**MICHIGAN DEPARTMENT OF TRANSPORTATION**
**BRIDGE DESIGN GUIDES**

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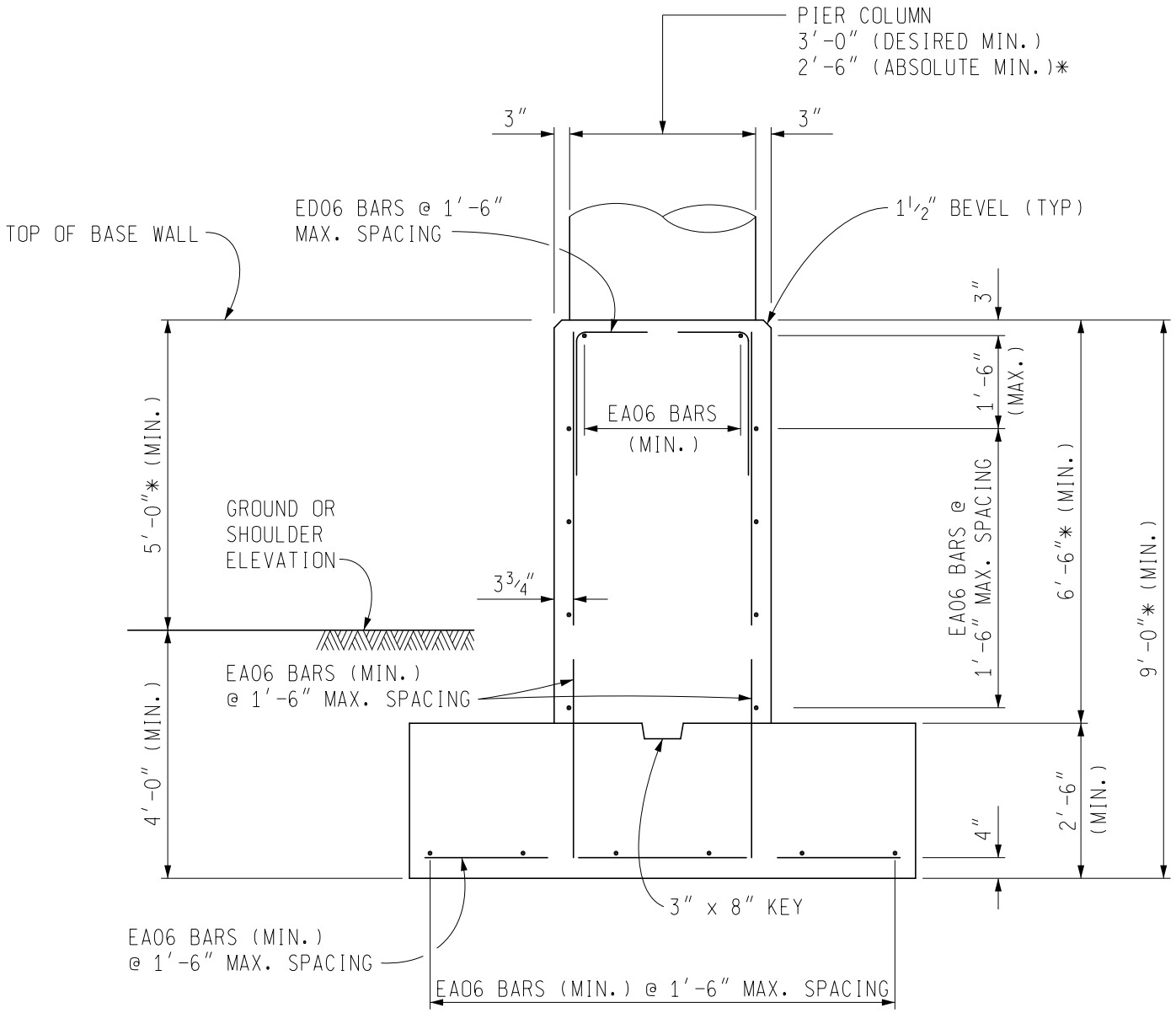
**SECTION 5 - SUBSTRUCTURE (cont)**



**SECTION 6 - SUPERSTRUCTURE**

| DRAWN BY: BLT<br>CHECKED BY: VZ<br>APPROVED BY: KCK | MICHIGAN DEPARTMENT OF TRANSPORTATION<br>BUREAU OF DEVELOPMENT<br>BASE WALL DETAILS FOR<br>PIER ADJACENT TO ROADWAY | ISSUED: 07/24/23<br>SUPERSEDES: 02/14/11 |
|---|---|---|




* THE WIDTH OF THE PIER COLUMN SHOULD BE 3′-0″ MINIMUM WHENEVER PRACTICAL. INCREASE THE MINIMUM HEIGHT OF THE BASE WALL ABOVE THE ADJACENT GROUND OR SHOULDER TO 5′-3″ IF THE WIDTH OF THE PIER COLUMN IS LESS THAN 3′-0″. COLUMNS WITH A WIDTH LESS THAN 3′-0″ ARE MORE SUSCEPTIBLE TO FAILURE WHEN STRUCK, AND THE ADDITIONAL HEIGHT OF THE BASE WALL ENSURES THE COLUMN IS PROTECTED AFTER FUTURE OVERLAYS OF THE ROADWAY ADJACENT TO THE PIER.

## SECTION OF BASE WALL

NOTES:

EXTEND BASE WALL TO END OF FOOTING WHEN GUARDRAIL ATTACHMENT IS ANTICIPATED.

