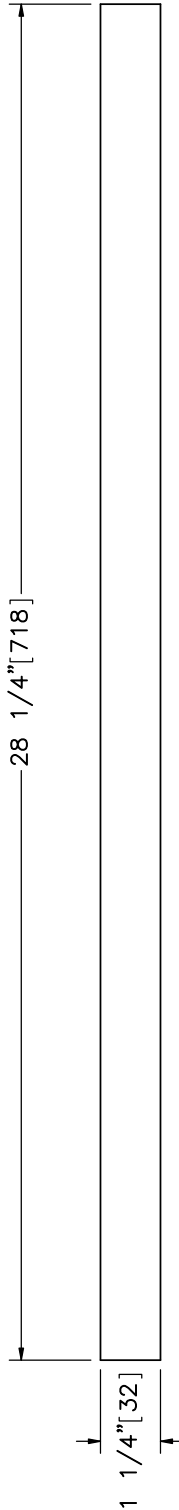
SHEET: 4 of 14  
DATE: 05/22/2018  
DRAWN BY: JDU  
REV. BY: JEK/RWB/CG



| Item No. | QTY. | Description                          | Material Specification | Treatment Specification |
|----------|------|--------------------------------------|------------------------|-------------------------|
| -        | 4    | Splice Plate Assembly                | -                      | ASTM A123               |
| b1       | 2    | 28 1/4"x1 1/4"x1/4" [718x32x6] Plate | ASTM A572 Gr. 50       | -                       |
| b2       | 2    | 28 1/4"x2"x1/4" [718x51x6] Plate     | ASTM A572 Gr. 50       | -                       |

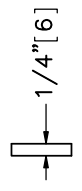
  

|                                      |                                      |                            |
|--------------------------------------|--------------------------------------|----------------------------|
| <br>Midwest Roadside Safety Facility | Iowa Bicycle Rail<br>Test No. IBBR-1 | SHEET:<br>5 of 14          |
|                                      | Splice Plate Assembly                | DATE:<br>05/22/2018        |
| DWG. NAME:<br>IBBR-1_R5              | SCALE: 1:3<br>UNITS: in.[mm]         | DRAWN BY:<br>JDU           |
|                                      |                                      | REV. BY:<br>JEK/RWB/<br>CG |

