

601-R-660 GUARDRAIL

(Revised 11-15-17)

The Standard Specifications are revised as follows:

SECTION 601, BEGIN LINE 12, DELETE AND INSERT AS FOLLOWS:

601.02 Materials

Materials shall be in accordance with the following:

Alternate Material Blocks Blockouts	926.03
Guardrail Posts	910.10
Rail Accessories, Fittings, and Hardware	910.11
Steel Thrie-Beam Rail	910.09
Steel W-Beam Rail	910.09
Timber Posts and Blocks Blockouts	911.02(f)

SECTION 601, BEGIN LINE 50, DELETE AND INSERT AS FOLLOWS:

~~The~~W-beam or Midwest Guardrail System, MGS, W-beam guardrail, components, assembly, post spacing, post lengths, and installation for each location shall be as shown on the plans. Double-facing of the guardrail will be required at the locations shown on the plans. *For W-beam guardrail, in* locations where conditions will not allow the use of 7 ft posts, 6 ft posts may be substituted when approved.

The base metal thickness of the steel W-beam rail element for a curved guardrail system shall be 0.105 in. The base metal thickness of the steel W-beam terminal connector shall be 0.138 in. *The controlled released terminal, CRT, wood breakaway posts shall be S4S timber and shall otherwise be in accordance with 911. The curved rail timber posts shall be in accordance with 911. All structural tubing shall be in accordance with ASTM A 500. The remaining steel components shall be in accordance with 910.*

SECTION 601, BEGIN LINE 75, DELETE AND INSERT AS FOLLOWS:

When new guardrail is being installed where there is no existing guardrail and traffic is to be maintained during the work, the mounting of the ~~blocks~~blockouts and the rail elements to the posts shall be completed as soon as practical after the posts are installed. The time between the installation of the posts and the mounting of the ~~blocks~~blockouts and rail elements shall not exceed 24 h. Drums shall be placed to mark all installed guardrail posts left bare overnight. The spacing of these devices shall be numerically equal to the worksite speed limit, but not less than 20 ft.

All damaged galvanized surfaces shall be coated in accordance with 910.11(a)4.

W-beam guardrail shall be installed as shown on the plans with the W-beam rail element splice at the post. MGS W-beam guardrail shall be installed as shown on the plans with the W-beam rail element splice at midspan. MGS W-beam guardrail installed with half or quarter post spacing shall be spliced as shown on the plans.

The nested W-beam guardrail element shall consist of two rail elements, one set

inside the other. The length of nested guardrail placed over a culvert shall not be spliced.

601.04 Guardrail Erection

~~Blocks~~Blockouts and rail elements shall be erected in a manner resulting in a smooth, continuous installation. All bolts shall be of sufficient length to extend beyond the nuts and shall be drawn tight. Rail installed along a radius of 150 ft or less shall be shop curved. Rail elements shall be lapped as shown on the plans.

SECTION 601, BEGIN LINE 125, DELETE AND INSERT AS FOLLOWS:

601.06 Guardrail Transitions

Guardrail transitions shall be required to connect guardrail to bridge rail, guardrail to piers, and new W-beam guardrail to existing rub rail type guardrail. The required type of guardrail transition shall be as shown on the plans. ~~The fabrication, assembly, and installation of thrie beam components and timber posts and blocks for guardrail transitions will be required for the locations shown on the plans.~~

An MGS guardrail transition, with or without curb, shall be required to connect guardrail to bridge rail, guardrail to piers. An MGS height transition shall be required to connect MGS W-beam guardrail to existing W-beam or existing rub rail type guardrail. The required type of guardrail transition shall be as shown on the plans.

The fabrication, assembly, and installation of thrie-beam rail, W-beam rail components, and posts and blockouts for guardrail transitions will be required for the locations shown on the plans.

SECTION 601, BEGIN LINE 132, DELETE AND INSERT AS FOLLOWS:

601.07 Guardrail End Treatments

Guardrail end treatments shall be required to terminate guardrail installations at the locations shown on the plans. The type I guardrail end treatment shall be either as shown on the plans, or shall be selected from the Department's list of approved Guardrail End Treatments. The type II guardrail end treatment shall be as shown on the plans. The type OS or MS guardrail end treatments shall be selected from the Department's list of approved Guardrail End Treatments. The reflectorization of guardrail end treatments, and the grading requirements shall be as shown on the plans.