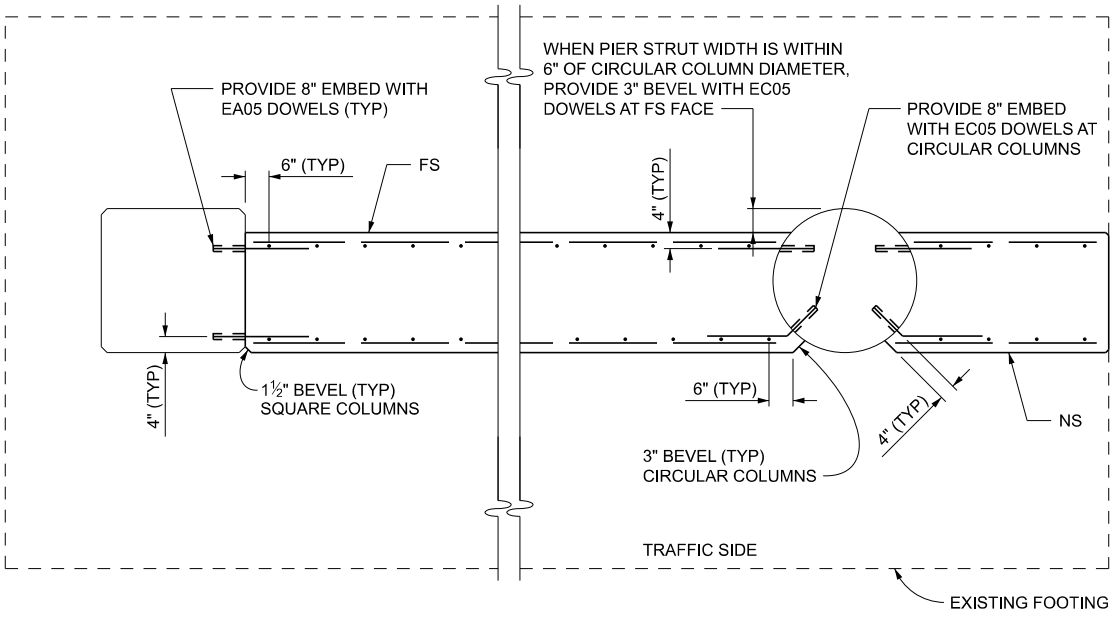
FOR ADDITIONAL REQUIREMENTS SEE BRIDGE MANUAL CHAPTER 7.

THE MINIMUM LENGTH OF THE BASE WALL MUST BE 10′-0″.

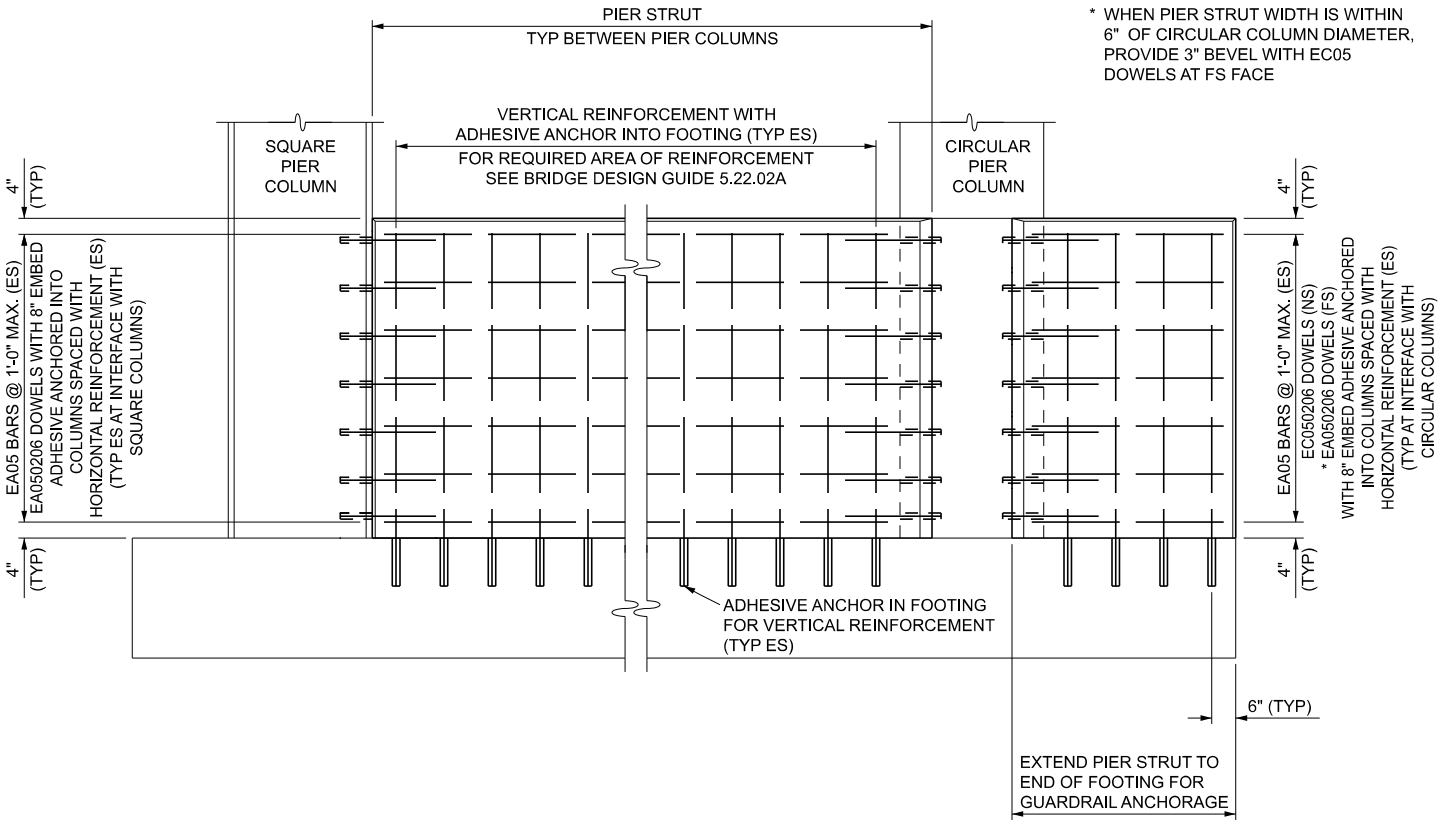
REINFORCEMENT SHOWN IS THE MINIMUM REINFORCEMENT. INCREASE THE SIZE AND/OR SPACING OF THE REINFORCEMENT WHEN THE DESIGN OF THE BASE WALL OR FOOTING REQUIRES IT.