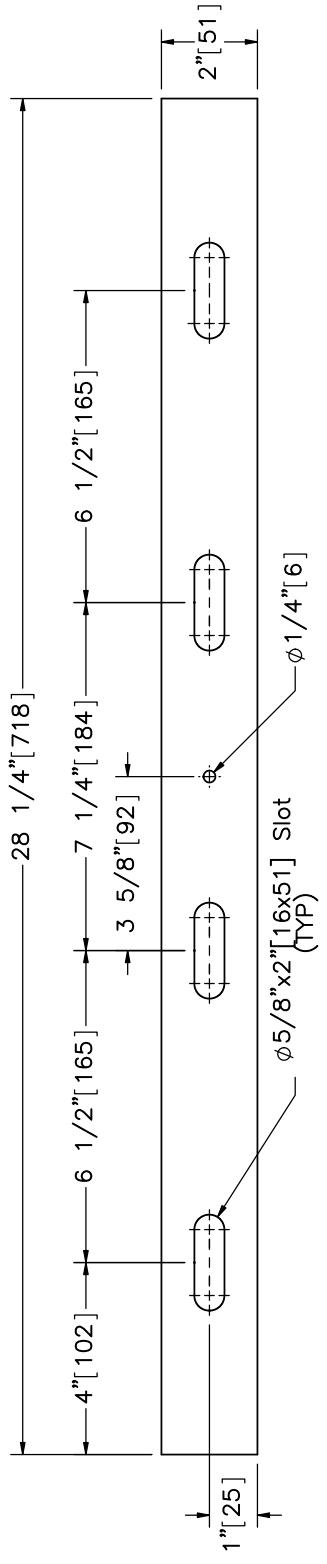


ELEVATION VIEW

PROFILE VIEW

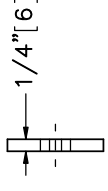


Part b1



PLAN VIEW

PROFILE VIEW



Part b2



Midwest Roadside Safety Facility

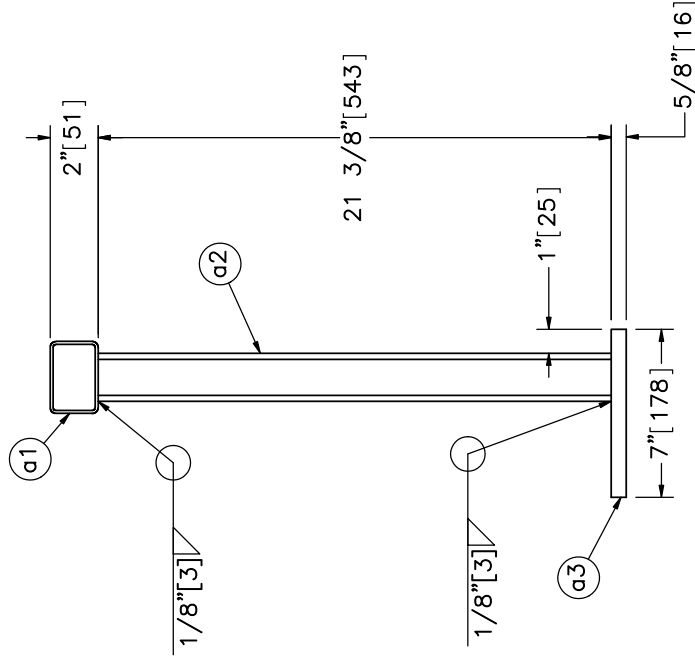
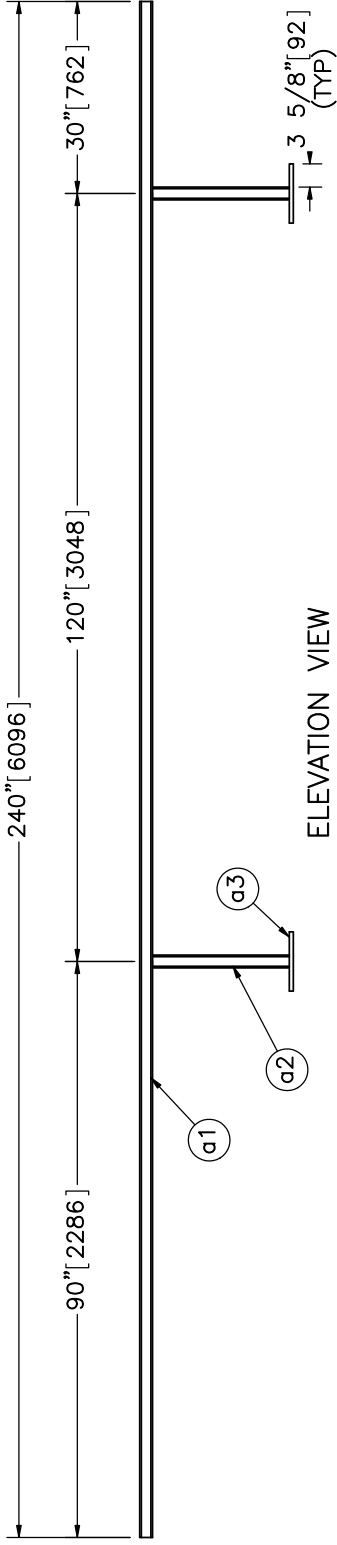
Iowa Bicycle Rail  
Test No. IBBR-1

Splice Plate Component Details

|           |            |
|-----------|------------|
| SHEET:    | 6 of 14    |
| DATE:     | 05/22/2018 |
| DRAWN BY: | JDU        |
| REV. BY:  | JEK/RWB/CG |

DWG. NAME:  
IBBR-1\_R5

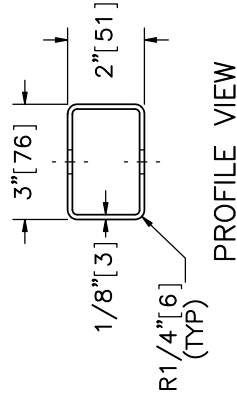
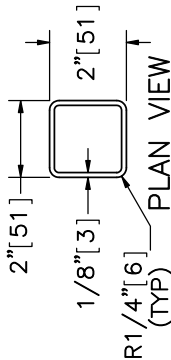
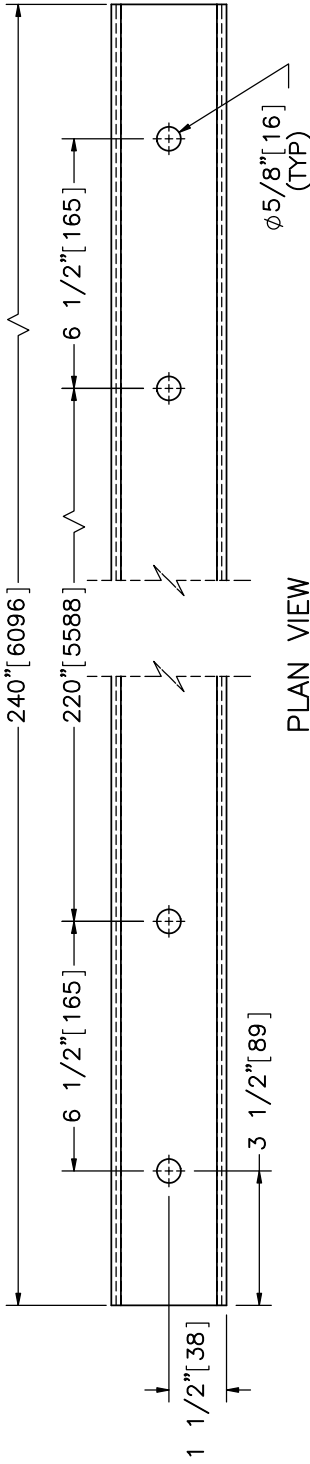
SCALE: 1:4  
UNITS: in.[mm]



