

**GENERAL NOTES:**

PROVIDE PIPE MATERIAL IN ACCORDANCE WITH ASTM DESIGNATION A53, GRADE B, SCHEDULE 40.

PROVIDE STEEL FOR STRUCTURAL ITEMS IN ACCORDANCE WITH SPEC. 3306 AND GALVANIZE IN ACCORDANCE WITH SPEC. 3394 UNLESS OTHERWISE NOTED.

SEE STANDARD PLAN 5-297.740 (2 OF 4) FOR STEEL CONNECTION DETAILS.

SEE STANDARD PLAN 5-297.740 (3 OF 4) FOR SIGN MOUNTING DETAILS.

SEE STANDARD PLAN 5-297.740 (4 OF 4) FOR SIGN CONNECTION DETAILS.

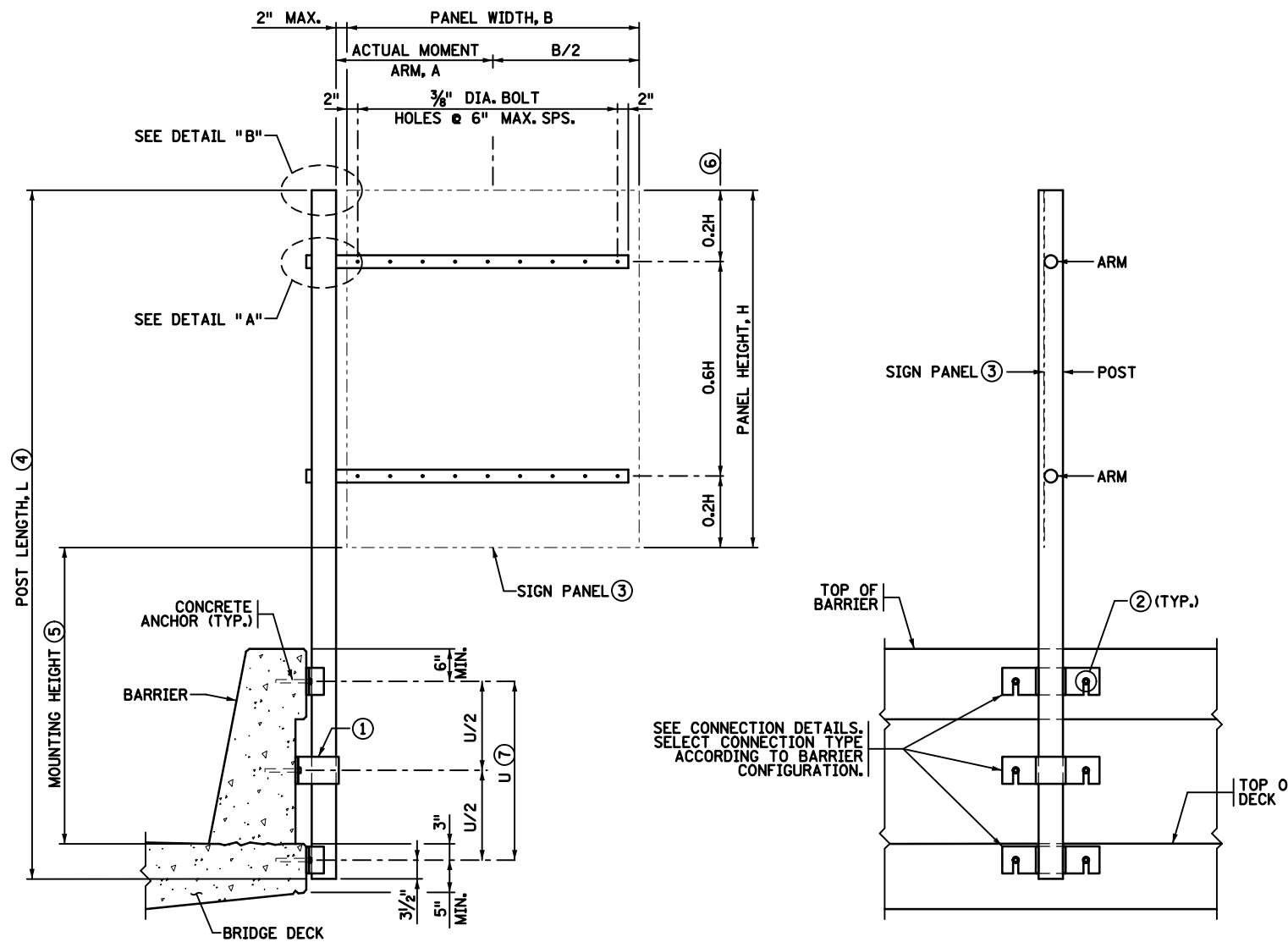
- ① INTERMEDIATE CONNECTION. TYPE AS REQUIRED PER SELECTION TABLE. OFFSET CONNECTION SHOWN, SELECT CONNECTION TYPE ACCORDING TO BARRIER CONFIGURATION.
- ② CONCRETE ANCHOR (TYP.). SEE TABLE FOR ANCHOR ROD DIAMETER AND EMBEDMENT. ANCHOR ROD ACCORDING TO SPEC. 3385, TYPE A WITH FLAT WASHER AND LOCK NUT OR PAIR OF JAM NUTS. FASTEN ANCHOR ROD TO CONCRETE WITH AN APPROVED ADHESIVE. PROVIDE AN ADHESIVE WITH A MINIMUM CHARACTERISTIC BOND STRENGTH IN UNCRACKED CONCRETE OF 1.5 KSI. SLIGHTLY ADJUST POSITION OF SIGN AND ANCHORS HORIZONTALLY IF REINFORCEMENT IS ENCOUNTERED. SEE TABLE FOR PROOF LOAD AND MINIMUM INSTALLATION TORQUE REQUIREMENTS. A HIGHER TORQUE MAY BE REQUIRED BY THE EPOXY MANUFACTURER. SEE SPECIAL PROVISIONS FOR ADDITIONAL REQUIREMENTS. DISTRICT BRIDGE ENGINEER TO CONFIRM THE CONCRETE CONDITION IS SUFFICIENT TO ACCEPT ANCHORS PRIOR TO PLACEMENT ON EXISTING STRUCTURES.
- ③ SINGLE SIGN PANEL SHOWN. FOR SIGN MOUNTING DETAILS AND MULTIPLE SIGN PANEL PLACEMENTS, SEE SIGN MOUNTING DETAILS SHEET.
- ④ TOP OF POST ELEVATION TO MATCH TOP OF SIGN FOR SINGLE SIGN PANEL PLACEMENT OR TOP OF RISER POST FOR MULTIPLE SIGN PANEL PLACEMENTS. SEE SIGNING TABULATIONS FOR DETAILS.
- ⑤ SEE SIGNING TABULATIONS FOR MOUNTING HEIGHT. MINIMUM CLEARANCE FROM BOTTOM OF SIGN PANEL TO TOP OF ROADWAY IS 5'-0". MAXIMUM CLEARANCE IS 7'-0".
- ⑥ APPROXIMATE LOCATION OF ARM MEMBERS RELATIVE TO A RECTANGULAR SIGN PANEL. ACTUAL LOCATIONS SHALL BE DETERMINED USING THE RATIOS PROVIDED AND ROUNDING OF THE 0.6H DIMENSION TO THE NEAREST 3" INCREMENT. THE 0.2H DIMENSIONS SHALL BE EQUAL. FOR OTHER SHAPES, POSITION ARM MEMBERS TO ACCEPT THE STANDARD SIGN MOUNTING HOLES (PUNCH CODES). SEE THE MnDOT STANDARD SIGNS AND MARKINGS MANUAL FOR INFORMATION.
- ⑦ THE MINIMUM DISTANCE BETWEEN UPPER AND LOWER POLE CONNECTION POINTS IS 1'-10" BY DESIGN. ALL CONFIGURATIONS WITH A CONNECTION SPACING GREATER THAN 1'-10" AND MEETING THE MINIMUM TOP AND BOTTOM COVER REQUIREMENTS ARE ACCEPTABLE.
- ⑧ DO NOT USE ON STRUCTURAL TUBE RAILING (DESIGN T-1).

