Deep Beam Rail

Normally sold under the Department’s construction item 606, the materials specifications refer to section 710.06. Under 710.06 the AASHTO specification for guardrail, M180 - Type II, Class A is called out.

Generally ODOT uses two types of beam elements. The W Beam (seen below) and the Thrie beam (shown later in this training). The typical W-beam cross section is shown above. All Dimensions are show except thickness. Thickness is specified by the specification’s Class designation. Class A, Type II requires a nominal 0.111” thickness.

2.1
**Dimensions**

Dimensions should be verified to assure the delivered product meets what you ordered.

1. Measure the thickness of beam. Thickness should meet requirements of Table 1, AASHTO M180, Class A, Type II.
   
   A) Nominal Thickness 0.111 inches.
   
   B) Tolerance for under thickness - maximum 0.009 inches.

Proper measurement of sheet metal thickness is performed with a set of micrometers. They don’t have to be digital but it does make the readout easier. Using a ruler is not acceptable.
2. Measure the width of beam. The width should meet the requirements of Section 10.2.1 of ASSHTO M180. The specification calls for a flat sheet width (before rolling the section) of 19". A nominal measurement described below should verify the 19" dimension.

A. Total finished width 12 1/4 inches [total nominal sheet width 19"]

B. Tolerance (for the 19" dimension) is 1/8 under.

C. Pictured below is the 12 1/4 dimensional check

D. Not pictured should be a vertical check for depth of 3 1/4"

The two (vertical and horizontal) dimensions should establish correct section
Coating Thickness Measurement

To Measure Coating Thickness:

1. The coating thickness requirement in the specification is the total amount of galvanizing ON BOTH SIDES of a beam, measured in ounces for sq. ft.

2. Minimum coating thickness requirements are shown in Table 2 of AASHTO M 180.

3. Typically the requirement is the single spot check 3.60 oz of zinc per square foot and the triple spot check is 4.00 oz of zinc per square foot. To be acceptable both the single and triple spot checks need to be met.

4. A single spot is defined as five (5) magnetic thickness gage readings in one area. A triple spot check is 3 single spot check readings. The three (3) spots should be distributed across the material. Measurements, when possible, should be taken on a flat surface to assure accuracy.

Readings with a magnetic thickness gage
Example of Spot Check Calculation

**Spot Checks**

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<th>#2</th>
<th>#3</th>
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<tr>
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<tr>
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<td>3.6</td>
<td>3.1</td>
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<td>4</td>
<td>3.7</td>
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<tr>
<td>5</td>
<td>3.4</td>
<td>3.5</td>
<td>4.1</td>
</tr>
</tbody>
</table>

Divide by (5) to get Average / Round off to nearest 10th

|    | 3.6 | 3.9 | 3.8 |

Multiply by 0.59 to convert to oz of zinc per square foot

<table>
<thead>
<tr>
<th>Spot check</th>
<th>Reading (mils)</th>
<th>Multiplier</th>
<th>oz/sq. ft</th>
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<tbody>
<tr>
<td>#1</td>
<td>3.6</td>
<td>0.59</td>
<td>2.1</td>
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<td>#2</td>
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<tr>
<td>#3</td>
<td>3.8</td>
<td>0.59</td>
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Multiply by 2 because the coating requirement is for the amount of galvanizing on both sides of beam.

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<td>4.6</td>
<td>4.4</td>
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</tbody>
</table>

All single spot checks are required to be over 3.60 oz per. s.f. so these (3) are okay. And the average of these three for the triple spot check is 4.4 which is above the required minimum of 4.00 oz. per. s.f.
Markings And Material requirements

Guardrail elements require the following markings:

A. Name or brand of manufacture
B. Identification symbols or code for heat
C. Number & coating lot
D. AASHTO Specification Number
E. Class & Type

Markings should be checked against certifications to see the material supplied you has the correct documentation. The traffic side of beam, and in the valley of the center of corrugation.
5. **Mechanical Requirements**

Along with Dimensional and coating requirements the other key issue is the mechanical properties of the material. Listed below is the information that can be found in the applicable specification for guardrail.

5.1 Base metal requirements are:

A. Yield paint is 50,000 psi minimum

B. Tensile strength is 70,000 psi minimum

C. Elongation in 12% in a 2” gage length - minimum

Generally certified test data should be received with all material showing that they meet specification requirements. If certified test is not supplied, your firm has a choice. Reject the material or send it out to a private laboratory have the mechanical requirements tested.

AS A GENERAL STATEMENT: IF YOUR FIRM BOUGHT MATERIAL TO MEET AASHTO M180 CERTIFIED TEST DATA IS A REQUIREMENT OF THAT SPECIFICATION. WHY WOULD YOU PERFORM TESTING TO DOCUMENT MATERIAL QUALITY WHEN YOUR ORDER SHOULD HAVE PROVIDED YOU THAT DATA.

Certified test data is not a letter of certification. It is actual test results for the materials you have received showing all test data required under the specification to validate the specification has been met.
## Certified Analysis Example

### Certified Analysis

<table>
<thead>
<tr>
<th>Specification</th>
<th>Mass</th>
<th>Density</th>
<th>Theory</th>
<th>Analysis</th>
<th>Difference</th>
<th>Percent</th>
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<td>056</td>
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<td>045</td>
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All cut-out parts are of domestic origin.