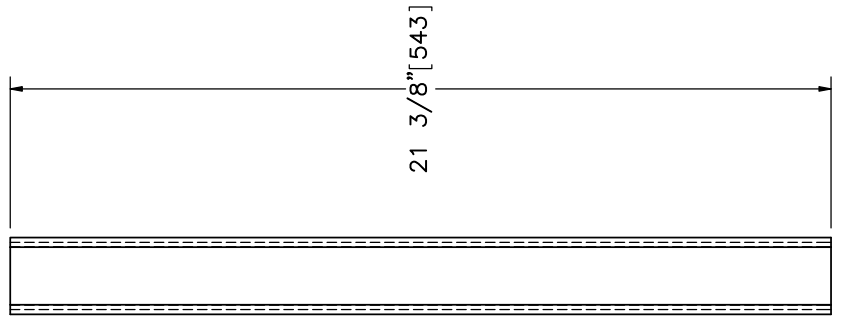
| Item No. | QTY. | Description                                       | Material Specification | Treatment Specification |
|----------|------|---|------------------------|-------------------------|
| -        | 5    | Rail and Post Assembly                            | -                      | ASTM A123               |
| a1       | 1    | HSS 3"x2"x1/8" [76x51x3], 240" [6,096] Long Tube  | ASTM A1085             | -                       |
| a3       | 2    | 8"x7"x3/8" [203x178x10] Plate                     | ASTM A572 Gr. 50       | -                       |
| a2       | 2    | HSS 2"x2"x1/8" [51x51x3], 21 5/8" [549] Long Tube | ASTM A1085             | -                       |


|                                  |  |                                      |                     |
|----------------------------------|--|--------------------------------------|---------------------|
|                                  |  | Iowa Bicycle Rail<br>Test No. IBBR-1 | SHEET:<br>7 of 14   |
| Midwest Roadside Safety Facility |  | Rail and Post Assembly               | DATE:<br>05/22/2018 |
| DWG. NAME:<br>IBBR-1_R5          |  | SCALE: 1:30<br>UNITS: in.[mm]        | DRAWN BY:<br>JDU    |
|                                  |  | REV. BY:<br>JJK/RWB/<br>CG           |                     |