**IMPLEMENTATION INSTRUCTIONS**

- STEP 1: DETERMINE THE ACTUAL SIGN AREA, SA.  
ACTUAL SIGN AREA, SA = B x H IN (SF)
- STEP 2: DETERMINE THE ACTUAL MOMENT ARM OF THE PROPOSED SIGN. ACTUAL MOMENT ARM, A, IS THE DISTANCE FROM THE POLE EDGE TO THE SIGN CENTERLINE.
- STEP 3: DETERMINE THE DESIGN SIGN AREA FROM THE SELECTION TABLE. THE DESIGN SIGN AREA REPRESENTS THE UPPER BOUND SIGN FOR A STANDARD DESIGN CONDITION. FOR CONCRETE RAIL-MOUNTED SIGN SUPPORTS, THE DESIGN SIGN AREAS AVAILABLE ARE: 24.75 SF, 38.5 SF, AND 40.5 SF. IF THE ACTUAL SIGN AREA FALLS BETWEEN VALUES OF DESIGN SIGN AREA, USE THE LARGER VALUE. IF THE ACTUAL SIGN AREA FALLS ABOVE LARGEST OF DESIGN SIGN AREA VALUE, A SPECIAL DESIGN IS REQUIRED.
- STEP 4: DETERMINE THE DESIGN MOMENT ARM, DA, FROM THE SELECTION TABLE FOR THE SPECIFIED DESIGN SIGN AREA. THE DESIGN MOMENT ARM REPRESENTS THE UPPER BOUND FOR A STANDARD DESIGN CONDITION. FOR CONCRETE RAIL-MOUNTED SIGN SUPPORTS, THE DESIGN SIGN AREAS ARE DETERMINED BY THE CALCULATION SPECIFIED IN THE SELECTION TABLE. IF THE ACTUAL SIGN MOMENT ARM IS LESS THAN THE VALUE OF DESIGN MOMENT ARM FOR THE DESIGN SIGN AREA, THE DESIGN IS CONSIDERED ADEQUATE AND THE COMPONENT SIZES SPECIFIED IN THE TABLE MAY BE USED. IF THE ACTUAL SIGN MOMENT ARM IS GREATER THAN THE VALUE OF DESIGN MOMENT ARM FOR THE DESIGN SIGN AREA AND A LARGER DESIGN SIGN AREA IS AVAILABLE, THE COMPONENT SIZES SPECIFIED IN THE TABLE FOR THE LARGER DESIGN SIGN AREA MAY BE USED. IF THE ACTUAL MOMENT ARM FOR THE LARGEST DESIGN SIGN AREA FALLS ABOVE THE RANGE OF DESIGN MOMENT ARM VALUES, A SPECIAL DESIGN IS REQUIRED.