All cut-out panels are aligned N-0.06. All structural steel parts are certified N-193.

Any other material used is of material and origin specified in accordance with ASTM A527 and AASHTO M-183.

Not sure if the cut-out panels are in accordance with H-0.06. They are certified N-0.06. All other panels are in accordance with AASHTO M-183. All panels are in accordance with AASHTO M-183.

Certified by: [Signature]
B. **Thrie Beam**

All the requirements for the thrie beams are the same as W beams except for the width.

As per section 10.2.1 AASHTO M180

A. Overall finished Width 20 inches [Total Nominal width of metal if not bent 29 1/2']

B. Tolerance under nominal width is 1/8 inch
Certification should be received with all material showing it meets specification requirements. Any properties required by specification that aren’t on the certification should be tested by the certified supplier.
Certified Analysis

Material Test Report

| S13-41/331/ | U/L/0.05C/0.035 | 1.008 | 550/100 | 77,200 | 70 | 3.4 MILL. | RG-406 | 12-6756-31-13GA THROUGH BEAM |

Bolts comply with ASTM A-325 Specifications and galvanized to accordance with ASTM A-153, unless otherwise labeled.

All welds meet ASME code. All structural steel meets AISC code A-100.

All steel used in the manufacture is of domestic origin.

These materials are in accordance with D.O.T. Specifications.

State of Pennsylvania

Certified By: ____________________________

Approved By: ____________________________

Name of Producer: ____________________________

Date Of: ____________________________

Issued By: ____________________________

Typos: [Please]

My commission Expires March 26, 2030
Transition Section

All the requirements for the Transition Section are the same as for the “W” Beam & Thrie Beam.

Specifications For Materials

Certification should be received with all material showing it meets specification requirements. Any properties required by specification that aren’t on the certification will require testing by the certified supplier.
CERTIFIED ANALYSIS

TRANSMISSION CERTIFIED DATA

ORDER NUMBER: N/A  PROJECT: STOCK

SHIP TO: CTIO

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2.13

ALEX, THE RECORDER OF THE MANUFACTURE TO OY KOREK KOKKU.

ALL OUTBOUND ITEMS ARE IN KOREK KOKKU. ALL STRUCTURE STORM SHEETS ARE TO 

BE STORED WITH ASST 123.

ALL DUTIES AND DUES ARE IN KOREK KOKKU.

CERTIFIED TO CONFORM TO ASTM A-1037 SPECIFICATIONS AND ARE MANUFACTURED IN ACCORDANCE WITH AISI A-123, UNLESS OTHERWISE STATED.

CERTIFIED ON 10TH DAY OF MARCH, 2003.

Certified By

Official Transcript

On the...
D. Back-Up Plate

Back up plates, if specified for use at non-splice points, shall consist of 305-mm (1ft) sections of beams and shall be of the same Class and Type specified for the full-length beams.

The same criteria used for guardrail sections is used for back up plates. Certification should be received with all material showing it meets specification requirements. Any properties required by specification that aren’t on the certification will need to be tested by the certified supplier.

Certified analysis will look similar to the one below (OR HAVE THE SAME DATA)
CERTIFIED ANALYSIS

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ORDER NUMBER: N/A
CUSTOMER PO: N/A
PROJECT: STOCK
SHIPPED TO: OHIO

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<td>M-180</td>
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</tbody>
</table>

ALL STEEL USED IN THE MANUFACTURE IS OF DOMESTIC ORIGIN.
ALL GUARDRAIL MEETS AASHTO M-180, ALL STRUCTURAL STEEL MEETS AASHTO M-183.
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 10th day of May, 2001.

[Signature]

[Expire]
End and Buffer Sections

End and Buffer have the same dimensional and coating requirements as guardrail. AASHTO currently requires the same metal thickness and actual dimensions as the guardrail is required to meet. Additionally, AASHTO’s specification provides sketches showing other dimensional requirements. The difference for end and buffer sections is the mechanical requirements.
Lower mechanical properties for end and buffer sections:

Yield Point, - 33000 psi, minimum
Tensile Strength, - 45000 psi minimum
Certified Test Data example for End Sections

CERTIFIED ANALYSIS

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<tr>
<th>MATERIAL</th>
<th>BOLT</th>
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2.18

2.18
**DOMESTIC STEEL**

The Ohio Revised Code, section 153.011, requires all steel used in ODOT projects be made in the United States. This requirement also appears in ODOT project proposals. That means that documentation is required specifically defining that the steel was “melted and manufactured” in the United States. For example, we don’t want a bolt that was “made in the US”, but the steel was melted in Japan and shipped over here to be made into a bolt.

**Acceptable Documentation Includes:**

A mill certification from a United State producing steel mill that is located in the United States.

A certification from either the material producer or the supplier stating in writing the steel was melted and manufactured in the United States.

The Director may make exceptions to this rule for bridge projects only in the following cases. (Ohio Revised Code section 5525.21)

The cost of the contract item does not exceed one tenth of one percent of the total contract cost or $2500, whichever is greater.

**OR**

The material is not produced in the US in sufficient quantity, or is not reasonably available.

If you have any questions about this policy, please contact the Office of Materials Management.