| PREPARED BY<br>DESIGN DIVISION | 5.22.01 |
|---|---|

| DRAWN BY: BLT | MICHIGAN DEPARTMENT OF TRANSPORTATION<br>BUREAU OF DEVELOPMENT | ISSUED: 02/26/24 |
|---|---|---|
| CHECKED BY: VZ | PIER STRUT RETROFIT | SUPERSEDES: |
| APPROVED BY: KCK | | |




PIER STRUT PLAN

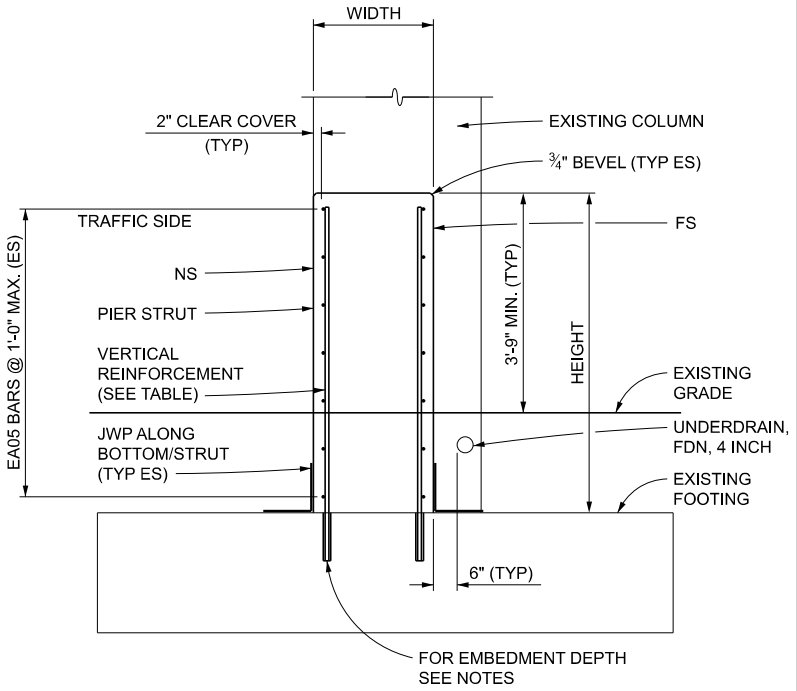



PIER STRUT ELEVATION

| PREPARED BY DESIGN DIVISION | 5.22.02 |
|---|---|

| DRAWN BY: BLT | MICHIGAN DEPARTMENT OF TRANSPORTATION<br>BUREAU OF DEVELOPMENT | ISSUED: 02/26/24 |
|---|---|---|
| CHECKED BY: VZ | PIER STRUT RETROFIT | SUPERSEDES: |
| APPROVED BY: KCK | | |

| PIER STRUT RETROFIT<br>REINFORCED CONCRETE DESIGN | | | |
|---|---|---|---|
| HEIGHT (FT) | WIDTH (FT) | VERTICAL REINFORCEMENT ($IN^2/FT$) | APPLIED TENSION LOAD (KIP/FT) |
| 5.0 | 1.5 | 1.11 | 60 |
| 6.0 | 2.0 | 0.90 | 52 |
| 7.0 | 2.0 | 1.11 | 61 |
| 8.0 | 2.5 | 0.94 | 54 |
| 9.0 | 2.5 | 1.11 | 61 |
| 10.0 | 3.0 | 0.95 | 56 |
| 11.0 | 3.0 | 1.05 | 61 |
| 12.0 | 3.0 | 1.18 | 67 |




PIER STRUT SECTION

NOTES:

NS DENOTES NEAR SIDE, FS DENOTES FAR SIDE, AND ES DENOTES EACH SIDE.

DETAILS INCLUDED IN THIS GUIDE MAY BE USED TO RETROFIT EXISTING BRIDGE PIERS THAT MEET ONE OF THE CONDITIONS OUTLINED IN BRIDGE DESIGN MANUAL SECTION 12.08.08.

INFORMATION PROVIDED IN THE TABLE APPLIES WHEN THE LENGTH OF THE PIER STRUT IS LESS THAN THE CRITICAL WALL LENGTH OVER WHICH THE YIELD LINE MECHANISM OCCURS (Lc). IF THE LENGTH OF THE PIER STRUT EXCEEDS Lc, DESIGN THE REINFORCEMENT IN ACCORDANCE WITH AASHTO LRFD SECTION A13.3.1. FOR DEFINITIONS OF YIELD LINE MECHANISM AND Lc SEE AASHTO LRFD A13.3.1.

AT MEDIAN PIERS, PLACE VERTICAL REINFORCEMENT, SPECIFIED IN THE TABLE, IN BOTH FACES OF THE PIER STRUT. THE WIDTH OF THE STRUT AT MEDIAN PIERS SHOULD MATCH THE WIDTH/DIAMETER OF THE EXISTING PIER COLUMNS.

VERTICAL ADHESIVE ANCHORS IN THE PIER FOOTING MUST BE DESIGNED FOR THE APPLIED TENSION (SEE TABLE) AND SHEAR LOADS USING THE DESIGN STRENGTH OF THE CONCRETE IN THE PIER FOOTING AND ASSUMING A CRACKED SECTION. THE ADHESIVE SYSTEM AND MINIMUM EMBEDMENT DEPTH OF THE VERTICAL REINFORCING ANCHORED INTO THE FOOTING IS REQUIRED TO MEET THE PROVISIONS OF BRIDGE DESIGN MANUAL SECTION 7.06.02.B.

