

GUARDRAIL POST STEEL

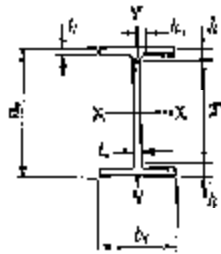
Guardrail posts meeting materials certification are evaluated and checked for:

1. Dimensional acceptance
2. Physical test results
 - a. Chemical
 - b. Physical
3. Galvanized or painted coating

Construction specifications for steel guardrail posts are defined under ODOT state specification 606

- a. The materials specification referred to in 606 is Material Spec 710.15
- b. Material specification 710.15 calls for ASTM A36

DIMENSIONS

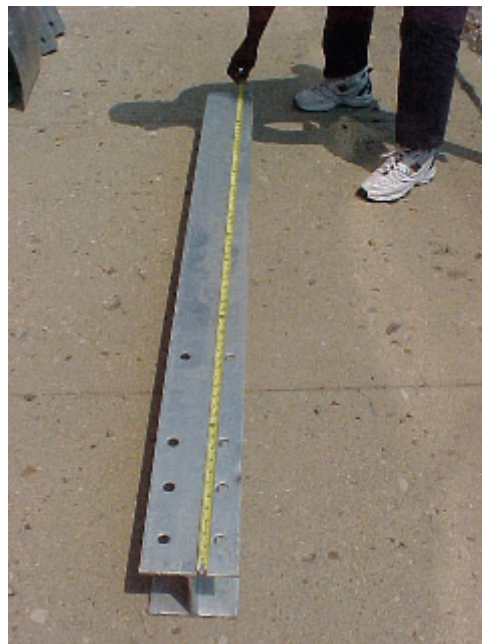


W SHAPES Dimensions

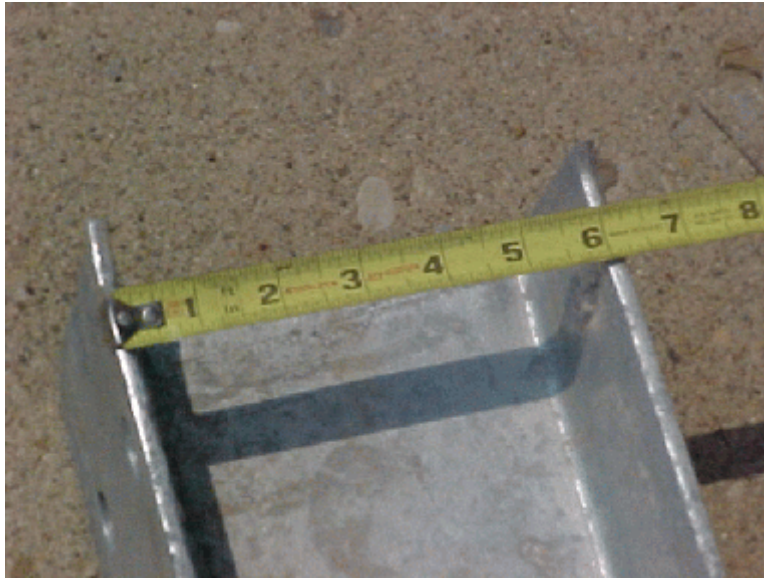
Designation	Area A	Depth d	Web			Flange			Distance				
			Thickness tw	Lw 2	Width bf	Thickness tf	T	k	k1				
										in.	in.	in.	in.
W 8x67	19.7	9.00	8	0.570	5/16	5/16	8.240	8 1/2	0.935	15/16	6 1/2	17 1/2	13 1/16
x58	17.1	8.75	8 1/4	0.500	1/2	5/8	8.220	8 1/4	0.810	1 1/16	6 1/2	15 1/16	11 1/16
x48	14.1	8.50	8 1/2	0.400	3/8	3/4	8.110	8 1/2	0.685	1 1/16	6 1/2	14 3/16	9 1/2
x40	11.7	8.25	8 1/4	0.360	3/8	3/4	8.070	8 3/4	0.560	5/8	6 1/2	13 1/4	8 1/2
x35	10.3	8.12	8 1/8	0.330	3/8	3/8	8.020	8	0.495	3/4	6 1/2	12 1/2	7 1/2
x31	9.13	8.00	8	0.285	5/16	3/8	7.995	8	0.435	3/8	6 1/2	11 1/2	6 1/2
W 8x28	8.25	8.06	8	0.285	5/16	3/8	6.555	6 1/2	0.465	3/8	6 1/2	10 1/2	7 1/2
x24	7.08	7.92	7 7/8	0.245	1/4	3/8	6.495	6 1/2	0.400	3/8	6 1/2	9 1/2	6 1/2
W 8x21	6.15	8.22	8 1/4	0.250	3/8	3/8	5.270	5 1/2	0.400	3/8	6 1/2	8 1/2	6 1/2
x18	5.26	8.14	8 1/8	0.230	1/4	3/8	5.250	5 1/2	0.330	3/8	6 1/2	7 1/2	6 1/2
W 8x15	4.44	8.11	8 1/8	0.245	1/4	3/8	4.415	4	0.315	3/8	6 1/2	7 1/2	6 1/2