For contracts letting prior to July 1, 2018 the following applies. When a 31-in. guardrail end treatment is required to terminate MGS W-beam guardrail, a 27 3/4 in. guardrail end treatment with an MGS height transition may be substituted when approved by the Engineer.

Double facing of guardrail end treatment type I will be required when it is used in conjunction with double faced guardrail.

Each unit shall be installed in accordance with the manufacturer's recommendations. A copy of the manufacturer's FHWA eligibility letter stating that its product complies with the requirements of NCHRP 350 or MASH test level 3 shall be provided.

SECTION 601, BEGIN LINE 171, DELETE AND INSERT AS FOLLOWS:

601.08 Impact Attenuators

Impact attenuators shall be placed or reset to obtain the proper height where shown on the plans. The unit for each new location shall be of the width recommended by the manufacturer and for the test level specified and shall be chosen from those shown on the Department's list of approved Impact Attenuators. Each unit shall be placed in accordance with the manufacturer's recommendations, on a PCC pad. *A copy of the manufacturer's FHWA eligibility letter stating that its product complies with the requirements of NCHRP 350 or MASH test level 3 shall be provided.*

SECTION 601, BEGIN LINE 200, DELETE AND INSERT AS FOLLOWS:

~~Impact attenuators may be placed on the Department's approved list based on the manufacturer's documentation subject to the Department's acceptance. The manufacturer shall provide a copy of the test report stating that its product fully complies with the requirements of NCHRP 350 crash test level 3, and that its product has been approved by the FHWA. Products will be maintained on the Department's approved list by a manufacturer's certification submitted annually in October and the Department's continued acceptance. This certification shall state that the product has not been changed since the NCHRP 350 crash testing, that the NCHRP 350 test results still apply to this product, and that the FHWA approval is still applicable.~~

601.09 Extension of Existing Guardrail

Extension of existing rub rail type guardrail with new W-beam guardrail shall require adjusting the post heights in the last 25 ft of existing rub rail type guardrail adjacent to the extension as shown on the plans. Guardrail transition type VH shall be used to make this adjustment. The post spacing of the guardrail transition type VH shall equal that of the last 25 ft of existing rub rail type guardrail adjacent to the extension. The rub rail shall be terminated at the last existing post in the transition in accordance with 601.06.

Extension of existing rub rail type or W-beam guardrail with new MGS W-beam guardrail shall require adjusting the splice location and post height in the last 37 ft 6 in. of the existing rub rail type or W-beam guardrail as shown on plans. MGS height transition shall be used to make this adjustment. The rub rail shall be terminated at the last existing post in the transition in accordance with 601.06.

601.10 Removal of Existing Guardrail

Removal of existing guardrail shall be in accordance with the applicable requirements of 202 and these requirements. The locations shall be as shown on the plans. When it is specified that the removed guardrail is to become the property of the Department, the rail elements, posts, and ~~blocks~~blockouts shall be removed without being damaged. The removed material shall be stored as directed.

601.11 Adjusting Existing Guardrail Height

The height of the existing guardrail shall be adjusted by the use of moveable ~~blocks~~blockouts as shown on the plans. The height shall be measured to the top of the rail

element along the face of the rail. Existing fixed ~~blocks~~*blockouts* shall be replaced with moveable ~~blocks~~*blockouts* installed at the proper height. Existing moveable ~~blocks~~*blockouts* shall be disconnected from the posts and re-mounted at the proper height.

601.12 Resetting Guardrail

This work shall consist of the removal of existing guardrail and, and if necessary, storing it, and then re-erecting it where shown on the plans or as directed.

601.13 Method of Measurement

Guardrail, guardrail with rub rail, shop curved guardrail, adjusting guardrail height, guardrail removal, and resetting guardrail will be measured by the linear foot along the top of the rail element, complete in place. Nested guardrail will be measured per each 100 lft run placed. Modified posts for nested guardrail will be measured per each, complete in place. *MGS structure top-mounted posts will be measured per each, complete in place. Long span MGS W-beam guardrail will be measured per each for the type specified and corresponding run length between outermost CRT posts.* Guardrail transitions, W-beam and MGS W-beam guardrail cable terminal anchors, and guardrail end treatments will be measured per each, complete in place. Guardrail buried end treatments type II will be measured per each. Impact attenuators and ~~resetting~~*resetting* impact attenuators will be measured per each for the type and width and test level, complete in place. The curved W-beam guardrail connector system and the curved W-beam guardrail terminal system will be measured per each for the type specified. Grading at guardrail end treatments, the reflectorization of guardrail end treatments, and concrete used in anchoring guardrail end treatments will not be measured for payment.

Impact attenuator spare parts packages will be measured per each for the type and width, test level, and stage for which it is specified.

601.14 Basis of Payment

W-beam and MGS W-beam guardrail will be paid for at the contract unit price per linear foot for the specified post spacing. Thrie-beam and thrie-beam double faced guardrail will be paid for at the contract unit price per linear foot for guardrail, thrie-beam and guardrail, thrie-beam, double faced, complete in place. Nested guardrail will be paid for at the contract unit price per each 100 lft run, complete in place for guardrail, W-beam, nested. *Long span MGS guardrail will be paid for at the contract unit price per each type specified and corresponding run length between outermost CRT posts, complete in place for guardrail, MGS, long span.* W-beam and MGS W-beam guardrail cable terminal anchors will be paid for at the contract unit price per each, complete in place. Modified posts for nested guardrail will be paid for at the contract unit price per each for modified posts, nested guardrail. *Structure top-mounted posts will be paid for at the contract unit price per each for guardrail, MGS, structure top-mounted posts.*

W-beam guardrail with rub rail will be paid for at the contract unit price per linear foot for guardrail, WR-beam complete in place. Shop curved guardrail, adjusting guardrail height, guardrail removal, and resetting guardrail will be paid for at the contract unit price per linear foot. Guardrail transitions and guardrail end treatments will be paid

for at the contract unit price per each for the type specified. Guardrail buried end treatments type II will be paid for at the contract unit price per each, complete in place.

Impact attenuators and ~~resetting~~ *resetting* impact attenuators will be paid for at the contract unit price per each for the type and width, and test level specified. The curved W-beam guardrail connector system and curved W-beam guardrail system will be paid for at the contract unit price per each for the type specified, complete in place.

SECTION 601, BEGIN LINE 297, INSERT AS FOLLOWS:

- Guardrail, MGS, Height Transition*..... *EACH*
- Guardrail, MGS, Long Span, _____*..... *EACH*
type
- Guardrail, MGS, Structure Top-Mounted Posts*..... *EACH*
- Guardrail, MGS, Transition, _____*..... *EACH*
type
- Guardrail, MGS W-Beam, _____ft _____ in. Spacing**LFT*
- Guardrail, MGS W-Beam, Cable Terminal Anchor*..... *EACH*
- Guardrail, MGS W-Beam, Double Faced, _____ft _____ in. Spacing*.....*LFT*
- Guardrail, MGS W-Beam, Shop Curved, _____ft _____ in. Spacing*.....*LFT*

SECTION 601, BEGIN LINE 322, DELETE AND INSERT AS FOLLOWS:

For W-beam guardrail, ~~The~~the substitution of 6 ft posts for 7 ft posts where conditions will not allow the use of the longer post will be at the same contract unit price of the longer post.

The substitution of W 6 x 8.5 for W 6 x 9 steel posts, in MGS W-beam guardrail, will be at the same contract unit price for heavier post.

SECTION 911, BEGIN LINE 191, DELETE AND INSERT AS FOLLOWS:

~~Wood~~*Timber* guardrail posts, and wood parts in connection with guardrails, shall be treated with a preservative in accordance with the applicable provisions of AWPA Standards T1 and U1.

Timber post may be used within a run of MGS W-beam guardrail as shown on the plans. Timber posts shall not be used within a run of W-beam guardrail.

SECTION 911, BEGIN LINE 213, DELETE AND INSERT AS FOLLOWS:

(f) Sawed Timber Posts and ~~Blocks~~Blockouts for Thrie-Beam and W-Beam Guardrail

The requirements for posts and ~~blocks~~blockouts prior to treatment shall be as shown below.

1. Species and Grades

~~Wood~~*Timber* posts shall be of the species listed, and shall be in accordance with the grading requirements specified in Table A. ~~Wood blocks~~*Timber blockouts* shall be of the species listed, and shall be in accordance with the grading requirements specified in

Table B. ~~Wood~~Timber posts and ~~blocks~~blockouts shall have a nominal cross section and dimensions as shown on the plans.

SECTION 911, BEGIN LINE 227, DELETE AND INSERT AS FOLLOWS:

Posts and ~~blocks~~blockouts shall be graded in accordance with grading rules based on principles and methods specified in ASTM D 245. Where there is a conflict between AWPAs and ASTM standards, AWPAs will prevail. Where there is a conflict between either AWPAs or ASTM standards and this specification, this specification will prevail.

All material shall show the approved grading agency stamp indicating mill origin, species, and grade.

TABLE B

SPECIES AND GRADING REQUIREMENTS FOR SAWED TIMBER GUARDRAIL BLOCKS BLOCKOUTS		
SPECIES	POSTS & TIMBERS GRADE	GRADING RULES AGENCIES ^a
HARDWOODS		
Red Oak (Northern Red, Black, Pin, Laurel, Cherry-Bark, Scarlet, Water and Willow Oaks) ^b , Hard Maple (Black & Sugar) and Red Maple, White Ash, White-Heartwood Beech, Yellow Birch, Hickory (Mockernut, Pignut, Shagbark, and Shellbark Hickories)	Grade GRP	Department
SOFTWOODS		
Douglas Fir, Douglas Fir-Larch	No. 2 or better	WWPA or WCLIB
Southern Pine Species	No. 2 or better	SPIB
Jack Pine, Red Pine, and Eastern White Pine (Northern White Pine)	No. 1 or better	NHPMA
^a NHPMA (Northern Hardwood and Pine Manufacturers Assoc.); WWPA (Western Wood Products Assoc.); WCLIB (West Coast Lumber Inspection Bureau); and SPIB (Southern Pine Inspection Bureau). ^b Southern Red Oak will not be allowed.		

SECTION 911, BEGIN LINE 276, DELETE AND INSERT AS FOLLOWS:

3. Department Grade GRB

The requirements for ~~blocks~~blockouts to be in accordance with the Department's Grade GRB, Guardrail ~~Blocks~~Blockouts, will be as follows.

SECTION 911, BEGIN LINE 304, DELETE AND INSERT AS FOLLOWS:

4. General Requirements

Posts and ~~blocks~~blockouts shall be in accordance with the following general requirements.

a. Decay

Posts and ~~blocks~~blockouts shall be free from decay before treatment.

b. Unsound Wood

Posts containing unsound wood will be rejected. ~~Blocks~~*blockouts* may contain small spots of unsound wood provided they are well scattered.

c. Crook or Bow

Crook or bow shall not exceed 1 in. per 10 ft length.

d. Dimensional Tolerances

Posts and ~~blocks~~*blockouts* shall be sawed square to within -1/2 in. of the specified cross-sectional dimensions. A tolerance of -2 in. will be allowed on the specific length of the posts. A tolerance of -1/2 in. will be allowed on the specified length of the ~~blocks~~*blockouts*.

5. Pressure Treating Posts and ~~Blocks~~*Blockouts*

Pressure treating posts and ~~blocks~~*blockouts* shall be in accordance with the following requirements and AWPAs Standards T1, and U1.

a. Machining

Posts and ~~blocks~~*blockouts* shall be sawed to their final shape and holes bored prior to treatment.

SECTION 911, BEGIN LINE 351, DELETE AND INSERT AS FOLLOWS:

e. Preservative Treatment

All posts and ~~blocks~~*blockouts* shall be treated with a preservative as specified herein.

f. Material for Preservative Treatments

The preservative used for treating posts and ~~blocks~~*blockouts* shall be in accordance with the appropriate AWPAs Standards listed in table C.

TABLE C

MATERIAL	AWPA STANDARDS
Ammoniacal Copper Zinc Arsenate, ACZA	P5 and P22
Chromated Copper Arsenate, CCA	P5 and P23

g. Treatment Methods

Wood for guardrail posts and ~~blocks~~*blockouts* shall be treated to be in accordance with AWPAs Standard T1, and the requirements specified herein.

h. Sorting and Spacing

The material in a charge shall consist of the same species or consist of species within one group shown in table D. The material shall have similar moisture content and be of similar form and size. ~~Blocks~~*Blockouts* and posts may be treated in the same charge.

Pieces in the charge shall be separated by horizontal stickers so that preservative and steam, if used, shall contact all horizontal surfaces.

TABLE D

SPECIES GROUPINGS FOR TREATMENT IN SAME CHARGE	
GROUP	SPECIES
A	Southern Pine
B	Douglas Fir
C	Jack Pine*
D	Hardwoods
* Also Red Pine and Eastern White Pine Blocks Blockouts	

SECTION 911, BEGIN LINE 387, DELETE AND INSERT AS FOLLOWS:

i. Retentions

The minimum retentions in lb/cu ft for the outer 0.6 in. of guardrail posts and ~~blocks~~blockouts shall be those listed in table F. Retentions shall be determined by chemical assay with samples taken after treatment in accordance with the inspection after treatment requirements shown below and the AWP Standards listed in table E.

TABLE E

MINIMUM REQUIREMENTS FOR RETENTION OF PRESERVATIVE			
PRESERVATIVE	RETENTION, lb/cu ft		AWPA STANDARD
	POSTS	BLOCKS BLOCKOUTS	
CCA or ACZA	0.60	0.40	A11

If ~~blocks~~blockouts are treated along with posts, retention of the charge shall be determined by assay of borings from posts.

m. Penetration

The penetration requirements for heartwood and sapwood shall be as specified in table F. Samples to determine penetration shall be taken after treatment in accordance with the inspection after treatment requirements shown below.

TABLE F

PENETRATION REQUIREMENTS FOR POSTS AND BLOCKS BLOCKOUTS		
SPECIES	MINIMUM PENETRATION	
	HEARTWOOD	SAPWOOD
Allowed Species*	0.3 in.	0.6 in. or 90%, whichever is greater
* For Red Oak, 65% of the total annual rings shall be penetrated. If this is not possible, properly conditioned wood may be treated to refusal.		

n. Inspection After Treatment

Following treatment, the charge shall be inspected in accordance with AWP Standard M2, Part A, section 4. All non-compliant material shall be removed from the remaining acceptable material before shipment.

Sampling and testing for preservative retention and penetration will be done by the Department.

o. Branding

All post and ~~blocks~~*blockouts* shall be burn branded clearly and permanently on one of the wide faces. The brand shall be within 12 in. of the top of the post. The brand shall show the treater's identification, the plant designation, and the year of treatment. The month may also be included. The brand shall also show the species or group code designation shown in table G, the preservative type, and retention, all in accordance with AWWA Standard M6.

SECTION 911, BEGIN LINE 441, DELETE AND INSERT AS FOLLOWS:

6. Field Treatment of Posts and ~~Blocks~~*Blockouts*

Cuts, holes, or injuries to the surface of posts and ~~blocks~~*blockouts* which occur after pressure treatment shall be field-treated by brushing, spraying, dipping, soaking, or coating. The Contractor shall ensure that all injuries, such as abrasions and nail and spike holes, are thoroughly saturated with the field-treating solution. Holes bored in pressure-treated materials shall be poured full of preservative. Horizontal holes may be filled by pouring the preservative into the holes with a bent funnel after temporarily plugging the other end of the hole.

The solution used for field treatment shall be copper naphthenate in accordance with AWWA Standard P34.

7. Rejection for Degrade After Treatment

Guardrail posts or ~~blocks~~*blockouts* developing the following degrade prior to installation will be rejected regardless of prior approvals.

- a. single checks greater than 3 in. deep or checks opposite each other totaling more than 3 in. deep, measured with a probe not more than 1/16 in. thick;
- b. single checks 1/4 in. wide or wider measured at the widest point, and extending more than 1/3 of the length of the post or ~~block~~*blockout*;
- c. single checks greater than 3/8 in. wide measured at the widest point;
- d. splits greater than 3 in. long which are in the plane of the bolt hole;
- e. crooks or bows exceeding 1 in. per 10 ft length; and all twists;
- f. combinations of checks, splits, or shakes which are otherwise in accordance with the specifications but which may cause the post or ~~block~~*blockout* to separate into several pieces.

SECTION 926, BEGIN LINE 105, AS FOLLOWS:

926.03 Alternate Material Guardrail ~~Blocks~~Blockouts

Non-timber blockouts shall be dimensioned as tested and shall be used with the type of guardrail as tested, in accordance with NCHRP 350 *or* MASH. ~~Blockouts shall be accompanied by a certification from the manufacturer stating the blockouts furnished have the same chemistry, mechanical properties, and geometry as those certified to have passed the NCHRP 350 crash test and have been certified by the FHWA to be acceptable for use on NHS facilities~~ *Blockouts shall be accompanied by a copy of the FHWA eligibility letter stating that the product complies with the requirements of NCHRP 350 or MASH test level 3.*

Alternate material blockouts meeting the criteria may be used interchangeably with timber blockouts as long as the line and grade of the face of the guardrail is true to that shown on the plans.