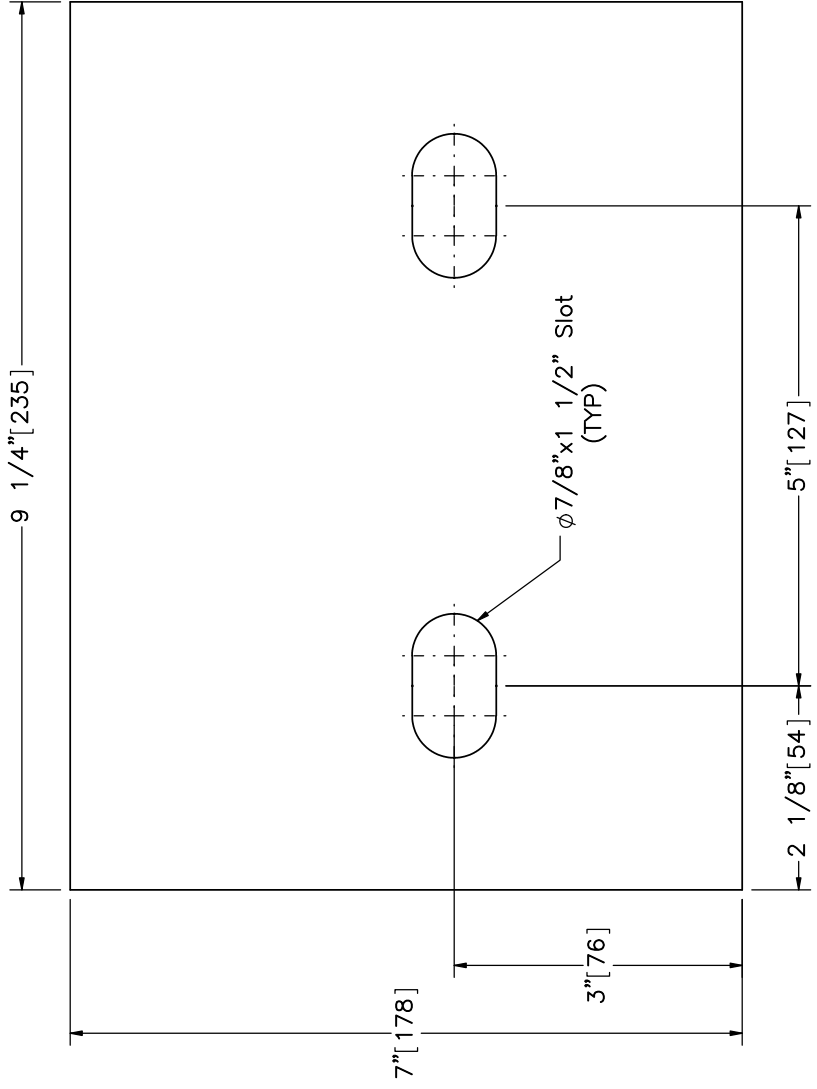
Part a1



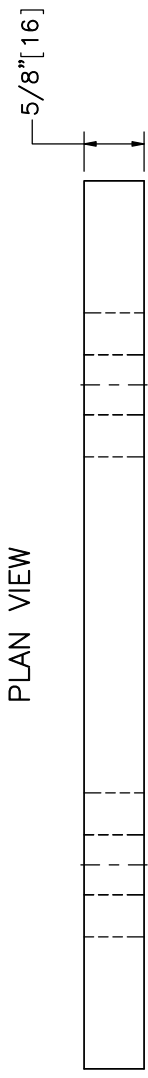
Part a2

|   |                                      |                            |
|---|--------------------------------------|----------------------------|
|  | Iowa Bicycle Rail<br>Test No. IBBR-1 | SHEET:<br>8 of 14          |
|   | Rail and Post Details                | DATE:<br>05/22/2018        |
| Midwest Roadside<br>Safety Facility   | DWG. NAME:<br>IBBR-1_R5              | DRAWN BY:<br>JDU           |
|   | SCALE: 1:5<br>UNITS: in. [mm]        | REV. BY:<br>JEK/RWB/<br>CG |