PIER STRUTS WITH HEIGHTS AND WIDTHS OTHER THAN THOSE LISTED IN THE PIER STRUT RETROFIT REINFORCED CONCRETE DESIGN TABLE SHALL BE DESIGNED IN ACCORDANCE WITH AASHTO LRFD SECTION 3.6.5.

PLACE ½" JOINT FILLER BETWEEN PIER COLUMNS OR STRUTS AND SLOPE PAVING OR HEADER. FOR SLOPE PAVING DETAILS AT THE INTERFACE WITH PIER COLUMNS OR STRUTS, SEE STANDARD PLAN B-102-SERIES.

INCLUDE PAY ITEMS FOR UNDERDRAIN OUTLET AND UNDERDRAIN OUTLET ENDINGS. FOR UNDERDRAIN AND OUTLET ENDING DETAILS SEE STANDARD PLAN R-80-SERIES.

| PREPARED BY<br>DESIGN DIVISION | 5.22.02A |
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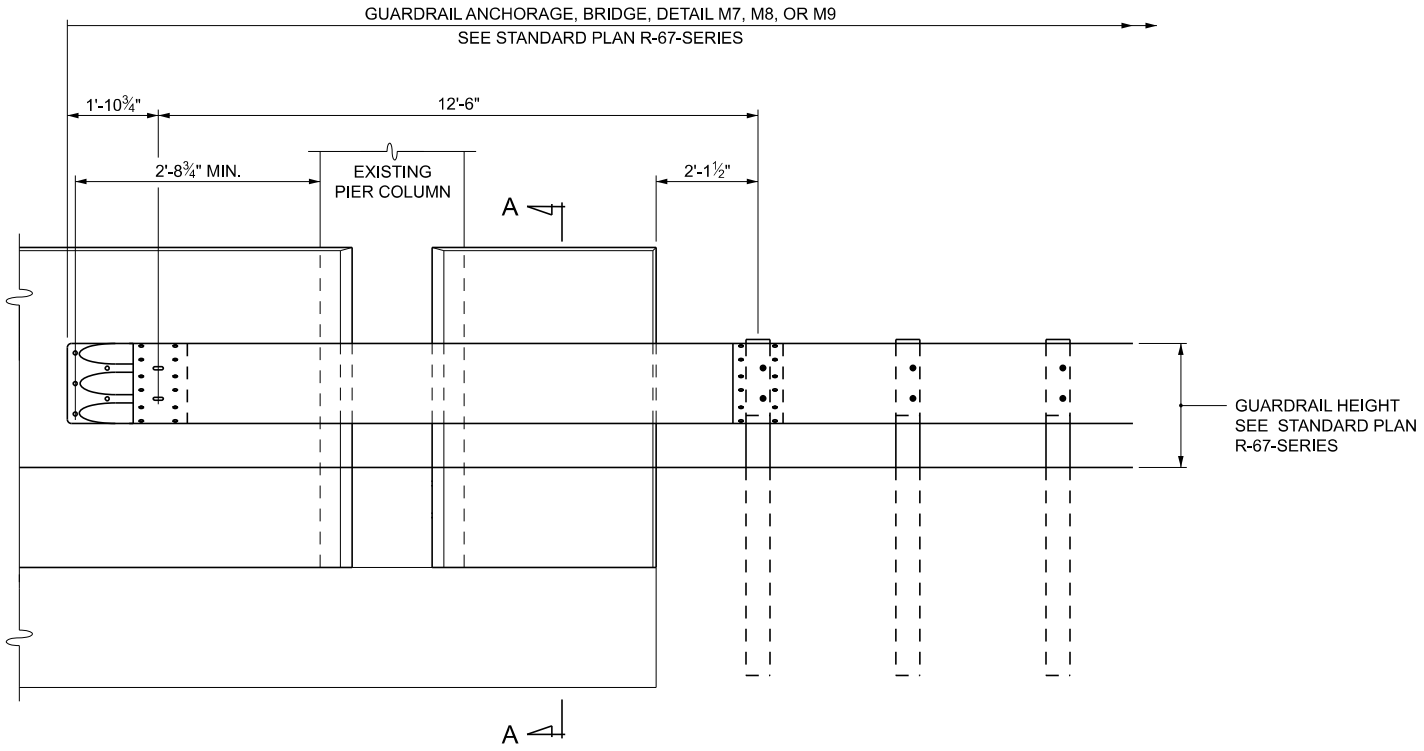
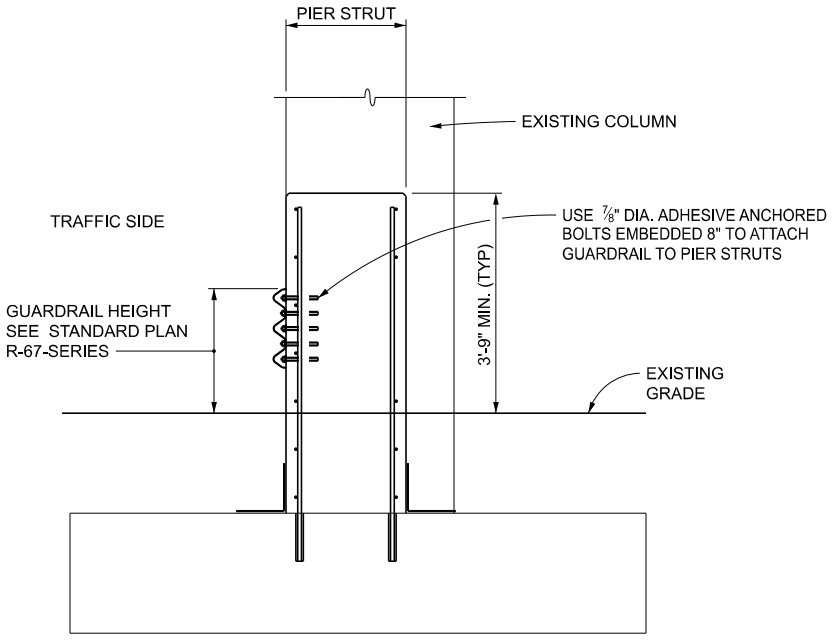
| DRAWN BY: BLT | MICHIGAN DEPARTMENT OF TRANSPORTATION<br>BUREAU OF DEVELOPMENT | ISSUED: 02/26/24 |
|---|---|---|
| CHECKED BY: VZ | PIER STRUT RETROFIT | SUPERSEDES: |
| APPROVED BY: KCK | | |