**EXAMPLES**

- EXAMPLE #1:
- ACTUAL PARAMETERS:  
SIGN PANEL WIDTH, B = 54"  
SIGN PANEL HEIGHT, H = 60"
- ACTUAL SIGN AREA, SA = 54" x 60" x (1 SF / 144 SQ. IN.) = 22.5 SF  
ACTUAL MOMENT ARM, A = (1/2 x 54") + 2" = 29"
- DESIGN PARAMETERS:  
SINCE THE ACTUAL SIGN AREA IS LESS THAN THE DESIGN SIGN AREA OF 24.75 SF, USE DESIGN SIGN AREA = 24.75 SF  
DESIGN MOMENT ARM, DA = 717.75 / 22.5 SF = 31.9"
- SOLUTION:  
ACTUAL SIGN AREA, 22.5 SF < DESIGN SIGN AREA, 24.75 SF, OK  
ACTUAL MOMENT ARM, 29" < DESIGN MOMENT ARM = 31.9", OK  
USE INFORMATION FOR A TYPE I DESIGN FROM THE SELECTION TABLE.
- EXAMPLE #2:
- ACTUAL PARAMETERS:  
SIGN PANEL WIDTH, B = 68"  
SIGN PANEL HEIGHT, H = 50"
- ACTUAL SIGN AREA, SA = 68" x 50" x (1 SF / 144 SQ. IN.) = 23.61 SF  
ACTUAL MOMENT ARM, A = (1/2 x 68") + 2" = 36"
- DESIGN PARAMETERS:  
SINCE THE ACTUAL SIGN AREA IS LESS THAN THE DESIGN SIGN AREA OF 24.75 SF, USE DESIGN SIGN AREA = 24.75 SF  
DESIGN MOMENT ARM, DA = 717.75 / 23.61 SF = 30.4"
- SOLUTION:  
ACTUAL SIGN AREA, 23.61 SF < DESIGN SIGN AREA, 24.75 SF, OK  
ACTUAL MOMENT ARM, 36" > DESIGN MOMENT ARM = 30.4", UNACCEPTABLE  
TRY NEXT ROW IN SELECTION TABLE.
- DESIGN PARAMETERS:  
USE DESIGN SIGN AREA = 38.5 SF  
DESIGN MOMENT ARM, DA = 1695 / 23.61 SF = 71.8"
- SOLUTION:  
ACTUAL SIGN AREA, 23.61 SF < DESIGN SIGN AREA, 38.5 SF, OK  
ACTUAL MOMENT ARM, 36" < DESIGN MOMENT ARM = 71.8", OK  
USE INFORMATION FOR A TYPE II DESIGN FROM THE SELECTION TABLE.



**ELEVATION**

(TYPE S BARRIER ON BRIDGE DECK SHOWN. ALL OTHERS SIMILAR.)