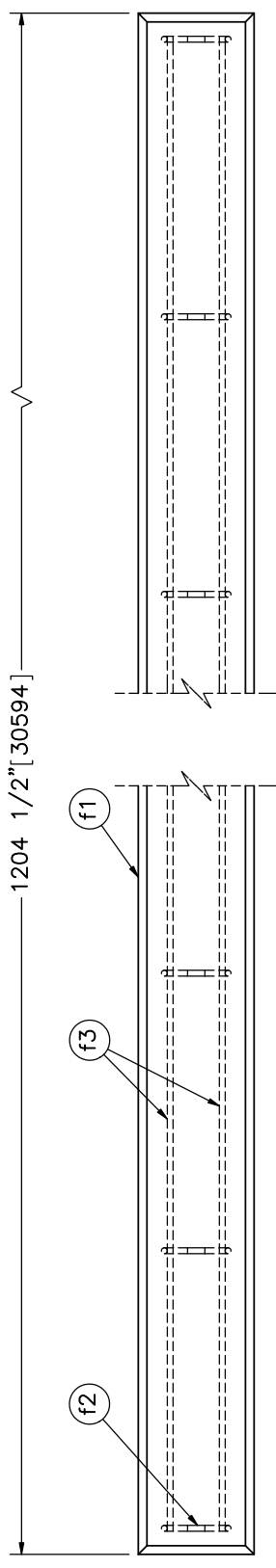
PLAN VIEW



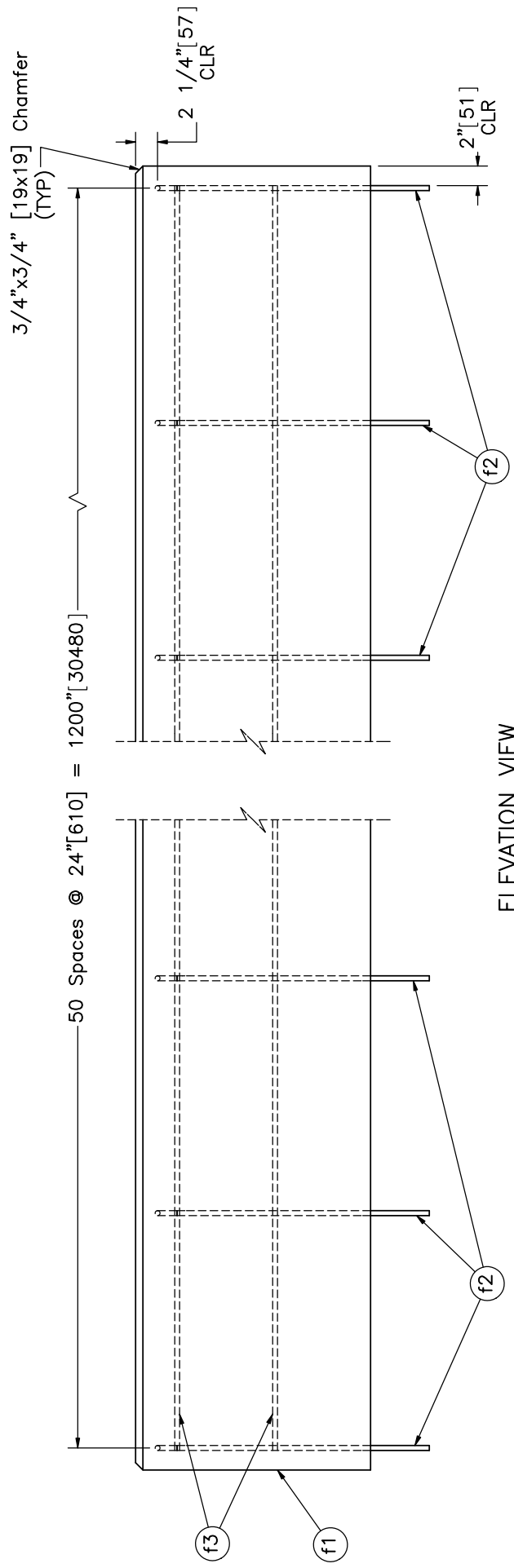
ELEVATION VIEW

Part a3

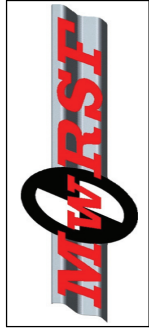
|   |  |  |
|---|--|--|
|  <p>Midwest Roadside Safety Facility</p> | <p>Iowa Bicycle Rail<br/>Test No. IBBR-1</p> | <p>SHEET: 9 of 14<br/>DATE: 05/22/2018<br/>DRAWN BY: JDU<br/>REV. BY: JJK/RWB/CG</p> |
|   | <p>Base Plate Details</p>                    | <p>SCALE: 1:2<br/>UNITS: in, [mm]</p>  |
| <p>DWG. NAME: IBBR-1_R5</p>   |  |  |



PLAN VIEW



ELEVATION VIEW



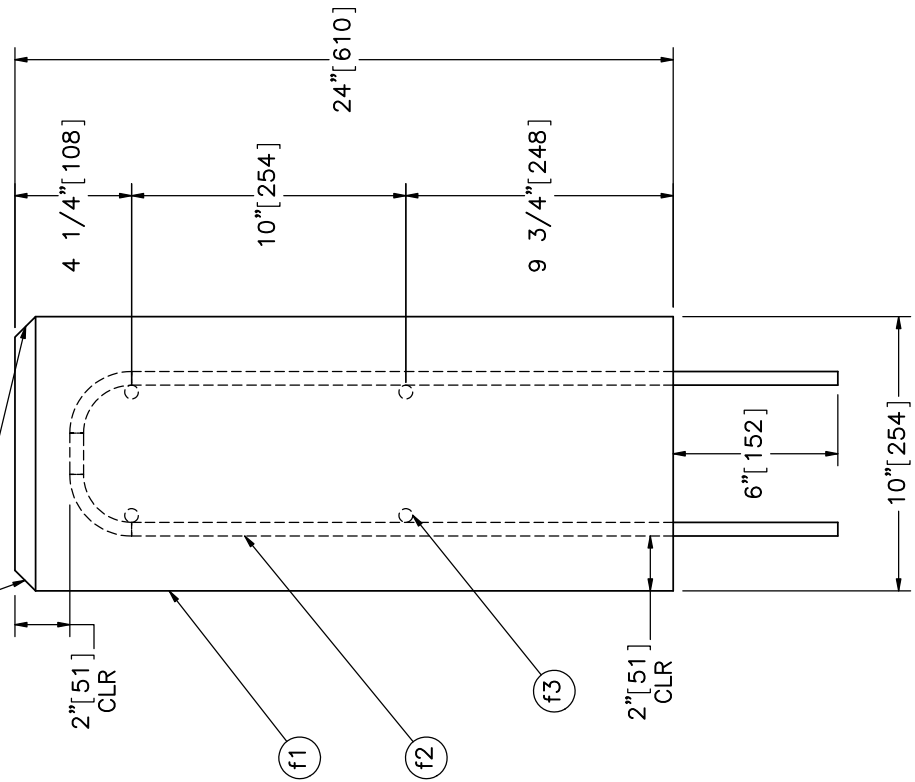
Midwest Roadside Safety Facility

Iowa Bicycle Rail  
Test No. IBBR-1

Concrete Parapet Assembly  
Details  
DWG. NAME: IBBR-1\_R5  
SCALE: 1:16  
UNITS: in.[mm]

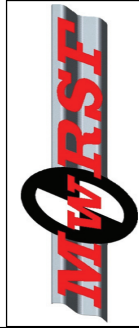
|           |            |
|-----------|------------|
| SHEET:    | 10 of 14   |
| DATE:     | 05/22/2018 |
| DRAWN BY: | JDU        |
| REV. BY:  | JEK/RWB/CG |

3/4" x 3/4" [19x19] Chamfer



PROFILE VIEW

| Item No. | QTY. | Description   | Material Specification                           | Treatment Specification          |
|----------|------|---|--|----------------------------------|
| -        | 1    | Concrete Parapet Assembly                           | -  | -                                |
| f1       | 1    | Concrete  | Min. $f'c = 4,000$ psi [27.6 MPa]<br>NE Mix 47BD | -                                |
| f2       | 51   | #4 [13] Rebar, 59 9/32" [1,506] Total Unbent Length | ASTM A615 Gr. 60                                 | Epoxy-Coated (ASTM A775 or A934) |
| f3       | 4    | #4 [13] Rebar, 1,200 1/2" [30,493] Total Length     | ASTM A615 Gr. 60                                 | Epoxy-Coated (ASTM A775 or A934) |