PIER STRUT ELEVATION
(SEE STANDARD PLAN R-67-SERIES FOR GUARDRAIL ATTACHMENT DETAILS)




SECTION A-A

| PREPARED BY<br>DESIGN DIVISION | 5.22.02B |
|---|---|

| DRAWN BY: BLT<br>CHECKED BY: VZ<br>APPROVED BY: DAJ | MICHIGAN DEPARTMENT OF TRANSPORTATION<br>BUREAU OF HIGHWAY DEVELOPMENT<br>BRIDGE RAILING, AESTHETIC PARAPET TUBE END WALL SECTIONS | ISSUED: 05/23/16<br>SUPERSEDES: 12/22/11 |
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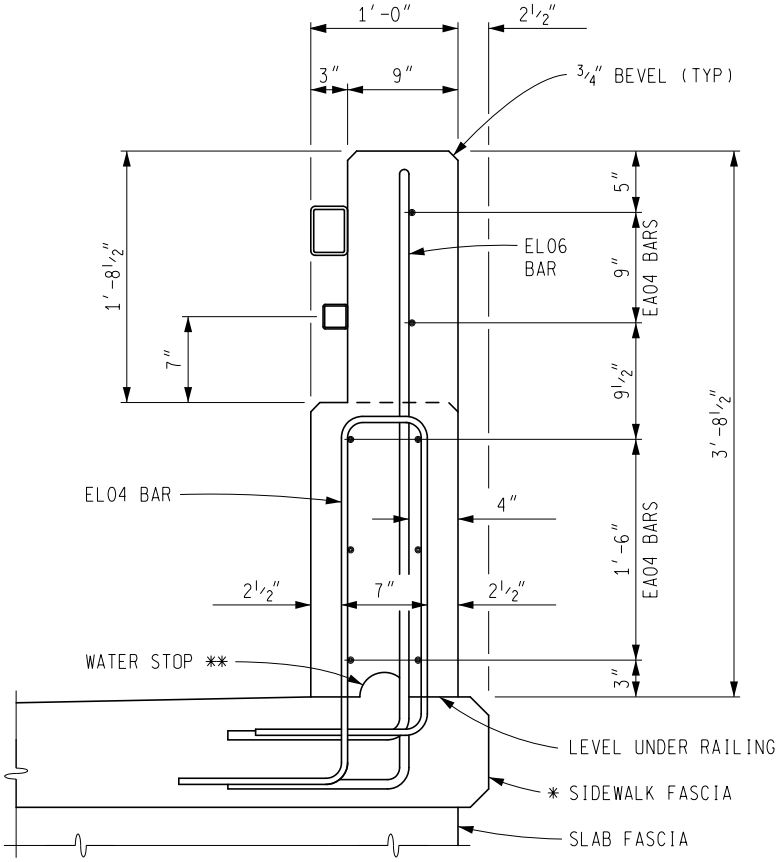
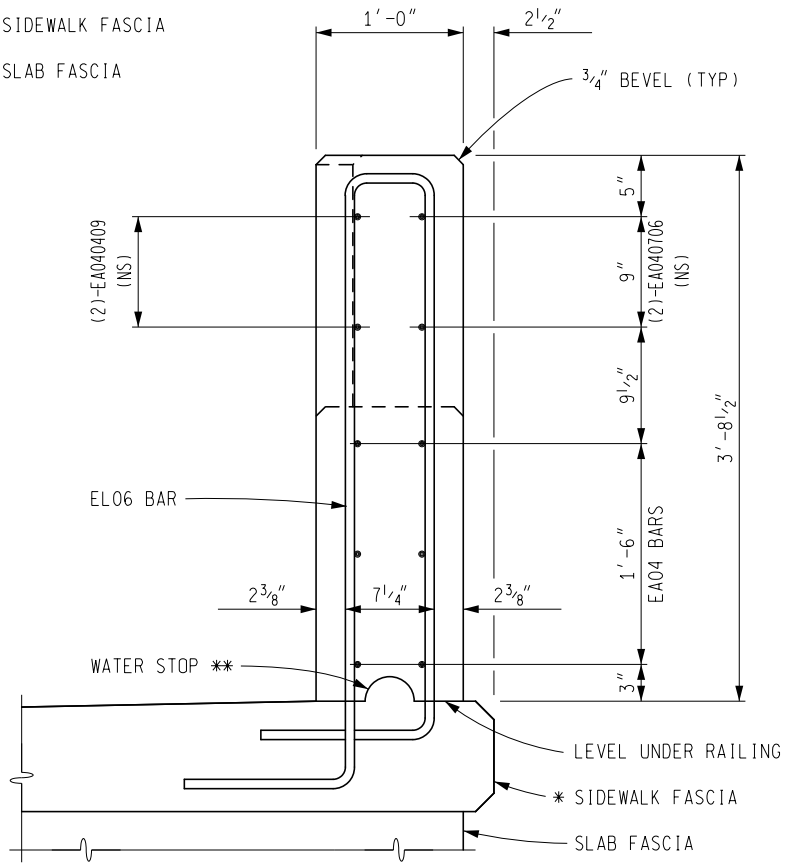



SECTION AT END WALL

(TUBE CONNECTION AREA)




SECTION AT END WALL

(FULL CONCRETE AREA)

NOTE:

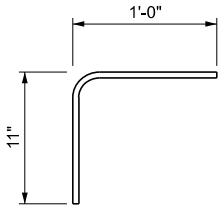
* IF BRIDGE RAILING IS MOUNTED FLUSH TO THE SLAB, THE "EL" BARS SHALL BE CAST IN THE SLAB.