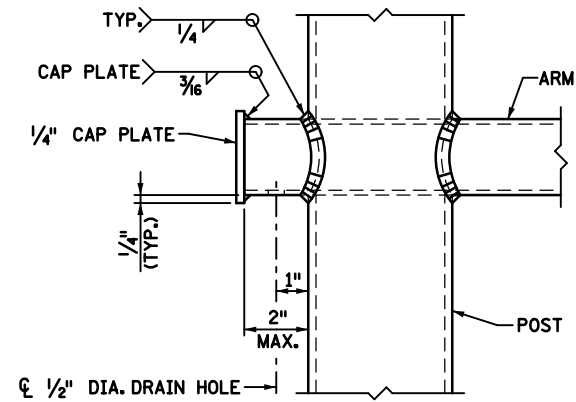
**END VIEW**

TYPE	DESIGN SIGN AREA (SF)	DESIGN MOMENT ARM, DA (IN)	NOMINAL POST SIZE (IN.)	NOMINAL ARM SIZE (IN.)	CONCRETE ANCHOR					FILL PLATE THICKNESS (IN.)	BENT PLATE THICKNESS (IN.)	SIDE PLATE THICKNESS (IN.)	CONNECTION SPACING, U
					DIAMETER (IN.)	EMBEDMENT (IN.)	NUMBER REQUIRED	TORQUE (FT-LBS)	PROOF LOAD (KIPS)				
I	24.75	717.75/SA	4	2	0.625	5.625	2	60	7.4	0.5	0.5	0.5	1'-6" MIN.
II	38.50	1695/SA	5	3	0.875	8	2	80	14.5	0.625	0.625	0.625	1'-6" MIN.
III	40.50(8)	2268/SA	5	3	0.875	8	3	80	14.5	0.75	0.625	0.625	1'-10" MIN.

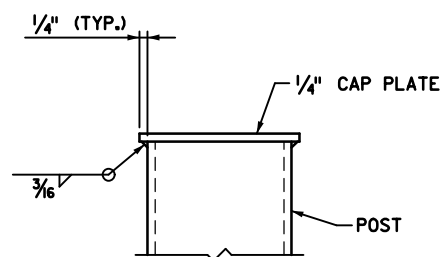
SA = ACTUAL SIGN AREA IN (SQUARE FEET)

**SELECTION TABLE**

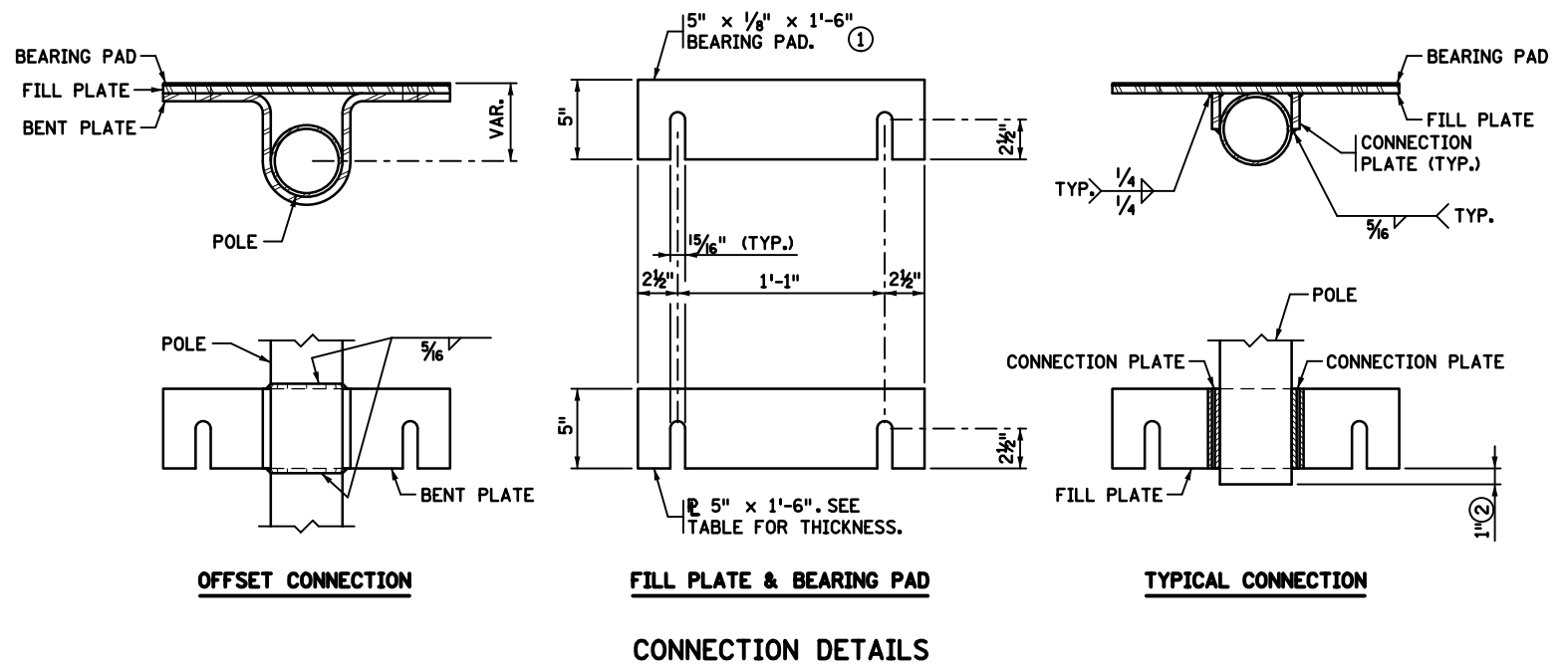
LEAD EXPERT OFFICE	KEVIN WESTERN STATE BRIDGE ENGINEER	CONCRETE RAIL MOUNTED SIGN	APPROVED: 06-04-2019 REVISED:	 THOMAS STYRBICKI STATE DESIGN ENGINEER	STANDARD PLAN 5-297.740	1 OF 4
		STANDARD PLAN	STATE PROJ. NO.		SHEET NO.	
			TRUNK HWY.		TOTAL SHEETS	