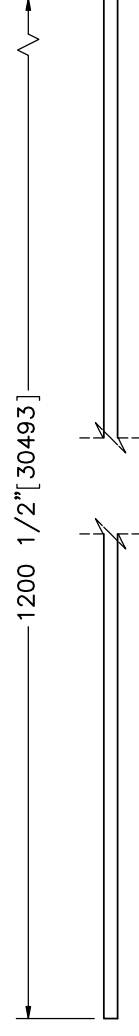
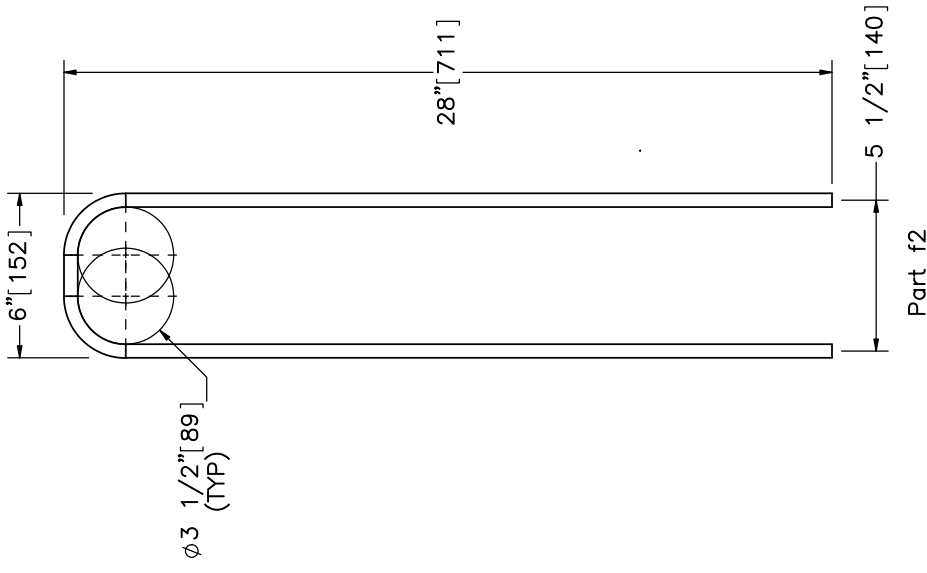
Midwest Roadside Safety Facility

Iowa Bicycle Rail  
Test No. IBBR-1

Concrete Parapet Assembly  
Details

DWG. NAME: IBBR-1\_R5  
SCALE: 1:7  
UNITS: in.[mm]

SHEET: 11 of 14  
DATE: 05/22/2018  
DRAWN BY: JDU  
REV. BY: JEK/RWB/CG



Midwest Roadside Safety Facility

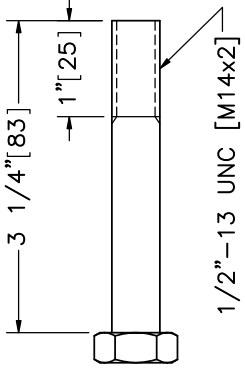
Iowa Bicycle Rail  
Test No. IBBR-1

Concrete Parapet Reinforcement  
DWG. NAME: IBBR-1\_R5  
SCALE: 1:7  
UNITS: in, [mm]

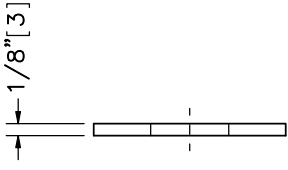
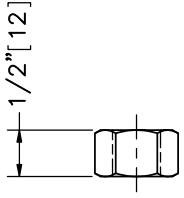
SHEET: 12 of 14  
DATE: 05/22/2018  
DRAWN BY: JDU  
REV. BY: JEK/RWB/CG

Bill of Bars

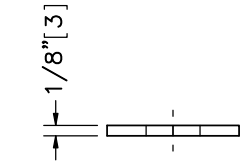
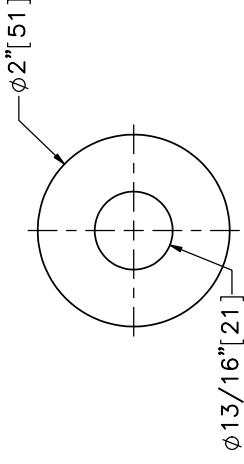
| Bar | QTY. | Size    | Total Unbent Length | Material Specification | Treatment Specification          |
|-----|------|---------|---------------------|------------------------|----------------------------------|
| f2  | 51   | #4 [13] | 59 9/32" [1,506]    | ASTM A615 Gr. 60       | Epoxy-Coated (ASTM A775 or A934) |
| f3  | 4    | #4 [13] | 1,200 1/2" [30,493] | ASTM A615 Gr. 60       | Epoxy-Coated (ASTM A775 or A934) |