x13	3.90	7.99	8	0.220	1/4	3/8	4.000	4	0.255	3/8	6 1/2	6 1/2	6 1/2
x10	2.94	7.89	7 7/8	0.170	3/16	1/2	3.940	4	0.205	3/8	6 1/2	5 1/2	6 1/2
W 6x25	7.34	6.25	6 1/4	0.320	5/16	3/8	6.080	6 1/2	0.485	7/16	4 1/2	10 1/2	7 1/2
x20	5.87	6.20	6 1/4	0.260	3/4	3/8	6.020	6	0.365	5/16	4 1/2	9 1/2	6 1/2
x15	4.43	5.99	6	0.230	3/4	3/8	5.990	6	0.260	5/16	4 1/2	8 1/2	6 1/2
W 6x16	4.74	6.28	6 1/4	0.260	3/4	3/8	4.020	4	0.405	3/8	4 1/2	7 1/2	7 1/2
x12	3.58	6.03	6	0.230	3/4	5/8	4.000	4	0.280	1/4	4 1/2	7 1/2	6 1/2
x 9	2.68	5.90	5 1/2	0.170	3/4	5/8	3.940	4	0.215	3/8	4 1/2	6 1/2	6 1/2
W 5x19	5.54	5.15	5 1/8	0.270	1/4	1/2	5.030	5	0.430	7/16	3 1/2	10 1/2	7 1/2
x16	4.68	6.01	5	0.240	3/4	1/2	5.000	5	0.360	3/8	3 1/2	9 1/2	7 1/2
W 4x13	3.84	4.36	4 1/2	0.280	3/4	1/2	4.060	4	0.345	3/8	2 1/2	10 1/2	7 1/2



W6 x 15 and W6 x 9 Posts



Performing dimensional check of post length.



Measuring the Depth of the post



Measuring the Flange width

Other dimensional checks should include thickness of the flange and thickness of the web. Also spacing and size of the holes. **How often?** Based on your quality control plan and to assure that delivered materials meet specification, plan, or standard drawing requirements.

Chemical Requirements

ASTM A36 has specific chemical requirements. Below is the typical table defining chemical requirements. Note that the chemical requirements for an A36 steel change depending on thickness or shape.

- Note: 1-Where “appears in this table, there is no requirement. The heat analysis for manganese shall be determined and reported as described in the heat analysis section of Specification A 6/A 6M.

