
USACE / NAVFAC / AFCEA UFGS-05650N (August 2001)

Preparing Activity: NAVFAC Superseding
UFGS-05650N (September 1999)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 22 December 2004

Latest change indicated by CHG tags

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DIVISION 05 - METALS

SECTION 05650

RAILROAD TRACK AND ACCESSORIES

08/01

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SECTION 05650

RAILROAD TRACK AND ACCESSORIES
08/01

NOTE: This guide specification covers the requirements for new railroad track work or the rehabilitation of existing railroad track.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

NOTE: On the drawings, show:

1. Location of various sizes of rail if required;
2. Location of compromise joints:
3. Locations of rail accessories such as rail anchors, gage rods, and guard rails;
4. Location of items of equipment such as derails, bumpers;
5. Location of turnouts, including dimensions from point of switch and center of last switch tie. Also type of switch stand; and
6. Track section and all needed dimensions.

PART 1 GENERAL

1.1 REFERENCES

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA 1-2	(1997) Ballast
AREMA 10	(2001) Concrete Ties (NOTE: merged into chapter 30 in 2002)
AREMA 3-1	(2001) Timber Cross Ties (NOTE: merged into chapter 30 in 2002)
AREMA 4-2	(1996; R 2002) Specifications
AREMA 5-1	(1992) Tie Plates
AREMA 5-2	(1968) Track Spikes
AREMA Manual	(2004) Manual for Railway Engineering
AREMA Track Plans	(2003) Portfolio of Trackwork Plans

AMERICAN WELDING SOCIETY (AWS)

AWS WHB-2.8	(1991) Welding Handbook, Vol II, Welding Processes, Chapter 2, Shielded Metal Arc Welding
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AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C6	(1999) Crossties and Switch Ties - Preservative Treatment by Pressure Processes
AWPA M2	(2001) Standard for Inspection of Treated Wood Products
AWPA M6	(1996) Brands Used on Forest Products

ASTM INTERNATIONAL (ASTM)

ASTM C 127	(2004) Density, Relative Density (Specific
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	Gravity), and Absorption of Coarse Aggregate
ASTM C 131	(2003) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(2004) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 142	(1997; R 2004) Clay Lumps and Friable Particles in Aggregates
ASTM C 535	(2003e1) Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D 1241	(2000) Materials for Soil-Aggregate Subbase, Base, and Surface Courses
ASTM D 1310	(2001) Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus
ASTM D 2240	(2004) Rubber Property - Durometer Hardness
ASTM D 3786	(2001) Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
ASTM D 3787	(2001) Bursting Strength of Textiles - Constant-Rate-of-Traverse (CRT), Ball Burst Test
ASTM D 412	(1998a; R 2002e1) Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 4491	(1999a) Water Permeability of Geotextiles by Permittivity
ASTM D 4632	(1991; R 2003) Grab Breaking Load and Elongation of Geotextiles
ASTM D 88	(1994; R 1999) Saybolt Viscosity
U.S. ARMY CORPS OF ENGINEERS (USACE)	
COE CW 02215	(1986) Plastic Filter Fabric
U.S. DEPARTMENT OF DEFENSE (DOD)	
MIL-D-11302	(Rev D; Notice 1) Derail, Railway
MIL-R-3911	(Rev D; Notice 1) Rail, Tee, Railway: Relayer Rail
MIL-STD-1699	(Rev B) Nondestructive Evaluation of Butt

Welds in Crane and Railroad Rails

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS MM-T-371

(Rev E) Ties, Railroad, Wood (Cross and Switch)

1.2 SUBMITTALS

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Turnouts

Road crossings

Car bumper

Railroad crossings

Layout drawings

SD-03 Product Data

Rails

Wood ties

Precast concrete ties

Tie plates

Tie pads

Track bolts, nuts, and spring washers

Standard, compromise, and insulated joint bars

Rail anchors

Rail clips and fasteners

Track spikes

Turnouts

Pre-manufactured road crossings crossing surfaces

Car bumper

Wheel stops

Derails

Gage rods

Switch point protectors

Switch stands

Geotextile fabric

SD-06 Test Reports

Ties preservative treatment

Ballast tests

SD-07 Certificates

Rail welding procedures

SD-10 Operation and Maintenance Data

Rails, Data Package 1; G

Accessories, Data Package 1; G

Pre-manufactured road crossings, Data Package 1: G

Turnouts, Data Package 1; G

Switch stands, Data Package 1; G

Submit data package in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

1.3 TEMPORARY WORK

During construction, provide suitable roads and crossing with necessary lights, signs, drainage, and other appurtenances required for safe public and local travel. Erect and maintain suitable temporary fences where required to prevent trespass upon work or damage to adjoining property. Maintain drainage and prevent accumulation of water that might affect roadbed stability.

1.4 QUALITY ASSURANCE

1.4.1 Layout Drawings

NOTE: Use layout drawing only where contract
drawings are schematic in nature.

[Layout Drawings: Submit [for approval by the Contracting Officer] before work is started. Do not prepare layout drawings until field surveys and measurements are completed. Do not order materials until layout drawings are approved. Include on layout drawings locations of turnouts, various sizes of rail, compromise joints, and locations of rail accessories.]

1.4.2 Ties Preservative Treatment

Ties shall be marked in accordance with AWP A M6 and inspected in accordance with AWP A M2, for conformance with the specified AWP A Standards, by an independent inspection agency approved by the Contracting Officer. The agency's report of inspection shall accompany delivery of the ties, and shall be provided to the Contracting Officer's representative.

PART 2 PRODUCTS

2.1 BALLAST [AND SUBBALLAST] [AND GEOTEXTILE]

2.1.1 Ballast

NOTE: A wide choice of materials may be used for ballast, depending on economics and availability. Use of crushed granite is recommended. Prepared ballast is preferred since production can be controlled. The use of unprepared ballast for heavy-duty track will increase maintenance requirements. The inapplicable types of ballast will be deleted, and brackets will be removed. The size numbers(s) will be indicated in this paragraph. Normally, prepared ballast will be used conforming

to sizes of the gradations established by the AREMA Manual. For prepared ballast, crush stone and slag, numbers 3, 4, 4A, 5 or 57 are acceptable. Size numbers 3, 4, and 4A are typically mainline ballast materials. Size numbers 5 and 57 are typically used on yard and house tracks. Any or all of these sizes can be specified, with a Contractor's option. The depth and other details of the ballast section will be shown on the contract drawings.

[Crushed stone,] [Crushed air-cooled blast-furnace slag,] [or] [Crushed open-hearth slag] Size No. [3,] [4,] [4A,] [5,] [or] [57] conforming to AREMA 1-2 for quality, soundness and gradation. Ballast materials shall meet the property requirements shown in Table I.