**DETAIL "A"**



**DETAIL "B"**



**OFFSET CONNECTION**

**FILL PLATE & BEARING PAD**

**TYPICAL CONNECTION**

**CONNECTION DETAILS**

**GENERAL NOTES:**

- ① PROVIDE 1/8" 60 DUROMETER PLAIN ELASTOMERIC BEARING PAD OR PREFORMED FABRIC PAD MEETING AASHTO LRFD BRIDGE CONSTRUCTION SPECIFICATIONS SECTION 18.10. WAIVE THE SAMPLING AND TESTING REQUIREMENTS UNDER SPEC. 3741, "ELASTOMERIC BEARING PADS," AND AASHTO M 251.
- ② POLE PROJECTION BEYOND FILL PLATE SHOWN FOR TYPICAL CONNECTION. USE FOR OFFSET CONNECTION AS REQUIRED.

LEAD EXPERT OFFICE  
KEVIN WESTERN  
STATE BRIDGE ENGINEER



CONCRETE RAIL MOUNTED SIGN  
STEEL CONNECTION DETAILS

APPROVED: 06-04-2019  
REVISED:

*Tom Styrbicki*  
THOMAS STYRBICKI  
STATE DESIGN ENGINEER

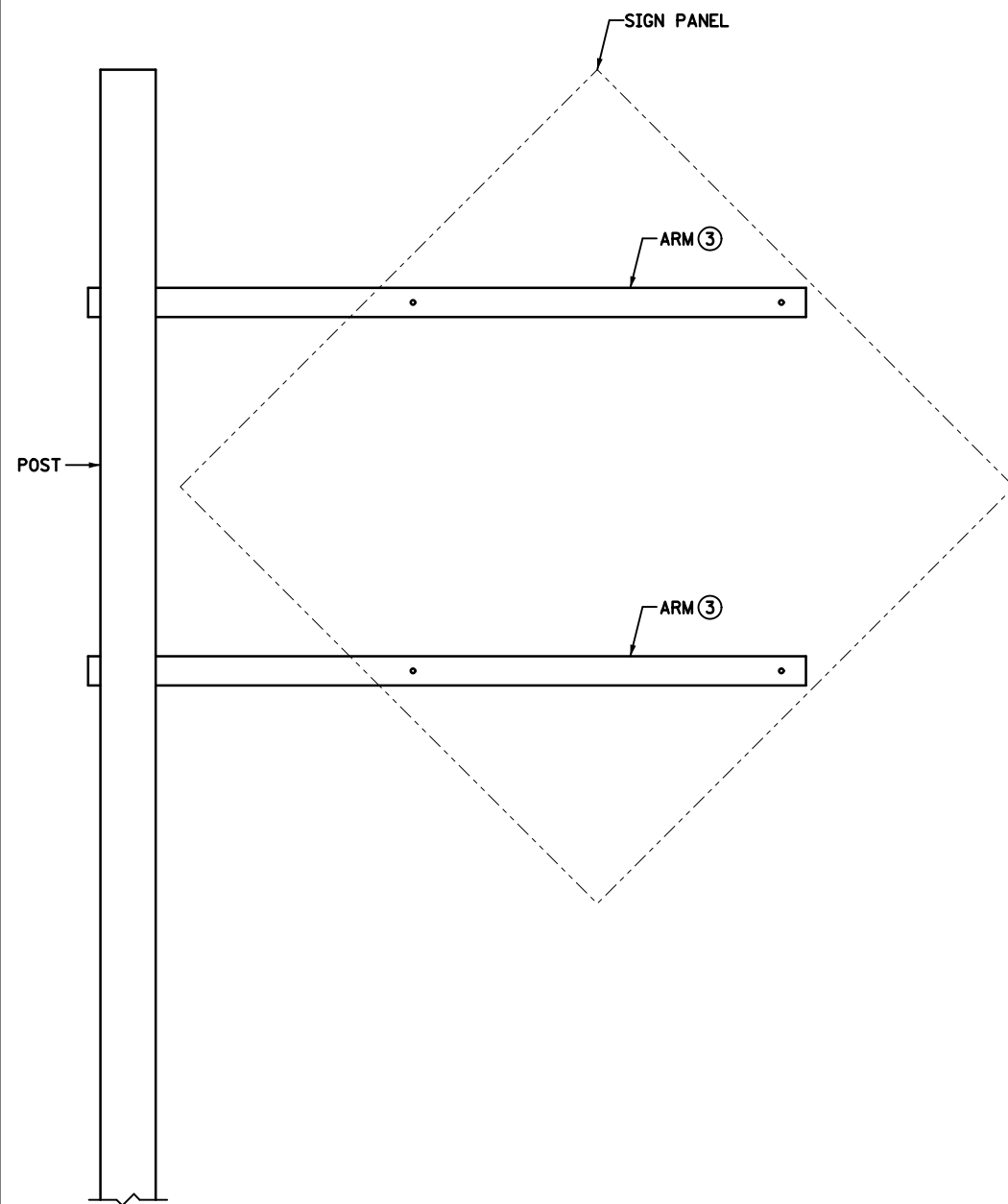
STANDARD PLAN  
5-297.740

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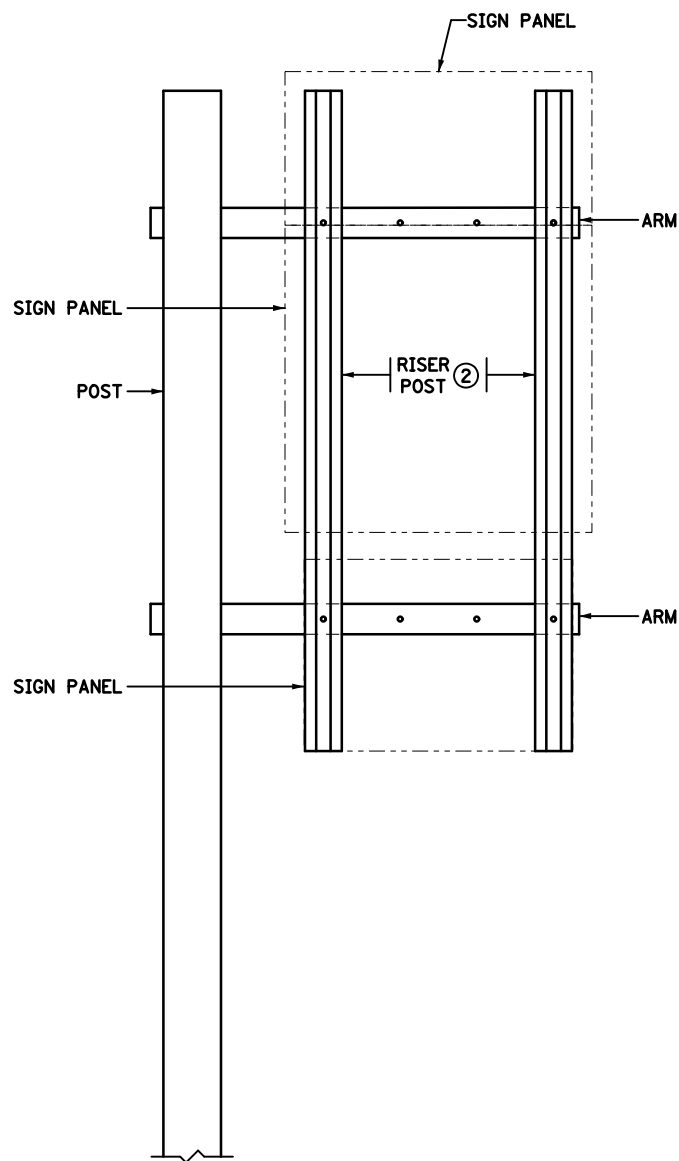
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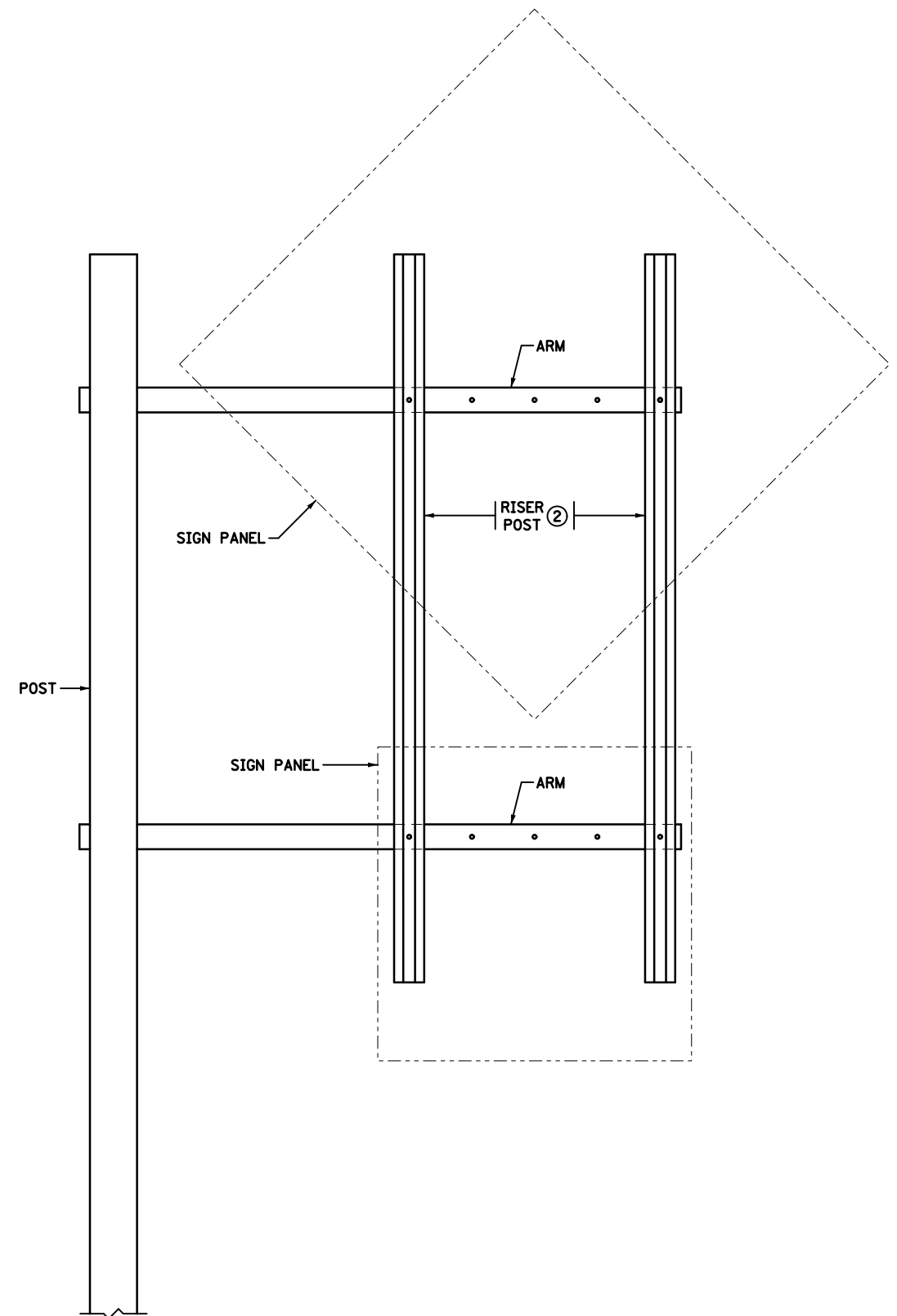
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**SINGLE PANEL PLACEMENT ①**  
(DIAMOND PANEL SHOWN)