Table 2

Product	Shapes ^A	Plates ^b				Bars			
Thickness, in. {mm}	All	To 3/4 {20}	Over 3/4 to 1 1/2	Over 1 1/2 to 2 1/2	Over 2 1/2 to 4	To 3/4 {20}	Over 3/4 to 1 1/2	Over 1 1/2 to 4	Over 4 {100}
		over 4 incl {100}	{20 to 40}	{40 to 65}	{65 to 100}	incl	{20 to 40}	{100}	{100}
			Incl	Incl	Incl		Incl	Incl	
Carbon, max, %	0.26	0.25	0.25	0.26	0.27	0.26	0.27	0.28	0.29
Manganese, %	...	0.29				...	0.60-0.90	0.60-0.90	0.60-
Phosphorus, max, %	0.04	...	0.80-1.20	0.80-1.20	0.85-1.20	0.90			
Sulfur, max, %	0.05	0.85-12.0				0.04	0.04	0.04	0.04
Silicon, %	0.40 max	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05
Cooper min % of copper steel is specified	0.20	0.04	0.05	0.05	0.05	0.40max	0.40max	0.40max	
		0.05	0.05	0.05	0.05	0.40max			
		0.05				0.20	0.20	0.20	0.20
		0.40max	0.40max	0.15-0.40	0.15-0.40				
		0.15-0.40							
		0.20	0.20	0.20	0.20				
		0.20							

- Manganese content of 0.85-1.35% and silicon content of 0.15-0.40% is required for shapes over 426 lb/ft (634 kg/m).
- For each reduction of 0.01 percentage point below the specified carbon maximum, an increase of 0.06 percentage point manganese above the specified maximum will be permitted, up the maximum of 1.35%.

PHYSICAL REQUIREMENTS

Table 3 Tensile Requirements^A	
Plates, Shapes, B and Bars:	
Tensile strength, ksi {MPa}	58-80 {400-550}
Yield point, min, ksi {MPa}	36 {250} ^C
Plates and Bars^{D,E}:	
Elongation in 8 in. {200 mm}, min, %	20
Elongation in 2 in. {50 mm}, min %	23
Shapes:	
Elongation in 8 in. {200 mm}, min, %	20
Elongation in 2 in. {50 mm} min %	21 ^b

- See the Orientation subsection in the Tension Tests section of Specification A 6/A 6M.
- For wide flange shapes over 426 lb/ft {634 kg/m}, the 80ksi {550 Mpa} maximum tensile strength does not apply and a minimum elongation in 2in. {50 mm} of 19% applies.
- Yield point 32 ksi {220 Mpa} for plates over 8in. {200 mm} in thickness.
- Elongation not required to be determined for floor plate.
- For plates wider than 24in. {elongation requirement is reduced two percentage points. See the Elongation Requirement Adjustments subsection under the Tension Test section of Spec. A 6/A 6M}

Coating Thickness

ODOT specifications for galvanized coating for posts require Hot Dipped Galvanizing to ASTM A123. Again, this specification requirement can be tracked through the specification book. The tables below are duplicates of current ASTM A123 coating tables. **NOTE THE THICKNESS OF THE MATERIAL CONTROLS THE SPECIFICATION. IF THERE ARE MULTIPLE THICKNESSES OF MATERIAL IN A COMPONENT THE COATING THICKNESS REQUIRED WILL BE DIFFERENT. EXAMPLE THE FLANGE AND WEB THICKNESSES OF A W6 X 9 (Flange is .215" Web is .170")**

Table 1 Minimum Average Coating Thickness Grade by Material Category:					
Material Category	All Specimens Tested Steel Thickness Range (Measured), in.				
	<1/16"	1/16to<1/8	>1/8to3/16	>3/16to<1/4	>1/4
Structural Shapes and plate	45	65	75	85	100
Strip and Bar	45	65	75	85	100
Pipe and Tubing	45	65	75	75	100
Wire	35	50	60	65	80

Table 2 Coating Thickness Grade

<u>Coating Grade</u>	<u>mils</u>	<u>Oz/ft²</u>	<u>um</u>	<u>g/m²</u>
35	1.4	0.8	35	245
45	1.8	1.0	45	320
50	2.0	1.2	50	355
55	2.2	1.3	55	390
60	2.4	1.4	60	425
65	2.6	1.5	65	460
75	3.0	1.7	75	530
80	3.1	1.9	80	565
85	3.3	2.0	85	600
100	3.9	2.3	100	705

The two tables above can be used to find the minimum galvanizing thickness required for a specific material. Table 1 gives the required thickness and table two gives a conversion chart between type of readings.