TABLE I - MINIMUM PROPERTY REQUIREMENTS - BALLAST

<u>Property</u>	<u>Test Method</u>	<u>Max. Value</u>	<u>Min. Value</u>
Percent Passing (75 mm) Sieve	ASTM C 136	1.0 percent	[_____]
Bulk Specific Gravity	ASTM C 127		
Rock		[_____]	2.60
Blast Furnace Slag		[_____]	2.30
Absorption	ASTM C 127		
Rock		2.0 percent	[_____]
Blast Furnace Slag		5.0 percent	[_____]
Clay Lumps and Friable Particles	ASTM C 142	0.5 percent	[_____]
Degradation	ASTM C 131 ASTM C 535	35 percent	[_____]
Soundness	ASTM C 88		
Sodium Sulfate - 5 Cycles		10 percent	[_____]

TABLE I - MINIMUM PROPERTY REQUIREMENTS - BALLAST

<u>Property</u>	<u>Test Method</u>	<u>Max. Value</u>	<u>Min. Value</u>
Percent Passing (No. 200) Sieve	ASTM C 136	1.0 percent	[_____]
Bulk Specific Gravity	ASTM C 127		
Rock		[_____]	2.60
Blast Furnace Slag		[_____]	2.30
Absorption	ASTM C 127		
Rock		2.0 percent	[_____]
Blast Furnace Slag		5.0 percent	[_____]
Clay Lumps and Friable Particles	ASTM C 142	0.5 percent	[_____]
Degradation	ASTM C 131 ASTM C 535	35 percent	[_____]
Soundness	ASTM C 88		

TABLE I - MINIMUM PROPERTY REQUIREMENTS - BALLAST

<u>Property</u>	<u>Test Method</u>	<u>Max. Value</u>	<u>Min. Value</u>
Sodium Sulfate - 5 Cycles		10 percent	[_____]

[2.1.2 Subballast

NOTE: Where subballast is needed, insert appropriate paragraphs. Indicate the kind of subballast to be used; the depth and other details of the subballast section will be shown on the contract drawings. In general, the subballast will consist of material superior to that of the subgrade and inferior to the ballast. Operation of trains over track laid on new roadbed without some type of top-of-subgrade preparation such as addition of subballast or appropriate soil stabilization, tends to drive the ties into the roadbed, forming depressions which later develop into ballast pockets requiring extra maintenance. See Section 02713, "Cement Stabilized [Base] [Subbase] Course at Airfields and Roads" and Section 02714, "Lime Treated Subgrade [Lime Modified Soils]" for information on soil stabilization.

Consists of aggregate-soil mixtures conforming to an ASTM D 1241 Type I, Gradation [A] [B] [C] [D] mixture as approved.

] [2.1.3 Geotextile Fabric

Consists of a needle-punched nonwoven material that provides a permeable layer, planar flow, and tensile reinforcement, while retaining the soil matrix. Fabric shall be inert to commonly encountered chemicals, mildew, rot, insects, rodents and shall be treated to resist degradation caused by exposure to sunlight. Fabric will conform to the properties in Table II.

TABLE II - MINIMUM PROPERTY REQUIREMENTS - GEOTEXTILE FABRIC

<u>Fabric Property</u>	<u>Test Method</u>	<u>Fabric Requirement Minimum Value</u>
Grab Tensile Strength, (kg)	ASTM D 4632	(79)
Grab Tensile Elongation, percent	ASTM D 4632	20
Coefficient of Water Permeability, (cm/sec)	ASTM D 4491	0.10
Puncture Strength, (kg)	ASTM D 3787*	(50)
Mullen Burst Strength, (kPa)	ASTM D 3786	(2758)
Apparent Opening Size (AOS) (Metric Micrometers)	COE CW 02215	(212)

*Tension testing machine with ring clamp; steel ball replaced with a 8 mm diameter solid steel cylinder, with flat tip and beveled edges, centered

TABLE II - MINIMUM PROPERTY REQUIREMENTS - GEOTEXTILE FABRIC

<u>Fabric Property</u>	<u>Test Method</u>	<u>Fabric Requirement Minimum Value</u>
within the ring clamp.		

TABLE II - MINIMUM PROPERTY REQUIREMENTS - GEOTEXTILE FABRIC

<u>Fabric Property</u>	<u>Test Method</u>	<u>Fabric Requirement Minimum Value</u>
Grab Tensile Strength, (lbs)	ASTM D 4632	175
Grab Tensile Elongation, percent	ASTM D 4632	20
Coefficient of Water Permeability, (cm/sec)	ASTM D 4491	0.10
Puncture Strength, (lbs)	ASTM D 3787*	110
Mullen Burst Strength, (psi)	ASTM D 3786	400
Apparent Opening Size (AOS) (U.S. Standard Sieve)	COE CW 02215	70

*Tension testing machine with ring clamp; steel ball replaced with a 5/16 inch diameter solid steel cylinder, with flat tip and beveled edges, centered within the ring clamp.

]2.2 RAILS

NOTE: The weight and section of new rail will be inserted; use either 52 kg 115 pound, RE section, or larger rail. Rail sections available for new rail purchases include: 115 RE, 119 RE, 132 RE, 133 RE, 136 RE, and 140 RE. Relay rail having nominal weight of 41 kg 90 pound or greater may be used, providing the relay rail meets the requirements of MIL-R-3911. Due to everchanging markets for new and relay rail, it may be beneficial to allow the Contractor the option to provide an acceptable rail section. The 52 kg 115 pound new rail will be specified for main line, access tracks, or other tracks, where the train movement may be classified as heavy or the design speed is in excess of 65 kph 40 mph. Rail no less than 41 kg 90 pounds may be used when available and when consultation with the serving railroad establishes that 41 kg 90 pound rail will be acceptable for use by the equipment of the serving railroad. New rail is preferred for new construction. However, there are some projects where relay rail can be justified if the construction cost is substantially below that of new rail. Relayer rail should not be considered unless the reduced estimate fully reflects the reduced service life of the relayer rail. A comparison of the usable metal in the heads of new 52 kg 115 pound rail and the corresponding relayer rail (Section and wear per MIL-R-3911) show that the relayer rail has

about 33 percent less usable metal. A similar comparison of the usable metal in the heads of 41 kg 90 pound rail shows that the relayer rail has about 55 percent less usable metal. Based on construction cost, the rail constitutes about 47 percent of the total track above roadbed. Therefore for economy; (1) 52 kg 115 pound relayer rail track should cost at least 15 percent ($33 \text{ percent} \times .47 = \text{about } 15 \text{ percent}$) less than new 52 kg 115 pound rail track, and (2) 41 kg 90 pound relayer rail track should cost at least 25 percent ($55 \text{ percent} \times .47 = \text{about } 25 \text{ percent}$) less than new 41 kg 90 pound rail track. Other conditions can be evaluated in a similar manner. Where relayer rail is used, add paragraph entitled "Relayer Rail." Where relayer rail is only used, delete article entitled "Rails."

NOTE: While the use of continuously welded rail and concrete ties may be beneficial in some situations, the cost effectiveness of general use has not been proven at this time. A thorough life-cycle cost analysis should be performed prior to specifying these materials.