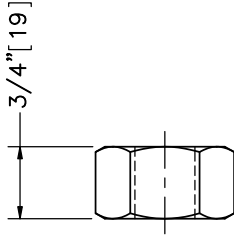
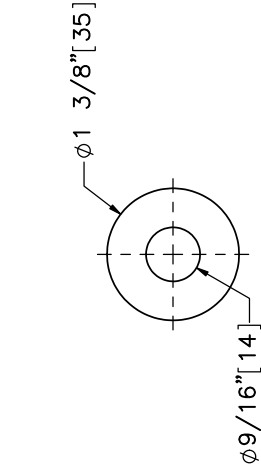
Part c1



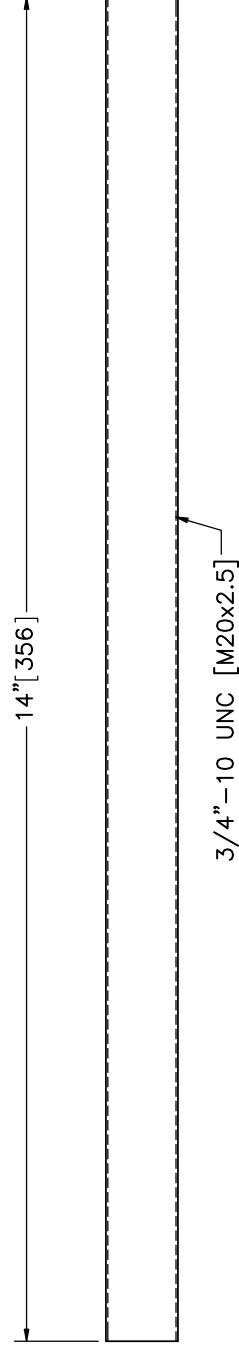
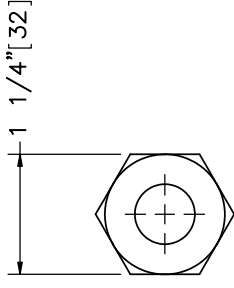
Part e1



Part c2



Part e2



Part d1



Midwest Roadside  
Safety Facility

Iowa Bicycle Rail  
Test No. IBBR-1

Hardware

DWG. NAME:  
IBBR-1\_R5

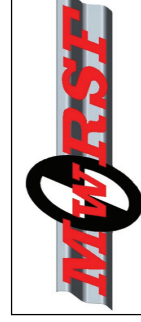
SCALE: 1:2  
UNITS: in./mm

REV. BY: JEK/RWB/CG  
DRAWN BY: JDU

SHEET: 13 of 14

DATE: 05/22/2018

| Item No. | QTY. | Description   | Material Specification  | Treatment Specification  | Hardware Guide |
|----------|------|---|---|--|----------------|
| a1       | 5    | HSS 3"x2"x1/8" [76x51x3], 240" [6,096] Long Tube                  | ASTM A1085  | -  | -              |
| a2       | 10   | HSS 2"x2"x1/8" [51x51x3], 21 5/8" [549] Long Tube                 | ASTM A1085  | -  | -              |
| a3       | 10   | 8"x7"x3/8" [203x178x10] Plate                                     | ASTM A572 Gr. 50  | -  | -              |
| b1       | 8    | 28 1/4"x1 1/4"x1/4" [718x32x6] Plate                              | ASTM A572 Gr. 50  | -  | -              |
| b2       | 8    | 28 1/4"x2"x1/4" [718x51x6] Plate                                  | ASTM A572 Gr. 50  | -  | -              |
| c1       | 16   | 1/2"-13 UNC [M14x2], 3 1/4" [83] Long Heavy Hex Head Bolt and Nut | Bolt- ASTM F3125 Gr. A325 Type 1 or equivalent<br>Nut - ASTM A563DH or equivalent | ASTM A153 or B695 Class 55 or F1136 Gr.3 or F2329 or F2833 Gr. 1 | FBX14b         |
| c2       | 32   | 1/2" [13] Dia. Plain Round Washer                                 | ASTM F844   | ASTM A123 or A153 or F2329                                       | FWC14a         |
| d1       | 20   | 3/4"-10 UNC [M20x2.5], 14" [356] Long Fully Threaded Rod          | ASTM F1554 Gr. 105  | ASTM A123 or B695 Class 55 or F2329                              | FRR20b         |
| e1       | 20   | 3/4" [19] Dia. Plain Round Washer                                 | ASTM F844   | ASTM A123 or A153 or F2329                                       | FWC20a         |
| e2       | 20   | 3/4"-10 UNC [M20x2.5] Heavy Hex Nut                               | ASTM A563DH   | ASTM A153 or B695 Class 55 or F2329                              | FBX20a         |
| f1       | 1    | Concrete  | Min. f'c = 4,000 psi [27.6 MPa]<br>NE Mix 47BD                                    | -  | -              |
| f2       | 51   | #4 [13] Rebar, 59 9/32" [1,506] Total Unbent Length               | ASTM A615 Gr. 60  | Epoxy-Coated (ASTM A775 or A934)                                 | -              |
| f3       | 4    | #4 [13] Rebar, 1,200 1/2" [30,493] Total Length                   | ASTM A615 Gr. 60  | Epoxy-Coated (ASTM A775 or A934)                                 | -              |
| -        | 1    | Epoxy   | Min. bond strength = 1,560 psi [10.8 MPa]<br>(Hit; HIT-RE 500 V3)                 | -  | -              |