** 2" HIGH x 4" LONG (±). FORMING NOT REQUIRED. USE WHEN RAILING IS MOUNTED FLUSH TO THE SLAB.

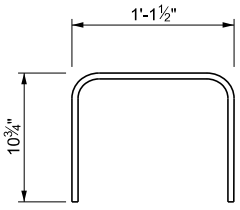
| PREPARED BY DESIGN DIVISION | 6.29.10B |
|---|---|

| | | |
|---|---|---|
| DRAWN BY: BLT<br>CHECKED BY: VZ<br>APPROVED BY: KCK | MICHIGAN DEPARTMENT OF TRANSPORTATION<br>BUREAU OF DEVELOPMENT<br>BRIDGE RAILING, AESTHETIC PARAPET TUBE<br>SIDEWALK SECTION | ISSUED: 02/26/24<br>SUPERSEDES: 11/27/23 |

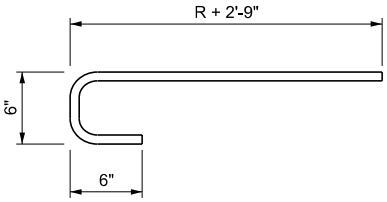
R = ℄ BEAM TO SLAB FASCIA DISTANCE



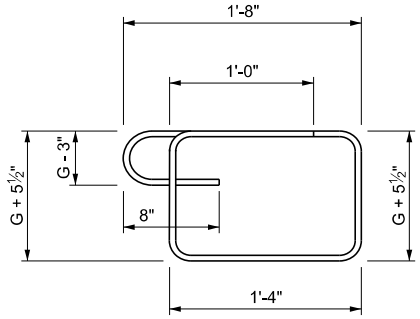

EB04 BAR



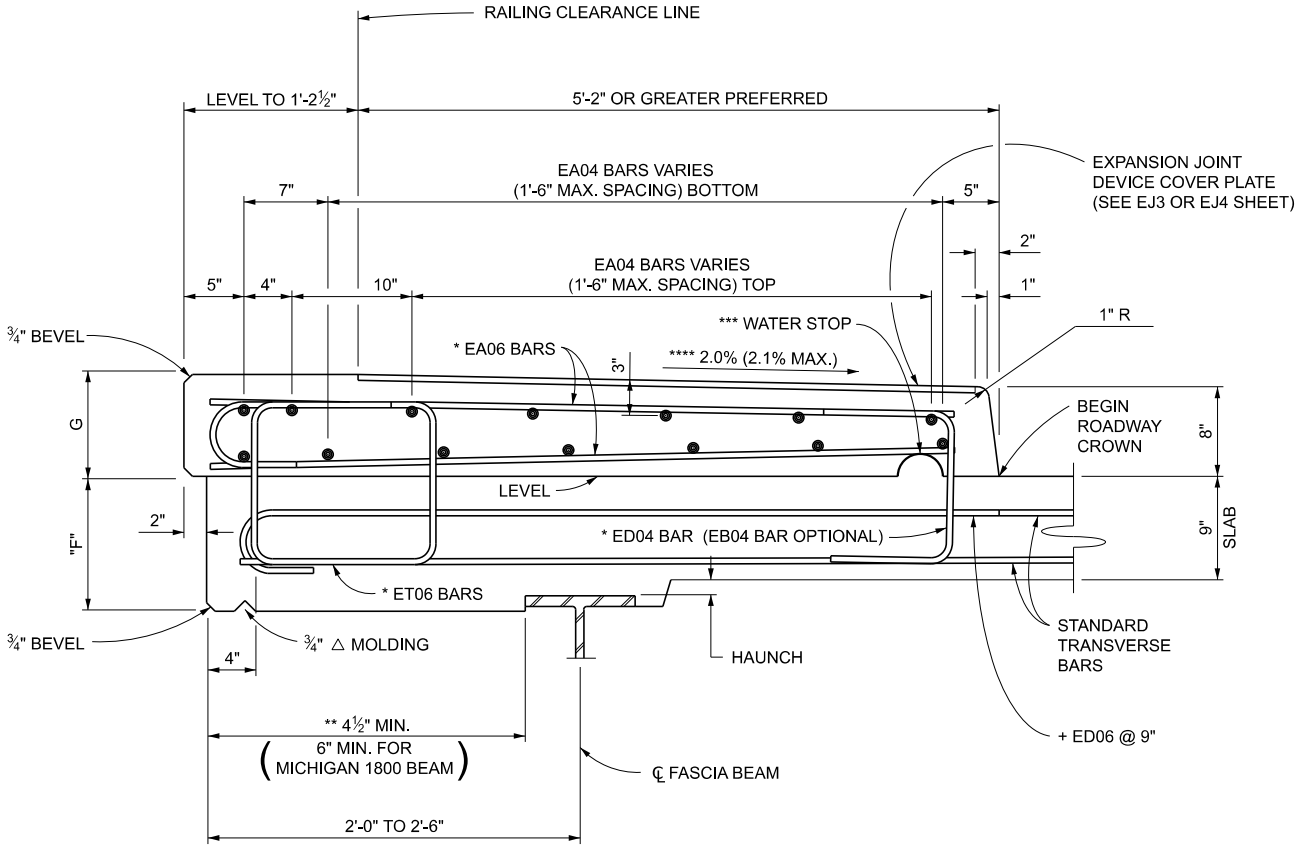

ED04 BAR




ED06 BAR




ET06 BAR




NOTES:

"F" CONSTANT EQUALS SLAB THICKNESS PLUS HAUNCH PLUS THICKEST FASCIA BEAM FLANGE PLUS ½" PLUS AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN SLAB THICKNESS AT CURB LINE.