**MULTIPLE PANEL PLACEMENT ①**



**MULTIPLE PANEL PLACEMENT ①**

**GENERAL NOTES:**

BOLT TYPE D SIGN PANELS TO ARM MEMBERS AT 24" MAXIMUM INTERVALS SIMILAR TO THE TYPE D STRINGER AND PANEL-JOINT DETAIL (SEE M<sub>h</sub>DOT STANDARD SIGNS AND MARKINGS MANUAL).

BOLT TYPE C SIGN PANELS TO ARM MEMBERS OR RISER POSTS ACCORDING TO SINGLE/MULTIPLE PANEL PLACEMENT DETAILS. SEE THE M<sub>h</sub>DOT STANDARD SIGNS AND MARKINGS MANUAL FOR MOUNTING HOLES (PUNCH CODES) INFORMATION.

- ① SEE SIGN TABULATIONS FOR DIMENSIONAL INFORMATION.
- ② USE 2.5 LB/FT RISER POSTS IN ACCORDANCE WITH SPEC. 3401. SEE STANDARD SIGN PLANS FOR LOCATIONS OF PUNCHED HOLES IN RISER POSTS FOR MOUNTING OF SIGNS. USE RISER POST LENGTH AS PANEL HEIGHT, H, FOR DETERMINATION OF ARM MEMBER LOCATIONS.
- ③ SEE STANDARD PLAN 5-297.740 (1 OF 4) FOR POSITION OF ARMS FOR RECTANGULAR PANELS. FOR OTHER SHAPES, POSITION ARM MEMBERS TO ACCEPT THE STANDARD SIGN MOUNTING HOLES (PUNCH CODES). SEE THE M<sub>h</sub>DOT STANDARD SIGNS AND MARKINGS MANUAL FOR INFORMATION.

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STATE BRIDGE ENGINEER



CONCRETE RAIL MOUNTED SIGN  
SIGN MOUNTING DETAILS

APPROVED: 06-04-2019  
REVISED:

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STATE DESIGN ENGINEER

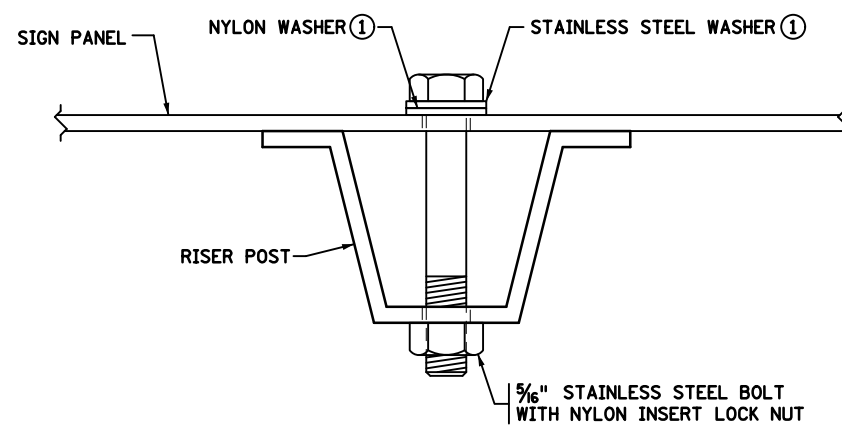
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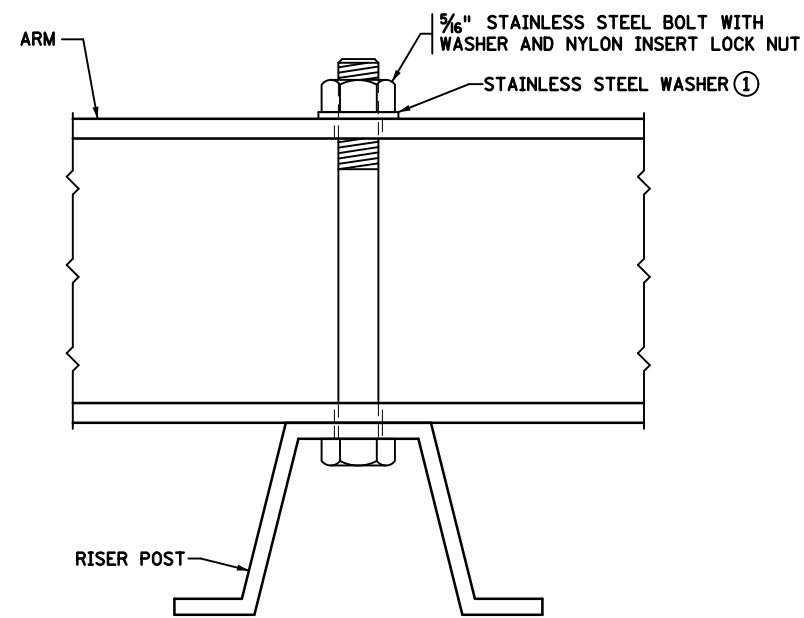
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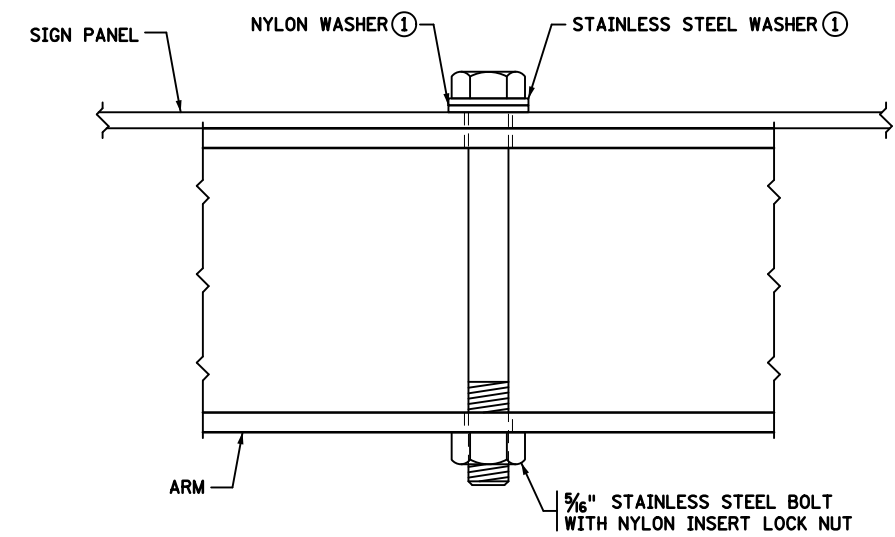
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**SIGN TO RISER POST CONNECTION**



**RISER POST TO ARM CONNECTION**



**SIGN TO ARM CONNECTION**

**GENERAL NOTES:**

USE STAINLESS STEEL 5/16" BOLTS, WASHERS, AND NYLON INSERT LOCK NUTS AS SHOWN.

PROVIDE FASTENERS IN ACCORDANCE WITH SPEC. 3391.

① PROVIDE STAINLESS STEEL WASHERS AND NYLON WASHERS AS SHOWN. STAINLESS STEEL AND NYLON WASHERS SHALL HAVE IDENTICAL DIMENSIONS (T=1/32" MIN., I.D.=3/8" MAX., O.D.=7/8" MAX.).

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CONCRETE RAIL MOUNTED SIGN  
SIGN CONNECTION DETAILS

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5-297.740

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STANDARD PLAN

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