Midwest Roadside Safety Facility

|                                      |                |                            |
|--------------------------------------|----------------|----------------------------|
| Iowa Bicycle Rail<br>Test No. IBBR-1 |                | SHEET:<br>14 of 14         |
| Bill of Materials                    |                | DATE:<br>05/22/2018        |
| DWG. NAME:<br>IBBR-1_R5              | SCALE: 1:512   | DRAWN BY:<br>JDJ           |
|                                      | UNITS: in.[mm] | REV. BY:<br>JEK/RWB/<br>CG |

| REV. | DATE OF ISSUE  | Page | NATURE OF CHANGES   | REVIEWER   | REVISED BY |
|------|--|------|---|------------|------------|
| 0    | 5/10/2018  | -    | Original drawing created from assembly made by Chaz   | -          | JDJ        |
| 1    | 5/11/2018  | 1    | Moved impact location, edited note 2.   | JEK        | JDJ        |
|      |  | 2    | Edited part callout. Added dimensions. Edited note 1.   |            |            |
|      |  | 3    | Changed scale to 1:35. Edited dimensions.   |            |            |
|      |  | 4    | Added assembly note. Changed scale for detail B and detail D to 1:5.<br>Edited part call out for detail D.  |            |            |
|      |  | 5    | Added part callout. Edited sheet name.  |            |            |
|      |  | 6    | Edited dimensions.  |            |            |
|      |  | 7    | Added part callout. Edited sheet name. Edited annotations.  |            |            |
|      |  | 8    | Edited dimensions.  |            |            |
|      |  | 9    | Removed profile view, added elevation view. Edited dimensions.  |            |            |
|      |  | 10   | Add part callout. Edited dimensions.  |            |            |
|      |  | 11   | Added dimensions. Edited part callout.  |            |            |
|      |  | 12   | Edited bill of bars.  |            |            |
|      |  | 13   | Edited dimensions.  |            |            |
|      | BOM  |      | Edited description for part nos. a1, a2, a3, c1, c2, d1, e1, e2, f2, and f3.<br>Edited material specification for part nos. e2, and f1. Edited treatment specification for part no. d1. Edited hardware guide for part nos. c1, and d1. |            |            |
| 2    | 5/14/2018  | 1    | Edited impact location dimension. Edited note 2.  | JEK        | JDJ        |
|      |  | 7    | Added and edited dimensions.  |            |            |
|      |  | 11   | Added dimensions.   |            |            |
|      |  | 12   | Edited dimensions.  |            |            |
|      |  | 13   | Edited dimensions.  |            |            |
|      |  | 1    | Moved impact location to upstream of post no. 4.  |            |            |
| 2    | Added dimensions. Added note 2. Moved part no. f2 callout. |      |   |            |            |
| 4    |  | 4    | Edited dimensions.  |            |            |
|      |  | 5    | Added 1/4" diameter hole to part no. b2. Added dimensions.  |            |            |
|      |  | 6    | Added dimensions.   |            |            |
|      |  | 9    | Changed holes to slots, increased length to 9.25", and changed thickness to 5/8" on part a3. Added dimensions.  |            |            |
|      |  |      |   |            |            |
| 3    | 5/17/2018  |      |   | JEK/RWB/CG | JDJ        |

|   |           |     |   |         |     |
|---|-----------|-----|---|---------|-----|
|   |           | 13  | Increased outside diameter on part no. c2 to 1 3/8", increased outside diameter on part no. e1 to 2". |         |     |
|   |           | BOM | Edited descriptions for part nos. c2, e1, and f3. Added row for epoxy.                                |         |     |
|   |           | 2   | Edited dimensions. Edited notes 1 and 2.  |         |     |
|   |           | 6   | Edited orientation of profile view on part no. b2.  |         |     |
|   |           | 8   | Decreased height of part no. a2 by 1/4".  |         |     |
|   |           | 11  | Edited dimensions.  |         |     |
| 4 | 5/18/2018 | 2   | Added dimensions. Edited part callouts. Edited note 1 and 2.  |         |     |
|   |           | 13  | Edited length of part no. d1.   |         |     |
|   |           | BOM | Edited description for part no. d1. Added epoxy type.   |         |     |
| 5 | 5/22/2018 |     |   | JEK     | JDJ |
|   |           |     |   | RWB/JEK | JDJ |