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

\+ THE DETAILED REINFORCEMENT IN THE SLAB (ED06 BARS) IS THE MINIMUM FOR THE RAILING. THE DESIGN OF THE SLAB OVERHANG MAY REQUIRE ADDITIONAL REINFORCEMENT (OR INCREASING THE REINFORCEMENT AREA (DIAMETER) SHOWN). ALL TOP TRANSVERSE BRIDGE SLAB REINFORCEMENT IS HOOKED SIMILAR TO THE ED06 BAR DETAILED ON THIS SHEET. BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

* SPACE WITH ALTERNATE TRANSVERSE SLAB BARS (1'-6" MAX.). EB04 BAR MAY BE ADHESIVE ANCHORED INTO 6" DEEP HOLE INSTEAD OF ED04 BAR. PLACE ADDITIONAL ET06 BAR 6" EACH SIDE OF ℄ RAILING POST.

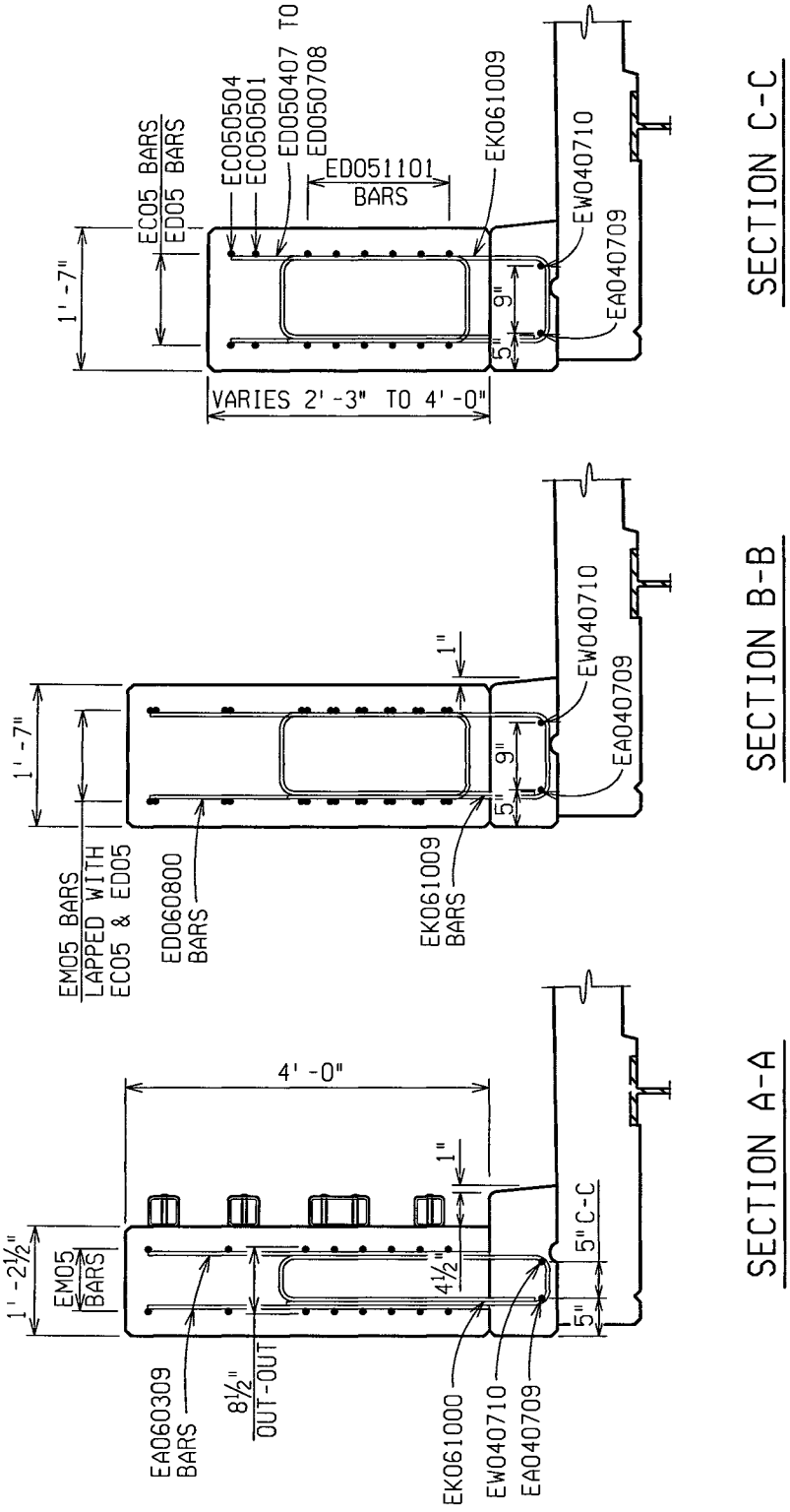
** APPLIES TO CURVED BRIDGES ONLY.

*** 2" HIGH x 4" LONG (±). FORMING NOT REQUIRED.

**** USE A TARGET CROSS SLOPE (2.0%) LESS THAN THE MAXIMUM TO ACCOUNT FOR INCONSISTENCIES IN CONCRETE FINISHING.

| | |
|---|---|
| PREPARED BY<br>DESIGN DIVISION | 6.29.10C |

| DRAWN BY: BLT<br>CHECKED BY: VZ<br>APPROVED BY: TGF | MICHIGAN DEPARTMENT OF TRANSPORTATION<br>BUREAU OF HIGHWAY DEVELOPMENT<br>BRIDGE RAILING, 4 TUBE<br>BICYCLE RAILING SECTIONS | ISSUED: 08/15/03<br>SUPERSEDES: / / |
|---|---|---|