Coatings are checked using a CALIBRATED magnetic thickness gage. CALIBRATION depends on the type of gage your company has but generally it is shims of known thicknesses used to check the gages reading. The operator places the known thickness shim on an smooth uncoated piece of steel. The gage is then read to see if the gage's value matches the shims known thickness (generally gages are in mils (1/1000th of an inch))

The following example is used for verification of materials.

The flange and web of a W6 x 9 is to be checked.

From table 1

the flange's minimum coating is a 85 coating grade (flange thickness is .215")

the web's minimum coating is a 75 coating grade (web thickness is .170")

An acceptable reading point is an average of 5 millage readings. A minimum of three reading points is required to accept a material. (There are also controls for how many items are represented by 3 readings. This is defined in the ASTM specifications)

Shown below is an example for a single reading:

Shown below is an example for a single reading:

Make 5 magnetic thickness measurements widely dispersed on the piece being tested.

The averaged value should meet or exceed the specification requirement:

Readings 5.1, 5.4, 4.2, 5.4, 5.9 = Average= 5.2 mils

Table 2 conversion - Table 2 says a grade 85 is 3.3 mils < 5.2 mils is therefore greater than the 85 coating grade and is acceptable.



Shown above is a magnetic thickness gage with a 5.0 mil reading on the post flange

Other A36 Components

There are many other guardrail components that should meet the requirements of ASTM A36 and the galvanizing coating requirements of ASTM A123. The reader will need to work through the items but here are a few standards.

Single & Barrier Rail Gr-4.1 (m)