New [_____] kg [_____] pound [_____] section conforming to AREMA 4-2. Provide in [12] or [24] m [39] or [78] foot lengths. Provide no closure pieces less than 4 m 13 feet. [Bend in shop curved rail to proper radii, where degree of curvature exceeds 0.31 rads 18 degrees.]

[2.2.1 Relayer Rail

40 kg ninety pounds or heavier up to 62 kg 136 pounds. Characteristics shall conform to requirements of MIL-R-3911 as modified in Table III:

TABLE III - RELAY RAIL CHARACTERISTICS

Minimum Weight per Yard
(original (kg))

(40 to 62)

Wear:

Max. top wear (mm)
(5)

Max. side wear (mm)
(3)

Length:

As ordered but not less than (4 m).

Defects permitted:
None

Max. Lip (mm)

TABLE III - RELAY RAIL CHARACTERISTICS
(2)

TABLE III - RELAY RAIL CHARACTERISTICS

Minimum Weight per Yard
(original (lbs))

(90 to 136)

Wear:

Max. top wear (in.)
(3/16)

Max. side wear (in.)
(1/8)

Length:

As ordered but not less than (13 feet).

Defects permitted:
None

Max. Lip (in.)
(1/16)

Relayer rail shall be of the same section and drilling pattern throughout the project, except that the drilling pattern for bolt holes at turnouts shall be as indicated. [No mingling of new and relayer rail will be permitted, and all relayer rail of the same section and drilling pattern shall be kept together in one area.]

]2.3 WOOD TIES

NOTE: Choose one of the following options. The second option is for projects located at the Charleston Naval Shipyard, Charleston, South Carolina.

NOTE: Because of differences in treatability of the many species of wood used to manufacture railroad ties, installations should limit the number of acceptable species to those most commonly used in their geographic area. White and Red Oak, and Southern Pine will provide the best service in eastern states, however, Southern pine should not be used on mainlines, or as switch ties. Douglas fir will be most available in western states. In areas with high humidity, such as the southeastern states, gum ties should not be used. Consult the EFD applied biologist to determine the most appropriate, and available local species. Activity may require anti-splitting devices on all ties.

1. Cross ties will be 175 mm 7 inches thick by 225 mm 9 inches wide. The length of cross ties will be 2.60 m 8 feet 6 inches.

2. If locally available, oak is preferred for switch ties. A bill of material for switch ties should be provided on the drawings for each proposed type of turnout. The AREMA Plan 912, contains bills of switch ties for various size of turnouts and crossovers.

[Except as otherwise noted, ties shall be in accordance with FS MM-T-371, Type[s] [II cross ties] [and] [III switch ties], treated in accordance with AWPA C6. Species shall be [red and white oak] [Southern pine] [Douglas fir] [as listed in FS MM-T-371 except that species shall not be mixed in a charge or bundle]. Each treated piece shall be permanently marked or branded, by the producer, in accordance with AWPA M6. All ties [except Southern, red, and ponderosa pine] shall be incised prior to treatment. Splits shall not be longer than 100 mm 4 inches nor wider than 6 mm 1/4 inch at either end. Splits longer than 100 mm 4 inches but not longer than the width of the face in which the split appears shall be acceptable if anti-splitting devices are installed with splits compressed. S-irons, dowels, and end plates are acceptable anti-splitting devices. Treatment shall be verified by an approved independent inspection agency report. Note: When Government inspections result in product rejection, the Contractor shall promptly segregate and remove rejected material from the premises. The Government may also charge the Contractor additional cost of inspection or test when prior rejection makes reinspection or retest necessary.]

[Cross ties shall not be less than 175 mm 7 inches in height by 225 mm 9 inches in width. Cross ties shall be 2.60 m 8 feet 6 inches in length. Switch ties shall be the necessary length as shown in AREMA Track Plans, Plan No. 912. Ties shall be red or white oak or yellow pine. Upon delivery of each lot to the shipyard, the Contractor shall provide certification documents of the results of tests for penetration and retention for species performed by an American Wood Preservers' Association (AWPA) or equivalent certified inspection agency. The certification documents shall certify that the preservative, penetration and retention meet specification requirements for treatment. Retention shall be verified in accordance with AWPA C6 for ties. The Contractor shall not be allowed to commence work until documentation has been reviewed/approved. The Contractor shall notify the Contracting Officer, for coordination of receipt inspection of ties. The Contracting Officer will then contact Code 420 for inspection/acceptance. Unless arrangements are made in advance, receipt inspection/approval may take up to 5 working days. Ties lacking brands in accordance with AWPA M6 shall be rejected regardless of conforming certification documents. The Government reserves the right to perform inspection and core sampling. Ties shall be delivered directly from the manufacturer to the work site or laydown area on Government premises.]

2.3.1 Cross Ties

Size: 175 mm thick by 225 mm wide 7 inches thick by 9 inches wide. Length: 2.60 m 8 feet 6 inches.

2.3.2 Switch Ties

Size: 175 mm thick by 225 mm wide 7 inches thick by 9 inches wide [____].
Length and quantities as indicated.

2.3.3 Tie Plugs

Conform to AREMA 3-1. Treat plugs with creosote-coal-tar solution of 128 kg per cubic meter 8 pounds per cubic foot in accordance with AWPA C6. Provide plugs to fit holes from which spikes are drawn.

2.4 PRECAST CONCRETE TIES

NOTE: While the use of continuously welded rail and concrete ties may be beneficial in some situations, the cost effectiveness of general use has not been proven at this time. A thorough life-cycle cost analysis should be performed prior to specifying these materials.

Provide in the dimensions indicated, designed and manufactured in accordance with AREMA 10. Provided by manufacturers regularly engaged in the manufacture of precast concrete ties and essentially duplicate items that have been in satisfactory use at least 2 years prior to bid opening.

2.5 TIE PLATES

Provide new [or used] tie plates [in good condition] conforming to AREMA 5-1. Provide plates of the dimensions and punching pattern to fit the rail. [Relayer (used) tied plates provided shall have no deformities or cracks, a minimum amount of surface rust, no pitting in excess of 2 mm 1/16 inch deep, no cutters (bottom ribs), 1:40 cant on rail seat area, a maximum of 3 mm 1/8 inch wear on seat section and physical dimensions in accordance with AREMA 5-1. The relayer tie plates may be repunched to accept base of existing rails but no slotting shall be accepted. New holes must have 25 mm one inch clearance from closest existing hole and no hole shall be punched on the shoulder side of tie plate.] [Relayer tie plates shall be approved on individual basis by the Contracting Officer.]

2.6 TIE PADS

Conform to AREMA 10 for use with precast concrete ties.

2.7 TRACK BOLTS, NUTS, AND SPRING WASHERS

Provide new throughout the project. Provide oval-neck, heat-treated, carbon-steel track nuts and carbon-steel track bolts conforming to AREMA 4-2. Spring washers shall conform to AREMA 4-2 and shall be of the size to fit the bolt and nut used and a minimum of 13 mm 1/2 inch thick.

2.8 JOINT BARS

Provide new [or used] joint bars [in good condition] conforming to AREMA 4-2. For new construction, provide bars of the "toeless" head free type, of the size, shape, and punching pattern to fit the rail. Joint bars shall be [600 mm] [900 mm] [24 inches] [36 inches] long and have [four] [six] bolt holes. For repair work, provide [head-contact] [____] joint bars.

Contractor shall verify the punching pattern of existing rail before ordering joint bars.

2.9 COMPROMISE JOINT BARS

Provide new, conforming to AREMA 4-2, for changes in rail size or where rail drilling differs. Compromise joints shall be angle bar type of forged or cast steel accurately machined to properly align the combination of rail sections indicated. Steel shall have physical properties equal to or exceeding AREMA specifications for those of standard rolled steel joints. Joints shall be manufactured by an established track appliance manufacturer.

2.10 TRACK SPIKES

AREMA 5-2 for track spikes, size [150 by 16] [138 by 14] mm [6 by 5/8] [5 1/2 by 9/16] inches. Provide new spikes throughout the project.

2.11 RAIL CLIPS AND FASTENERS

Provide single tight fit clips with fillers as necessary to fit rail section furnished. Clip or fastener design shall anchor rail against longitudinal movement.

2.12 ACCESSORIES

2.12.1 Rail Anchors

Standard manufacture as approved and of the size to fit the rail section. Where special installation tools are required, furnish a minimum of one tool for each 2,000 anchors.

2.12.2 Gage Rods

Provide Type A gage rods of 31 mm 1 1/4 inch round steel rods with double adjustable clamps at both ends, suitably sized for use with the standard rail section furnished. Provide Type B gage rods of 31 mm 1 1/4 inch round steel rods with a hook at one end and a single adjustable clamp at the other end, suitably sized for use with the standard rail section furnished. Use the product of a manufacturer who is regularly engaged in the manufacture of steel gage rods.

2.12.3 Switch Point Guard-Rail Type Protectors

Guard-rail type, standard manufacturer's product of [heat-treated rail] [manganese steel], and of size to fit rail section furnished. [Protectors shall be bolted to rails.]

2.12.4 Flangeway Guard

Flangeway guard assembly shall include steel casting blocks, hook bolts, set bolts, and steel angle. The steel casting blocks and hook bolts shall be sized and provided to fit the rail section furnished and shall be a standard manufacturer's product, designed and constructed for use as a flangeway guard in railroad applications in pavement. Provide and secure steel angles to the steel casting blocks by the set bolts as indicated; other steel shapes shall not be substituted for steel angles shown. Prior to paving, the flangeway guard shall be coated with two coats of an asphalt varnish applied to a dry-film thickness of at least 0.05 mm two mils total thickness.

2.12.5 Wheel Stops

Cast steel of double wedge design, and of standard commercial manufacture for the purpose.

2.12.6 Derails

Conform to MIL-D-11302 and satisfactory for use with the weight rail specified. Provide derails at locations and in numbers indicated or specified. Complete unit shall weigh not less than [15] [_____] kg [100] [_____] pounds.

2.12.7 Car Bumper Post

Standard product of a commercial manufacturer of railroad accessories. Post shall be made from structural steel sections arranged for attachments to the rails by bolting, and located so that the thrust will be transmitted through the cross ties to ballast and earth. Post shall consist of a head to accept horizontal thrust of the car couple and transmit it to tension members and compression members having at least a moment of inertia not less than [17.1] [_____] . Complete unit shall weigh not less than [365] [_____] kg [800] [_____] pounds.

2.13 OIL

Oil for rail and other track materials, except joints, shall conform to the following:

- a. Flash point: minimum 55 degrees C 130 degrees F, ASTM D 1310.
- b. Asphalt: 100 penetration, minimum 45 percent.
- c. Viscosity: Saybolt Universal, 55 degrees C 130 degrees F, 240 to 350 seconds, ASTM D 88.

2.14 ELECTRODES

Provide AWS low-hydrogen, high-tensile 140-16 (extrapolation) or 25-20 electrode, Grade 310-16 and 310-15 stainless steel rod welding electrodes. Provide electrodes of the smallest practical diameter worked at the lowest compatible current. Coating on low-hydrogen type electrodes shall be thoroughly dry when the electrode is provided. Use electrodes taken from hermetically sealed packages within one hour of the time the package is opened. Electrodes not used within this one-hour period and electrodes taken from non-hermetically sealed packages shall be dried for at least one hour between 371 and 427 degrees C 700 and 800 degrees F. Electrodes so dried may be stored at temperatures between 107 and 205 degrees C 225 and 400 degrees F until used, or, if not stored and not used within one hour after this drying is completed, shall be re-dried before use. Do not use electrodes which have been wet.

2.15 TURNOUTS

NOTE: If justified, No. 8 self-guarded frogs in accordance with AREMA Track Plans, Plan No. 641 and Notes, may be specified in place of the No. 8 rigid-bolted frog except (1) for tracks where the

design speed exceeds 40 km per hour 30 miles per hour,
or (2) for tracks installations outside the United
States. Spring rail frogs shall not be used on
military track.

Component parts of the turnouts to be furnished shall be the products of manufacturers regularly engaged in the manufacture of such products, and shall essentially duplicate items that have been in satisfactory use at least 2 years prior to bid opening. The parts need not all be made by the same manufacturer, but each turnout shall be the product of a single firm. Provide complete, including all track materials and switch ties in accordance with appropriate area trackwork plan. Switch assemblies, stands, rigid bolted frogs, and guard-rail assemblies shall conform to AREMA Track Plans. One switch point in each turnout shall be manganese tipped in accordance with AREMA Track Plans Plan 220-52-E-82, installed on the side opposite the turnout side of the switch. Rail used in turnout shall be new end hardened, [_____] kg pound [_____] section, drilled for [four] [six] holes. Bend in stock rail shall be in accordance with AREMA.

2.15.1 Turn Out Plates

Provide plates and rail braces in strict accordance with the current AREMA trackwork plan governing the turnout with respect to the number of the turnout. Provide turnout plate system complete with slide plates, heel plates, guard rail tie plates, hook twin tie plates, including those for the frog, rail braces, standard tie plates or other accessories required to complete the installation. Hook twin tie plates shall be in accordance with AREMA Track Plans, Plan 241-85. Gage plates shall be solid. Rail braces shall be either fixed or adjustable type of standard manufacture.

2.15.2 Switch Stands

NOTE: The type of switch lamp required will be indicated on the drawings. The type or types required will be retained in the contract specification and those not required will be deleted. Those lamps with reflector units only are preferred and will be specified where possible. Those lamps with reflectors and daylight disks will be used only at important crossovers or turnouts from main running tracks. Illuminated switch lamps will not be specified except for special main track movements, or as required by the serving railroad or by special regulations.

Low-stand type, adjustable from top with shims through a moveable cover and a replaceable double crank of malleable iron, [complete with reflectorized red and white aluminum target minimum thickness 1.8 mm 14 gage,] self-locking connecting rod, reversible target tip arm crank, parallel throwing latch and interchangeable parts. [Each stand shall be equipped with one of the following switch lamps as indicated:

- [a. Reflecting type: Approved reflecting switch lamps fitted with standard commercial-type double red and white reflecting lenses but without day signal targets.]

- [b. Reflecting type with daylight disk: Approved reflecting switch lamps fitted with standard commercial-type double red and white reflecting lenses, and with approved day signal targets.]
- [c. Illuminated type: Approved illuminated lamps with primary battery, battery housing, and cable.]]

2.16 ROAD CROSSINGS

2.16.1 [Bituminous] [Wood] [or] [Treated Timber] Crossings

Wood and treated timber material for road crossing shall conform to AWPA C6. Bituminous crossings shall conform to Section 02741 BITUMINOUS CONCRETE PAVEMENT.

[2.16.2 Rubber Railroad Crossings

Manufacturers standard product for a rubber railroad crossing consisting of manufactured panels of full depth rubber or partial depth panels of rubber and steel conforming to the following requirements:

- a. Partial depth panels shall be reinforced with steel plates, arches, or post tensioned cable fully encased in the rubber. Post tensioned cables shall be encased with a polycarbon material before rubber encasement.
- b. Rubber hardness of 55 to 80 (tested in accordance with ASTM D 2240, Durometer A).
- c. Rubber tensile strength of 6.9 to 17.3 MPa 1000 psi to 2500 psi (tested in accordance with ASTM D 412).
- d. Rubber elongation of 100 to 400 percent (tested in accordance with ASTM D 412).
- e. Headers shall be manufacturer's standard rubber header.
- f. Shims shall be hardwood, treated with creosote in accordance with AREMA 3-1, for lumber and timber in ground contact.
- g. Materials for securing the crossing shall be as recommended by the rubber crossing manufacturer.
- [h. Provide components pertinent to each manufacturer's system to provide each rubber railroad system complete and ready for use.]

NOTE: Railroad grade crossings manufactured with recovered rubber are designated in 40 CFR 247.12, Comprehensive Procurement Guideline for Products Containing Recovered materials, as affirmative procurement item. Specifiers shall give preference to products containing recovered material when price, performance, and availability meet project performance requirements. Use of the following offers the opportunity to meet this requirement. If this material is suitable but price and availability are uncertain, include as an option.

- [i. [As an option, provide] [Provide] rubber from recovered rubber with a minimum of 85 percent total recovered material content.]

]PART 3 EXECUTION

3.1 GENERAL TRACKWORK

Perform track construction not covered specifically herein in accordance with AREMA Manual recommended practices.

3.2 SUBGRADE PREPARATION

Obtain approval of roadbed surface, grade, and drainage prior to distribution of construction material. Provide equipment that will not form ruts or water pockets when distributing material over the finished road bed. Where subgrade or road bed surface is damaged, perform repairs including regrading and recompaction in accordance with Section 02300 EXCAVATION.

3.3 TIES

NOTE: The number of cross ties per length of rail will be inserted in the blank space in this paragraph in accordance with the following:

1. For mainlines, access tracks, or other tracks where the movement may be classified as heavy or the desired speed is in excess of 65 kph 40 mph, 24 ties will be used to the 12 m 39 foot rail.
2. For body tracks in yards, sidings, running tracks, and access tracks where the train speed is less than 65 kph 40 mph and train movement is not classified as heavy, 20 ties will be used to the 12 m 39 foot rail.
3. If locally available, oak cross ties should be used for road crossings. In addition, all curved track should have oak ties or as a minimum 6 oak ties spaced uniformly among the number of cross ties required per each length of rail.

3.3.1 Wood Ties

Space cross ties [_____] to the [10] [12] m [33] [39] foot rail. Space switch ties and bridge ties as indicated. [Use oak cross ties in road crossings.] [All curved track should have oak ties installed.] [All curved track should have as a minimum [6] [_____] oak ties spaced uniformly among the number of ties required.] Lay ties normal to the centerline of the track with the wide heartwood face down. Provide the best ties at rail joints. Do not move or place ties with picks, shovels, mauls, sledges, or spiking hammers. Make ends of ties on one side of the track parallel to the rail so that center of tie will be on the approximate centerline of the track. Align the ends on the inside of curves and continue on that side

until reaching a curve in the opposite direction. On double tracks, align the ties on the outside ends. Provide full bearing for tie plates. Restrict adzing to that necessary to provide a sound true bearing for the tie plate. Where necessary to adz, dap or drill holes in the timber tie. Saturate cut surface with creosote or other approved preservatives.

3.3.2 Precast Concrete Ties

Provide ties in accordance with AREMA 10.

3.4 TIE PLATES

Place tie plates with full bearing on the tie. Tie plates shall be free of dirt and other foreign material when installed. Set tie plates at right angles to the rail with the outside shoulder against the base of the rail, and centered on the tie. Place tie plates so that the rails will have full bearing on the plate and the plate will have full bearing on the tie.

3.5 TIE PADS

Place pad on concrete tie so that rail will have full bearing on tie pad.

3.6 RAILS

Clean base of rail and tie plate prior to laying. Lay rails without bumping or striking to standard gage 1435 mm 4 feet 8 1/2 inches on tangents and on curves up to 0.21 rad 12 degrees. Widen gage on curves greater than 0.21 rad 12 degrees, 3 mm 1/8 inch for each additional increment of 0.035 rad 2 degrees above 0.21 rad 12 degrees to a maximum gage of 1448 mm 4 feet 9 inches. Gage the track normal to the rails at joints, centers, and quarters as spikes are being driven. Stagger joints in opposite rails not less than 4 m 13 feet apart, except closer joints may be required at turnouts or insulated joints. Rails of less than standard length may be used, but no less than 4 m 13 feet, to space the joints on curves. No joint shall be less than 1.8 m 6 feet from the ends of open-deck bridges, or less than 0.91 m 3 feet from switch points. [Do not install joints within 6 m 20 feet of a road crossing, outer perimeter of structure, or location which restricts access to the joint. Where joints are required in these areas, the joints shall be welded.] Provide allowance for thermal expansion at bolted rail joints by using rail-expansion shims of wood, fiber, or metal. Remove shims to within 12 rails of the laying. Provide shims of the thickness, based upon rail temperature during construction, as shown in Table IV. Determine the temperature of the rail by use of a thermometer placed on the base of the rail in the shade. Use rail saws to cut rail. Drill new holes. Holes cut with a torch will not be acceptable. [Adjacent relayer rails shall be matched to prevent lipped or uneven joints, and any mismatched rail ends shall be ground or built-up welded.]

TABLE IV - SHIM THICKNESS

<u>10 Meter Rail</u>		<u>12 Meter Rail</u>		<u>24 Meter Rail</u>	
<u>Rail Temperature, Degrees C</u>	<u>Shim Thickness, mm</u>	<u>Rail Temperature, Degrees C</u>	<u>Shim Thickness, mm</u>	<u>Rail Temperature, Degrees C</u>	<u>Shim Thickness, mm</u>
Below -23	8	Below -14	8	Below 2	8
-23 to -10	6	-14 to -4	6	2 to 8	6

TABLE IV - SHIM THICKNESS

<u>10 Meter Rail</u>		<u>12 Meter Rail</u>		<u>24 Meter Rail</u>	
<u>Rail Temperature, Degrees C</u>	<u>Shim Thickness, mm</u>	<u>Rail Temperature, Degrees C</u>	<u>Shim Thickness, mm</u>	<u>Rail Temperature, Degrees C</u>	<u>Shim Thickness, mm</u>
-9.5 to 1	5	-5 to 7	5	8.5 to 15.5	5
2 to 15	3	8 to 18	3	16 to 23	3
15.5 to 30	2	19 to 30	2	23 to 30	2
Over 30	None	Over 30	None	Over 30	None

TABLE IV - SHIM THICKNESS

<u>33 Foot Rail</u>		<u>39 Foot Rail</u>		<u>78 Foot Rail</u>	
<u>Rail Temperature, Degrees F</u>	<u>Shim Thickness, Inches</u>	<u>Rail Temperature, Degrees F</u>	<u>Shim Thickness, Inches</u>	<u>Rail Temperature, Degrees F</u>	<u>Shim Thickness, Inches</u>
Below -10	5/16	Below 6	5/16	Below 35	5/16
-10 to 14	1/4	6 to 25	1/4	35 to 47	1/4
15 to 34	3/16	26 to 45	3/16	48 to 60	3/16
35 to 59	1/8	46 to 65	1/8	61 to 73	1/8
60 to 85	1/16	66 to 85	1/16	74 to 85	1/16
Over 85	None	Over 85	None	Over 85	None

3.7 JOINT BARS

NOTE: The location of compromise joints will be shown on the drawings. Where compromise joints are required, the bracketed portion of this paragraph will be retained. If compromise joints are not required, the portion of this paragraph in brackets will be deleted.

Coat clean joint bars with petroleum or petroleum based compound with a corrosion inhibitor. Rail joints shall be installed so that the bars are not cocked between the base and head of the rail. Base shall be properly seated in the rail and the full number of correct-size bolts, nuts, and spring washers installed. Apply corrosion resistant grease to the bolt threads prior to application of nuts. Place bolts with nuts alternately on inside and outside of rail and draw tight before spiking. Bolts shall be tightened at the center of the joint and working both ways to the ends of the joint. At initial tightening, make bolt tension 89 to 134 kN/bolt (20,000 to 30,000) lbs/bolt. After track has been in service and before acceptance of the work, check all bolts and tighten. Allow two threads of all bolt lengths to protrude from the nut after tightening. [Connect rails of different sections by properly fitting compromise joint bars.] The

mismatch for compromise joints for either tread surface or gage side alignment shall not exceed 2 mm 1/16 inch.

3.8 WELDING JOINTS

3.8.1 Welded Rail Joints

Properly clean rails of foreign substances such as dirt, grease, loose oxide, and slag, prior to welding. Rail ends shall be properly aligned with the provisions for proper joint gap, and lateral and vertical positioning of the rail ends. Proper joint gap and positioning of rail ends shall be in accordance with the recommendations and specifications of the manufacturer and supplier of the particular welding process used, all subject to prior approval by the Contracting Officer. Weld rail in an approved manner and by workmen familiar with the welding method used. Do not weld when the rail temperature is lower than that recommended for the welding method used. Welding together of rails which have been drilled for bolted joints will not be permitted. [Rail joints [except those joints at fittings] shall be welded.] [Use the [_____] method.]

[3.8.1.1 Thermite Self-Preheat Method

See Section 05652N WELDING CRANE AND RAILROAD RAIL - THERMITE METHOD for specifications.

]3.8.1.2 Manual Shielded-Arc Welding Method

Use this process in accordance with applicable provisions of the AWS WHB-2.8 and the following instructions:

- a. Rail end preparation: Bevel the ends of the rails at approximately 0.61 rad 35 degrees full bevel on the head, 0.61 rad 35 degrees double bevel on the web, and 0.61 rad 35 degrees full bevel on the upper side of the base. Retain a narrow "nose", approximately 2 mm 1/16 inch, of the original rail-end face across the base and up the web following the beveling operation, to permit proper alignment of rail ends. When beveling with a torch, first preheat each rail end to 260 degrees C 500 degrees F. After torch cutting, grind off scale and oxides. Grind level faces only after preheating. Use proper grinding wheel and speed to avoid grinding "burns" or formation of "hard spots" from localized overheating.
- b. Alignment of rails: Align the beveled rail ends, allowing approximately 3 mm 1/8 inch root clearance, and place a copper shim under the joint opening. Clamp the rails during the welding with up to 6 mm 1/4 inch vertical camber (ends high) in 1.2 m four feet, centered over the joint to compensate for contractional distortion.
- c. Preheating joints: Preheat the joint area to approximately 260 degree C 500 degrees F for a distance of 150 to 200 mm 6 to 8 inches on each side of the joint, using a suitable heat source such as an oxy-acetylene or propane torch.
- d. Arc welding: Initiate welding of the joint immediately after preheating in the following sequence: base, web and head. Weld alternately on both sides of the base and web. Do not entrap foreign material, such as slag, in the weld. Ground, chip, or arc-air the root of the initial weld to sound metal before welding

is started from the second side. Maintain a 260 degrees C 500 degrees F to moderately higher interpass temperature. Proceed with welding until the joint is completed and sufficient metal has been deposited to permit grinding to finish contour in the head area. Provide slight reinforcement of the web and top of base areas.

- e. Postheating of welds: Postheat the joint area to approximately 370 degrees C 700 degrees F immediately after the welding operation, using the same technique for preheating. After postheating, protect the weld area against rain and snow and cool as slowly as possible by covering with an insulating blanket.
- f. Grinding of welds: Remove the excess deposited weld metal from the sides and top of the rail head using a heavy-duty grinder. Grind the area smooth, finishing closely as practical to the original contour. Use proper grinding wheel, speed, and rate of metal removal to avoid grinding "burns" or formation of "hard spots" from localized overheating. Exercise care to prevent grinding cracks.
- g. Temperatures: Measure the temperatures as indicated herein by temperature pencils.

3.8.2 Electric Flash-Butt Method

Welding process shall conform to applicable provisions of AREMA 4-2.

3.9 SPIKING WOOD TIES

Spike rail promptly after laying. Do not remove gage until spikes are driven. Start and drive spikes vertically and square with the rail and allow about 3 mm 1/8 inch space between spike head and rail base. Provide four rail-holding spikes on each tie on tangent track and on curved track up to 0.105 rad 6 degrees of curvature; spikes being staggered with outside spikes in each tie near the same edge, and inside spikes near opposite edge of tie with position of spikes the same on ties requiring four spikes. Provide six rail-holding spikes on each tie on curves of larger than 0.105 rad 6 degrees of curvature, one on outside and two on inside of each rail. Provide eight rail-holding spikes on each tie through road crossings. At joints, hold rail in place by reversing the normal position of the spike when it is driven.

[3.9.1 Plate Holding Spikes

Plate holding spikes shall have pilot holes predrilled in accordance with AREMA 3-1. Swab field-drilled pilot holes with creosote prior to spiking.

]3.9.2 Tie Plugs

If spikes are withdrawn, swab the holes with creosote and plug with creosoted tie plugs of proper size to fit the hole. If spikes are withdrawn and spikes are to be re-inserted in existing spike holes, the holes shall be swabbed with creosote and plugged with creosoted tie plugs prior to re-driving the spike.

3.10 FASTENING CONCRETE TIES

Install fastenings for concrete ties in accordance with manufacturer's recommendations. Protect exposed portions of fasteners from corrosion.

3.11 TURNOUTS AND CROSSOVERS

NOTE: The contract drawings will show the distances between point of switch and the center of last switch tie for each type of turnout to be used on the project. Such a layout is needed to establish firm dimensions for the lengths of turnouts (see AREMA Track Plans Plan No. 912) for quantity estimates, location of switch ties, measurement, and payment.

Locate turnouts and crossovers as indicated. Frog, switch, and guard-rail assemblies shall be complete. Accurately bend stock rails. [A switch point protector shall be provided at each switch, on the rail directed by the Contracting Officer.] Place headblocks at right angles to the main track and securely spike. Except where directed otherwise, set switch stands on the closed-point side when the switch is in normal position. Adjust switches properly. Swab turnout fixtures with oil. [Changes in rail section will not be permitted within the limits of switch ties.]

3.12 ACCESSORIES

3.12.1 Rail Anchors

NOTE: The number and position of rail anchors will be shown on the drawings and will be based on amount of traffic, character of traffic, and local conditions. When required, anchors will be placed in accordance with AREMA recommendations for "Light Density Lines" in AREMA 5. This recommendation calls for 16 anchors per 12 m 39 foot length of track, that is 8 anchors to resist movement in each direction. When heavy traffic, steep grades or other factors result in rail creeping additional anchors may be specified.

Locate as indicated. Apply [_____] anchors per 12 m 39 feet of rail in the pattern indicated. Distribute anchors uniformly along rail without application on joint ties. Install rail anchors on gage side of rail against same tie face on opposite rails. Rail anchors shall grip the base of the rail firmly and shall have full bearing against face of tie. Rail anchors shall not be removed by driving them along the rail. Rail anchors shall not be applied to track on an open-deck bridge. Where anchors are applied on track approaching an open-deck bridge, every third tie shall be box anchored for at least two rail lengths off each end of the bridge.

3.12.2 Guard Rails

Install guard rails on curves, bridges and trestles [as indicated] [in accordance with AREMA Track Plans]. Bridge guard rails shall be approximately 275 mm 11 inches from gage side of track rails, and shall extend a minimum of 9.10 m 30 feet beyond the structure. Ends shall be curved inward and beveled. Fully bolt guard rails. Guard rails shall not be higher than the running rails, and shall not be more than 25 mm one inch

lower than the running rail. Each guard rail shall be spiked with two spikes to each tie, but shall not be tie-plated. Unfit track rail in short lengths can be used for guard rails. Relay rail of the same size as the running rail may be used if it meets the requirements of MIL-R-3911.

3.12.3 Derails

Install derails where indicated. Place derails so that derailed equipment will not foul other tracks.

3.12.4 Bumpers and Wheel Stops

Install bumpers and wheel stops where indicated.

3.13 BALLAST DISTRIBUTION

NOTE: For projects where large amounts of track are being ballasted, ballast distribution from railcars is beneficial. The provision of a Government locomotive and crew to move ballast cars for Contractor may result in a lower unit cost for ballast distribution. If the activity has a locomotive available for use, insert the point of contact and telephone number for arranging use of the locomotive. If no locomotive is available, delete that portion of this paragraph.

Ballast shall not be distributed until area where ballast is to be installed has been approved by the Contracting Officer. No payment will be made for ballast which is distributed without the Contracting Officer's approval. Ballast distribution shall be to depth indicated and may be from either trucks or railroad cars. [The Government will furnish a locomotive for unloading ballast along the track if a carload or more is used. Arrangements for use of the locomotive shall be made by contacting the Contracting Officer.] Take care when distributing ballast from automotive equipment to prevent forming of ruts that would impair proper roadway drainage. Ruts formed that would impair drainage shall be leveled and graded to drain. [Excess ballast shall be picked up and redistributed at the Contractor's expense.] [If additional ballast is required for dressing, it shall be added by the Contractor at no increase in unit price.] [No ballast cars shall be released until they have been inspected by the Contracting Officer. Cars may be weighed by the Government at no cost to the Contractor.]

3.14 SURFACING

3.14.1 Superelevation

Superelevate curves as shown unless otherwise directed by the Contracting Officer. Obtain superelevation by raising outside rail of curve. Maintain inside rail at grade. Maximum superelevation shall be [_____] mm inches. Full superelevation shall be carried throughout each curve [, unless otherwise directed or shown]. Superelevation runoff shall be at a uniform rate, and shall extend at least the full length of the spirals. The normal rate of superelevation runoff will be 13 mm in 9.45 m 1/2 inch in 31 feet; however, this may be increased to 25 mm in 9.45 m one inch in 31 feet with prior approval of the Contracting Officer.

3.14.2 Preliminary Surfacing

Perform preliminary alignment and surfacing after unloading of ballast. After preliminary alignment, bring the track to grade and surface in lifts not exceeding 150 mm 6 inches each. After each lift, tamp the ballast. Place jacks close enough together to prevent undue bending of rail or stress of rail and joint. Raise both rails uniformly except where superelevation is required. Power tamp ballast under both sides of cross ties from each end to a point 375 mm 15 inches inside each rail. Fill the center with ballast, but do not tamp the center between the above stated limits. Tamp both ends of the cross ties simultaneously, including tamping inside and outside of the rail. Regardless of the kind of ballast or the kind of power tamper used, work tamping tools opposite each other on the same tie. Tamp ballast under switch ties for the entire length of each switch tie. After tamping has been completed and jacks removed, re-spike loose ties securely in proper position with full bearing on tie plates.

3.14.3 Final Surfacing

After preliminary surfacing has been completed, [or for track being repaired, where preliminary surfacing is not required,] check line and grade stakes[, operate engine and equipment over track,] and align track. Bring track to grade and re-tamp ballast in the manner described for preliminary surfacing. Decrease tamping distance inside rail on cross ties from 375 to 325 mm 15 to 13 inches. Give track a final lining conforming to established track centers. Dress ballast to section indicated and bring subgrade shoulders to line and surface.

[3.14.4 Final Adjustments

Sixty calendar days after track has been accepted and put in operation, the Contractor shall perform necessary resurfacing adjustments without cost, to leave the track in alignment and on grade.

]3.15 TOLERANCE

Completed track shall meet the following tolerances. Repair track not meeting the tolerances specified below to meet the requirements at no additional cost to the Government.

3.15.1 Alignment

Shall not deviate from uniformity more than the following prescribed amounts:

3.15.1.1 Tangent Track

Change between any adjacent 9.45 m 31 foot stations measured at the mid offset from a 18.90 m 62 foot line may not be more than 13 mm 1/2 inch from the gage line. (The gage line shall be defined as the line on the gage side of the line rail, 16 mm 5/8 inch below the top of the centerline of the railhead. Either rail may be used as the line rail; however, the same rail must be used for the full length of the tangential segment of track.)

3.15.1.2 Curved Track

Change between any adjacent 9.45 m 31 foot stations measured at the mid-ordinate from a 18.90 m 62 foot chord may not be more than 10 mm 3/8

inch for 0.63 rad 36 degree curves and flatter. For curves greater than 0.63 rad 36 degrees, change between any adjacent 4.72 m 15 1/2 foot stations measured at the mid-ordinate from a 9.45 m 31 foot chord may not be more than 13 mm 1/2 inch. (The ends of the chord must be at points on the gage side of the outer rail, 16 mm 5/8 inch below the top of the railhead.)

3.15.2 Track Surface

May not deviate from uniformity more than the amount prescribed below:

- a. Runoff in any 9.45 m 31 foot of rail at the end of a raise may not be more than 13 mm 1/2 inch.
- b. Deviation from uniform profile on either rail at the midordinate of a 18.90 m 62 foot chord may not be more than 13 mm 1/2 inch.
- c. Deviation from designated elevations on a spiral may not be more than 13 mm 1/2 inch.
- d. Deviation in cross level in spirals in any 9.45 m 31 foot may not be more than 13 mm 1/2 inch.
- e. Deviation from zero cross level at any point on tangent or from designated elevation on curves between spirals may not be more than 13 mm 1/2 inch.
- f. Difference in cross level between any two points less than 18.90 m 62 foot apart on tangents and curves between spirals may not be more than 16 mm 5/8 inch.

3.15.3 Gage

3.15.3.1 Track Gage

Within plus 6 mm 1/4 inch of standard gage in tangent track and curves less than 0.21 rad 12 degrees.

3.15.3.2 Curved Track

For curves larger than 0.21 rad, 12 degrees, lay rail to within plus 6 mm 1/4 inch or minus 3 mm 1/8 inch of required gage.

3.15.3.3 Guard Face Gage

Distance between guard lines measured across the track at right angles to gage line, and is measured at the point of frog on both sides of the turnout. Design value for guard face gage is 1.32 m 52 3/4 inches. Guard face gage shall be within plus or minus 6 mm 1/4 inch of design value.

3.15.3.4 Guard Check Gage

Distance between gage line of a frog and guard line of its guard rail, or guarding face, measured across the track at right angles to the gage line. The design value for guard check gage is 1.37 m 54 5/8 inches. Guard check gage shall be within plus or minus 3 mm 1/8 inch of design value.

3.16 RAILROAD CROSSING

Install [bituminous] [wood plank] [prefabricated sectional treated timbers] [or] [rubber] crossing as indicated, and in accordance with manufacturer's recommendations and specifications.

3.17 BONDING AND GROUNDING TRACK

NOTE: This article is to be used in instances of minor amount of grounding requirement or repair of existing system. Major signal systems or lightning protection should be covered under an electrical specification.

NOTE: Whenever rail facilities are required for unloading fuel, ammunition, other flammable or explosive materials, or if the track is located adjacent to electrical equipment, the rails and related track materials capable of conducting electrical current must be bonded, grounded and insulated from the remaining track. See OPNAV 05 "Ammunition and Explosives Ashore." In addition, when rail is used as conductors for carrying electrical information or operating switches and signals, rails must be bonded, grounded and insulated.

Track shall be bonded and grounded as indicated. Where track is designated for bonding and grounding, rails shall be bonded electrically continuous and effectively grounded. The grounding system shall consist of ground conductors and ground rods. Make connections by the exothermic weld process in accordance with manufacturer's instructions. Maximum resistance to ground from grounded rail or structure shall not exceed 10 ohms. When work, in addition to that indicated or specified, is directed in order to obtain the specified ground resistance, the provision of the contract covering "changes" shall apply.

3.17.1 Rail Joint Bond

Bond rail joints on both rails of each track. Bond rails together with not less than No. 1/0 AWG 10 mm 3/8 inch diameter bare stranded soft drawn copper conductor. Track to be bonded and grounded shall be electrically isolated from the remaining track.

3.17.2 Rail Cross-Bond and Ground

Rail cross-bond and ground shall be as indicated. Make connections between grounding system or ground rods and rails with a minimum No. 1/0 AWG bare stranded soft drawn copper cable, installed at least 300 mm 12 inches below the bottom of the ties. Ground rods shall be 19 mm 3/4 inch diameter copper-clad steel rods. Rods shall have a hard, clean, smooth, continuous copper surface and the portion of copper shall be uniform throughout the length of the rod. The copper shall have a minimum wall thickness of 0.32 mm 0.013 inch at any point in the rod. Each ground rod shall be di-stamped near the top with the name or trademark of the manufacturer and the length of rod in meters feet. Connection of conductors to the ground rods shall

be by all bronze, U bolt type ground clamp. Ground rods shall be a minimum of 3 m 10 feet long and shall be driven vertically full length. Provide one cross-bond and ground for each section of bonded and grounded track.

3.18 SUPPLEMENTARY INSTALLATIONS

NOTE: Signs, signals, and any other safeguards required for the safe operation or protection of the railroad installation will conform to the applicable state or municipal requirement for design, size, lettering and location. Where no such requirements exist, or for projects within the activity, the recommended practice of the AREMA covering these items will govern. The applicable specifications may be included in this section or, if necessary, may be included in another section of the specification.

Furnish and install permanent signs and signals such as crossing, clearance, derail and other safeguards as directed.

3.19 FIELD QUALITY CONTROL

3.19.1 Inspection of Rail Welds

3.19.1.1 Visual Inspection

Inspect new rail fittings thoroughly. Pay particular attention to any defect that might hinder satisfactory operation. [Inspect bolted joints for loose bolts and smooth transitions between rails of different sections.] Inspect each welded joint thoroughly after removal of mold and grinding of excess metal. Pay particular attention to surface cracking, slag inclusion, gas pockets, and lack of fusion. Correct or replace parts of welds found defective. Method of correction shall be as approved by the Contracting Officer.

3.19.1.2 Ultrasonic Inspection of Welded Rail Joints

[Inspect each weld ultrasonically following the visual inspection.] [The Government will test each weld ultrasonically following the visual inspection.] Inspect and test in accordance with MIL-STD-1699. Clean rails at testing locations as directed by the Contracting Officer. The Contractor is responsible for the correction or replacement of defective parts or welds. The method of correction shall be as approved by the Contracting Officer.

3.19.2 Inspection of Track

Perform tests to verify gage, alignment, cross level and grade at least once every 30 m 100 feet or less of track centerline length. Measure gage between points on inside of rails, 16 mm 5/8 inch below top of railhead.

-- End of Section --