| PREPARED BY<br>DESIGN SUPPORT AREA | 6.29.17D |
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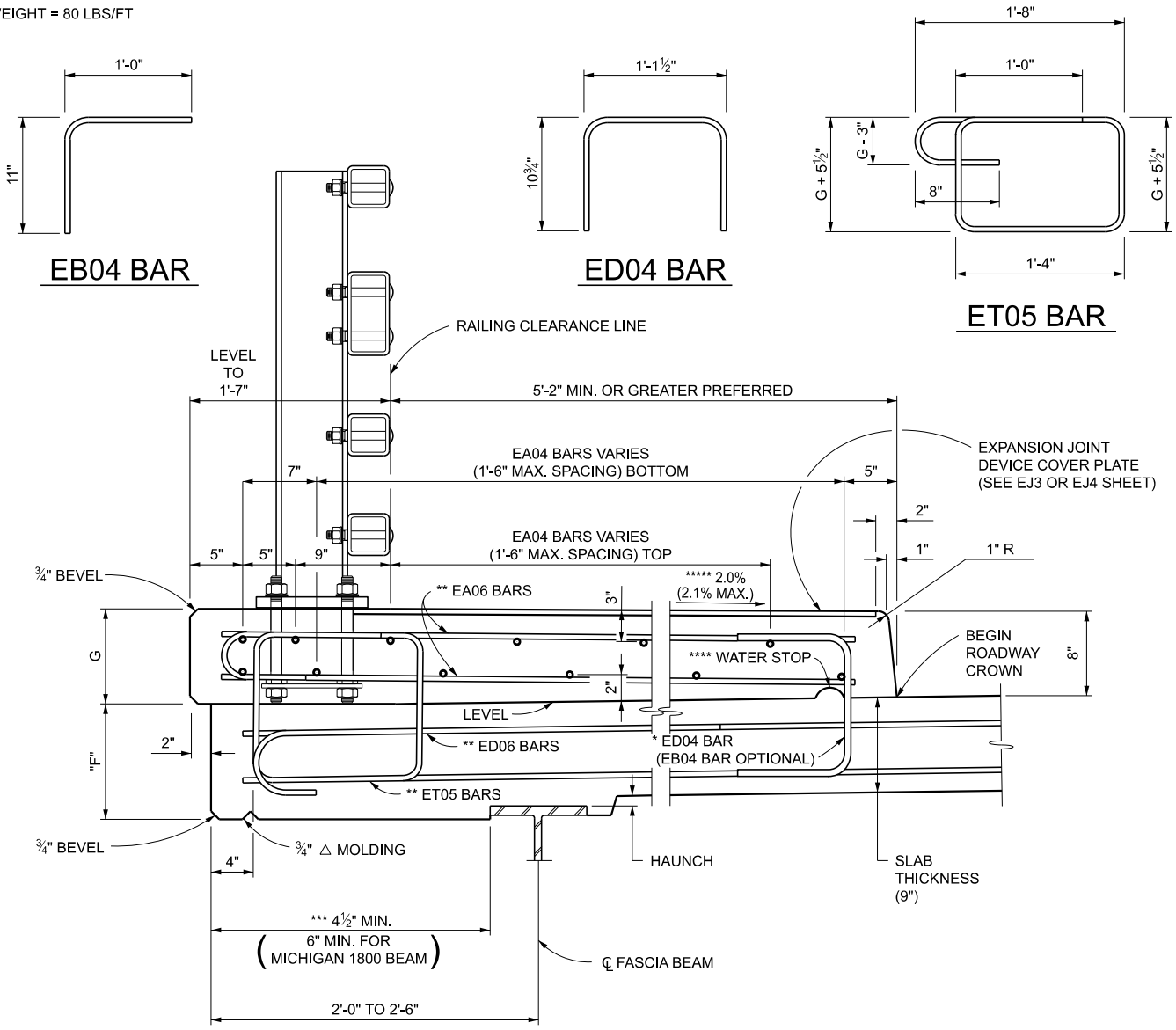
|---|---|---|
| DRAWN BY: BLT<br>CHECKED BY: VZ<br>APPROVED BY: KCK | MICHIGAN DEPARTMENT OF TRANSPORTATION<br>BUREAU OF DEVELOPMENT<br>BRIDGE RAILING, 4 TUBE - SIDEWALK SECTION<br>PEDESTRIAN RAILING OPTION | ISSUED: 02/26/24<br>SUPERSEDES: 11/27/23 |

WEIGHT = 80 LBS/FT




NOTES:

"F" CONSTANT EQUALS SLAB THICKNESS PLUS HAUNCH PLUS THICKEST FASCIA BEAM FLANGE PLUS ½" PLUS AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN SLAB THICKNESS AT CURB LINE.

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

THE DETAILED REINFORCEMENT IN THE SLAB (ED06 BARS) IS THE MINIMUM FOR THE RAILING. THE DESIGN OF THE SLAB OVERHANG MAY REQUIRE ADDITIONAL REINFORCEMENT (OR INCREASING THE REINFORCEMENT AREA (DIAMETER) SHOWN). BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

* EB04 BAR MAY BE ADHESIVE ANCHORED INTO 6" DEEP HOLE INSTEAD OF ED04 BAR. SPACE WITH ALTERNATE TRANSVERSE SLAB BARS (1'-6" MAX.).

** AT EACH POST PLACE 7 - ET05 BARS SPACED AT 6", ED06 BARS (SEE GUIDE 6.29.17) AND EAO6 BARS WITH ALTERNATE ET05 BARS. PLACE ET05 BARS, ED06 BARS AND EA06 BARS AT 12" MAXIMUM IN REMAINING AREAS.

*** APPLIES TO CURVED BRIDGES ONLY.

**** 2" HIGH x 4" LONG (±). FORMING NOT REQUIRED.

***** USE A TARGET CROSS SLOPE (2.0%) LESS THAN THE MAXIMUM TO ACCOUNT FOR INCONSISTENCIES IN CONCRETE FINISHING.

| | |
|---|---|
| PREPARED BY DESIGN DIVISION | 6.29.17E |