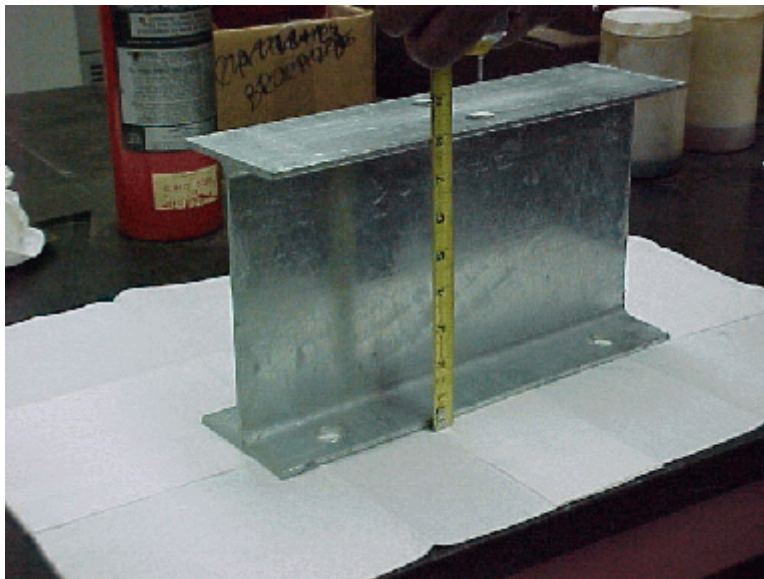
Post A

Type A anchor Assemble

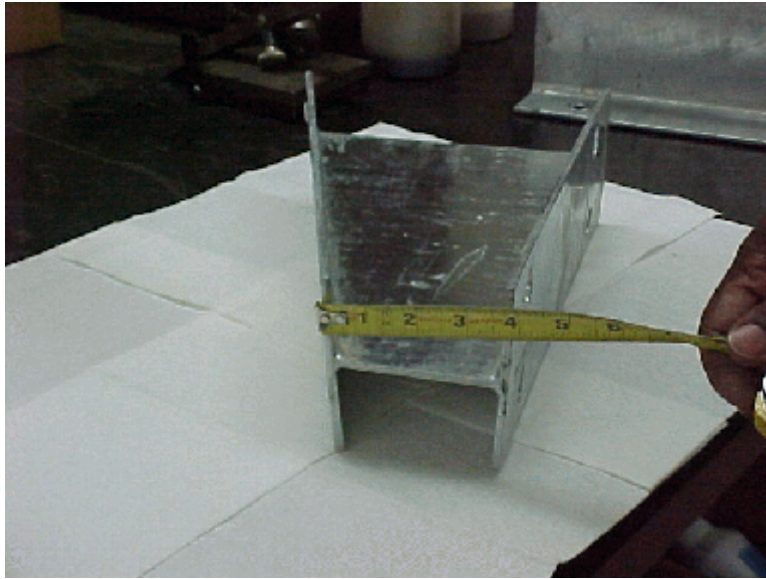
Post B

Brace Rod Plate Gr-4.2 (m)

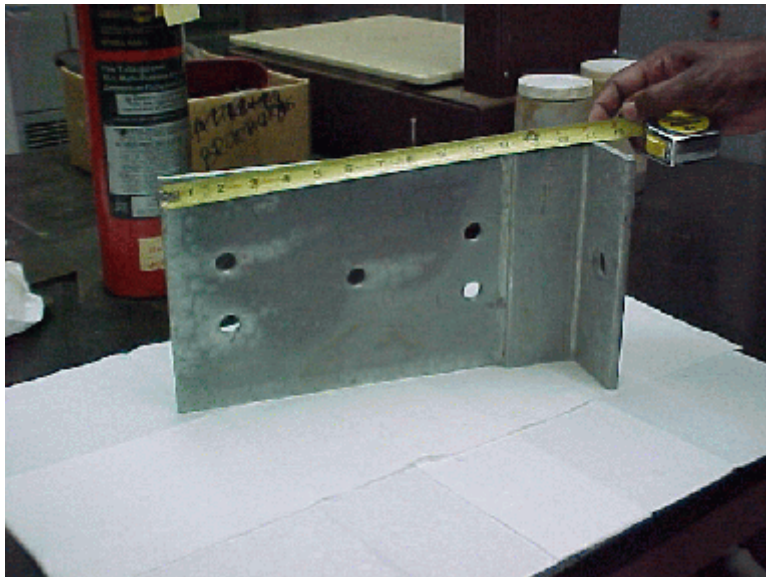
Type T anchor Assembly



A post spacer



B post spacer



T Type Brace Rod Plate

A36 Posts Certification

The following is an example of checking a certification to see if the submitted certification provides acceptable documentation that a Guardrail post meets materials requirements. First issue is what are we checking? As listed before, the general items will be:

1. Dimensions
2. Physicals
 - a Chemical tests
 - b Physical tests
3. Coating thickness

A certification for a guardrail post is included on the next page.

So how do I cover the items I need?

1. A dimensional check can be performed on one or two pieces to assure the posts are correct. On the certification on the next sheet the size of the member being shipped is also listed.
2. Chemical test results are listed on the certification on the next page. These values should be reviewed against the specification requirements to assure they meet.
3. The Yield, Ultimate tensile and Elongation for the actual heat number are also listed. Again these values should be compared to the specification requirements.

As a quick example: Yield is a minimum of 36,000 psi
 Ultimate Tensile should be between 58,000 and 80,000

The marked block in the attached certification shows a yield of 43,300 psi. The tensile strength is 65400 psi. Both of these numbers meet the example requirements.

4. Coating. To check coating you need to know thicknesses of the material (this you have from your dimensional inspection) and then you can check the specification for the required minimum zinc coating thickness.

On this certification the average WEIGHT of Coating is 4.0. WEIGHT OF COATING IS IN OZ not mils as was our last coating example. Going back to page 2-6 a maximum coating of 100 = 2.3 oz/sq ft. The specification say 4.0 so the specification exceeds the minimum.

WHILE THIS CERTIFICATION HAS THAT COATING NUMBER THE CERT LISTS THE SAME COATING NUMBER FOR ALL ITEMS. A GOOD QUALITY CONTROL WILL MAKE CHECK READINGS TO VERIFY THE COATING.

Certified Analysis

CERTIFIED ANALYSIS

Page: 1

CUSTOMER: STATE OF OHIO

ORDER NUMBER: N/A
CUSTOMER PO:

PRINT DATE: 11/18/2000
PROJECT: STOCK
SHIPPED TO: OHIO

OH

B/L NUMBER :

Mat. No.	Yield Point	Tensile Strength	Elong. %	C.	MN.	P.	S.	SI.	CU.	CR.	CA.	VN.	Avg Wt of Coating	Quantity	Class	Type	DESCRIPTION	
20251	43000	64000	24.0	.140	.070	.010	.022	.210	.000	.000	.000	.000	4.0	200.0 PC			5'6 POST/DB:DB	
																	A-36	20251
10639	47500	55400	25.0	.120	.070	.011	.026	.210	.000	.000	.000	.000	4.0	2500.0 PC			5'9 POST/8-1/2 DB:DB	
																	A-36	10639
02222	38400	50900	32.0	.090	.030	.007	.006	.030	.000	.000	.000	.000	4.0	100.0 PC	R	2	10/HOLE PLATE/CAT/ROLLUP	
																	X-100	02222
202741	52000	56000	38.0	.130	.090	.012	.005	.240	.000	.000	.000	.000	4.0	100.0 PC			PL .625X12X10	
																	A-36	202741
5745	44570	50470	35.1	.050	.050	.008	.006	.030	.000	.005	.000	.000	4.0	1000.0 PC			SLOT COUPLD '38	
																	A-36	5745
2-990450	53600	72000	26.0	.110	.080	.010	.044	.250	.000	.000	.000	.000	4.0	50.0 PC			5'9 POST/10 1/2 DB:DB	
																	A-36	2-990450
00383	60655	78558	34.0	.200	.130	.014	.008	.030	.000	.000	.000	.000	4.0	50.0 PC			5/16X1.75X1.75 HAMB/1"ESC	
																	A-36	00383
001601	50720	74300	23.0	.190	.140	.020	.037	.270	.000	.000	.000	.000	4.5	90.0 PC			1/2X1/2X1/2 PWT 4 HBL/SLUICE	
																	A-36	001601
10892	46500	60700	22.0	.130	.080	.015	.020	.220	.000	.000	.000	.000	4.0	100.0 PC			3'4 POST/8.50/.75X14X1.00	
																	A-36	10892

ALL STEEL USED IN THE MANUFACTURE IS OF DOMESTIC ORIGIN.

ALL GUARDRAIL SHEETS MEETS ASTM A-100, ALL STRUCTURAL STEEL MEETS ASTM A-103.

ALL OTHER GALVANIZED MATERIAL CONFORMS WITH ASTM-123.

ALL BOLTS AND NUTS ARE OF DOMESTIC ORIGIN.

BOLTS COMPLY WITH ASTM A-307 SPECIFICATIONS AND ARE GALVANIZED IN ACCORDANCE WITH ASTM A-153, UNLESS OTHERWISE STATED.

NUTS COMPLY WITH ASTM A-563 SPECIFICATIONS AND ARE GALVANIZED IN ACCORDANCE WITH ASTM A-153, UNLESS OTHERWISE STATED.

State of Ohio, County of Allen. Sworn and subscribed before me this 18th day of November, 2000.

Notary Public:

Notary Expires: