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USACE / NAVFAC / AFCEC | **UFGS-34 11 00 (April 2008)**

Preparing Activity: USACE | **Superseding**
UFGS-34 11 00 (January 2007)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2024
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DIVISION 34 - TRANSPORTATION

SECTION 34 11 00

RAILROAD TRACK AND ACCESSORIES

04/08

-- End of Section Table of Contents --

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SECTION 34 11 00

RAILROAD TRACK AND ACCESSORIES
04/08

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NOTE: This guide specification covers the requirements for new railroads after the roadbed has been prepared, and railroad rehabilitation.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

****

PART 1 GENERAL

****

NOTE: This section will be used only for railroad construction after the roadbed has been prepared. Sections 31 11 00 CLEARING AND GRUBBING and 31 00 00 EARTHWORK will be used for specifying roadbed preparation. CAUTION: Coordination of this section with other sections of the specifications and with the project drawings is required.

The following information should be shown on the drawings:

a. Location of various sizes of rail if required.

b. Approximate location of compromise joints.

c. Locations of accessories such as welded joints, rail anchors, guard rails, gage rods, bonded and grounded track, etc.

d. Locations of items of equipment such as derails and car bumpers.

e. Location of turnouts, including dimensions from point of switch and center of last switch tie. Also type of switch stand and quantity and location of switch ties.

f. Track section with all needed dimensions.

g. Superelevation locations and amounts.

h. Highway grade crossing location, type, and details (cross-sections) as required. Standard details for each type of crossing are available on CADD through the PCASE program.

****

1.1 UNIT PRICES

****

NOTE: When lump sum payment is desired in the Invitation for Bids for work covered under this section the UNIT PRICES paragraphs will be deleted and subsequent paragraphs renumbered.

****

Each bid item will be measured by the unit listed in the Bid Schedule. Materials must be actually used or installed in the completed work. No measurement will be made for wasted materials or materials used for the convenience of the Contractor. The quantities thus determined will be paid for at their respective unit prices as shown in the Unit Price Schedule. This payment will constitute full compensation for furnishing materials, equipment, and labor and incidentals necessary to complete the work required, and for removing and properly disposing of replaced materials. Any required work or materials, such as lubricants and creosote, which are not listed on the Unit Price Schedule, are considered subsidiary to the items listed, and include their cost in the costs for the listed items. Bid items are self-explanatory except as described below.

1.1.1 Rail

****

NOTE: Use the following paragraph for new track construction. Use paragraphs Out-of-Face Rail Replacement and Spot Rail Replacement below for rehabilitation work.

****

Rail will be paid for on a unit price per linear meter ft of rail weight shown in the Unit Price Schedule. Stock rails and closure rails will be included for payment in the turnout unit price. The rails in road crossings will be included for payment for rail. Payment [will] [will

not] include such items as [furnishing the rail,] [cutting and drilling the rail,] [installing the rail,] [and] [delivering the old rail removed from track to the designated storage area].

1.1.1.1 Out-of-Face Rail Replacement

Measurement will be by the linear meter of 30.5 m ft of 100 ft or more of contiguous replacement rail acceptably installed. Payment will be at the contract unit price per linear meter ft for "Out-of-Face Rail Replacement".

1.1.1.2 Spot Rail Replacement

Measurement will be by the linear meter of less than 30.5 m ft of less than 100 ft of contiguous replacement rail acceptably installed. Existing rails which are adjusted in the track during spot rail replacement will not be measured for payment. Existing rails which must be transposed or exchanged during spot rail replacement, as determined by the Contracting Officer, [will] [will not] be measured for payment. Payment will be at the contract unit price per linear meter ft for "Spot Rail Replacement".

1.1.2 Joint Bars

****
NOTE: List joint bars required.
****

Joint bars will be paid for at the unit price per pair under "Furnish Joint Bars" for the following items: [_____].

1.1.3 Compromise Joints

Compromise joints will be paid for at the contract unit price per joint for "Furnish Compromise Joint".

1.1.4 Turnouts

1.1.4.1 New Turnouts

Turnout construction will be measured and paid for at the contract unit price for "Furnish and Install New Turnouts". Include the complete switch, switch stand, connecting rod, switch rods, attachments, switch points, slide plates, rail braces, frog, fillers, joint bars and track bolts for the switch and frog, switch ties, and all other required items, including rail, rail anchors, standard tie plates, and spikes. Ballast will be paid for at the unit price for ballast. The pay limit for turnout construction begins at the center of the No. "0" tie at the front of the turnout to the last long switch tie of the rear of the turnout.

1.1.4.2 Turnout Repair

The following are turnout and track crossing unit price pay items:

1.1.4.2.1 "Switch Repair"

(1) "Replace Switch Stand" - Each
(2) "Replace Switch Points" - Each
(3) "Install or Replace Heel Fillers" - Each
(4) "Install or Replace Heel Filler Bolt Assembly" - Each
(5) "Install or Replace Switch Plates" - Each

(6) "Install or Replace Switch Braces" - Each
(7) "Remove and Respike Braces and Plates" - Each
(8) "Adjust Adjustable Braces" - Each
(9) "Install or Replace Switch Rods and Clips" - Each
(10) "Replace Connecting Rod" - Each
(11) "Grind and Dress Switch Point and Adjacent Stockrail" - Each
(12) "Clean, Adjust, and Lubricate Switch" - Each
(13) "Rebuild Switch Point Protector" - Each
(14) "Rebuild Switch Point" - Each
(15) "Paint Switch Stand

1.1.4.2.2 "Frog Repair"

(1) "Replace Frog" - Each
(2) "Install or Replace Frog Plates or Hook Plates" - Each
(3) "Rebuild Frog" - Each
(4) "Grind and Dress Frog, Install or Replace Frog Bolt Assembly" - Each

1.1.4.2.3 "Guard Rail Repair"

(1) "Replace Guard Rail" - Each
(2) "Install or Replace Guard Rail Plates" - Each
(3) "Install or Replace Guard Rail Bolt Assembly" - Each
(4) "Install or Replace Guard Rail Fillers" - Each
(5) "Install or Replace Clamp Assembly including Fillers and Wedges" - Each
(6) "Tighten all Bolts in Turnouts" - Each

1.1.5 Track Crossing

Track crossings will be paid for at the contract unit price for "Furnish and Install Track Crossing".

1.1.6 Crossties and Switch Ties

****
NOTE: If only one of the AREMA Manual standard crosstie grades listed below is to be used, list only the specified grade and delete the other grade.
****

Crossties will be measured for each defective crosstie removed and for each new crosstie acceptably furnished and installed as indicated. Switch ties will be measured for each length of defective switch tie removed and for each length of new switch tie acceptably furnished and installed as indicated. Defective crossties and switch ties removed become the property of the Contractor. Crossties will be paid for at the contract unit price for each type listed below:

"152 by 203 mm 6 by 8 in Grade Crosstie"
"178 by 229 mm 7 by 9 in Grade Crosstie"

Switch ties will be paid for at the contract unit price each for the length of switch tie listed below:

"2.74 m 9 ft 0 in Switch Tie"
"3.05 m 10 ft 0 in Switch Tie"
"3.35 m 11 ft 0 in Switch Tie"

"3.66 m 12 ft 0 in Switch Tie"
"3.96 m 13 ft 0 in Switch Tie"
"4.27 m 14 ft 0 in Switch Tie"
"4.57 m 15 ft 0 in Switch Tie"
"4.88 m 16 ft 0 in Switch Tie"
"5.18 m 17 ft 0 in Switch Tie"

1.1.7 Geotextiles

****
NOTE: Remove this paragraph when Geotextiles are not required.
****

Geotextile quantities will be paid for at the unit price as shown on the Unit Price Schedule. Payment for material used in laps, seams, or extra lengths such as anchorage and for associated equipment such as securing pins along with the associated materials, equipment, labor, and operations is included in the contract unit price for "geotextile" and do not pay for separately. For payment purposes, installed geotextile will be measured in place to the nearest square meter square yard of placement area. Only material must be actually used or installed in the completed work will be paid for.

1.1.8 Ballast, Out-of-Face Surface and Aligning

Measure ballast based upon certified scale tickets for railcars or other delivery vehicles. Payment for ballast material will be made at the contract unit price per net metric ton ton of each gradation acceptably furnished and placed in track for "Furnish and Place Ballast". Submit copies of waybills and delivery tickets during the progress of work. Before the final statement is allowed, file certified waybills and delivery tickets for ballast actually used. Out-of-Face Surface and Aligning will be measured by the unit track-meter track-ft for each track-meter track-ft of raise of each type or fraction thereof, acceptably performed. Payment will be at the contract unit price per track meter ft for each item given below:

"Out-of-Face Surface and Aligning - skin Lift"
"Out-of-Face Surface and Aligning - 51 mm 2 in Raise"
"Out-of-Face Surface and Aligning - 102 mm 4 in Raise"
"Out-of-Face Surface and Aligning - 152 mm 6 in Raise"
"Out-of-Face Surface and Aligning - [_____] mm [_____] in Raise"

1.1.9 Subballast

****
NOTE: Remove this paragraph when Subballast is not required.
****

Measure subballastbased upon certified scale tickets. Payment for subballast material will be made at the contract unit price per net metric ton ton of each gradation acceptably furnished and placed and compacted on the track bed for "Furnish, Place, and Compact Subballast." Submit copies of waybills and delivery tickets during the progress of work. Before the final statement is allowed, file certified waybills and delivery tickets for subballast actually used.

1.1.10 Bridge Work

****

NOTES: Remove this paragraph when Bridge Work is not required in the contract. This paragraph should be edited to include payment for the items shown if they are not paid for separately under the Bidding Schedule.

Open deck bridge repair would not be track construction. Repair would require bridge tie renewals and wood guard rail renewals as separate items.

****

The following items relating to bridge repair will be measured separately for payment and are described under other sections of these specifications.

ITEM DESCRIPTION	UNIT
Timber Pile Repair	Linear m feet
Timber Pile Replacement	Linear m feet
Shotcrete Repair	Square m feet
Bridge Tie Replacement (Open-deck)	Each
Rivet Replacement	Each
Gabion and Gabion Mattress	Cubic m yard

All other work relating to bridge repairs will not be measured but will be paid for under the contract lump sum prices listed below for work at the following locations: [_____].

1.1.10.1 Lump Sum Payment

Payment for each lump sum is full compensation for all material, labor, equipment, and incidentals necessary to complete the work as shown on the drawings and as specified herein. Lump sum payment will be exclusive of those items specifically covered by the unit prices referenced above. The lump sum payment items include, but are not limited to, permitting, traffic maintenance, demolition, excavation, excavation supports, backfill, clearing, grubbing, protection of utilities and signals, timber repairs, temporary supports, jacking bridges, concrete construction, ballast retaining walls, pipe, end walls, removal and reinstallation of existing track, surface preparation, and painting.

1.1.10.2 Track over Ballasted-deck Bridges

Repair of track over ballasted-deck bridges will be measured and paid for at the contract unit price for the applicable repair item. Removal of track over ballasted-deck bridges which are to be repaired is considered incidental to the bridge repair. Reconstruction of track over open deck bridges will be measured per track m ft and paid for at the contract unit

price for TRACK CONSTRUCTION AND OUT-OF-FACE RELAY.

1.1.11 Track Spikes

Measurement will be by the unit keg for each keg of spikes acceptably furnished. Payment will be at the contract unit price per keg under "Furnished Track Spikes". Payment [will] [will not] be made for installation incidental to tie replacement or rail relay.

1.1.12 Track Bolt Assemblies

****
NOTE: List required bolt sizes.
****

Track bolt assemblies include bolt, spring washer (nutlock and nut). Measurement will be for each bolt furnished of the following sizes: [_____]. Payment will be at the contract unit price per each "Furnished Track Bolt Assembly". Payment [will] [will not] be made for installation incidental to rail joint repair or rail relay.

1.1.13 Tie Plates

****
NOTE: List tie plate sizes required.
****

Measurement will be for each tie plate acceptably furnished of the following size: [_____]. Payment will be at the contract unit price per each under "Furnish Tie Plates". Payment [will] [will not] be made for installation incidental to tie replacement or rail relay.

1.1.14 Rail Anchors

****
NOTE: List rail weight and section for which anchors are required.
****

Measurement will be for each anchor of the following weight [_____] and section [_____] acceptably furnished and installed. Payment will be at the contract unit price for "Furnish and Install Rail Anchors".

1.1.15 Insulated Joints

****
NOTE: List rail weight and section for which insulated joints are required.
****

Insulated joints will be measured for each insulated joint acceptably furnished and installed and will be paid for at the contract unit price for "Furnished and Installed Insulated Joints". Insulated joints will be required for the following rail weight [_____] and section [_____].

1.1.16 New Bumpers

****
NOTE: List type of bumpers required.

****

New bumpers of [_____] type will be measured for each bumper acceptably furnished and installed. Payment for furnishing and installing new bumpers will be at the contract unit price per each under "Furnish and Install New Bumpers".

1.1.17 New Wheelstops

****
NOTE: List type of wheelstops required.
****

New wheelstops of [_____] type will be measured by the unit pair for each pair of wheelstops acceptably furnished and installed. Payment for furnishing and installing new wheelstops will be at the contract unit price for each pair for "Furnish and Install New Wheelstops".

1.1.18 Salvaged Bumpers and Wheelstops

Salvage of existing track bumpers and wheelstops will be measured and paid for each bumper or pair of wheel stops salvaged.

1.1.19 Install Bumpers

Installation of salvaged bumpers will be measured for each bumper under "Install Track Bumper".

1.1.20 Install Wheelstops

Installation of salvaged wheelstops will be measured for each pair of wheelstops acceptably installed and will be paid for at the contract unit price for "Install Wheelstops".

1.1.21 Cushion Head for Bumper

Payment for furnishing and installing cushion head will be at the contract unit price per each new cushion bumper head.

1.1.22 Fastenings

Payment for fastenings used in the installation or reinstallation of bumping post, wheelstops, or cushion head for bumpers are considered incidental and included in the installation pay item for each.

1.1.23 Inner Guard Rail

Inner guard rail will be measured by the linear m ft of rail acceptably furnished and installed and will be paid for at the contract unit price for furnished and installed "Inner Guard Rail". Each rail of dual guard rail installations will be measured separately. The other track materials (OTM, i.e., joint bars, bolt assemblies, tie plates and spikes) will be included with the guard rail.

1.1.24 Adjusted gage Rods

Readjusting existing gage rods, as designated by the Contracting Officer, will be measured for each and be paid for at the contract unit price per each under "Adjust gage Rods".

1.1.25 New gage Rods

New gage rods will be measured for each gage rod acceptably furnished and installed and will be paid for at the contract unit price for "Furnish and Install gage Rods".

1.1.26 Salvaged gage Rods

Removal and salvage of existing gage rods will be measured and paid for at the contract unit price for each under "Salvage gage Rod".

1.1.27 Installed Salvaged gage Rods

Installation of salvaged gage rods will be measured for each gauge rod acceptably installed and will be paid for at the contract unit price for each under "Install Salvaged gage Rods".

1.1.28 New Derails

New derails will be measured and paid for at the contract unit price per each new derail acceptably furnished and installed under the bid item "Furnish and Install New Derail".

1.1.29 Installed Derails

Installation of salvaged derails will be measured for each derail acceptably installed and will be paid for at the contract unit price for each under "Install Derail".

1.1.30 Rail Welding

1.1.30.1 Rail Welding Thermite

Thermite rail welding to eliminate joints will be measured for payment based upon the number of rails welded and accepted by the Contracting Officer. Payment will be made for costs associated with rail welding of Government furnished and Contractor furnished rails. No payment will be made for replacement welds found unacceptable by ultrasonic testing.

1.1.30.2 Rail Welding Electric Arc

Electric Arc rail welding of [rebuilt rail ends] [engine burns] [_____] will be measured for payment based upon the number of rails welded and accepted by the Contracting Officer. Payment will be made for costs associated with rail welding of Government furnished and Contractor furnished rails. No payment will be made for replacement rails or replacement welds found unacceptable by ultrasonic testing.

1.1.31 Rail Joint Gap Adjustment

Measurement will be by the unit for each rail gap acceptably adjusted by replacing rail. Rail gaps which are created by rail adjusting (pulling or bumping) operations will not be measured for payment. Payment will be at the contract unit price per each under "Spot Rail Replacement".

1.1.32 Rail Joint Repair

Measurement will be by the unit for each joint acceptably repaired

(disassembly, cleaning, inspection, repairing any rail end mismatch, and reassembly with new bolt assemblies). Joints which are repaired coincident with adjacent other repair work, such as spot rail replacement, will not be measured for payment. Payment will be at the contract unit price per each under "Rail Joint Repair".

1.1.33 Respiking

Measurement will be by the unit for each 90.7 kg 200 pound keg utilized in track respiking. Respiking of joints located in a rail which is being shifted as part of a regaging operation will not be measured for payment. Spiking of ties installed under this contract will not be measured for payment. Respiking of ties in areas of "Rail Joint Repair" will not be measured for payment. Payment will be made at the contract unit price per tie under "Respiking".

1.1.34 Rail Cropping

Measurement will be by the unit for each rail end acceptably cropped and redrilled. Payment will be at the contract unit price for "Rail Cropping".

1.1.35 Tighten Bolts

Measurement will be made by the track km mile of bolts tightened, or removing and installing bolts that cannot be tightened, or replacing bolts that are missing. Payment will be made at the contract unit price for km mile or portion thereof under "Tighten Bolts".

1.1.36 Bolt Assembly Replacement

Measurement will be by the unit for each bolt assembly acceptably replaced. Payment will be at the contract unit price for "Bolt Assembly Replacement".

1.1.37 Track Construction

Track construction is defined as the initial construction of track or total reconstruction of track from the subgrade up. The pay item "Track Construction" includes all plant, equipment, and labor necessary to install rail, ties, and track materials and construct the track in accordance with this specification. Furnish track materials under their respective pay items in the contract Unit Price Schedule. Track construction will be measured and paid for by the track m ft for construction acceptably performed at the contract unit price for "Track Construction".

a. Reconstruction of track through grade crossings and between points 6 meters 20 ft beyond the outside limits of the crossing surface as shown will be considered to be track construction.

b. Track relocation or realignment of existing track by more than 1 meter 3 ft when associated with the relocation of turnouts or other work will be measured and paid for as "Track Construction".

c. Minor shifting of existing track associated with the replacement of turnouts, or any shifting less than 1 meter 3 ft is considered to be minor work incidental to related lining and surfacing work.

d. Where track construction abuts a turnout, the pay limit for

construction of various items will be the center of the No. "0" tie in front of the turnout and the last long switch tie at the rear of the turnout and does not include turnout.

e. Rail, ties, and other track materials for use in track construction will be included for measurement and payment under the respective contract unit prices for furnishing that material. Ballast and subballast will be measured and paid for at the contract unit prices for "Furnish and Install Ballast" and "Furnish, Place, and Compact Subballast". Costs for surfacing and alignment will be included in the contract unit price for "Track Construction".

1.1.38 Track Removal and Salvage

Removal of track will be measured by the track-meter track-ft, acceptably removed, and materials salvaged, inspected, inventoried, marked, stacked, and transported to designated storage sites. Track removal and salvage will be paid at the contract unit price per track meter ft under "Track Removal and Salvage".

1.1.39 Track Removal and Scrap

Track removal and scrap will be measured by the track meter ft of track acceptably removed and all of the scrap materials removed from the installation. Track removal and scrap will be paid for at the contract unit price per track meter ft of "Track Removed and Scraped".

1.1.40 Turnout Removal and Salvage

Turnout removal and salvage consist of removing all turnout materials, including switch ties. Limits of the turnout removal and salvage will be from the switch point to the last long switch tie. Also, included is the transportation of the materials to the designated storage site. The removal and salvage will be measured for each turnout removed and turnout material salvaged.

1.1.41 Straight Rail Turnout

****
NOTE: Straight rail turnout is performed when a turnout is removed, but one track is to remain in service.
****

Straight rail turnout consists of installing crossties in place of switch ties and replacing the previously removed switch and frog with rail and other track materials. The straight rail turnout will be measured for each turnout removed.

1.1.42 Rail Bonds

Rail bonds will be measured for each bond acceptably furnished and installed and will be paid for at the contract unit price for each of the following:

a. "Furnish and Install Railhead Bonds"
b. "Furnish and Install Duplex Web Bonds"

1.1.43 Rail Grounds

Rail grounds, including grounding rods, connecting cables, and hardware will be measured by the unit for each rail ground assembly acceptably furnished and installed and will be paid for at the contract unit price for each "Ground Assembly" furnished and installed.

1.1.44 Removal of Existing Crossing Surfaces

Removal and disposal of existing crossing surfaces and adjacent pavements will be measured by the square meter yard of surface or pavement acceptably removed and will be paid for at the contract unit price for "Pavement Removal". Removal of aggregate crossings will not be measured for payment as this work is considered incidental to "Track Construction".

1.1.45 Salvage of Grade Crossing Panel

Salvage of existing grade crossing panels and other materials will be measured by the track meter ft of crossing surface acceptably salvaged and will be paid for at the contract unit price per track m ft under "Grade Crossing Panel Salvage".

1.1.46 Track Removal and Track Construction Through Crossings

Track removal through crossings will be measured by the track meter ft and paid for as "Track Removal". Track construction using existing rail through crossings will be measured and paid for at the contract unit prices as specified in the appropriate sections of this specification. Track construction furnishing rail and other track material will be measured and paid for at the unit prices as specified in the appropriate sections of this specification.

1.1.47 Grade Crossing Surface Installation

****

NOTE: Throughout this section, delete crossing types not applicable to the work by coordinating with the project standard drawings and cross sections. Designer should add a separate bid item for signs if required.

****

Grade crossing surface installation will be measured by the track meter ft of crossing surface acceptably installed and paid for at the contract unit prices for the items listed below:

TYPE	DESCRIPTION
1	GRAVEL: (SEMI-PERMANENT)
1A	GRAVEL: WITH TIMBER HEADERS
2	TIMBER: FULL DEPTH
2A	TIMBER: FULL DEPTH, PREFABRICATED TIMBER SECTIONAL

TYPE	DESCRIPTION
3	ASPHALT: FULL-DEPTH WITH TIMBER HEADERS
4	CONCRETE: CAST-IN-PLACE
4A	CONCRETE: PRECAST CROSSING PANELS/SYSTEMS
5	RUBBER (ELASTOMERIC)

1.1.48 Subdrains

Subdrains acceptably installed will be measured and paid for by the linear meter ft at the contract unit price for "Grade Crossing Subdrains".

1.1.49 Conduit

****

NOTE: Delete this paragraph if grade crossing conduit is not required for automatic crossing protection warning devices. Installation should be considered if future crossing signal installation is anticipated.

****

PVC cable conduit of 100 mm 4 in diameter acceptably installed will be measured and paid for by the linear m ft at the contract unit price for "Grade Crossing Conduit".

1.1.50 Cleaning Flangeways

Cleaning the gage side flangeways in grade crossings are considered incidental work.

1.1.51 Ultrasonic Testing of Rail

Ultrasonic testing will be measured by the track meter ft and will be paid for as "Ultrasonic Testing".

1.1.52 Electric Arc Welding

Electric arc welding will be measured and paid for by the item, rebuilt in the track or in the shop and installed in the track. Items to be included are as follows:

a. "Switch point", each.
b. "Frog", each.
c. "Batter rail end", each.
d. "Guard rail", each.
e. "Engine burn", each.
f. "Railroad crossing", each.

1.2 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide

specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges
AASHTO M 288	(2021) Standard Specification for Geosynthetic Specification for Highway Applications

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

AREMA Eng Man	(2023) Manual for Railway Engineering

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189	(2020) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA M2	(2019) Standard for the Inspection of Preservative Treated Wood Products for Industrial Use
AWPA M6	(2024) Brands Used on Preservative Treated Materials
AWPA P2	(2024) Standard for Creosote Solutions

AWPA U1	(2024) Use Category System: User Specification for Treated Wood

ASTM INTERNATIONAL (ASTM)

ASTM A242/A242M	(2024) Standard Specification for High-Strength Low-Alloy Structural Steel
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A325M	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)
ASTM A490	(2014a) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A490M	(2014a) Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A992/A992M	(2022) Standard Specification for Structural Steel Shapes
ASTM C88	(2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	(2023) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C127	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C142/C142M	(2017; R 2023) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C535	(2016) Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C702/C702M	(2018) Standard Practice for Reducing

	Samples of Aggregate to Testing Size
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D217	(2021a) Standard Test Methods for Cone Penetration of Lubricating Grease
ASTM D402/D402M	(2014) Distillation of Cut-Back Asphaltic (Bituminous) Products
ASTM D445	(2019a) Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
ASTM D566	(2017) Standard Test Method for Dropping Point of Lubricating Grease
ASTM D1241	(2015) Materials for Soil-Aggregate Subbase, Base, and Surface Courses
ASTM D1310	(2014) Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2171/D2171M	(2018) Standard Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer
ASTM D3740	(2019) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D3776/D3776M	(2009a; R 2017) Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
ASTM D4354	(2012; R 2020) Sampling of Geosynthetics for Testing
ASTM D4355/D4355M	(2014) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D4491/D4491M	(2017) Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4595	(2017) Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method

ASTM D4751	(2020) Standard Test Method for Determining Apparent Opening Size of a Geotextile
ASTM D4759	(2011; R 2018) Standard Practice for Determining the Specification Conformance of Geosynthetics
ASTM D4791	(2019) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM E11	(2024) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
ASTM F667/F667M	(2016; R 2021) Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2009; Rev 2012) Manual on Uniform Traffic Control Devices

UL SOLUTIONS (UL)

UL 651	(2011; Reprint May 2022) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

1.3 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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 and Air Force projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Bridge Repair; G, [_____]

SD-03 Product Data

Wood Ties

Engineered Polymer Composite Ties

Steel Ties

Concrete Ties

New Jointed Rail; G, [_____]

Relay Rail; G, [_____]

Joint Bars

Compromise Joint Bars

Miscellaneous Track Materials

Crossing Material or Surface

Acceptable Replacement Materials; G, [_____]

Traffic Maintenance and Detour Plans; G, [_____]

Thermite Welding Procedures; G, [_____]

Electric Arc Welding

Materials and Samples

SD-04 Samples

Geotextile

Ballast

Subballast

SD-06 Test Reports

Sampling and Testing

Wood Ties

Engineered Polymer Composite Ties

Concrete Ties

Geotextiles

Ultrasonic Test

SD-07 Certificates

Wood Ties

Engineered Polymer Composite Ties

Ballast

Subballast

Materials and Samples

SD-10 Operation and Maintenance Data

Rail; G, [_____]

Turnouts and Track Crossings; G, [_____]

Switches; G, [_____]

Grade Crossings; G, [_____]

SD-11 Closeout Submittals

As-Built Drawings; G, [_____]

1.4 QUALITY ASSURANCE

1.4.1 Track Construction

Perform track construction under the direction of qualified and competent supervisory personnel experienced in railroad construction.

1.4.2 Welding

Perform welding under the direct supervision of an experienced welding supervisor or foreman.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Materials and Samples

Submit a complete schedule of the materials proposed for installation within 60 days of receipt of notice to proceed, and before installation of the materials; include a list of equipment proposed for the work. The Contracting Officer will notify the Contractor of the materials approved or disapproved. Promptly segregate disapproved materials that have already been delivered to the project site from the approved materials and remove from the premises. If materials are disapproved, provide acceptable replacement materials at no additional cost to the Government. Submit performance data for components or products proposed as an equivalent to those specified. The Contracting Officer's written approval is required for any such equivalent type component or product proposed to be used. Initial approval by the Contracting Officer will not prevent the removal and replacement of materials that are materially defective or materials not meeting this specification that are discovered during construction and/or routine quality control/quality assurance operations. Submit manufacturer's certificates of conformance for the following materials:

a. Rail.
b. Tie plates.
c. Track bolts, nuts, and spring washers.
d. Joint bars.
e. Rail anchors.
f. Track spikes.
g. Turnouts.
h. Rail welding process.
i. Premanufactured car bumpers.
j. Premanufactured road crossings and/or crossing surfaces.

1.5.2 Geotextiles

Ship and store geotextiles in their original ultraviolet resistant cover until the day of installation. Protect geotextiles from vandalism, temperatures greater than 60 degrees C 140 degrees F, dirt, dust, mud, debris, moisture, sunlight, and ultraviolet rays. Clearly label geotextiles delivered to the project site on the material cover to show the manufacturer's name, brand name, fabric type, location and date manufactured, lot identification, width, and length. Submit independent testing laboratory's certified test reports for geotextiles, including necessary analysis and interpretation. Provide results of the laboratory testing performed on samples of the geotextile material delivered to the jobsite. Submit test reports at least [5] [_____] working days prior to the installation of the geotextile.

1.6 PROJECT/SITE CONDITIONS

1.6.1 Temporary Work

Provide, during construction, suitable roads and crossings with all 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 the accumulation of water that might affect the stability of the roadbed is not permitted.

1.6.2 Traffic Control

Provide traffic control that comply with MUTCD. Place suitable warning signs near the beginning of the work site and well ahead of the work site for alerting approaching traffic from both directions. Place small markers along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Mark painting equipment with large warning signs indicating slow-moving painting equipment in operation.

1.6.3 Welding

Do not perform welding in rain, snow, or other inclement weather without adequately protecting the weld from the elements.

1.6.4 License Agreement

****
NOTE: The Designer should assess the need to include this paragraph and its subparagraphs in the project specifications. Delete if not applicable.
****

The work under this contract is being accomplished under a license agreement between the [_____] RAIL CORPORATION (hereinafter referred to as the Railroad Company) and the UNITED STATES OF AMERICA executed on [_____].

1.6.4.1 Provisions and Requirements

The following provisions and requirements are made a part of this contract in order for the UNITED STATES OF AMERICA to perform its obligations under the License agreement:

a. Perform the work in conformance with the standards of care and practice appropriate to the nature of the work.

b. Allow the Railroad Company to view and inspect the work at any time.

c. Do not enter the Railroad Company's premises until specifically authorized by the Contracting Officer. Notify the Contracting Officer at least 7 days prior to the planned date for entering the premises of the Railroad Company.

d. Take any safety precautions that the Railroad Company deems necessary. Do not locate equipment, unless being utilized to perform work on the railroad track, within 3.5 m 12 ft of the centerline of the nearest railroad track. Attend such equipment allowed within 3.5 m 12 ft of the centerline of the nearest railroad track at all times.

e. Furnish evidence of Workmen's Compensation coverage for both itself and for all subContractors.

f. Maintain at all times during any construction, maintenance, or removal work, the following insurance coverages:

(1) Contractor's Public Liability and Property Damage Liability Insurance, including automobile coverage, with a combined single limit of $2,000,000 per occurrence;

(2) For each subcontractor, Contractor's Protective Public Liability and Property Damage Liability Insurance, including automobile coverage, with a combined single limit of $2,000,000 per occurrence;

(3) Railroad Protective Public Liability and Property Damage Liability Insurance with a combined single limit of $2,000,000 per occurrence.

1.6.4.2 Insurance Policy Requirements

The Railroad Protective Liability policy must name the [_____] Rail Corporation, [_____] Corporation, and [_____] as the named insureds and include an endorsement in the form appearing in the Standard Provisions of the contract documents. Furnish to the Railroad Company, the Railroad Protective Liability policy and the certificates evidencing the other insurance coverage required in this section. Each policy and/or certificate must provide that cancellation of the insurance cannot be accomplished unless at least ten (10) days notice is given to the Railroad Company.

PART 2 PRODUCTS

2.1 BALLAST

****

NOTE: No. 5 ballast should only be used around turnouts and other areas requiring a smooth walking surface. Depth of ballast will be indicated on the drawings.

A wide choice of materials may be used for ballast, depending on economics and availability. 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 number will be indicated in this paragraph. Normally, prepared ballast will be used conforming to sizes of gradations established by AREMA Manual. Ballast, crushed stone and slag numbers 4, 4A, or 5 are acceptable. Size numbers 4 and 4A are typically mainline ballast materials. Size number 5 is 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.

Blast furnace slag should be considered a last choice or limited to areas with low rainfall and moisture and obtained from a source that is known to have provided good performing ballast in recent years. Most slag ballast tend to cement together over time or otherwise disintegrate more rapidly than better quality crushed rock. Water seems to accelerate this process. (This behavior is much like some poorer quality limestones.) Thus, unless its performance is already well known, using slag

for ballast is much riskier than using crushed rock.
****

Submit samples of the ballast [and subballast] material for testing. Submit samples a minimum of [30] [60] [90] [_____] days prior to the installation of the material. Obtain samples from the quarry, supplier, or other source that will be used to provide the ballast [and subballast] materials for this project using the methods described in ASTM D75/D75M. [Submit one representative sample no less than 90.6 kg 200 lbs of ballast material for each 9070 MT 10,000 ton of ballast to be installed.] [Submit one representative sample no less than 90.6 kg 200 lbs of subballast material for each 9070 MT 10,000 ton of subballast to be installed.]Prepared ballast must be crushed stone, [crushed air-cooled blast-furnace slag,][or][crushed steel furnace slag] Size No. [4,][4A,][or][5] conforming to Chapter 1, Part 2, of AREMA Eng Man for quality, soundness and gradation. In the portion retained on each sieve specified, the crushed gravel must contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the plane. When two fractures are contiguous, ensure the angle between planes of the fractures is at least 30 degrees in order to count as two fractured faces. Flat and elongated particle dimension ratio used in ASTM D4791 must be 1:3. Submit certificates of Compliance for the ballast [and] [subballast] materials to be installed in this project. Ballast materials must meet the property requirements shown in TABLE I.

TABLE I. MINIMUM PROPERTY REQUIREMENTS - BALLAST

Property	Maximum Value	Minimum Value	Test Method
Percent passing 0.075 mm No. 200 sieve	1.0 percent	--	ASTM C136/C136M ASTM C117
Bulk specific gravity			
Rock	--	2.60	ASTM C127
Blast furnace slag	--	2.30	
Absorption			
Rock	2.0 percent	--	ASTM C127
Blast furnace slag	5.0 percent	--	
Clay lumps and friable particles	0.5 percent	--	ASTM C142/C142M
Degradation Soundness	35 percent	--	ASTM C535
Sodium sulfate - 5 cycles	10 percent	--	ASTM C88
Flat or elongated particles	5 percent	--	ASTM D4791

2.2 SUBBALLAST

****

NOTE: Subballast should be used in frost areas where the ballast thickness requirement exceeds 250 mm 10 inches. Where subballast in necessary, indicate the kind of subballast to be used; the depth and other details of subballast section will be shown on the contract drawings. In some cases, the subballast material may be substituted for the lower portion of the ballast layer. The subballast is often constructed as a filter layer between the ballast and subgrade. Gradation of subballast generally ranges from the largest subgrade particles to the smaller or middle ballast particle sizes. Where practical, subballast should be placed in layers and thoroughly compacted to form a stable foundation for the ballast. AREMA Manual has a procedure for selecting gradation based on gradation of ballast and subgrade.

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Provide subballast consisting of aggregate-soil materials conforming to an ASTM D1241 Type I, Gradation [A] [B] [C] [D] mixture.

2.3 GEOTEXTILE

****

NOTE: Requirements for geotextile will be deleted unless a thorough investigation indicates that geotextile is necessary. Where geotextile is necessary, subballast is recommended and the following information should be shown on the drawings:

a. Locations for geotextile installation.

b. Locations for drainage work, including subdrains to provide drainage for the geotextile.

c. Typical cross-section through track showing rail, tie, ballast, subballast, geotextile, and subgrade with dimensions.

d. Locations for disposal of spoil materials.

Numerical values listed in TABLE II, except AOS, represent Minimum Average Roll Values (MARV) and are the value in the weaker principal direction as defined in AASHTO M 288.

Color should be grey or tinted to prevent "snow blindness" of personnel during installation.

The permeability of the geotextile should be at least five times greater than the permeability of the subgrade soil, but not less than the specified value. The pressure used to measure the nominal thickness (necessary to calculate the permeability)

in ASTM D1777 should be based on the pressure expected to be placed on the geotextile in the installation.

Most railroad applications use overlap as a method of joining separate pieces of geotextile.

See UFC 3-230-01 for additional information on subsurface drainage and filtration criteria.

The minimum depth of ballast for the track section being constructed/reconstructed is to be specified. However, where geotextiles are used in the track structure, the minimum depth of ballast/subballast between the tie and the geotextile of 300 mm 12 in. should be enforced to avoid severe damage to the geotextile.

****

Submit geotextile samples for testing. Submit samples a minimum of [30] [60] [90] [_____] days prior to the beginning of installation of the geotextiles. Provide one sample for each 20 units (rolls, panels, etc.) of geotextile to be used in the contract. Ensure all samples are from the same production lot as will be supplied for the contract. Identify samples by the manufacturer's name, brand name, lot designation, and project name. Ensure the minimum size of sample submitted for testing is the full width of the geotextile by [1.7] [9] [_____] m [5] [30] [_____] ft.

2.3.1 Physical Property Requirements

Provide a nonwoven, pervious sheet of polymeric material consisting of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed. Provide geotextile that contains stabilizers and/or inhibitors as necessary to make the filaments resistant to deterioration from ultraviolet light and heat exposure, particularly prior to placement and coverage. Ensure the fibers are formed into a network which is dimensionally stable. Finish the edges of the geotextile in a way to prevent the outer fibers from being pulled away from the geotextile. Provide geotextile that exceeds the applicability property requirements stated in TABLE II.

TABLE II - PROPERTY REQUIREMENTS-GEOTEXTILE

PROPERTY	MINIMUM REQUIREMENTS*	TEST METHOD
Weight**	0.57 kg/0.836 sq m15 oz/sq yd	ASTM D3776/D3776M Option B
Color	Grey or tinted	--
Strength	Class 1	AASHTO M 288

TABLE II - PROPERTY REQUIREMENTS-GEOTEXTILE		
PROPERTY	MINIMUM REQUIREMENTS*	TEST METHOD
Apparent opening size (AOS) (maximum required valve)	Less than 0.22 mm No. 70 sieve	ASTM D4751
Permittivity	0.1 per sec	ASTM D4491/D4491M
Ultraviolet degredation at 500 hours	50 percent strength retained	ASTM D4355/D4355M
*These property requirements are Minimum Average Roll Values in the weaker principal direction.		
**Do not limit geotextile selection by the minimum weight shown. Base selection on the other property requirements listed. Heavier geotextiles have shown greater resistance to abrasion.		

2.3.2 Dimensional Requirements

Match each roll of geotextile to the roadbed width. Ensure each roll of geotextile is at least 3.6 m 12 ft.

2.4 JOINT BARS

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NOTE: Lone toe joint bars are not recommended for high used tracks.

****

Provide joint bars of the size, shape, and punching pattern to fit the rail being joined.

2.4.1 New Joint Bars

Use new joint bars with new rail. Use joint bars of the "toeless" and "head free design" to match rail section. Ensure new joint bars conform to the requirements of "Specifications For High-Carbon Steel Joint Bars" or "Specifications For Quenched Carbon-Steel Joint Bars and Forged Compromise Joint Bars" found in Chapter 4, Part 2 of AREMA Eng Man for the joint bar and assemblies recommended in Chapter 4, Part 1 of AREMA Eng Man.

2.4.2 Used Joint Bars

Ensure used joint bars in good condition are used with relay rail only. Provide "toeless" type joint bar. Do not employ the used "long toe" type of joint bar where, because of the tie plate punching pattern, the spike slots are used to spike the rail to alignment at the joints. Ensure used joint bars are straight, free from cracks, breaks, and other visual defects. Excessive rust, dirt, and other foreign materials on the joint bars are not permitted. Used joint bars must be of the proper size to make good contact with the underside of the rail head and the top of the rail base on the rails being joined. Provide joint bars with alternating round and oval bolt holes. Bolt holes must not show excessive wear that would prevent use of the oval neck track bolt normally used with that joint bar. Joint bars that have been flame-gouged, flame cut, or otherwise altered are considered scrap and do not use.

2.4.3 Compromise Joint Bars

Ensure compromise joint bars are of the size, shape, and punching pattern to fit the rail sizes and sections being joined. Use only factory designed and constructed (forged or cast) compromise joint bars to join rails of different sizes.

2.4.3.1 New Compromise Joint Bars

Provide compromise joint bars conforming to the requirements of "Specifications For Quenched Carbon-Steel Joint Bars and Forged Compromise Joint Bars" found in Chapter 4, Part 2 of AREMA Eng Man.

2.4.3.2 Used Compromise Joint Bars

Requirements for joint bars in paragraph Used Joint Bars also apply to used compromise joint bars.

2.5 GREASE

Use grease for lubricating moving parts in turnouts and other trackwork with the following typical characteristics:

Calcium Soap, percent	9.0
Solid Additive (Graphite),percent	11.5
Penetration, ASTM D217 at 25 degrees C 77 degrees F worked	340
Dropping Point ASTM D566 at 25 degrees C 77 degrees F	101/214
Oil Viscosity, square mm/record at 40 degrees C cSt at 104 degrees F	81.8
ASTM D445 SUS at 38 degrees C 100 degrees F	379

Other types of grease or lubricating oil (like SoyTrak) may be used provided that the grease or oil has been used successfully by local commercial railroads and has the approval of the Contracting Officer.

2.6 OIL FOR CORROSION PROTECTION

Provide oil for protecting rail and other track materials from corrosion, except joints, conforming to the following general specification:

Asphalt, 100 penetration minimum 45 percent	ASTM D402/D402M
Flash point, minimum 55 degrees C 130 degrees F	ASTM D1310
Viscosity, kinematic, 60 degrees C 480 to 700 sq mm/s 140 degrees F 480 to 700 centistokes	ASTM D2171/D2171M

2.7 RAIL

Submit manufacturer's data on new rail including: rail weight, rail section, drilling, rail length, date rolled, and the name of the mill

where the rail was rolled. Include chemical analysis for Industrial Grade Rail. For relay rail the required information includes weight, section, lengths, and the name of the supplier. Provide the maximum allowable vertical wear on the rail head and the maximum allowable horizontal wear on the side of the rail. Also provide the design of the joint bars and compromise joint bars proposed to be furnished with each rail section.

2.7.1 New Jointed Rail

****

NOTES: Designer will indicate the desired rail weight and section. Rail weights/sections recommended for new rail purchases include: 115 RE, 132 RE, 133 RE, and 136 RE.

The designer will insert the rail section and the drilling pattern for each rail section required. Recommended rail drillings and joint bar punchings are found in Chapter 4, Part 1 of AREMA Manual. An example specification for 57 kg 115 lbs rail and a 6-hole joint bar would be:

RAIL	DRILLING
115RE	89-152-152 mm (3-1/2, 6, 6 inch)

****

2.7.1.1 General Requirements

Comply with the following:

2.7.1.1.1 Rail Lengths

Provide new rail consisting of a [_____] kg/m lbs/yd section or heavier and conforming to the specifications in Chapter 4, Parts 1 and 2 of AREMA Eng Man that were in effect at the time of its manufacture. Provide new rail in [11.9][24.4] m [39][80] ft lengths.

2.7.1.1.2 Rail Drilling

Provide new rail with the rail ends drilled. Drilluniformly and to the patterns specified.

RAIL	DRILLING
[_____]	[_____]

2.7.1.2 New Industrial Grade Rail

Produce all steel in an electric furnace. Ensure steel is continuous cast and free of hydrogen. Cull out and eliminate all injurious hot marks, or surface imperfections. Control cool rail to AREMA specifications. Provide rolled rail in accordance with the general physical dimensional requirements of AREMA design and meeting the Section tolerances and Chemical Composition listed below.

SECTION TOLERANCES	
Height	+1.5 to -0.7 mm+0.060 to -0.025 inch
Head Width	+1.2 to -1.1 mm+0.045 to -0.045 inch
Base Width	+1.5 to -1.5 mm+0.060 to -0.060 inch
Web Width	+1.5 to -0.7 mm+0.060 to -0.025 inch

GENERAL COMPOSITION			
		PRODUCT ANALYSIS PERCENT	
ELEMENT	CHEMICAL ANALYSIS PERCENT	UNDER MINIMUM	OVER MAXIMUM
Carbon	0.65 to 0.85	0.04	0.04
Manganese	0.70 to 1.30	0.06	0.06
Phosphorus Maximum	0.040		0.008
Sulfur Maximum	0.050		0.008
Silicon	0.10 to 0.50		0.50

2.7.1.2.1 Testing

Test rail ultrasonically to the following calibration guidelines:

CALIBRATION GUIDLINES	
Head	2.4 mm0.10 inch Flat bottom Hole
Web	3.2 mm0.13 inch Flat Bottom Hole
Base	3.2 mm X 12.7 mm.013 x 0.50 inch Slot

2.7.1.2.2 Straightness

Straighten rail for line in a press or roller straightener. End straightness must meet the following guidelines:

Droop	1.0 mm 0.040 inch Maximum
Dip	1.0 mm 0.040 inch Maximum
Hook	1.0 mm 0.040 inch Maximum

2.7.2 Used Jointed Rail

****

NOTES: Due to the ever-changing markets for used rail, it may be beneficial to allow the Contractor the option to provide an acceptable rail section for relay. Hence, the list of acceptable rail sections, acceptable rail weights, and sections should be chosen for compatibility with the existing rail and to minimize the number of different rail weights and sections on the installation. Delete unacceptable weights/sections from the list. Normally, rail less than 115 lbs should not be purchased for DOD track.

The designer will insert the rail section and the drilling pattern for each rail section required. To the greatest extent practical, the specified drillings should match the drilling pattern in the existing rail that is to remain in track. Recommended rail drillings and joint bar punchings are found in Chapter 4, Part 1 of AREMA Manual. An example specification for 57 kg 115 lbs rail and a 6-hole joint bar would be:

RAIL	DRILLING
115RE	89-152-152 mm 3-1/2, 6, 6 inch

****

2.7.2.1 Relief Rail

Used rail for spot rail replacement of defective rails (relief rail) must be the same weight, section, drilling, and length as the rail being replaced. Relief rail must meet the requirements specified for relay rail.

2.7.2.2 Relay Rail

****

NOTE: Relay rail is typically available in nominal lengths of 10 and 12 meters 33 and 39 ft. Relay rail can be justified if the construction cost is substantially below that of new rail.

A comparison of the usable metal in the heads of a new 57 kg/m 115-lbs RE rail and a 57 kg/m 115-lbs relay rail shows that the relay rail has about 32 percent less usable metal. Based on construction cost, the rail constitutes about 47 percent of the total track above roadbed; therefore, for economy, track constructed with 57 kg/m 115-lbs relay rail should cost at least 15 percent (33 percent times 0.47 equals about 15 percent) less than track constructed with new 57 kg/m 115-lbs rail. Other conditions can be evaluated in a similar manner.

Specifying relay rail that meets AREMA is not adequate for military track. AREMA permits excessive end batter because rail ends are intended

to be cropped off before welding. All relay rail should have ultrasonic inspection after it is installed. For Army projects the default values in Table IV are the maximum values. For Navy projects, the maximum wear must be 5 mm 3/16 inch for the top and 3 mm 1/8 inch for the side.

FORSCOM projects require the used of 115RE, 132RE, 133RE or 136RE rail sections.

****

Control cool relay rail. [Ensure used rail for out of face replacement and new construction is 45 kg/m 90 lb/yd or heavier and has the same section and drilling pattern for each rail weight. Acceptable rail weights and sections are: [90 ARA-A,] [100 ARA-B,] [112 AREA,] [115 AREA,] [130 AREA,] [132 AREA,] [133 AREA,] [136 AREA,] [_____]] [All relay rail provided must be the same section.]Do not cut relay rail into jointed rail from continuous welded rail.

2.7.2.2.1 Rail Drilling

Provide relay rail with the rail ends drilled. Drill uniformly and to the patterns specified.

RAIL	DRILLING
[_____]	[_____]

2.7.2.2.2 Length

Relay rail must be standard [10.1] [11.9] m [33] [39] ft lengths. Not more than 10 percent of the lot may be shorts. No rail shorter than 8.2 m 27 ft will be accepted.

2.7.2.2.3 Maximum Allowable Wear

For each rail, the average top wear must meet the requirements on Table IV, except rail in turnouts which must conform to paragraph Maximum Wear Used Rails Installed in Turnouts. Measure side wear 16 mm 5/8 in below the original top of rail.

TABLE IV. ALLOWABLE WEAR LIMITS FOR RELAY RAIL

Nominal Rail Weight, kg/m lbs/yds	Maximum Allowable Wear, mm inch	
	Top	Side
57.0 or lessLess than 115	3.21/8	6.41/4
Greater than 57.0115 or Greater	6.41/4	9.53/8

2.7.2.2.4 Condition and Appearance

Provide relay rail that is free from obvious defects and clean in appearance. Rail that has severe pitting and corrosion or has been flame-gouged, or spike nipped will not be accepted. Ensure rail is

straight from line and surface and free from any kinks or bends. Ensure rail bases are solid and free from visual defects such as plate wear, spike notching, pitting, and flame-gouging. Remove all existing bond wires from relay rail by shear cutting old cables immediately adjacent to the weld or pin. Remove bond wire heads completely from the gage side.

2.7.2.2.4.1 Maximum Allowable Lip

Lip or overflow must not exceed 3 mm 1/8 inch on either side of the rail head.

2.7.2.2.4.2 Engine Burns

Engine burns must not be greater than 13 mm 1/2 inch diameter and 0.8 mm 1/32 inch deep. A maximum of 6 engine burns is allowed per rail and engine burns must not affect more than 25 percent of the total order.

2.7.2.2.4.3 End Batter and Chipping

Rail end batter must not exceed a maximum of 3 mm 1/8 inch when measured 13 mm 1/2 inch from the rail end with a 460 mm 18 inch straightedge laid only on the rail being measured. Chipped or broken rail ends will not be accepted.

2.7.2.2.4.4 Running Surface Damage

Running surface damage must not exceed 6 mm 1/4 inch long by 13 mm 1/2 inch wide, and must be no greater than 1.5 mm 1/32 inch deep. Flat spots are not permitted on the rail head.

2.7.2.2.4.5 Defects Not Permitted

Relay rail having any of the following defects is not acceptable: bolt hole cracks or breaks, broken base, breaks, crushed head, detail fracture, engine burn fracture, head-web separation, piped rail, horizontal split head, vertical split head, torch cut rail ends, torch cut bolt holes, and compound or transverse fissures. The presence of any of these defects in the rail render that rail as scrap.

2.7.3 Welded Rail

****

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

****

Provide new rail consisting of, [_____] kg/m lbs, [_____] section and conforming to Chapter 4, Part 2 of AREMA Eng Man. Provide relay rail conforming to TABLE IV, [_____] kg/m lbs. Ensure relay rail that is to be welded meets the criteria specified in Chapter 4, Part 2 of AREMA Eng Man for welded rail. Mingling of new and relay rail will not be permitted.

2.8 TIE PLATES

2.8.1 General

Provide tie plates of the dimensions and punching pattern (A or B) to fit the rail. Use new tie plates conforming to Chapter 5, Part 1 of AREMA Eng Man with new rail. Used tie plates in good condition may be used with relay rail and ensure they are the dimensions as originally specified by AREMA Eng Man. Used tie plates smaller than 190.5 by 254 mm 7-1/2 by 10 inch are not allowed for use with relay rail having nominal weights less than 49.6 kg/m 100 lbs/yd, or no smaller than 190.5 by 279 mm 7-1/2 by 11 inch double-shoulder for use with relay rail having nominal weights of 49.6 kg/m 100 lbs/yd and greater. Both flat and canted plates will be required to match the existing tie plates that are in track. Use canted tie plates in all new rail and relay out-of-face rail replacements.

2.8.2 Used Tie Plates

Ensure used tie plates are free from excessive rust, pitting, mechanical damage, and dirt and other foreign materials. Cracked or broken plates are considered as scrap and do not use. Ensure shoulders on the tie plates project a minimum of 6 mm 1/4 inch above the plane of the rail seat. The thickness of the tie plate must be at least 13 mm 1/2 inch when measured anywhere in the rail seat area. Provide square spike holes which are not corroded, worn, or mechanically enlarged.

2.9 WOOD TIES

****

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. Red Oak, White Oak, and Southern Pine will provide good service in the eastern states while Douglas Fir will generally be more available in the western states. Southern Pine should not be used as mainline ties or as switch ties. Gum and pine ties are not recommended for use in areas having high humidity, such as the southeastern states. If unsure about the most appropriate species of wood for timber ties in the job geographic area, the engineering department of the local commercial railroad should be consulted.

The size and form of the crossties will be inserted in this paragraph using the following guidance.

a. For main lines, access tracks, or other tracks where the movement may be classified as heavy or the desired speed is in excess of 64.4 km/hr 40 miles per hour, crossties will be not less than 178 mm 7 in.) thick by 229 mm 9 in. wide. The length of crossties will be 2.591 m 8 ft 6 in. or 2.743 m 9 ft.

b. For yard or body, industrial, storage, siding, and running tracks, and for access tracks where the movement is not classified as heavy, crossties not less than 152 mm 6 in. thick by 203 mm 8 in. wide

can be used. The length of crossties will either be 2.438 m 8 ft or 2.591 m 8 ft 6 in..

c. For road crossings, ties 178 mm 7 in. thick by 229 mm 9 in. wide and 2.743 m 9 ft long will be required, unless the manufacturer recommends a different length.

d. 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. AREMA PORTFOLIO SET, Plan 912 contains bills of switch ties for various size turnouts and crossovers.

Other local species may be listed if used by railroads in the area.

****

Submit name of the tie manufacturer, Rail Tie Association membership, the wood species proposed, the quantities of ties for each specie proposed, and product data for the ties to be furnished, including the type of seasoning to be utilized, prior to ordering the ties. Ensure all ties are new. Provide Ash, Beech, Red and White Oak, [Gum,] [Spruces] [_____] [Pine,] [Douglas Fir,] [and] [other Fir] species.

a. Provide Ash or Oak switch ties. Ensure conditioning and seasoning conform to the requirements of AWPA U1 for the individual wood species. Provide well seasoned ties. Prior to preservative treatment, dry wood ties to the oven dry moisture content, or less, as specified in paragraph 3.14 of AWPA U1. The wood may be air dried, vapor dried, or boultonized.

b. Condition and treat ties which are to be dried by artificial means as soon as possible after sawing, but no more than 30 days later. Ensure the temperature used for boultonizing is as high as possible but in no case less than 94 degrees C 200 degrees F. Transfer vapor dried ties from drying cylinders to treatment cylinders as quickly as possible to avoid loss of heat from the seasoned ties. Pressure treat ties in accordance with Chapter 30, Part 3 of AREMA Eng Man by the empty cell process with a 60/40 creosote/coal tar solution (Grade C) in accordance with AWPA P2 to a minimum retention of 128 kg/cu m 8 lbs/cu ft of wood.

c. Treat bridge ties in accordance with paragraph BRIDGE TIES. Record treatment as specified in AWPA M2. Permanently mark or brand treated ties by the producer in accordance with AWPA M6. Provide ties that are produced by a member of the Railway Tie Association. Incise all ties, except Southern, Red, and Ponderosa Pine, on all four sides in the pattern specified in AREMA Eng Man, Chapter 30, Part 3, prior to treatment.

d. Provide splits that are longer than 100 mm 4 inch and no wider than 5 mm 1/4 in at either end. Splits longer than 100 mm 4 inch but no longer than the width of the face in which the split appears, will be acceptable if specified anti-splitting devices are installed with the splits compressed. Perform any required adzing and drilling for spikes prior to treatment.

e. Notify the Contracting Officer at least 15 days prior to the shipment of any treated ties or timbers from the manufacturer's plant, to provide the Government the opportunity to inspect the materials before shipment. When inspections of onsite materials result in product rejection, promptly segregate and remove rejected material from the premises. The Government may also charge the Contractor any additional cost of inspection or test when prior rejection makes reinspection or retesting necessary.

f. Submit certified [test] [and] [inspection] reports for crossties and switch ties subsequent to treatment, a minimum of seven calendar days prior to any ties being installed in track. [Test] [and] [inspection] reports must contain the information required by Part 7 of AWPA M2. Submit certificates of compliance prior to any ties being installed in track.

2.9.1 Crossties

Provide wood crossties conforming to Chapter 30, Part 3 of AREMA Eng Man.

2.9.1.1 Except at Road Crossings

Provide sawed wood ties no less than [_____] mm inch thick and [_____] mm inch wide, with a length of [2.44] [2.6] [2.75] m [8.0] [8.5] [9.0] ft.

2.9.1.2 At Road Crossings

Provide sawed wood ties no less than 178 mm thick and 229 mm wide 7 inch thick and 9 inch wide with a length of 2.75 m 9 ft, unless recommended otherwise by the manufacturer of crossing surface materials.

2.9.2 Switch Ties

Provide sawed switch ties conforming to Chapter 30, Part 3 of AREMA Eng Man that are 178 mm 7 inch thick and 229 mm 9 inch wide. Provide length and quantities as shown.

2.9.3 Bridge Ties

****
NOTE: Delete this paragraph and paragraphs Ballasted-Deck Bridge Ties and Open-Deck Bridge Ties if bridge work is not included in the contract.
****

Use method for treatment of bridge ties in accordance with AWPA U1. Base treatment standards on the type of deck on the bridge. Drill bolt holes prior to treatment. Saw ties to dimensions and furnish the quantities indicated on the contract drawings. Field verify all dimensions and quantities prior to furnishing timber bridge ties.

2.9.3.1 Ballasted-Deck Bridge Ties

Use standard crossties in track over ballasted deck bridges.

2.9.3.2 Open-Deck Bridge Ties

Bridge ties for open-deck bridges must be sized on two sides and of adequate size to distribute the track load to all stress-carrying

stringers. Preservative treatment must be in accordance with AWPA U1 for above-ground exposure.

2.9.4 Tie Plugs

Tie plugs must fit holes from which spikes are drawn. The plugs must comply and be treated in accordance with Chapter 30, Part 3 Section 3.1.5 of AREMA Eng Man.

2.9.5 Anti-splitting Devices

Equip crossties and switch ties on each end with gang nail end plates anti-splitting devices of the type specified, regardless of whether or not the wood has shown any tendency to split. Use products conforming to Chapter 30, Part 3 Sections 3.1.6 and 3.1.7 of AREMA Eng Man.

2.10 BRIDGE TIMBERS

****

NOTE: Delete this paragraph if bridge work is not included in the contract.

****

Bridge timbers include all structural members such as stringers, caps, and posts. Incise timbers on two sides. Ensure creosote preservative treatment is in accordance with AWPA U1 for above ground exposure and has fire-retardant coating for creosoted wood in accordance with AREMA Eng Man, Chapter 7 Section 1.11.

2.11 BRIDGE LUMBER

****

NOTE: Delete this paragraph if bridge work is not included in the contract.

****

Treate lumber used in decks and bracing above the waterline for above ground exposure. Treat lumber used in retaining walls, fender systems, and bracing below the high waterline for soil contact exposure. Ensure preservative treatment is in accordance with AREMA Eng Man, Chapter 73.

2.12 BRIDGE PILES

****

NOTE: Delete this paragraph if bridge work is not included in the contract.

****

Preservative treatment of piles must conform to AREMA Eng Man, Chapter 7, Part 1, Section 1.9 for piles. Piles used as friction or end-bearing piles must be a First-Class pile in accordance with AREMA Eng Man, Chapter 7, Part 1, Section 1.9.4. Second-class piles can be used in retaining walls, dolphins, and fender systems supports.

2.13 ENGINEERED POLYMER COMPOSITE TIES

****

NOTE: Engineered polymer composite ties, also commonly known as plastic ties, are a relatively new

technology compared to the more conventional sawn wood and concrete ties. Engineered polymer composite ties are inherently resistant to moisture, rot, and insects and may be preferred for certain locations. Besides out-of-face applications, engineered polymer composite ties can be used for maintenance (intermingled) replacement of deteriorated wood crossties.

Recommended size requirements for engineered polymer composite ties follow the same basic guidance as in the NOTE for paragraph WOOD TIES above pertaining to wood tie sizes.

Engineered composite ties are designed to use the same tie spacing and ballast structure as wood ties. The ties can be installed using conventional hardware and installation equipment. Specific installation detials, such as which fasteners work best, size of pre-drill holes, etc., should be based on the manufacturer's recommendations.

For increased lateral and longitudinal track stability, engineered polymer composite ties can be manufactured with specially designed surface patterns to create a mechanical interlock between the tie and the ballast. Individual manufacturers have different proprietary designs to provide a range of lateral track stability. Experinece has shown that this interlock (track stability) can be achieved with little or no train traffic commonly needed upon replacement of wood ties.

****

Submit name of the tie manufacturer, dimensions, and the pre-drill size as recommended by the tie manufacturer for the type and size fastening system being used. Use engineered polymer composite ties conforming to Chapter 30, Part 5 of AREMA Eng Man. Incorporate a surface pattern to provide a minimum single tie lateral push result of 11.1 kN 2,500 lbf after no more than 100,000 gross tons of accumulated traffic. Submit certified test reports for crossties and switch ties, a minimum of seven calendar days prior to any ties being installed in track. Document compliance of the ties to the performance criteria in Chapter 30, Part 5 of AREMA Eng Man. Submit certificates of compliance prior to any ties being installed in track.

2.13.1 Crossties

2.13.1.1 Except at Road Crossings

Provide engineered polymer composite crossties, except at road crossings, which are no less than [_____] mm inch thick and [_____] mm inch wide, with a length of [2.44] [2.6] [2.75] m [8.0] [8.5] [9.0] ft.

2.13.1.2 At Road Crossings

Provide engineered polymer composite crossties at road crossings which are no less than 178 mm thick and 229 mm wide 7 inch thick and 9 inch wide. Use a length of 2.75 m 9 ft, unless recommended otherwise by the

manufacturer of the crossing surface materials.

2.13.2 Switch Ties

Provide switch ties conforming to Chapter 30, Part 5 of AREMA Eng Man that are 178 mm 7 inch thick and 229 mm 9 inch wide. Provide length and quantities as shown.

2.13.3 Ballasted-Deck Bridge Ties

Engineered composite ties for use in track over ballasted deck bridges must be standard crossties.

2.13.4 Tie Plugs

Tie plugging may be utilized in engineered polymer composite ties in similar fashion as they are used in sawn wood ties. Polymer-based plugging compounds (e.g., polyurethane) are recommended.

2.14 STEEL TIES

****

NOTE: AREMA has a lighter weight steel tie section than specified below that can be used for yard tracks subject to light loads. Change section minimum properties to:

Length	**2540 mm 100 inch**
Width	**260 mm 10.2 inch**
Thickness	**10 mm 0.4 inch**
Section Depth	**97 mm 3.8 inch**
Moment of Inertia	**316 cm^4 7.6 in^4**

****

Submit name of the tie manufacturer, dimensions, type of fixation and the chemical analysis of the steel. Provide steel ties conforming to Chapter 30 of AREMA Eng Man. Construct steel ties with hook-in shoulders of a 178 mm 7 inch minimum spade. Design and furnish ties with elastic type rail fixation system for Pandrol E clips or safelock, or an approved equal. Provide ties with a brand rolled into the material indicating the section and manufacturer. Provide steel ties with the following minimum section:

Steel Ties	
Length	2590 mm 102 inch
Width	300 mm 11.8 inch
Thickness	10 mm 0.4 inch

Section Depth	118 mm 4.6 inch
Moment of Inertia	610 cm^4 14.6 in^4

Manufacture ties from steel free of injurious segregation with a minimum tensile strength of 312 MPa 45,000 psi. Use steel with the chemical composition conforming to ASTM A242/A242M or ASTM A992/A992M

2.15 CONCRETE TIES

****

NOTE: Delete if concrete ties are not required. Concrete ties may be preferred for certain locations.

****

Submit name of the tie manufacturer, dimensions, type of fixation and the chemical analysis of the concrete mix. Provide concrete ties and fastening system complying with the material and strength requirements specified in Chapter 30 of AREMA Eng Man for [monoblock] [reinforced two-block] [prestressed two-block] ties. Ensure concrete ties are a minimum of [2.44 m 8 ft] [_____] in length, width of [_____], and height of [_____]. Provide concrete ties with a factored design positive bending moment of [_____] kN-m Inch-kips at center of seat. Furnish concrete with dual durometer rubber pads, which have 50 to 60 shore A durometer on the bottom surface and 75 to 85 Shore A durometer reinforced rubber on the top surface. Submit certified test reports for ties and fastening system, a minimum of seven calendar days prior to any ties being installed in track. Document the testing required by Chapter 30 of AREMA Eng Man.

2.16 TURNOUTS AND TRACK CROSSINGS

****

NOTE: Detailed information on frogs may be found in AREMA PORTFOLIO SET. Self-guarded frogs, in accordance with AREMA Track Work Plan No. 641 and Notes, may be specified in place of rigid-bolted frogs except: (1) for tracks where the design speed exceeds 48.3 km/hr 30 miles per hour, or (2) for track installations outside the United States. Do not use spring rail frogs on military track. 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.

****

Ensure component parts of the turnouts to be furnished are the products of manufacturers regularly engaged in the manufacture of such products which 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 ensure each turnout is the product of a single firm. Provide switch assemblies, stands, frogs, and guardrails assemblies conforming to the requirements of AREMA Eng Man.

2.16.1 Rail and Joint Bars

****

NOTE: The rail weight and section to be used in each turnout and track crossing constructed, reconstructed, or having steel replaced will be shown on the Contract Drawings and/or listed in this paragraph along with the turnout or crossing identification number and turnout size number. Example:

TURNOUT TRACK OR CROSSING ID	SIZE OR CROSSING ANGLE	RAIL	DRILLING
T51	No. 8	90RA	72-138 mm 2-11/16-5-1/2 inch

Designer may want new rail in turnouts to match new switch points.

****

Furnish and install rail, joint bars, and miscellaneous track materials used in turnout and track crossing construction as part of the complete turnout or crossing. Use rail and miscellaneous track materials in turnout and track crossing construction of the the weight and section [shown on the contract drawings] [as listed:

TURNOUT TRACK OR CROSSING ID	SIZE OR CROSSING ANGLE	RAIL	DRILLING
[_____]	[_____]	[_____]	[_____]

]

2.16.2 Maximum Wear Used Rails Installed in Turnouts

[The average top (vertical) wear must be 3 mm 1/8 in or less. Gage side head wear must not exceed 3 mm 1/8 inch] [Ensure all rail installed in turnouts is new].

2.16.3 Frogs, Switches, Guardrails and Appurtenances

Provide frogs, switches, guardrails and appurtenances consisting of materials suitable for use in heavy tonnage main track. Ensure used turnout materials are fully reconditioned and within plus or minus 3 mm 1/8 inch of the original specification for that turnout design. Use materials in the turnout of the same weight and section. Provide materials in good condition and free from excessive rust, dirt, and other

foreign materials. Provide rail weight and section as specified.

2.16.3.1 Switches

****
NOTE: List length, type, and quantity of switch points and size, type, and quantity of other turnout materials required for turnout repairs in the drawings schedule. If new switch points are required, edit the following paragraphs accordingly. Switch point Detail 5000 can also be used. Designer may want new rail in turnouts to match new switch points. The Navy recommends the use of manganese tipped switch points on the side opposite the turnout side of the switch.
****

Usewitches for new turnout construction or complete turnout replacement consisting of 5029 mm 16 feet and 6 inches reinforced straight split switches with graduated risers generally conforming to AREMA Eng Man, Plan Number 112. Use switch materials to replace defective materials as indicated.

a. Ensure switch points are new. Ensure switch point detail is AREMA Eng Man, Plan No. 221, Detail 4000 or 6100. [Ensure one switch point in each turnout is manganese tipped in accordance with AREMA Eng Man, Plan No. 220-52-E-82, installed on the side opposite the turnout side of the switch (example the right switch point is manganese tipped on a left hand turnout).]

b. Provide new switch rods and connecting rods.

c. Provide new or used gage plates, switch plates, slide plates, and heel plates in good condition and not worn or corroded. Provide either rigid or adjustable rail braces. For a given turnout all rail braces must be of the same design.

d. Provide heel blocks that are either cast or forged steel, either new or used, and in good condition. Provide new, heat treated heel block bolt assemblies. Provide either new or used heel joint bars good condition which are manufactured for the purpose. If floating heel blocks are used, use special no. 5 double shoulder plates to maintain 160 mm6.25 inch heel spread.

2.16.3.2 Frogs

Provide [bolted rail] [railbound manganese] [solid manganese self-guarded] frogs in the sizes indicated.

a. Provide [new] [remanufactured] frogs. Do not use cracked or broken used frog castings. Cracked or broken frog castings that have been repaired by welding are not acceptable and do not use. Ensure remanufactured frogs meet the following wear requirements:

(1) Provide frog points that are in good condition and not worn, chipped, or broken.

(2) Maximum allowable wear on used or reconditioned frogs is:

Frog Point	3 mm 1/8 in
Top Surface	3 mm 1/8 in
Raised Guarding Face (Self-Guarded)	3 mm 1/8 in
All Wear Surfaces	3 mm 1/8 in

(3) Minimum flangeway depth for used frogs is 45 mm 1-3/4 inch. Minimum flangeway width is 48 mm 1-7/8 inch.

b. Provide new frog bolts, nuts, lock washers, and headlocks.

2.16.3.3 New or Replacement Guard Rails

Ensure new or replacement guard rails are a minimum of 4.6 m 15 ft in length and are new or used in good condition. Provide guard rails of any of the following designs: Tee rail in accordance with AREMA Eng Man, Plan No. 504, solid manganese steel in accordance with AREMA Eng Man, Plan No. 510, or an acceptable hook flange design. Ensure the guard face for used guard rails is smooth and not worn more than 3 mm 1/8 inch from its new condition. Equip guard rails bolted to the running rails with fillers. When fillers are installed or repaired, use new bolt assemblies. All bolts, nuts, and associated hardware must be new. Equip clamped guard rails with block wedges, filler wedges, and cotter keys. Provide new guard rail plates or use acceptable replacements. Install single-shoulder tie plates used with guard rails with the shoulder on the inside flush against the base of the guard rail.

2.16.3.4 Hook Plates

Hook plates must be new or acceptable used material and of the designs and lengths indicated on AREMA Eng Man, Plan Nos. 112 and 241.

2.16.3.5 Switch Stands

****

NOTE: The type and manufacturer of switch stand should be the same as presently used at the jobsite or serving railroad. Mixing positive-action and automatic-action switch stands on the same military base is not recommended. Examples of acceptable types of stands are Racor models 22 and 36D, or Bethlehem Steel models 51A and 53. Other specialty designs, like a rotary wheel switch stand, may be also required.

****

2.16.3.5.1 New or Replacement Switch Stands

Provide new or replacement switch stands conforming to AREMA Eng Man, Plan 251-64, which are new or fully reconditioned, low-stand type with model number [Bethlehem Steel model 51A][_____]. Provide [automatic-action][semi-automatic action (spring)] [positive-action (rigid)] switch stand with [adjustment from the top with shims through a moveable cover][spring connecting rods][adjustable connecting rods][_____].

2.16.3.5.2 Existing Switch Stands

Recondition existing switch stands, staffs and targets, where not designated for replacement, by cleaning to bare metal and then paint with one coat of metal primer.[Clean and re-lubricate the interior portion of the stands, including mechanisms.] Paint switch stand staff with two coats of black enamel paint. Similarly prepare and paint switch targets with two coats of red or white enamel paint to indicate switch position in accordance with normal railroad practice.

2.16.3.5.3 Switch Lamps

Equip each stand with one of the following switch lamps as indicated on the project plans:

2.16.3.5.3.1 Reflecting Type

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

2.16.3.5.3.2 Reflecting Type with Daylight Disk

Approved reflecting switch lamps fitted with standard commercial-type double red and white reflecting lenses, and with day signal targets.

2.16.3.5.3.3 Illuminated Type

Approved illuminated lamps with primary battery, battery housing, and cable.

2.16.4 Track Crossings

Provide new track crossings fabricated in accordance with AREMA Eng Man, Plan No. [_____]. Rail weight and section is [_____]. Provide tie layout in accordance with AREMA Eng Man, Plan No. [_____].

2.16.5 Rail Braces

Provide either the fixed or adjustable type rail braces of standard manufacture.

2.17 GRADE CROSSINGS

Use recyclable materials in grade crossings conforming to EPA requirements in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING.

2.17.1 Crossing Material or Surface

****

NOTES: Coordinate this paragraph with the drawings showing the typical railroad crossing cross-section and details.

Where suitable local materials meeting state specifications for a granular highway base course material are available, those materials may be substituted for the ASTM D1241 material specified below. Ballast or subballast materials may also be

used for semi-permanent aggregate crossings.
****

Within 30 days of the Notice to Proceed, submit the brand name of the premanufactured crossing material or crossing surface material proposed for use along with manufacturer's literature concerning the product; and for built-in-place crossings, the type of materials to be used along with manufacturer's literature. Submit detailed installation procedure for the premanufactured crossing material or crossing surface material proposed for use within 30 days of the notice to proceed. Ensure roadway width is as indicated in the contract drawings. Provide crossing material or surface complying with the following:

a. Construct a semi-permanent aggregate crossing of compacted crushed aggregate placed between the rails and as short approaches to the track. Provide aggregate consisting of a crushed gravel or crushed stone material conforming to the requirements of [ballast] [subballast] [ASTM D1241, Type I, Gradations A or B].

b. Construct a permanent aggregate crossing of compacted crushed aggregate placed in the track between bond timbers header as indicated. Provide crushed aggregate consisting of [ballast] [subballast] [a crushed aggregate material conforming to the requirements of ASTM D1241, Type I, Gradations A or B].

c. Provide [constructed-in-place] [prefabricated] full-depth timber crossings. Ensure timber road crossing materials are [oak] [acceptable hardwood]. Provide seasoning and treatment conforming to the requirements of AWPA U1 and paragraph WOOD TIES.

d. Use bituminous paving materials for full-depth asphaltic cement concrete (bituminous) crossing with bond timbers flangeway headers conforming to the applicable State of [_____] Highway Specification for a [_____] type mix design. Ensure bond timbers are [oak] [acceptable hardwood]. Provide seasoning and treatment conforming to AWPA U1 and paragraph WOOD TIES.

e. Provide concrete pavement materials for full-depth, cast-in-place concrete crossings conforming to the requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE.

f. Use premanufactured, precast concrete panels for grade crossings constructed of reinforced concrete having a minimum 28-day compressive strength of 34.5 MPa 5,000 psi. Ensure each panel is manufactured to meet HS20-44 loading in accordance with AASHTO HB-17, with 30 percent impact increment. Base loading on single axle loads of 14,500 kg 32,000 lbs. Use precast crossing panels that are the product of a company regularly engaged in the manufacture of such panels, and whose products have been successfully used in the commercial railroad industry for at least 2 years.

g. Provide full depth panels for premanufactured elastomeric crossing systems. Ensure elastomeric systems with or without steel composition grade crossing panels are the product of a company regularly engaged in the manufacture of such products, and whose products have been successfully used in the commercial railroad industry for at least 2 years.

2.17.2 Rail

****
NOTE: The use of 57 kg/m 115-lbs rail as the minimum through crossings and for 6 m 20 ft on either side of the crossing is recommended. The use of welded joints or long (24.4 m (78 feet) rail for the crossing area is also recommended to eliminate any joints in the crossing area. The use of 178 mm by 229 mm by 2.74 m 7 inches by 9 inches. by 9 feet long ties is recommended throughout the crossing area. Although 2.59 m 8-1/2 feet ties are acceptable, they are the minimum length that should be used in the crossing.
****

Provide rail within the road crossing and for at least 6 m 20 ft on either side of the crossing that is [_____] [115RE] as specified in paragraph Rail and Joint Bars.

2.17.3 Ties

Provide ties within the road crossing and for at least 6 m 20 ft on either side of the crossing consisting of hardwood or polymer composite and as specified in paragraphs Crossties and Switch Ties.

2.17.4 Track Materials

For premanufactured crossing surfaces or systems, provide tie plates, spikes or other rail fasteners, rail anchors, and other track materials conforming to the manufacturer's recommendations. Unless specified by the crossing manufacturer, provide track materials as specified in paragraph MISCELLANEOUS TRACK MATERIALS.

2.17.5 Threaded Fasteners and Screw Spikes

****
NOTE: Screw spikes having an ultimate tensile strength of 483 MPa 70,000 psi are commercially available.
****

Use threaded fasteners in grade crossings of the sizes and lengths specified by the grade crossing manufacturer or as indicated for built-in-place crossings. Use screw spikes with a minimum ultimate tensile strength of 414 MPa 60,000 psi and galvanized for corrosion protection.

2.17.6 Pipe for Subdrains

Pipe for subdrains must be [152] [203] [_____] mm [6] [8] [_____] inch diameter corrugated, perforated [polyethylene complying with ASTM F667/F667M] [bituminous coated galvanized corrugated steel].

2.17.7 Cable Conduit

Provide cable conduit under grade crossings consisting of 102 mm 4 inch diameter PVC pipe conforming to UL 651, and a minimum of Schedule 80.

2.18 MISCELLANEOUS TRACK MATERIALS

Submit manufacturer's data for all track materials to be furnished. Provide miscellaneous track materials as follows:

2.18.1 Spikes

2.18.1.1 Track Spikes

Provide new track spikes conforming to Chapter 5, Part 2 of AREMA Eng Man. Use track spikes size 152 by 16 mm 6 by 5/8 inch with 49.6 kg/m 100 lbs or heavier rail. Use track spikes 140 by 14 mm 5-1/2 by 9/16 inch with 44.6 kg/m 90 lb and under rail.

2.18.1.2 Bridge Spikes

[Use minimum 19 mm 3/4 in diameter washer head screw spikes that allow a minimum of 127 mm 5 inch penetration into the stringers to connect the bridge ties to the stringers on an open-deck bridge, in accordance with AREMA Eng Man, Chapter 7, Part 7.]

2.18.2 Bolts, Nuts, and Spring Washers

Use new track bolts, nuts, and spring washers throughout the project for both new and relay rail.[Use bolts in both steel and timber bridge connections.]

2.18.2.1 Bolts and Nuts

The various rail, joint bars, and rail drillings require various lengths and diameters of bolt assemblies. Determine the number of bolt assemblies of each size required. All bolt diameters must be the largest possible for a given rail drilling and joint bar punching. Provide track bolts and nuts conforming to Chapter 4, Part 2 of AREMA Eng Man. Ensure track bolts are long enough to leave at least two threads exposed after the nut is tightened.[Use ASTM A325M ASTM A325 or ASTM A490M ASTM A490 bolts for steel bridge connections. Use hot dip galvanized steel bolts, minimum 19 mm 3/4 in diameter with lengths as required for timber bridge connections.]

2.18.2.2 Spring Washers

Size spring washers and nuts to ensure that the spring washer develops its full reactive force and does not jam into the joint bar hole. Provide spring washers of the size to fit the bolt and nut used and conforming to Chapter 4, Part 2 and Section M12 of AREMA Eng Man.

2.18.3 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 Chapter 5 of AREMA Manual. This recommendation calls for 16 anchors per 11.9 meters 39-ft length of track, that is 8 anchors to resist movement in each direction. Where heavy traffic, steep grades or other factors result in rail

creeping additional anchors may be specified.
****

Where special tools are required to install or remove anchors, furnish a minimum of one tool for each 5,000 anchors, or fraction thereof, not to exceed 5 tools per job.

2.18.3.1 New Installation

Provide [new] [repinched] rail anchors for new installations. Use sizes conforming to the various sizes of rail on the project and conforming to "Specifications for Rail Anchors" in Chapter 5, Part 7 of AREMA Eng Man. Anchors may be either drive-on or spring type.

2.18.3.2 Salvaged Rail Anchors

Rail anchors salvaged from the track being removed are the property of the Contractor and remove from the site. Do not reinstall used anchors unless they have been repinched.

2.18.3.3 Rail Clips and Fasteners

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

2.18.4 Insulated Joints

Provide insulated joints conforming to applicable portions of Chapter 4, Part 2 of AREMA Eng Man. Do not use conventional continuous insulated joints with fiber insulation. Unless otherwise directed by the Contracting Officer, use insulated joints for the following rail sections, rail drilling, and number of joints:

RAIL SECTION	DRILLING	NO. JOINTS
[_____]	[_____] - [_____]	[_____]

2.18.5 Bumping Posts, Cushion Heads and Wheelstops

Provide new bumping posts, cushion heads, and wheelstops of a standard design that has been in use by commercial railroad industry for at least 5 years. Use bumping posts, cushion heads, and wheelstops manufactured by a company regularly engaged in the manufacture of these products.

2.18.5.1 Bumping Posts

Provide bumping posts consisting of all-steel construction, that bolt firmly onto the rail, and of a type designed for general service. Provide bumping posts that have tension with 3800 mm^2 6 sq inch cross-sectional area and compression members with a moment of inertia no less than 15 X 10^6 mm^4 37 $inch^4$ of A36 steel. Bumping post must be capable of withstanding a yield load of 2450 kN 550,000 pounds.

2.18.5.2 Cushion Heads

Provide cushion heads consisting of all steel construction, that firmly

bolt, attach, or clamp onto the bumper or end dock (platform or ramp). Cushion heads must resist 356 kN 80,000 lbs of compression.

2.18.5.3 Wheelstops

Provide wheelstops consisting of all-steel construction, that firmly bolt or clamp onto the rail, and of a type designed for general service.

2.18.6 Used Bumping Posts and Wheelstops

Do not furnish used bumping posts and wheelstops. Used bumping posts and wheelstops [must be salvaged from existing tracks which are removed or rebuilt under this Contract] [will be provided by the Government]. Use new fastening materials to install or reinstall used bumping posts or wheelstops. Furnish new fastening materials conforming to the applicable sections of this specification.

2.18.7 Inner Guard Rail

Inner guard rail must be Class IV or better used rails as indicated in Part 2, Chapter 4, "Inspection Classification of Second Hand Rail for Welding", of AREMA Eng Man. Rail must be 36 kg/m 80 lbs/yd or greater. Ensure all rails used at any one inner guard rail location are the same weight and section. Ensure joint bars match the rail provided and are in good condition.

2.18.8 Gage Rods

2.18.8.1 New Gage Rods

Provide new, double-clamp style gage rods manufactured in conformance with "Specifications for Special Trackwork" of AREMA Eng Man. Provide double clamp style gage rods that are threaded on both ends and equip with four malleable steel casting clamps to rigidly hold both sides of the base of both rails.

2.18.8.2 Used Gage Rods

Do not furnish used gage rods. Used gage rods [will be provided by the Government] [must be salvaged from existing track]. Clean and inspect salvaged gage rods prior to reinstallation. Scrap bent or broken gage rods.

2.18.9 Derails

****

NOTE: Derails may be either a hinged type, a sliding type, or a switch point derail. The contract drawings should indicate the required location, type, size, and direction. Sliding type derails are typically installed with a derail stand and operating mechanism for throwing the derail. A split switch derail is to be installed where absolute protection is required. If a switch point derail is to be installed, the project plans will show the layout of the switch point derail and this paragraph will be modified accordingly.

****

2.18.9.1 New Derails

Provide new derails of a standard design that has been in use by the commercial railroad industry for at least 5 years. Provide derails consisting of all-steel construction and designed to be permanently spiked to a crosstie. Provide either one-way or two-way derails as indicated. Provide either sliding type or hinged type derails as indicated. When the type of derail indicated requires a derail stand, connecting rod, and operating mechanism for proper operation, provide the derail and all necessary components as a unit. Provide locations, sizes, and directions of the derails as indicated on the contract drawings.

2.18.9.2 Used Derails

Do not furnish used derails. Used derails [will be provided by the Government] [must be salvaged from existing tracks that are removed or rebuilt under this Contract]. Use new track spikes and other fastening materials to install or reinstall the used derails. Furnish new fastening materials conforming to the applicable sections of this specification and AREMA Eng Man.

2.19 SALVAGED MATERIALS

2.19.1 Dunnage

Pallets, sills, and other material used for packaging and stacking salvaged track items must be clean, free of decay or other defect, and sufficiently sturdy for the service intended.

2.19.2 Marking Paint

Provide a good quality oil-based spray marking paint or a good quality oil-based paint marker.

2.19.3 Salvaging Rail

Salvage rail as directed; the Government will make available salvaged rail to the Contractor subject to the following:

a. Nondefective and reclaimable rails salvaged from existing tracks may be used to execute spot rail replacement work at other locations of the project, subject to review and approval of the materials by the Contracting Officer.

b. Reclaimable defective rails may be used to construct inner guard rails provided all defects can be cropped off. Make detailed inspection of such rails to ensure that rails which contain critical defects such as transverse defects, head-web separations, vertical split heads, pipe, split webs, etc., are not incorporated in the work. Inspect loose rails located along the right-of-way and use as directed.

2.19.4 Joint Bars

Nondefective joint bars salvaged from existing tracks may be used to execute spot replacement work at other locations of the project, subject to review and approval of the material by the Contracting Officer.

2.19.5 Tie Plates

Tie plates salvaged from existing tracks, which are not either broken, cracked, or severely corroded or worn, may be used to execute the work subject to review and approval of the material by the Contracting Officer.

2.20 RAIL BONDING AND GROUNDING

2.20.1 Rail Bonds

****
NOTES: Designer will select the length of web bonds based on the joint bar size; 600 mm 24 in. joint bars require 854 mm 34 in. bond wires, and 900 mm 36 in. joint bars require 1154 mm 46 in. bond wires.

Double bonding is required for crossing signals only (installation of both rail head and web bonds).

If only static electricity bonding/grounding (without signals or lightning protection) is required, the size of cables may be reduced. If local experience indicates drive in tight connections performs satisfactorily, 12 mm drive in tight from American Steel drive socket terminal # 34100 type CPN or approved equal can be used.
****

Provide exothermic type ("Cadweld") bonds applied to the field side of the rail head[, or [1154] mm [46] inch bonds welded to the rail web]. The bond cables must be flexible bare copper stranded 1/0 AWG cables with preformed ends. Bond cables must be flexible bare copper stranded cables with preformed ends and must conform to applicable requirements of AREMA Eng Man Vol. 3.

2.20.2 Grounding Rods

Grounding rods must be [19 mm 3/4 in diameter copper clad steel rods] [25 mm 1 inch diameter zinc-coated steel rods]. The minimum length of ground rods must be 2.5 m 8 ft.

2.20.3 Ground Connection Cables

Make connections between the grounding system or ground rods and rails with a bare flexible copper stranded 2/0 AWG cable.

2.20.4 Electrical Connecting Hardware

Provide electrical connecting hardware consisting of bronze pressure bar type materials having no rotating parts coming in direct contact with conductors.

2.21 WELDING

2.21.1 Rail Welding Kits

Ensure kits for thermite type rail welds are approved by the Contracting Officer before use. Provide welding kits for all rail sections used and no differentiation will be made between Contractor-furnished and

Government-furnished rail sections for measurement and payment purposes.

2.21.2 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. Ensure coating on low-hydrogen type electrodes is thoroughly dry when the electrode is provided. Use electrodes taken from hermetically sealed packages within one hour of the time the package is opened. Dry electrodes not used within this one-hour period and electrodes taken from non-hermetically sealed packages 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, re-dry before use. Do not use electrodes which have been wet.

PART 3 EXECUTION

3.1 REMOVAL, SALVAGE, AND DISPOSITION OF MATERIALS

****
NOTE: Delete paragraphs which are not applicable to the salvaged materials.
****

Do not dismantle tracks and segments of track until approved to do so by the Contracting Officer. Salvage the following materials for later use by the Government. Some of these items will be used in the repair of tracks as indicated.

3.1.1 Materials To Be Salvaged

****
NOTE: Provide list of materials to be salvaged. For example: "All 90RA Rail, All 90RA Joint Bars".
****

Materials to be salvaged for later use by the Government are:

a. [_____].

b. [_____].

Other materials are the property of the Contractor and remove from the project.

3.1.2 Methods and Procedures

The Contractor may use any methods to dismantle the track, provided proper measures are taken to ensure the safety of the laborers and the general public, and no damage is caused to track components to be salvaged or other tracks and structures which are indicated to remain. Do not cause damage to adjacent sidewalks or paved roadways during removal of existing tracks. Restore damage to these facilities caused by the Contractor at Contractor's expense.

3.1.3 Inventory of Track Materials

Keep a detailed inventory of excess and salvaged track materials stockpiled for the Government. Record detailed inventory in appropriate format and furnish to the Contracting Officer.

3.1.4 Inspection and Reconditioning of Used Track Materials

Clean and inspect salvaged track materials for defects to determine their suitability for further use.

3.1.4.1 Cleaning By Hand or Mechanical Means

Clean rail, joint bars, gage rods, tie plates, rail anchors, and other materials by hand or mechanical means to remove all adhering dirt and heavy rusting so that the bare steel can be examined.

3.1.4.2 Visual Examination of Rails

Visually examine rails for evidence of defects such as those illustrated on Form 402-A found in Chapter 4 Part 3 of AREMA Eng Man. Bring such defects to the attention of the Contracting Officer who will be the final judge as to the serviceability of the rail. Mark rails having bolt hole cracks or end batter under paragraph TRACK REPAIR that can be reconditioned for use by cropping and redrilling at the location of the defect with yellow paint. Reject rails with other defects or which cannot be reconditioned scrap and mark with bright red paint and stack separately.

3.1.4.3 Visual Examination of Joint Bars

Existing joint bars and compromise joint bars which are removed and no longer required at that location due to rail replacement or other work may be cleaned and reused at other locations, subject to review and approval of the Contracting Officer. Salvage or scrap joint bars and compromise joints that are not reused. Visually examine joint bars for defects and wear. Scrap joint bars with bolt hole or spike slot cracks. Scrap barr which do not fit tightly against the rail or bars in which the bolt holes are excessively corroded or worn. The Contracting Officer will be the final judge of the serviceability of joint bars. Mark scrapped bars with bright red paint and stack separately.

3.1.4.4 Visual Examination of Gage Rods

Visually examine gage rods for bends, cracks, or breaks. Bent, cracked, or broken gage rods are considered as scrap, marked with bright red paint and stacked separately.

3.1.4.5 Visual Examination of Tie Plates and Rail Anchors

Visually examine tie plates and rail anchors for cracks, breaks, excessive wear, and excessive corrosion. Track material with these defects are considered scrap, mark with bright red paint and stack separately.

3.1.4.6 Gage Rods

Remove and salvage gage rods which exist in tangent track and in curved track with a curvature of 10 degrees or less. Reuse salvaged gage rods that have been inspected and cleaned to the maximum extent possible.

3.1.4.7 Grade Crossing Materials

Salvage existing premanufactured grade crossing panels, rail and other track materials as indicated, or as designated by the Contracting Officer. All salvaged materials will remain the property of the Government, and reinstall as indicated or transport to the military installation storage yard. Remove grade crossing materials to be salvaged, clean as required for proper reinstallation, mark or label as necessary for proper reinstallation, and transport to the reinstallation location or to the storage yard.

3.1.5 Transport and Stack Excess and Salvaged Materials

3.1.5.1 Material Not Used In Track Repair

Stack excess and salvaged materials which are not used in track repair work at a site on the military installation designated by the Contracting Officer.

3.1.5.2 Stacking of Rails

Stack rails on approved sills a minimum of 152 mm 6 inch above the ground. Stack rails with the heads up and with the ends even. Separate each layer by at least three 50 by 100 mm 2 by 4 inch wood strips evenly spaced along the length of the rail. Group rails by weight, section, drilling, condition, length, and amount of wear. Mark the weight, section, drilling, and length on one of the rails near the mid-height of the stack. Paint these markings neatly near one end of the rail.

3.1.5.3 Stacking of Joint Bars, Gage Rods, and Tie Plates

Sort joint bars, gage rods, and tie plates by section, punching and condition and stack on pallets. Steel band each pallet stack for forklift handling. The maximum weight on any pallet is 680 kg 1,500 lbs. Wire compromise joint bars together in pairs and stack on pallets, separate from other bars.

3.1.5.4 Containers

Sort rail anchors by type and size and place in kegs, steel drums, or other approved containers. Label containers with the rail weight and section.

3.1.5.5 Stacking of Special Trackwork Materials

Palletize and stack special trackwork materials as directed by the Contracting Officer. Mark the rail weight, rail section, and length on each switch point. Mark the weight, section, and frog number on the side of each frog casting. Place other salvaged switch materials in steel drums and label as to rail weight, section, length of points, and turnout size.

3.1.6 Material to be Scrapped

****
NOTE: Remove or edit above paragraphs and retain this paragraph when materials are to be scrapped.
****

[All material] [_____] must be scrapped and must become the property of the Contractor.

3.2 PLACEMENT OF BALLAST [AND SUBBALLAST]

Place ballast [and subballast] to the lines and grades indicated. The average thickness must be within 6 mm 0.25 inch of the thickness indicated. Subgrade must conform to the requirements of Section 31 00 00 EARTHWORK. Do not place ballast [and subballast] on soft, muddy, or frozen areas. Where the prepared subgrade (roadbed) is soft, muddy, rutted, exhibits severe depressions, or is otherwise damaged, do not place the ballast [and subballast] until the damaged subgrade has been repaired and the area has been approved by the Contracting Officer.

3.2.1 Subballast

****
NOTE: Remove these paragraphs when subballast is not required.
****

3.2.1.1 Subballast Placement

Place subballast in [two] uniform horizontal lifts of no more than 152 mm 6 inch for the full width of the cross-section to the total depth indicated. Shape each subballast layer to a section conforming to the subballast section shown on the drawings and thoroughly compact.

3.2.1.2 Subballast Compaction

Compact each subballast lift using approved compaction equipment. Use sufficient roller weights, vibration frequencies (where applicable), tire pressures (where applicable), and number of passes to obtain in-place densities across the full width of the subballast and throughout the entire depth of the layer of no less than 95 percent of the ASTM D1557 laboratory maximum dry density for the subballast material. Prior to placement of subsequent subballast layers, scarify the top of the previous layer to a depth of approximately 50 mm 2 inch to insure proper bond of the layers. Field measure density in accordance with ASTM D1556/D1556M (use base plate as shown in the drawing) [or ASTM D6938. Check and adjust the calibration curves, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D6938 result in a wet unit weight of soil and use ASTM D6938 to determine the moisture content of the soil. Also check the calibration curves furnished with the moisture gages along with density calibration checks as described in ASTM D6938. Make calibration checks of both the density and moisture gages by the prepared containers of material method, as described in paragraph Calibration, in ASTM D6938, on each different type of material to be tested at the beginning of a job and at intervals as directed.] Take one field density test for each 1000 square meters yards of each layer of material placed in each area.

3.2.2 Ballast

3.2.2.1 Ballast Placement

****
NOTE: Show detail of ballast section on the

drawings.

****

Place Number 5 AREMA ballast in the tracks where indicated; use 50 mm 2 inch of Number 5 ballast near turnouts and for 10 m 30 feet each side of the switch stand to provide a smooth walking surface for railroad employees. All other areas require size AREMA Number [4] [4A] ballast.

3.2.2.2 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 the Contractor may result in a lower unit cost for ballast distribution. If the installation has a locomotive available for use, insert the point of contact and telephone number for arranging use of the locomotive. Examples would be "... Rail Movements Branch, Directorate of Logistics, extension 1234 at least 4 hours ..." If no locomotive is available indicate that Government locomotive is not available and the Contractor must provide equipment to unload ballast in paragraph LOCOMOTIVE.

****

Do not disturb ballast until the [subgrade] [subballast] has been approved by the Contracting Officer. No payment will be made for ballast which is distributed without the Contracting Officer's approval.

a. Distribute ballast distribution to the depth indicated, from either trucks or railroad cars. [If available, the Government will furnish a locomotive for unloading ballast along the track if a carload or more is used. Make arrangements for use of the locomotive by contacting [_____] at least [_____] hours in advance of the time the locomotive is needed.] [A government locomotive is not available for unloading ballast.]

b. Prevent forming of ruts that would impair proper roadway drainage when distributing ballast from trucks and off track equipment. Level any ruts formed greater than 25 mm 1 inch and grade to drain.

c. Unload ballast as close as possible to the point of use so that unnecessary handling is prevented. Pick up and redistribute excess ballast at the Contractor's expense. If additional ballast is required for dressing, add it at no increase in unit price.

d. Do not release ballast cars until they have been inspected. Ballast cars may be weighed by the Government before and after dumping the ballast at no cost to the Contractor.

3.2.2.3 Ballast Below Ties

For new construction, the last 100 mm 4 inches ballast below the tie, place the shoulder ballast and the ballast in the tie cribs subsequent to the rail and tie installation. For surfacing existing track, place the ballast subsequent to rail and tie replacements.

3.3 TRACK CONSTRUCTION AND OUT-OF-FACE RELAY

Ensure track construction not covered specifically herein is in accordance with AREMA recommendations and recommended practices.

3.3.1 Roadbed Preparation

****

NOTE: If the roadbed will require any major amount of preparation, such as compaction or provisions for drainage not covered by other sections of the specifications, this paragraph will be either revised or augmented to cover the work required, or Section 31 00 00 EARTHWORK will be added. If no roadbed preparation is required, delete this paragraph. If geotextiles are used, the "road crossing" tailoring option should be on to get the reference paragraph requirements for geotextiles.

****

Perform clearing and grubbing, grading, excavation, embankment preparation, and subgrade preparation in accordance with Section [_____]. Obtain approval of roadbed surface, grade, and drainage prior to any distribution of construction material. Where the subgrade or roadbed is damaged during distribution of materials, fill and compact ruts and depressions and ensure the roadbed surface is reapproved prior to track construction.

3.3.2 Geotextile for Track Construction

****

NOTE: Delete this paragraph if geotextile is not required.

****

Install geotextile between the subgrade and the ballast as shown. Perform installation in accordance with subparagraph Geotextile Installation under paragraph Highway Crossings.

3.3.3 Unloading the Materials

The use of picks in the handling of ties will not be permitted. Unload rails from cars with an approved derrick or crane and place with the head up without dropping and with sufficient support under the base. Distribute rails of proper length as necessary for road crossings, switches, joint spacing, and other special conditions.

3.3.4 Ties

****

NOTE: The center to center spacing will be inserted in the blank space in this paragraph in accordance with the following:

a. For main lines, access tracks, or other tracks where the movement may be classified as heavy or the desired speed is in excess of 32 km/hr 20 miles per hour, 480 to 560 mm 19.5 in. spacing will be used.

b. For body tracks in yards, sidings, running tracks, and access tracks, where the train speed is less than 32 km/hr 20 miles per hour and train movement is not classified as heavy, a 530 mm 21 in. spacing will be used.

****

Standard center-to-center spacing of crossties is [50][53] mm [19.5][21] inch. Space switch ties and bridge ties as indicated on the drawings. Lay ties perpendicular to the center line of the track with the grain up (heartwood side down) for wood ties. Use the best ties at the rail joints. Ensure the ends of ties on one side of the track are parallel to the rail and the center of the tie is on the approximate center line 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. The top surface of ties must provide full bearing for the tie plates. Adzing of wood ties is restricted to that necessary to provide a sound true bearing for the tie plate. Adzing in excess of 5 mm 0.2 inch is not permitted. Where adzing is necessary, saturate the cut surface of the wood tie completely with creosote or other approved preservatives.

3.3.5 Tie Plates

****

NOTE: For track rehabilitation where the track does not currently have tie plates, plates should be installed on each new tie installed. As defective ties are replaced, tie plates are installed with the new ties and with time the entire track has plates.

****

Tracks must be fully tie-plated. Ensure tie plates are free of dirt and other foreign material when installed. Place tie plates so that the rails will have full bearing on the plate, and the plate will have full bearing on the tie. Set tie plates at right angles to the rail with the outside shoulder against the base of the rail, and centered on the tie. Install canted tie plates to cant the rail inward.

3.3.6 Rail

Ensure the base of the rail and the surface of the tie and tie plate are free of dirt and other foreign materials prior to laying rail.

3.3.6.1 Laying Rail

Lay rail without bumping or striking, to standard gage (1.435 m 4 ft 8-1/2 inch between points 16 mm 5/8 inch below the top of the rail) on tangents and on curves up to 12 degrees. For curves 12 degrees and greater, widen the gage 3.2 mm 1/8 in for each increment of 2 degrees to a maximum of 1.448 m 4 ft 9 inch, in accordance with TABLE V. Gage the track at every third tie as spikes are being driven.

TABLE V. TRACK GAGE FOR HIGH DEGREE OF CURVATURE		
Degree of Curvature per 30.5 m 100-ft chord		
Equal to or Greater Than (Deg - Min)	But Less Than (Deg - Min)	Track Gage, m Ft. - In.
0 - 00	12 - 00	1.435 4 - 8-1/2
12 - 01	14 - 00	1.438 4 - 8-5/8
14 - 01	16 - 00	1.441 4 - 8-3/4
16 - 01	18 - 00	1.445 4 - 8-7/8
18 - 01	20 - 00	1.448 4 - 9

a. Lay jointed rails, one at a time, with space allowance for expansion being provided between rail ends in accordance with TABLE VI.

b. Gaps between rail ends in insulated joints must only be sufficient to permit insertion of standard end posts.

c. Use a standard rail thermometer to determine the rail temperature. Lay the thermometer close to the web on the side of the rail base which is shaded from the sun's rays in advance of the laying operation and leave there long enough to accurately record the temperature. The Contractor quality control representative must see that rail temperature is checked frequently and that proper rail expansion shims are used. Calibrate all thermometers against the Contracting Officer's rail thermometer which will have been accurately calibrated and will be considered as the standard.

d. Except through turnouts and at insulated joints, do not vary the staggering of the joints on one side no more than [460] [500] mm [18] [20] inch in either direction from the center of the opposite rail.

e. Do not use rails less than 10 m 33 ft in length in out-of-face rail relay. However, rails no less than 4 m 13 ft long may be used for final connections to existing rails to prevent joints from occurring at prohibited locations or to provide the specified joint stagger in curves.

f. Rail joints must not occur in or within 6 m 20 ft of a road crossing, alongside of or within 1.5 m 5 ft of the end of any switch or turnout guard rail, or the end of any open deck bridge.

3.3.6.2 Joints

Stagger joints in opposite rails one-half the rail length but no less than 3.5 m 12 ft apart, except closer joints may be required at turnouts and insulated joints. Do not install rail less than 4 m 13 ft in length in track. Ensure no joint is less than 2 m 6 ft from the ends of open-deck bridges, or less than 1 m 3 ft from switch points. Do not install joint within 6 m 20 ft of a road crossing, outer perimeter of any structure, or any location which restricts access to the joint. Where joints are required in these areas, weld the joints.

3.3.6.3 Expansion Allowance

Provide allowance for expansion at rail joints by using rail-expansion metal shims. Remove shims to within 12 rails of the laying. Provide shims of the thickness shown in TABLE VI. Determine the temperature of the rail by use of a thermometer placed on the rail base on the side away from the sun. Typical rail gap gages are as shown.

TABLE VI. SHIM THICKNESS

10.1 m 33-Ft. Rail 99 Joints per km160 Joints per Mile		11.9 m 39-Ft. Rail 84 Joints per km135 Joints per Mile		24.4 m 78-Ft. Rail 42 Joints per km68 Joints per Mile	
Rail Temperature (degrees C F)	Shim Thickness (mm) (in.)	Rail Temperature (degrees C F)	Shim Thickness (mm) (in.)	Rail Temperature (degrees C F)	Shim Thickness (mm) (in.)
Below -23 -10	85/16	Below -14 6	85/16	Below 2 35	85/16
-23 to -10-10 to 14	61/4	-14 to -46 to 25	61/4	2 to 835 to 47	61/4
-9 to 115 to 34	53/16	-3 to 726 to 45	53/16	9 to 1648 to 60	53/16
2 to 1535 to 59	31/8	8 to 1846 to 65	31/8	17 to 2361 to 73	31/8
Over 16 60	21/16	Over 19 66	21/16	Over 24 74	21/16

3.3.6.4 Cutting Rail

Use only rail saws or track chisels to cut rail. Drill new holes using a standard template. Do not burn holes in rail. Holes cut with a torch will not be accepted. When drilling of rail is necessary, remove all chips and burrs before applying joints.

3.3.6.5 Matching Rails

****

NOTE: Remove this paragraph when relay rail is not used.

****

Where relay rail is used, matching adjacent rails must not cause lipped or uneven joints. Weld any mismatched rail ends to provide proper match. Rail end mismatch must not exceed 3 mm 1/8 in on gage or tread portions of rail.

3.3.6.6 Rail Replacement

The following procedures apply to rail replacement work:

a. Spot rail replacement is defined as replacement of 30 m 100 ft or less of contiguous rails, usually with rails of the same section. Installation of relief rail in place of defective rail is considered spot rail replacement. Replacement of more than 30 m 100 ft of contiguous rails is considered to be out-of-face rail relay.

b. If spikes are withdrawn, plug the holes with treated tie plugs of proper size to fit the hole, prior to replacement of rail. If spikes are withdrawn and spikes are to be redriven in existing spike holes, plug the holes with treated tie plugs prior to redriving the spike. Do not install tie plugs in prebored holes unless spikes have been driven and withdrawn.

c. Spike all ties with new spikes in accordance with paragraph Spot Tie Replacement.

d. Ensure that rail ends at joints are not lipped or uneven. Ensure tread portion (vertical) or gage side (horizontal) rail end mismatch is no greater than 2 mm 1/16 inch. Correct rail end mismatch greater than 2 mm 1/16 inch by welding and grinding on the smaller rail. Grinding the larger rail is not permitted unless approved by the Contracting Officer. Make welded transitions at a rate of 1 to 80.

e. Rails removed from track will be designated by the Contracting Officer as relay (for use on project), reclaimer (to be salvaged and stockpiled), or scrap. Joint bars removed from track will be designated as relay, reclaimer, or scrap. Mark scrap materials as scrap using bright red paint, transport them off the military installation or to the military installation temporary scrapyard. Transport relay materials required to complete other repair work of this contract to the location of need. Classify and inventory materials and stack at the military installation storage site, all as indicated for salvage materials in paragraph Removal, Salvage, and Disposition of Materials.

f. Use metal rail expansion shims when laying rail. Do not use wood sticks or other material as shims. Provide a sufficient supply of each shim available to permit rail laying to progress without delay.

3.3.6.7 Out-of-Face Rail Relay

Replace existing rail with the designated new or used rail between designated limits in a continuous operation. It is expected that replacement of one rail of a given track will be completed prior to replacement of the opposite rail. Lay used rail [with previous gage side wear facing out, unless required to match existing wear patterns] [as directed by the Contracting Officer].

3.3.6.8 Spot Rail Replacement

Make spot rail replacements where necessary to replace existing defective rails or to compensate for rail joint gap adjustments.

3.3.6.8.1 Replacement Rail

Use replacement rail of equal length or longer than the rail it replaces. The minimum length of rail used is 4 m 13 ft.

3.3.6.8.2 Spot Rail Replacement Resulting in Joint Staggers

Unless otherwise approved by the Contracting Officer on a case by case basis, do not allow spot rail replacement to result in joint staggers less than 1.33 m 4 ft.

3.3.7 Joint Bars

****

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

AREMA Manual recommends an initial bolt tension of between 89,000 and 133,000 N 20,000 and 30,000 lbs per bolt in order to overcome the surface roughness and provide proper seating for the joint bars. After application of traffic, tension in the bolt is lost relatively rapidly and may lose from 22,000 to 44,000 N 5,000 to 10,000 lbs per bolt in the first month. Therefore, retightening of all track bolts after some period of time is necessary. Bolt tension recommended for subsequent tightening is within the range of 67,000 to 111,000 N 15,000 to 25,000 lbs per bolt. The torque required to develop the specified tension in a bolt is approximately as follows:

BOLT DIAMETER	TORQUE*
(mm)(inch)	(N m)(ft-lbs)
193/4	340250
227/8	408300
251	476350
291-1/8	544400
*For well oiled bolts with clean threads.	

****

Provide clean joint bars. Install rail joints so that bars are not cocked between the base and head of the rail. Properly seat bars in the rail and install the full number of correct-size bolts, nuts, and spring washers. Place bolts with nuts alternately on inside and outside of rail. Apply a corrosion resistant lubricant to the bolt threads prior to application of nuts. Tighten bolts to torque of approximately [_____] N-m ft-lbs, beginning at the center of the joint and working both ways to the ends of the joint. After the track has been in service [, but before acceptance of the work,] check all bolts and retighten to a torque of approximately [_____] N-mft-lbs. [Connect rail of different sections by properly fitting compromise joint bars. The mismatch for compromise joints for either tread surface or on the gage side must not exceed 3 mm 1/8 inch]. Replace defective joint bars designated on the contract drawings, discovered by the Contractor during track repair operations, or as identified by the Contracting Officer with acceptable joint bars.

3.3.8 Spiking

3.3.8.1 Spiking Procedures

Spike rail promptly after being laid. Start and drive spikes vertically and square with the rail. Pre-drill engineered polymer composite ties accordance with manufacturer's recommendations for size and depth. Drive spikes to allow approximately 3 to 5 mm 1/8 to 3/16 inch space between the underside of the spike and the top of the rail base. Do not overdrive spikes, or straighten while being driven. Do not install spikes through the slots in skirted-type, slotted joint bars (angle bars). Do not drive spikes against the ends of joint bars.

3.3.8.2 Number of Spikes

Use four rail-holding spikes on each tie on tangents and curves less than 4 degrees. Place spikes on the gage side of the running rail directly across from each other and place the spikes on the field side of the running rail directly across from each other. Offset spikes on the gage side longitudinally from the field spike and ensure all four spikes are rail-holding spikes next to the base of the rail. Hold this pattern consistent. On curves 4 degrees or greater, but no more than 36 degrees, use six spikes on each tie with the spikes located as follows: One rail-holding spike on the field side and two rail-holding spikes on the gage side for both rails. [Spike curves 36 degrees and greater with eight spikes per tie, located as follows: One rail-holding spike and one plate-holding spike on the field side and two rail-holding spikes on the gage side for both rails.] Use eight rail-holding spikes on each tie through road crossings.

3.3.9 Tie Plugs

If spikes are withdrawn from wood ties, 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 reinserted in existing spike holes, swab the holes with creosote and plug with creosoted tie plugs prior to redriving the spike. Do not install tie plugs in prebored holes unless spikes have been driven and withdrawn.

3.3.10 Rail Anchor Placement

****

NOTE: Coordinate this paragraph with paragraph Rail Anchors in PART 2.

****

Locate rail anchors as indicated on the project plans. Where the use of rail anchors is indicated, apply a minimum of [_____] anchors per 11.9 m 39 ft of rail in the pattern indicated on the project drawings. Space the rail anchors approximately uniformly along the rail length. Install rail anchors to the gage side of the rail against the same tie face on opposite rails. Ensure rail anchors grip the base of the rail firmly and have full bearing against the face of the tie. Do not move rail anchors by driving them along the rail. Do not apply rail anchors to track on an open-deck bridge. Where anchors are used on track approaching an open deck bridge, box anchor every third tie for at least four rail lengths, off each end of the bridge. Anchor rail immediately after spiking and before rail has experienced a large temperature change.

3.3.11 Inner Guard Rails

Install guard rails on bridges and trestles as indicated. Ensure guard rails are approximately 280 mm 11 inch from the gage side of track rails and extend a minimum of 15 m 50 ft beyond the structure. Curve the ends inward and beveled. Fully bolt guard rails. Ensure guard rails are not higher than the running rail and no be more than 25 mm 1 inch lower than the running rail. Spike each guard rail with two spikes to each tie but do not tie-plate. Unfit track rail in short lengths may be used for guardrails.

3.3.12 Derails

Install derails properly where indicated. Do not allow derailed equipment to foul other tracks. Install in accordance with the manufacturer's instructions. Where no specific installation instructions are available for salvaged derails, reinstall in accordance with good track construction practice to ensure proper performance of their intended function.

3.3.13 Superelevation

****
NOTE: Superelevation on military railroad track should not exceed 100 mm 4 inches. Superelevation for each curve will be shown on the drawings.
****

Superelevate curves as shown on the drawings unless otherwise directed by the Contracting Officer. Obtain superelevation by raising the outside rail of the curve. Maintain inside rail at grade. The maximum superelevation will be [_____] mm inch. Carry full superelevation throughout each curve, unless otherwise directed or shown on the drawings. Ensure superelevation runoff is at a uniform rate, and extends at least the full length of the spirals. The normal rate of superelevation runoff will be 13 mm per 9.4 m 1/2 inch per 31 ft; however, this may be increased to 25 mm in 9.4 m 1 inch in 31 ft with the prior approval of the Contracting Officer.

3.3.14 Preliminary Surfacing

The preliminary alignment and surfacing gangs must follow the unloading of the ballast. Complete rail renewal, tie renewal, bolt tightening, and ballast placement prior to commencement of surfacing and alignment work.

3.3.14.1 Lifts

a. Bring the track, after being aligned, to grade and surface in lifts not exceeding 100 mm 4 in each. After each lift, tamp the ballast. When using jacks, place them close enough together to prevent undue bending of rail or stress of rail and joint. Raise both rails at one time and as uniformly as possible, except where superelevation is required. Lift the track so that after a period of no less that 5 train operations (70 metric ton ton ballast car) after the last lift, it will be necessary to give the track a final lift of between 25 and 50 mm 1 and 2 inch to bring it to grade.

b. In areas where major track resurfacing is not required, perform a "skin lift" tamping operation to ensure that the ties are adequately tamped, the ballast section is adequately compacted and dressed, and

to correct minor deficiencies in surface and alignment. The rise in skin lift areas is 25 mm 1 in or less and usually does not require that additional ballast be placed.

c. A 50 mm2 inch rise must provide an average 50 mm2 inch raise in the track being surfaced.

d. A 100 mm 4 in rise must provide an average 100 mm4 inch raise in the track being surfaced, and make in at least two lifts not to exceed 50 mm 2 inches per lift.

e. A 150 mm 6 inch raise must provide an average 150 mm 6 inch raise in the track being surfaced, and make in at least 2 lifts. The initial lift must not exceed 100 mm 4 inch with the final lift not to exceed 70 mm 2-1/2 inch.

3.3.14.2 Tamping

Perform raising and tamping of track with an automatic, vibratory, squeeze type power tamper with 16 tamping heads, capable of raising both rails simultaneously and maintaining cross-level. The equipment to be used for surfacing operations is subject to approval by the Contracting Officer. Every tie in the track must receive two or more full insertions of the tamping heads. Power-tamp ballast under both sides of ties from each end to a point [300 mm 12 inches inside each rail for 2.4 m 8-ft ties,] [380 mm 15 inches inside each rail for 2.6 m 8 feet-6 inch ties,] [and] [460 mm 18 inches inside each rail for 2.7 m 9 ft ties]. Fill the center with ballast, but tamping will not be permitted in the center of the tie between the above stated limits. Tamp both ends of the ties simultaneously and tamp inside and outside of the rail at the same time. Do not use tamping tools with more than 35 percent wear and work opposite each other on the same tie. Tamp ballast under switch ties and road crossing ties the entire length of each tie. Tamp all ties to provide solid bearing against the base of the rail after the track or turnout is raised to grade at final surfacing. Bring all down ties up to the base of rail and machine tamp. Ensure the resultant track surface and alignment is uniform and smooth. Tamping of track in snow or frozen ballast conditions will not be permitted.

3.3.14.3 Replacement of Ties

After tamping has been completed and the jacks removed, replace all ties pulled loose to their proper position, respike and retamp to provide full bearing against the rail.

3.3.14.4 Track Off The Ends of Open Deck Bridges

Track off the ends of open deck bridges must maintain the same grade as the track on the bridge for a minimum of 8 m 25 ft beyond the bridge abutment and then transition smoothly to meet established track grades.

3.3.14.5 Runoff of Track Raises

Do not allow the runoff at the end of a rise to exceed 13 mm in 9.4 m 0.5 inches in 31 ft of track unless otherwise approved by the Contracting Officer.

3.3.14.6 Horizontal Realignment

Establish horizontal realignment of curved track using manual or mechanical means as described in the AREMA Eng Man Chapter 5, Part 3 Section 3.2, "String Lining of Curves by the Chord Method".

3.3.15 Final Surfacing

After preliminary surfacing has been completed, check grade and line stakes and bring the track to grade and alignment.

3.3.15.1 Final Tamping

Bring track to grade and retamp the ballast in the manner described for preliminary surfacing, except decrease the tamping distance inside the rail from 300 to 250 mm for 2.4 m ties, 380 to 330 mm for 2.6 ties, and 460 to 410 mm for 2.7 12 to 10 inch for 8 ft. ties, 15 to 13 inch for 8 ft 6 inch ties, and 18 to 16 inch for 9 ft ties.

3.3.15.2 Final Alignment

Give the track a final aligning conforming to the established track centers.

3.3.15.3 Final Dressing

After the final alignment, dress the ballast to the section indicated. After final dressing, do not allow ballast to cover the tops of the ties. Leave the portion of the subgrade outside the ballast line ith a full, even surface and properly dress the shoulder of the subgrade to the indicated section to provide proper drainage away from the track.

3.3.15.4 Surplus Ballast

Distribute surplus ballast remaining after final surfacing and dressing of the ballast section or otherwise dispose of as directed by the Contracting Officer.

3.3.16 Cleanup

Upon completion of the work, [remove all rubbish, waste, and discarded materials generated by the work from the project area] [dispose of rubbish, waste, and discarded materials in an approved manner as directed by the Contracting Officer]. Leave areas where the Contractor has worked, including but not limited to, project areas, material storage sites, and borrow or disposal areas in a clean, well-graded, and well-drained condition.

3.3.16.1 Shoulder Removal and Reconstruction

Where track construction or rehabilitation operations result in deposition of materials along the track shoulders that would impede the free drainage of the geotextile and track structure, remove the material. Where [undercutting] [ploughing] operations leave fouled shoulder materials that impede free drainage of the geotextile and the track structure, remove the shoulder material, and reconstruct the ballast shoulders using the materials and dimensions as indicated. Areas where shoulder removal and reconstruction are required [are] [are not] indicated on the drawings.

3.3.16.2 Spoil Materials

Dispose spoil materials removed from the track [as indicated] [off site at the Contractor's expense]. Do not place spoil materials on the shoulders, in ditches, in drains, or in other areas where they would impede the flow of water away from the track.

3.3.17 Final Adjustments

Sixty calendar days after the track has been accepted and put into operation, perform, at no cost to the Government, necessary resurfacing adjustments to leave the track in alignment and on grade.

3.3.18 Tolerances for Finished Track

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

3.3.18.1 Gage

Track gage must be within plus 6 mm 1/4 inch or minus 3 mm 1/8 inch of standard gage.

3.3.18.2 Alignment

****

NOTE: The alignment and track surface tolerances for out-of-face surfacing of secondary track (less than 16 km/hour 10 MPH) may be doubled from the values given below if alignment is not critical. Horizontal alignment and profile drawings are recommended.

****

Measure alignment as the deviation of the mid-offset of a 18.9 m 62 ft line, with the ends of the line at points on the gage side of the line rail, 16 mm 5/8 inch below the top of the railhead. Either rail may be used as the line rail on tangent track; however, use the same rail for the entire length of the tangent. The outside rail in a curve is always the line rail. Alignment on tangents are not allowed to deviate from uniformity more than 13 mm 1/2 inch. Alignment on curves are not allowed to deviate from uniformity more than 10 mm 3/8 inch.

3.3.18.3 Track Surface

Track surface must meet the following requirements:

a. The runoff at the end of a raise must not exceed 13 mm 1/2 inch in any 9.4 m 31 ft of rail.

b. The deviation from design profile on either rail at the mid-ordinate of a 18.9 m 62 ft chord must not exceed 13 mm 1/2 in.

c. Deviation from design elevations on spirals must not exceed 13 mm 1/2 inch.

d. Deviation from zero cross level at any point on tangent or from designated superelevation on curves or spirals must not exceed 13 mm

1/2 in.

e. The difference in cross level between any two points less than 18.9 m 62 ft apart on tangents, and on curves between spirals must not exceed 13 mm 1/2 in.

3.3.18.4 Guard Face Gage

Guard face gage is the distance between the guard lines measured across the track at right angles to the gage line, and is measured at the point of frog on both sides of the turnout. The design value for guard face gage is 1340 mm 52-3/4 inch. Ensure guard face gage is within plus or minus 3 mm 1/8 inch of the design value.

3.3.18.5 Guard Check Gage

Guard check gage is the distance between the gage line of a frog and the 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 1388 mm 54-5/8 inch. Ensure guard check gage is within plus or minus 3 mm 1/8 inch of the design value.

3.4 TURNOUTS AND TRACK CROSSINGS

Locate turnouts and crossovers as indicated on the drawings. Provide complete switch, frog and guardrail assemblies. Accurately bend rail. Changes in rail weight or section will not be permitted within the limits of the switch ties. Place headblocks at right angles to the main track and securely spike in place. Except where directed otherwise, install switch stands so that when the switch is set for the normal position, the connecting rod keeps the points closed with a pulling force. Adjust switches properly. Lubricate switch components and slide plates.

3.4.1 Turnout Reconstruction

****

NOTE: List the turnout identification numbers and/or other identifying information, such as location or milepost on the drawings. Indicate the appropriate work required on each turnout.

****

3.4.1.1 Install Salvaged Turnouts

Reconstruct turnouts using Government materials, except switch ties which are furnished and installed. This work includes transporting the turnout from the Government stockpile to the installation site and reconstruction of the turnout.

3.4.1.2 Salvage and Install Turnouts

Salvage (remove) and install turnouts. This work consists of removal of the turnout, transporting to the installation site all turnout materials except the switch ties, and reconstructing the turnout using new switch ties.

3.4.1.3 Turnout Removal and Salvaged or Scrapped

Salvage or scrap materials from turnouts that are removed from the track

and that are not to be reinstalled as indicated on the drawings.

3.4.1.4 Trackbed

Prepare the trackbed by excavating and wasting existing ballast or subgrade materials and establishing a firm top of subgrade as indicated on the contract drawings.[Place subballast as indicated and compact.][Place geotextile to the limits indicated.]

3.4.1.5 Replacement Turnout

Construct the replacement turnout at the location indicated on the contract drawings. Locate replacement turnouts so that the point of frog remains at the same location as the original turnout point of frog. Use dimensions, details, and configuration of each turnout as indicated on AREMA Eng Man, Plans Nos. 910 and 911. Place switch ties as indicated on AREMA Eng Man, Plans Nos. 112 and 912, except substitute even meter foot increments in length of switch ties, at Contractor's option, for 150 mm 6 inch increments in length of switch ties. The end of a switch tie must not be within 355 mm 14 inch of a spike. Shift connecting tracks to their new alignments as shown on the contract drawings and connect all tracks to the replacement turnout. Place tracks within 30 mm 0.1 ft of design alignment prior to ballasting work.

3.4.1.6 Matching

****

NOTE: Allow at least 50 mm 2 in. of clearance between moving parts of the switch and the top of the ballast. One hundred mm Four inches is the minimum clearance in Northern climates, where snow and ice accumulation and heaving occur. Select the appropriate clearance for the project location.

****

Properly fit and match switch points/stock rails, rail joints, frog castings, and other parts of the turnout that must fit together. Match both rail ends at all rail joints throughout the turnout and at the joints at the frog matched on both the top (tread portion) and on the gage side of the rail. Rail end welding and grinding [are][are not] acceptable methods to achieve a good match.

3.4.1.7 Placing of Ballast

Place ballast as required and the bring turnout to proper grade in a minimum of three lifts. Do not exceed an initial lift of 100 mm 4 inch. Do not exceed a final lift of 50 mm 2 inch and bring all tracks into final alignment at that time. Ensure tamping, ballast dressing requirements, and alignment tolerances are as indicated in paragraph TRACK CONSTRUCTION AND OUT-OF-FACE RELAY. Ensure ballast level in cribs beneath the connecting rod, switch point rails, and switch rods are at least 100 mm 4 inch below any steel.

3.4.1.8 Existing Switch Stand

Install the existing switch stand, or a replacement stand if specified, and adjust the switch operating mechanisms so that the switch operates smoothly and without excessive force being required. Lubricate all switch plates and connection points in the switch rod with a switch lubricant,

which does not allow sand or debris to adhere to the lubricant.

3.4.1.9 Rail Anchors

Box-anchor all switch ties to the extent possible. Anchor ties only when box-anchors can be applied to every rail on the tie.

3.4.2 Turnout Repair

****
NOTE: Designer will list the turnout identification numbers and/or other identifying information, such as location or milepost, along with the requirements in a schedule on the drawings.
****

Indicate turnouts which will remain in their existing location but require repairs in the "Schedule of Turnout Repairs" on the contract drawings and repaired as specified below.

3.4.2.1 Switch Ties

Remove and replace defective switch ties. Maintain existing nondefective switch ties in place. Install replacement switch ties at a uniform spacing, but no greater than 530 mm 21 inch center to center. The end of a switch tie must not be within 36 mm 14 inch of a spike. Do not interlace switch ties, where one tie penetrates the crib area of another tie.

3.4.2.2 Bolt Tightening

Tighten all bolts in all turnouts within the project area. Replace any bolt that cannot be tightened with a bolt assembly of the proper diameter and length.

3.4.2.3 Rebuild Switch Points and Protectors, Frogs, and Guard Rails

Reuild switchpoints, frogs, guard rails, or switch point protectors as specified in paragraph ELECTRIC ARC WELDING.

3.4.2.4 Regage Closure Rails

Regage track from heel of switch to the toe of frog. Perform regaging as specified in paragraph TRACK CONSTRUCTION AND OUT-OF-FACE RELAY.

3.5 HIGHWAY CROSSINGS

****
NOTE: Subdrains are recommended on all highway crossings. Drawings should show location of outfall pipe. Density requirements can be deleted if a separate specification section is provided for subgrade preparation.
****

Construct highway and other grade crossings within the project as indicated on the contract drawings.

3.5.1 Subgrade

[For new construction, blade the subgrade in the crossing area and for 6 m 20 ft beyond each end of the crossing to a level surface and compact to at least 90 percent CE55 maximum dry density for cohesive materials or 95 percent CE55 maximum dry density for cohesionless materials.][For track rehabilitation, excavate old contaminated ballast and subballast a minimum 300 mm 12 inch below the design elevation of the bottom of the tie, 300 mm 12 inch beyond the ends of the ties, and for at least 6 m 20 ft beyond each end of the crossing. Blade the subgrade to a level surface.] Clean drainage areas and slope away from the crossing in both directions along the track and the roadway. Install [surface ditches][subdrains] as indicated.

3.5.2 Geotextile Installation

****

NOTE: Coordinate these paragraphs with paragraph GEOTEXTILE. Delete these paragraphs if geotextile is not required.

The width of the geotextile should cover the entire width of the roadbed with no longitudinal seams or overlaps. Where mechanized geotextile laying equipment will be used to place the geotextile, the maximum diameter of the geotextile rolls should not exceed the capability of the equipment to be used on the project.

Prior to the placement of the cover material (ballast or subballast), the geotextile may be anchored in several ways, i.e., pins, small ballast piles, ballast bags, etc. If fixing of the geotextile is critical and adverse conditions exist, e.g., steep slopes or high winds, the specification can detail anchoring requirements, e.g., pin length and spacing. Care should be taken to prevent or quickly release any tension caused by anchoring and placement of the geotextile cover materials. Excessive tension can cause bridging of irregularities beneath the geotextile and increase the potential for puncture.

If there is reason to suspect movement which will reduce overlap, provision should be made in the specification to remove cover materials at selected areas in order to determine if required overlap is being maintained after cover placement.

****

Place geotextile between the subgrade and the ballast section in the crossing area and for 6 m 20 ft beyond each end of the crossing.

3.5.2.1 Preparation

Prepare surfaces on which geotextiles will be placed in accordance with the applicable portions of this specification, and ensure surfaces are free of irregularities such as sags, cavings, erosion, or vegetation. Correct any irregularities to ensure continuous, intimate contact of the

geotextile with the whole surface. Remove any loose material or debris prior to geotextile placement.

3.5.2.2 Placement

****
NOTE: Delete paragraph "b." if a protective sand layer is not specified.
****

a. When geotextile is to be installed in an existing track following removal of the ballast by undercutting or ploughing, take special care to remove as many of the large ballast particles that remain on the roadbed surface as possible.

b. Place a protective sand layer 50 mm 2 inch thick [or subballast] on top of the geotextile after it has been installed.

c. Carefully place the geotextile on the prepared surface with the long dimension parallel to the prepared surface. Place the geotextile free of wrinkles, folds, creases, and tension. Hold the geotextile in place by pins, small aggregate piles or ballast bags, until it is completely covered. Cover the geotextile immediately after placement in track. The maximum exposure time for the geotextile, from removal of the protective shipping cover to placement of the ballast/subballast cover materials which prevent exposure to sunlight, is 2 consecutive days.

d. The minimum overlap of geotextile splicing seams is 900 mm 36 inch. If several geotextile units are placed with the required overlap prior to the placement of the [ballast][subballast], check the overlap distance of each overlap as placement of [ballast][subballast] approaches the overlap. Ensure that the required overlap exists when the geotextile is covered.

e. The geotextile must remain free of any contamination such as mud, dust, sediment, debris, etc., that will impair its function. Remove contamination without damage to the geotextile or to the prepared surface at the Contractor's expense. If the geotextile is damaged, its function impaired by the cleaning efforts, or if it cannot be properly cleaned, repair the prepared surface, if necessary, and replace the damaged or impaired geotextile with geotextile meeting requirements of this specification. Do not operate equipment in direct contact with the geotextile. Direct surface drainage, as much as possible, away from the geotextile installation area to prevent accumulation of mud, debris, and sediment.

3.5.2.3 Placement of Cover Material

Place [ballast][subballast] cover material in contact with the geotextile ensuring intimate contact of the geotextile with the prepared surface and with the cover material. Perform placement without damage to the geotextile including tears, punctures, or abrasion.

3.5.2.4 Equipment Operations on the Cover Material

Place a minimum depth of 200 mm 8 inch of cover material over the geotextile before equipment is allowed to operate on the covered geotextile. Limit equipment operations on the covered geotextile to those

necessary for track construction and equipment turning is not allowed on the covered geotextile.

3.5.2.5 Minimum Ballast Depth

The minimum depth of ballast between the bottom of the tie and the top of the geotextile is 300 mm 12 inch.

3.5.2.6 Tamping Operations

Tamp ballast materials by setting the tamping force and insertion depth to the minimum necessary to adequately tamp the track. Monitor the depth of tamping and limit the depth to prevent detrimental effects of the tamper feet on the geotextile.

3.5.2.7 Double Layers

Double layers of geotextile is not allowed, except for splicing overlaps at seams.

3.5.3 Ballast Placement and Surfacing

Place and tamp ballast as specified in paragraph TRACK CONSTRUCTION AND OUT-OF-FACE RELAY except that in crossings, compact the ballast between the ties thoroughly with a vibratory compactor, or other approved means, after each raise. Tamp the ballast for the entire length of the crossties for highway crossings. Perform final alignment and surfacing of the track prior to placement of the crossing surface. Perform final surfacing to bring the track to the final grade and alignment as indicated on the contract drawings. Where the crossing involves two or more tracks, the top of the rail for all tracks must form a plane with the adjacent roadway surface. The top of rail elevation must be 50 to 100 mm 2 to 4 inches above surrounding pavement elevation, with a smooth transition of pavement. Compact the ballast in the cribs and on the shoulders using a vibratory plate compactor or other approved means.

3.5.4 Ties

Use [hardwood][concrete][polymer composite] ties. Space a minimum of 500 mm 20 inches center to center. For premanufactured grade crossings, provide ties conforming to the manufacturer's recommendations for the type of grade crossing surface materials being used.

3.5.5 Tie Plates, Spikes, and Anchors

Fully tie plate all ties within the crossing and for 6 m 20 ft beyond each end of the crossing, and spike with 4 rail-holding spikes per tie plate. [Fully box anchor each tie within the crossing.] [Install rubber tie pads between the tie and tie plate on all ties within the crossing area and for 6 m 20 ft beyond each end of the crossing.]

3.5.6 Rail

Rail within the crossing area and for 6 m 20 ft beyond each end of the crossing must be, at a minimum, [57][_____] kg/m [115][_____] lbs/yd. [Protect] [Do not protect] rail from corrosion by application of an approved rust inhibitor. Bolted joints are not permitted in any Type 2, Type 3, Type 4, or Type 5 crossing or within 6 m 20 ft of either edge of the crossing surface. Bolted joints will be eliminated by either field

welding the joints to form continuous rail throughout this area or by using 24.4 m 78 ft rail lengths.

3.5.7 Lining and Surfacing

Spike rail to line and mechanically tamp and surface the track to the grade and alignment of the existing track and roadway. Where the crossing involves two or more tracks, bring the top of rails for all tracks to the same plane.

3.5.8 Crossing Surface

****
NOTE: Provide Typical Railroad Crossing cross section and details on the drawings.
****

Ensure the surface of the highway is [in the same plane as][no greater than 6 mm 1/4 inch higher than] the top of the rails for a distance of 600 mm 2 ft outside of the rails for either single or multiple-track crossings. Make a smooth transition between the crossing surface and the adjoining pavement.

3.5.8.1 Type 1 Aggregate Crossings

Construct Type 1 crossings by placing the aggregate material between the rails and outside of the rails to form an approach ramp as indicated in the contract drawings.

3.5.8.2 Type 1A Aggregate with Timber Flangeway Guards Crossings

Install bond timber headers with the edge of the timber solid against the edges of the tie plates prior to placement of the aggregate. Fasten headers to the ties as indicated using the appropriate size and length fasteners. After installation of the bond timber, place the aggregate in the track and on the outside approaches and compact.

3.5.8.3 Type 2 Timber Plank Crossings

Install Type 2 crossings as shown or in accordance with the manufacturer's instructions for prefabricated timber crossing units. Allow the surface of the crossing timbers to form a smooth plane with the top of the rails and the adjacent roadway surface. Attach crossing timbers to the ties as indicated in the contract drawings using the appropriate size and length fasteners, unless otherwise specified by the manufacturer's instructions.

3.5.8.4 Type 3a Asphalt Crossings

Type 3a crossings are full-depth asphalt crossings as shown in the contract drawings. Place the asphalt in lifts not to exceed 50 mm 2 inch thick and compact with approved compaction equipment. General requirements for asphalt placement are specified in [_____] State Highway Specifications.

3.5.8.5 Type 3b Asphalt With Timber Flangeway Header Crossings

Type 3b crossings are full-depth asphalt crossings as shown in the contract drawings. Place the asphalt in lifts not to exceed 50 mm 2 inch thick and compact with approved compaction equipment. General

requirements for asphalt placement are specified in [_____] State Highway Specifications. Install flangeway timbers prior to the placement of the asphalt pavement. Install timbers with the dappled edge of the timber solid against the ends of the tie plates. Fasten flangeway timbers to the ties as indicated in the contract drawings using the appropriate size and length fasteners.

3.5.8.6 Type 4a Cast-in-place Concrete Crossings

Construct Type 4 crossings as shown in the contract drawings using the materials specified herein. Provide concrete forming, reinforcement, and placement conforming to the requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.5.8.7 Type 4b Prefabricated Concrete Panel Crossings

Install Type 4A crossings and crossing materials in accordance with the crossing manufacturer's instructions. Use tie spacings and track materials in the crossing in accordance with the installation instructions and manufacturer's recommendations.

3.5.8.8 Type 5 Full Depth Rubber Crossings

Install Type 5 crossings and crossing materials in accordance with the crossing manufacturer's printed instructions. Use tie spacings and track materials in the crossing in accordance with the installation instructions and manufacturer's recommendations.

3.5.9 Signs and Signals

The type and location of railroad-highway crossing warning signs and signals must conform to the requirements of MUTCD, Part VIII.

3.5.9.1 Location and Positioning of Signs

Locate and erect signs for both highway and railroad track installation as shown. Unless otherwise shown, erect signs so that sign face is vertical and at a deflection angle of 87 degrees from the center of the highway lane or track which the sign serves and facing the direction of travel. Where lanes or tracks are on curves, ensure sign faces are on a deflection angle of 87 degrees to the tangent to the curve. Erect signs so that specular reflection is minimized or eliminated. After installation is completed, the signs will be inspected during the day and at night by the Contracting Officer. If specular reflection is apparent on any sign, adjust its positioning to eliminate or minimize this condition. Make this adjustment and any subsequent adjustments at no additional cost to the Government.

3.5.9.2 Traffic Control

During installation of highway signs, provide for the safe and expeditious movement of traffic through the work area. Provide schedule of lane closures, work zone safety and traffic control, and related items.

3.5.10 Crossing Flangeways

Upon completion of the grade crossing installation, the flangeways through the crossing must be a minimum of 50 mm 2 inch deep and between 65 and 75 mm 2-1/2 and 3 inches wide. Ensure that adequate flangeways are provided

prior to installation of the final crossing surface.

3.5.10.1 Flangeway Filler

Except for Type I crossings, fill all open crossing flangeways with [asphaltic concrete and compact as indicated on the drawings][preformed rubber filler].

3.5.10.2 Clean Grade Crossing Flangeways

Where grade crossing flangeways are obstructed (filled in), remove foreign material to provide a minimum 50 mm 2 inch depth and 65 mm 2-1/2 inch width flangeways on the gage side of the rails.

3.5.11 As-Built Drawings

Submit one set of reproducible originals of the final as-built drawings for each automatic crossing protection installation prior to final acceptance by the Contracting Officer. Use materials and methods to produce these drawings meeting the requirements of this specification that result in drawings which are easy to revise without damage to the drawing.

3.6 BONDING AND GROUNDING TRACK

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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 UFC 4-860-01FA for details on which track must be bonded and grounded.

****

Bond and ground track as indicated. Where track is designated for bonding and grounding, ensure the rails are bonded electrically continuous and effectively grounded. Make connections by exothermite welds in accordance with the manufacturer's instructions.

3.6.1 Rail Joint Bond

Bond rail joints on both rails of designated track using an exothermic type bond. Apply bond to the field side of the rail [head] [web] unless otherwise approved by the Contracting Officer. Electrically insulate track to be bonded and grounded from the remaining track using one of the specified insulated joints.

3.6.2 Rail Cross-Bond and Ground

Install rail cross-bond and ground using an exothermic type bond. Apply the cross-bond to the [rail head][rail web]. [Install one cross-bond and ground at 30.5 m 100 ft intervals along the designated tracks.][Provide one cross-bond and ground for each section of bonded and grounded track.] Make connections between grounding system or ground rods and rails with bare stranded copper cable, install at least 300 mm 12 inch below the bottom of the ties. Drive ground rods vertically full-length. Locate the top of the ground rod at the toe of the ballast slope a minimum of 300 mm

12 inch below the top of the subgrade. Do not exceed a maximum resistance to ground from any grounded rail or structure of 25 ohms. Make any corrections needed to reduce the resistance to below 25 ohms at no cost to the Government.

3.6.3 Inspection of Rail Bond and Ground

Visually inspect loose, damaged, or missing rail bond wires, cross bond wires, ground connections, and ground rods. If there is a signal failure, bonding can be tested for current loss in the joints using a volt meter. Mark defective items for repair.

3.6.4 Rail Bonds At Signalized Grade Crossings

Bolted rail joints within the approach circuits to signalized highway grade crossings must be double-bonded using both a rail head bond and a web bond. Install rail head and web bonds in the locations indicated where the existing rail bonds are missing, broken, or otherwise ineffective.

3.6.5 Existing Bonds

Protect existing rail bonds[, cross-bonds][, ground connections, and grounding rods] from damage. Except for bonds attached to rails which are designated to be replaced in this contract, replace bonds which are damaged or destroyed by the Contractor's operation at no cost to the Government.

3.6.6 Removal of Defective Bonds

Remove rail head pin-type and welded-type bonds by shear cutting old cables immediately adjacent to the weld or pin. Remove rail web type pin bonds by knocking the old pin out with a drift. Do not use flames or torches to remove defective bonds.

3.7 INSTALLATION OF MISCELLANEOUS TRACK MATERIALS

3.7.1 Tie Plates

Furnish tie plates to the work sites as required. Deliver excess tie plates, remaining at the conclusion of the contract, to the military installation storage site and stack where directed by the Contracting Officer.

3.7.2 Insulated Joints

Install insulated joints where indicated and in accordance with the manufacturer's installation instructions.

3.7.3 Bumping Posts, Cushion Head, and Wheelstops

Bumping posts, cushion head, and wheelstops must be [removed,][installed,][or][reinstalled][_____]. Perform installation in accordance with the manufacturer's instructions. Where no specific installation instructions are available for salvaged bumping posts and wheelstops, reinstallation must be in accordance with good track construction practice to ensure proper performance.

3.7.4 Inner Guard Rails

Install inner guard rails as detailed in the contract drawings. Spike each rail to alternate crossties throughout the full length using two spikes per rail per tie; tie plates are not required. Install guard rails using acceptable joint bars of the proper size to fit the rails being joined. Bolt each joint with at least two bolts and one fully tightened bolt per rail.

3.7.5 Gage Rods

Install one gage in the crib immediately ahead of the switch point of all turnouts. Install two gage rods on the curved closure rail, one ahead of the joint, and one ahead of the toe of the frog in all turnouts.

3.7.6 Installation of Joint Bars

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NOTE: For low traffic volume tracks that are equipped with six hole angle bars, the bars may be installed by placing bolts in only the four center holes. Modify paragraph as needed if six hole bars are used, and designate locations for four bolt use.

****

Install joint bars with their full number of bolt assemblies unless otherwise noted. Seat bars properly on the rail and tighten the bolts beginning at the center of the joint and working toward the ends of the bars, alternating between rails. Use bolts of the proper diameter and length for the rail and joint bars at the joint. The use of extra washers to shim out track bolt nuts is prohibited. Place bolts with nuts alternately on inside and outside of rail.

3.8 BRIDGE REPAIR

Submit shop drawings necessary for the construction and erection of the railroad bridge work. Provide shop drawings made from measurements taken at the site wherever possible or from established measurements, when actual measurements are not available. The Contractor is responsible for the accuracy of the established measurements, the information furnished to the subContractors for the preparation of their Shop Drawings, and the checking of all Shop Drawings. Drawings must bear the stamp of a Professional Engineer. Repair bridge as follows:

3.8.1 State and Local Government Permits

Obtain necessary permits from state and local governments for work over public roads. Prepare traffic maintenance and detour plans; submit them for approval to the appropriate authorities; erect and maintain signs, barricades, lighting, and other traffic control devices in accordance with MUTCD; pay for police details; and stage the work to provide for the continued safe public use of the roadways beneath the bridges.

3.8.2 Work Hours

The Contractor may be required by local or state authorities to work at night or on split shifts to avoid peak traffic hours at bridges [_____]. No additional compensation will be made for any costs associated with meeting such requirements.

3.8.3 Schedule of Bridge Repair Work

Schedule the work of this project to minimize the duration of interruptions to rail service. Schedule bridge repair work, so that to the maximum extent practical, bridges on the same line are taken out of service and repaired simultaneously.

3.8.4 Timber Pile Repair

A timber pile can be spliced or shimmed to repair areas of deterioration or to compensate for settlement of the pile. Any spliced pile must achieve a bearing adequate for its design loading. Do not splice more than 50 percent of the piles in a single bend. Do not splice or shim more than 25 percent of the piles in the entire substructure.

3.8.5 Timber Pile Replacement

Replace any pile when it does not achieve adequate bearing, the pile has greater than 50 percent deterioration, or replacement is more economical. [Drive replacement pile along side existing piles] [Construct a two pile support pier under the bridge cap to carry the load of the deteriorated pile].

3.8.6 Bridge Tie Replacement Open-Deck Bridges

Where spot replacement of bridge ties is required, remove the existing tie without permanently disturbing the track surface. Use new bridge ties of the proper wood species, structural grade, and size for the intended application. Shimming of bridge ties will not be permitted.

3.8.7 Rivet Replacement

Where replacement is required, replace rivets with high-strength bolts as specified in Section 05 12 00 STRUCTURAL STEEL.

3.9 ELECTRIC ARC WELDING

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NOTE: An electric flash butt mobile rail welder should be used on large projects.
****

Perform welding to repair or rebuild frogs, switch point, guard rails, switch point protectors and rails (engine burns, battered ends, etc.) in accordance with AREMA Eng Man, Chapter 5, Part 5,Section 5.10 and AWS D1.1/D1.1M. Submit a detailed specification covering the step-by-step procedures to be employed in making the electric arc welds. Include a complete description of each of the following items as applicable and any other essential characteristics in the procedure specifications.

a. Type, size, and capacity of electric welding machine (250 amp minimum), grinder and other equipment. Also, type and size of material (welding rod or wire).

b. The method to be used to remove defective and excess metal prior to welding (arcair or grinding).

c. The method to be used to prevent warping.

d. The method used for preheating, including time and temperature.

e. The method of applying metal buildup and slag removal.

f. The method of securing original contour of items welded.

g. Quality control procedures to be followed.

h. Welding materials (rod or wire), name and manufacturer of materials (low carbon steel) for welding rail, rail frogs, guard rails, switch point protectors, and switch points without manganese inserts and materials (manganese alloy) for welding manganese frogs, RBM frogs, manganese switch point inserts and manganese railroad crossing inserts or castings.

3.9.1 Welding Supervision

Perform electric arc welding under the direct supervision of an experienced welding supervisor or foreman and by a certified welder.

3.9.2 Weather Conditions

Do not perform welding in rain, snow, or other inclement weather without adequate protection of the welding from the elements.

3.9.3 Welding Manganese Frogs and Crossings

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NOTE: Edit these paragraphs as needed to match the project requirements.
****

Tighten bolts, drive spikes down, and tamp ties under crossing and frogs for level surface, when welding manganese frogs and crossings. Grind out chips and cracks with grinding machine or gouge out with arcair gouging device even if crack goes through the entire casting. When gouging device is used, no finished grinding of cracks or chips is required. If cracks are gouged out to bottom of casting, reinforcement strap must be [placed underneath the hole.][welded to the bottom of the hole in casting with the wire feed machine, allowing the frog or crossing to be welded back to level surface using the skip method.]

3.9.3.1 Manganese Overheating

Ensure that manganese is not overheated in this process. If manganese shows signs of overheating, allow casting to air cool and then continue welding process. Repeat the process as many times as necessary to prevent manganese from overheating. [Use] [Do not use] flnge carbons to keep welding metal out of flangeways. Build welded surface slightly higher than normal surface of casting so when ground, it will have sufficient weld metal to grind to a level surface. Use a 600 mm 24 inch straightedge to check this work. Grind edges of flangeways and sides of points in a roll manner, using a frog and crossing flangeway gage as a guide.

3.9.3.2 Slotting

Slot manganese frogs and crossings with a 5 mm 3/16 inch slotting wheel. Also weld, grind, and slot connecting rail joints to frog in like manner.

Repeat the grinding and slotting process approximately 6 weeks from the time the frog is put back in service and thereafter when overflow appears on points and flangeways.

3.9.4 Welding Switch Points

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NOTE: Field welding of switch points is not recommended. Qualifications of welder are very important for this type of work.

****

Overflow of stock rail must be ground off of ball of rail on both sides and switch point ground to where cracks and chips are ground out. Grind off all grease and rust of point as far back as point is to be welded. Adjust switch point tight against stock rail and check gage. If gage just ahead of switch point is tight, open it to where gage reads 6 mm 1/4 inch open. Do the following before starting to weld: 1) Open switch point and place rail flange carbon between switch point and stock rail. 2) Pull switch tight against carbon and hold with spike; another rail carbon can be placed just on top of reinforcement binding strap on point to use as guide for first welding pass; carbon can then be removed or left in place. 3) Grind switch point with surface grinder or utility grinder. 4) Apply graphite or oil to switch points and plates to prevent rusting and to make switch throw easier. 5) Check with proper authority to ensure ample time to complete welding, grinding and cooling before traffic is due. Switch point must be ground welded complete without chipping weld slag.

3.9.5 Welding Switch Point Protectors

3.9.5.1 In Track

Perform the following operations: 1) Check with proper authority to ensure ample time to complete welding, grinding and cooling before traffic is due. 2) Use a steel ruler to determine the amount of weld needed on manganese switch point protectors; measure the top of the protector any place where there is no wear. 3) Grind out the work hardened surface and any cracks or chips. 4) Weld the protector with the semi-automatic wire feed machine slightly wider than the width of a new switch point protector; run a string bead along the bottom of the wear surface on the protector guard; leaving flux on this bead continue with string bead until protector is built back to size without overheating the protector. If signs of overheating appear, use intermittent welding procedure. 5) Grind back the protector to the correct width. 6) Use roll method on top inside corner of protector.

3.9.5.2 Out of Track

Perform the following operations: 1) Use a steel tape to determine the amount of weld needed on manganese switch point protectors; measure the top of the protector any place where there is no wear. 2) Ground out the work hardened surface and any cracks or chips. 3) Weld the protector with the semi-automatic wire feed machine to just a little wider than the width of a new switch point protector; the protector can be laid on its side and three flat beads run on wear surface of the protector guard; ground back to the size of a new protector. 4) Use intermittent method and skip welding to keep protector from overheating. 5) Use the roll method on inside corner of running wear surface of guard.

3.9.6 Welding Engine Burns

Remove the damaged steel of the rail by grinding or arcair to get below the burn area into sound metal. Remove sufficient amount of metal to eliminate all shatter cracks.

3.9.6.1 Depth and Length Limitations

Do not repair engine burns requiring welds greater than 10 mm 3/8 inch in depth below the top of the rail head by welding and grinding. While grinding out the damaged metal, stop the operation when it is discovered that the necessary weld will go too deep into the rail head. Weld the ground out portion and apply joint bars at the weld location with the rail undrilled at the middle bolt holes, centering the joint bars under the engine burn. Notify the supervisor of maintenance immediately so that the rail can be removed from track. Dispose these failed rails in accordance with current instructions. Do not weld engine burns which would require a weld longer than 200 mm 8 inch.

3.9.6.2 Ambient Limitations

Avoid welding and grinding engine burns when the air temperature is below 0 degrees C 32 degrees F. When welding is necessary below 0 degrees C 32 degrees F, protect the heated area by covering with insulating material to retard cooling. Do not weld engine burns during rain or heavy snow.

3.9.6.3 Number of Welds

Determine the maximum number of burns in a 12 m 39 ft rail, or equivalent, that can be economically welded. Unless otherwise directed, when a rail has more than 8 burns needing repair, replace the rail.

3.9.6.4 Welding Procedure

Weld the burn with semi-automatic wire feed machine. Use the skip method in this process because no preheating or post heating is needed. If engine burns are found in groups close together, grind out ten to fifteen burns at a time, welding one pass at a time on each of the burns. Repeat the process until all of the burns are completed to a surface just higher than the normal ball of the rail. Then cool the burn until hand can be placed on it. Grind welds to a level surface with cup wheel attachment grinder.

3.9.7 Welding Rail Joints

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NOTE: Remove this paragraph when not required.
****

Tighten bolts in the joint bars and pull the joint to a level surface. Check joint bars for wear and replace if they are badly worn. Use six hole bars if available. Place a straightedge across the joint to determine the amount of batter. Use straightedge with a minimum of 450 mm 18 inch in length. Do not weld a rail joint with less than 3 mm 0.012 inch of batter. If batter is 3 mm 0.012 inch or more, build up the rail joint. If rail cracks or chipped out places are present in rail ends, melt them out with acetylene torch, gouge out with arcair or grind out with grinder. If cracks or chips extend below ball, replace rail.

Replace rail if horizontal crack in ball of rail extends more than 200 mm 8 inch. Preheat rail ends to approximately 93 degrees C 200 degrees F before welding. Starting 40 mm 1-1/2 inches from the end, build the rail back as follows: Weld a 25 mm 1 inch strip into bed; grind the rail ends to a level surface with surface grinder or cup wheel attachment; and cross slot rail joint with 5 mm 3/16 inch grinding stone to keep rail ends from overlapping and chipping out.

3.10 THERMITE WELDING PROCEDURES

Submit a detailed statement covering the step-by-step procedures to be employed in making the welds, including a complete description of each of the following items, as applicable, and any other essential characteristics included in the welding procedures:

a. The manufacturer's trade name for the welding process.

b. The method used for cutting and cleaning the rail ends. Flame cutting of rail ends will not be allowed.

c. The minimum and maximum spacing between rail ends.

d. The method used for maintaining the rails in alignment during welding.

e. The method used for preheating, including time and temperature.

f. The tapping procedure, including the minimum time required to cool the weld under the mold insulation.

g. The method used, including a description of special tools and equipment, for removing the upset metal and finishing the weld to the final contour.

h. Quality control procedures to be followed.

i. The contractual agreements with any subcontractor employed by the Contractor in doing the work.

Perform thermite welding procedures by a technician certified to meet ANSI/ASNT CP-189, level II or III qualifications and comply with the following paragraphs:

3.10.1 End Preparation

Rails to be welded must meet the requirements Section 2.2, "Specifications for Fabrication of Continuous Welded Rail" given in Chapter 4, Part 2 of AREMA Eng Man. Align the rail ends in accordance with paragraph GAP AND ALIGNMENT. Rail ends must show no steel defects, dents, or porosity before welding. Do not make bolt holes in, or permit to remain in, the ends of the rail to be welded. One handling hole may be made in each end of welded string. Cut off rail ends containing such holes during track construction. Rail which must be cut for any reason must be cut square and clean by means of approved rail saws or abrasive cutting wheels in accordance with Chapter 5 of AREMA Eng Man, Section 10.3, "Recommended Practice For Use of Abrasive Wheels".

3.10.1.1 Cleaning

Clean rails to be welded of grease, oil, dirt, loose scale, and moisture

to a minimum of 150 mm 6 inch back from the rail ends, including the railhead surface. Clean using a wire brush, to completely remove dirt and loose oxide and by use of oxygen-acetylene torch to remove grease, oil and moisture. Use a power grinder with an abrasive wheel to remove scale rust, burrs, lipped metal and mill brands which would interfere with the fit of the mold, for 50 mm 2 inch on each side of the ends.

3.10.1.2 Gap and Alignment

The minimum and maximum spacing between rail ends must be as specified by the rail welding kit manufacturer and the approved welding procedures.

a. The ends of the rails to be welded must be properly gapped and aligned to produce a weld which conforms to the alignment tolerances below. Align rail on the head of the rail. Hold rail gap and alignment without change during the complete welding cycle.

b. Vertical alignment must provide for a flat running surface. Any difference of height of the rails must be in the base.

c. Align horizontally so that any difference in the width of heads of rails occurs on the field side. Horizontal offsets are not allowed to exceed 1 mm 0.04 in in the head and/or 3 mm 0.12 inch in the base.

3.10.2 Surface Misalignment Tolerance

Combined vertical offset and crown camber is not allowed to exceed 3 mm/m 0.04 inch/feet at 315 degrees C 600 degrees F or less. Combined vertical offset and dip camber is not allowed to exceed 1 mm/m 0.01 inch/feet at 315 degrees C 600 degrees F or less.

3.10.3 Gage Misalignment Tolerance

Combined horizontal offset and horizontal kink camber is not allowed to exceed 3 mm/m 0.04 inch/feet at 315 degrees C 600 degrees F or less.

3.10.4 Thermite Welding

Perform welding in accordance with Chapter 4, Part 2,Section 2.5 of AREMA Eng Man, articles "Thermite Welding - Rail Joints" and Section 2.2 "Specification for Fabrication of Continuous Welded Rail", except as modified by these specifications. Inspect all welds visually at the time of welding.

3.10.4.1 Thermite Weld Preheating

Preheat rail ends prior to welding to a sufficient temperature and for sufficient time as indicated in the approved welding procedures to ensure full fusion of the weld metal to the rail ends without cracking of the rail or weld.

3.10.4.2 Thermite Weld Cooling

Leave molds in place after tapping for sufficient time to permit complete solidification of the molten metal and proper slow cooling to prevent cracking and provide a complete weld with proper hardness and ductility.

3.10.5 Weld Finishing and Tolerances

Bring welded joints in the finished track to a true surface and alignment by means of a proper grinding or planing machine (shear). Perform finish grinding with an approved grinder operated by a skilled workman grinding evenly and leaving the joints in a smooth and satisfactory condition. Eliminate all cracks. Finish the completed weld by mechanically controlled grinding in conformance with the following requirements:

a. A finishing deviation of not more than plus or minus 1 mm 0.01 in of the parent section of the rail head surface will be allowed. Finish the gage side of the rail head to plus or minus 1 mm 0.01 in of the parent section.

b. Welds produced by welding kits which are specially designed to produce reinforced welds need not be ground in the finishing area except as necessary to remove fins, burrs, cracks, etc.

3.10.6 Weld Quality

Each completed weld must have full penetration and complete fusion and be entirely free of cracks or fissures. Welds must meet the acceptance criteria given in AWS D1.1/D1.1M.

3.10.7 Weld Numbering

Semi-permanently mark a sequential weld number on the rail immediately adjacent to the weld, using a quality lead paint marker at the time the weld is made. Number welds sequentially in the order in which they are made. The Contracting Officer will provide the initial weld number. Assign defective welds which are replaced a new sequential number by adding a letter to the defective weld number (e.g., defective weld 347 would be replaced by 347A).

3.11 TRACK REPAIR

3.11.1 Cutting and Drilling of Rail

Use only rail saws and abrasive cutting wheels for this operation. Other methods for cutting rail will not be acceptable. Cuts must be square and clean. When given the option of cutting existing rail or new rail being installed, cut the existing rail. When new holes are necessary, they must be drilled. Do not punch, slot, or burn holes with a torch. Ensure holes are sized and located as shown on the contract drawings. Peen or grind drilled bolt holes to remove sharp edges.

3.11.2 Rail Joints

In areas which do not require out-of-face rail replacement, tighten all track bolts. Defective track bolts, nuts and lock washers ("bolt assemblies"), and replace those that cannot be tightened. This work includes both spot replacement of assemblies at locations to be determined by the Contracting Officer ("Spot Bolt Assembly Replacement") and out-of-face replacement of all bolt assemblies within a rail joint ("Joint Repair").

3.11.2.1 Used Bolt Assemblies

Used bolt assemblies removed from rail joints are the Contractor's

property and do not reincorporated in the work. Remove existing bolt assemblies designated to be replaced by methods which do not damage joint bars or rails.

3.11.2.2 Joint Repair

****
NOTE: List locations where out-of-face joint repairs are required on the drawings.
****

Replacement of defective joint bars and correction of rail-end mismatch, as designated or directed by the Contracting Officer, is defined as joint repair work. At designated joint repair locations, remove both joint bars from the rails and inspect the rail ends for damage or defects.

3.11.2.3 Cleaning of Finishing Area

Clean the finishing area of mill scale, rust, and dirt by wire brushing, compressed air, solvents, or a combination of these or other methods.

3.11.2.4 Rail Ends

The clean rail ends will be jointly examined by the Contractor and the Contacting Officer for the presence of any rail defects that would make the rail unsuitable for further use at the location. If a rail is determined to have an end defect, either crop or replace the rail.

3.11.2.5 Joint Gap

Where pull-aparts have occurred, whether currently gapped or not, or where the rail joint gap exceeds 19 mm 3/4 inch, adjust the joint gap to the rail joint gap specified in TABLE VI. Perform rail joint gap adjustment work in conjunction with spot rail replacement work and bolt renewal work.

3.11.3 Spiking

Verify the proper gage, as indicated in this section, immediately prior to spiking.

3.11.4 Spot Tie Replacement

Replace defective ties as marked in the field and as directed by the Contracting Officer.

3.11.4.1 Paint Markings and Tie Inspection

Paint markings may exist on the existing rails and crossties. Such markings do not necessarily indicate work within the scope of the contract. Participate in a walk-through tie inspection with the Contracting Officer prior to commencement of tie replacement work. The scope of the tie replacement work will be determined at that time and relevant paint markings made or touched up as required.

3.11.4.2 Additional Tie Work

In areas where existing ballast inhibits tie inspection, additional ties may be required beyond those marked. The scope of such additional tie work will be identified by the Contracting Officer as adjacent work

progresses.

3.11.4.3 Old Spikes, Rail Anchors, tags and Tie Plates

Pull and scrap old spikes. Remove, sort, and salvage rail anchors. Remove and inspect tie plates and, classify as either relay or scrap. Mark scrap tie plates as scrap and do not reinstall in the track. Acceptable relay tie plates may be reused at that location or at other locations as required. Old stationing tags will be removed and replace on the new tie.

3.11.4.4 Humped Track

Where the track will not be surfaced, in order to prevent permanent distortion ("Humping") of the line and surface of the track when performing spot tie replacement, excavate the tie cribs and ends, remove the old ties, and install the new ties without jacking the rails. Resurface humped track at the Contractor's expense.

3.11.4.5 Minimal Humping

For spot or out-of-face tie replacement, where the track will be surfaced and aligned under this Contract, a minimal amount of humping will be allowed, provided the surfacing tolerances can be met.

3.11.4.6 Fouled or Muddy Ballast

Excavate and waste fouled or muddy ballast, as identified by the Contracting Officer, outside of the track area where it will not interfere with drainage of the track.

3.11.4.7 Insertion of New Ties

Insert new wood ties in track with the heartwood down, square to the line of the rails. Insert engineered polymer composite ties with the flat (tie plate) surface up, square to the line of the rails.

a. Insert ties so that the average tie spacing in any one rail length does not exceed 530 mm 21 in and so that the maximum spacing between any two ties does not exceed 610 mm 24 in and the maximum spacing is not less than 460 mm 18 in.

b. Crosstie position at joints must result in a "suspended joint" arrangement unless otherwise directed by the Contracting Officer.

3.11.4.8 Positioning of Tie Plates

Position tie plates on the tie so that the shoulder has full bearing against the base of the rail. Center the plate on the tie width, except position the plate up to 13 mm 1/2 in off-center if necessary to avoid spiking into an existing tie split. Ensure that all tie plates in a given stretch of track are either canted or flat. Do not mix canted and flat tie plates within a given stretch of track.

3.11.4.9 Re-spacing of existing ties

Re-spacing of ties is required to straighten slewed ties or to correct uneven tie spacing. Remove crib and shoulder ballast as required to facilitate sliding crossties to their final position or to insert new

ties. Do not use spike mauls or sledges to slide ties. Install rail anchors and ballast immediately after ties are re-spaced.

3.11.4.10 Track Gage

Set track gage at the time of spiking.

3.11.4.10.1 Tangent Track

For track rehabilitation or spot rail replacement on tangent, regage the track if the existing gage is less than 1420 mm 56 in or is equal to or greater than 1460 mm 57-1/2 in. Regage these sections of track to conform with the gage of the adjacent track; ensure the gage after regaging is between 1430 and 1450 mm 56-1/4 and 57 in.

3.11.4.10.2 Curved Track

Gage curved track as shown in TABLE V.

3.11.5 Joint Respiking

Many joints in track will be found with nonstandard spiking patterns and other deficiencies. These include joints with no tie plates, plates which are positioned so that it is not possible to spike through the plate on both sides of the joint, spikes driven against the ends of skirted joint bars, and similar deficiencies. Respike such joints in accordance with the following.

3.11.5.1 Substitution of Tie Plates

When tie plates are available which will permit spiking through the tie plate at the edge of the joint bar skirts on both sides of the rail, substitute them for existing plates.

3.11.5.2 Respiked Joints

Plug existing spike holes in all respiked joints.

3.11.6 Regaging

Where the existing track gage is less than 1420 mm 56 in or is equal to or grater than 1460 mm 57-1/2 in, or as designated by the Contracting Officer, regage the track. Regage these sections of track to conform with the gage of the adjacent track; ensure the track gage after regaging is between 1430 and 1450 mm 56-1/4 and 57 in.

3.12 SAMPLING AND TESTING

Sampling and testing is the responsibility of the Contractor. Submit one certified copy of Test Reports for each test performed on the ballast [and subballast] within 2 working days of the test completion. Perform sampling and testing by an approved commercial testing laboratory, or by the Contractor, subject to approval. If the Contractor elects to establish testing facilities, base approval of such facilities on compliance with ASTM D3740. Work requiring testing will not be permitted until the Contractor's facilities have been inspected and approved. The first inspection of the facilities will be at the expense of the Government and any subsequent inspections required because of failure of the first inspection is at the expense of the Contractor. Such costs will

be deducted from the total amount due the Contractor.

3.12.1 Ballast [and Subballast] Samples

Perform periodic sampling and testing of ballast [and subballast] material to ensure continued compliance with this specification. During construction, take one representative sample of the ballast [and subballast] material from each 1818 metric tons 2,000 tons of ballast [and subballast] delivered to determine the material gradation. For each 9090 metric tons 10,000 tons or a fraction thereof of ballast delivered, obtain an additional amount of material in order to perform the quality and soundness tests specified. Take samples for material gradation, quality, and soundness tests in conformance with ASTM D75/D75M. Reduce test samples from field samples in conformance with ASTM C702/C702M. Ensure sample sizes are sufficient to provide the minimum sample sizes required by the designated test procedures. If any individual sample fails to meet the gradation requirement, halt placement and take immediate corrective action to restore the specified gradation. If any individual sample fails to meet the specified quality and soundness requirements, halt placement and take immediate corrective action to restore the specified quality.

3.12.2 Ballast [and Subballast] Tests

3.12.2.1 Sieve Analyses

Make sieve analyses in conformance with ASTM C117 and ASTM C136/C136M. Sieves must conform to ASTM E11.

3.12.2.2 Bulk Specific Gravity and Absorption

Make bulk specific gravity and absorption tests in conformance with ASTM C127.

3.12.2.3 Percentage of Clay Lumps and Friable Particles

Determine the percentage of clay lumps and friable particles in conformance with ASTM C142/C142M.

3.12.2.4 Degradation Resistance

Determine resistance to degradation of materials in conformance with ASTM C131/C131M and ASTM C535. Test materials with gradations having 100 percent passing the 25 mm 1 in sieve in conformance with ASTM C131/C131M. Test materials having gradations with particles larger than 25 mm 1 in in conformance with ASTM C535.

3.12.2.5 Soundness Test

Make soundness tests in conformance with ASTM C88.

3.12.2.6 Percentage of Flat or Elongated Particles

Determine thepercentage of flat or elongated particles in conformance with ASTM D4791.

3.12.3 Tie Inspection

The Contractor is responsible for the quality of the treated ties. Permanently mark or brand each tie by the producer in accordance with

AWPA M6. Inspect each treated wood tie in accordance with AWPA M2 for conformance with the specified AWPA standards. The 100 percent inspection must be performed by an independent inspection agency approved by the Contracting Officer. Make inspectione at the wood treatment site. The agency's report of inspection must accompany delivery of the ties. Core and check preservative treatment once per 1000 ties delivered to the construction site.

3.12.4 Examination of Geotextile

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NOTE: The amount of geotextile being installed and the criticalness of the installation determine the size and scope of the geotextile testing and quality control/quality assurance program. Small jobs with minor importance may not warrant extensive preconstruction testing of the geotextile, and the manufacturer's Certificate of Compliance may be adequate for assuring that the physical properties are met. However, for large projects and critical installations, regardless of size, a complete regimen of preconstruction and quality control testing should be specified.

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[Sample the geotextile upon delivery to the project site. Use sampling procedures detailed in ASTM D4759and ASTM D4354 with the number of sample units selected from TABLE II of ASTM D4354. An independent testing laboratory must perform the index property tests specified in TABLE II on each of the sample units and determine conformance with the minimum requirements of TABLE II. Conformance must be determined in accordance with ASTM D4759.] [Test geotextile seams expected to perform a reinforcement function in accordance with ASTM D4595.] The Contracting Officer may examine any geotextiles for defects, damage, or nonconformance prior to installation. Any geotextile not meeting the minimum property requirements of paragraph GEOTEXTILE, or remove geotextile that is determined to be damaged or defective from the site and replace with additional geotextile meeting the requirements of this specification at no additional cost to the Government.

3.13 INSPECTION AND FIELD TESTING

Perform quality control inspection and field testing.

3.13.1 Track

Perform inspection to ensure that all the requirements of these specifications are met. Inspect bolted joints for loose bolts and for smooth transitions between rails of different sections. Check rail, tie plates, and ties to ensure that the rail is properly seated and has full bearing on the tie plate and tie. Upon completion of construction, take and record measurements of track gage, cross level, and alignment at least once every [30] [60] [_____] m [100] [200] [_____] feet of track centerline length. Provide a copy of these measurements to the Contracting Officer.

3.13.2 Welded Joints - Visual Inspection

Quality control inspection and field testing must be performed by a

technician certified to meet ANSI/ASNT CP-189 level II or III qualifications with a minimum of one year experience in testing rail for defects. Inspect each welded joint in the presence of the Contracting Officer after removal of the mold and grinding of excess metal. Pay particular attention to surface cracking, slag inclusion, gas pockets, and lack of fusion. Correct or replace, at no extra cost to the Government, any weld found defective. The method of correction must be as approved by the Contracting Officer.

3.13.3 Electric Arc Welding Inspection

Inspect electric arc welds to determine that the item welded conforms to the desired contour and contains no visible cracks or voids.

3.13.4 Thermite Weld Joints Testing

Each thermite weld joint must be [ultrasonically tested] [dye tested] following the visual inspection. The method of inspection and acceptance must be in accordance with AWS D1.1/D1.1M. Correct or replace defective welds, at no additional cost to the Government. The method of correction must be as approved by the Contracting Officer. Ultrasonic testing [must] [will] be performed by the [Contractor] [Government] after the rail has been installed in track. The testing will determine whether or not each weld meets the criteria of paragraphs Gap and Alignment, Weld Finishing and Tolerances, and Weld Quality. Cut welds, made in the track which the Contracting Officer determines to be unacceptable, out of the rail and replace by a section of new rail and two new welds. Make saw cuts at least 150 mm 6 in from the centerline of the faulty weld. Replacement welds and replacement rails are the sole expense of the Contractor. Renumber replacement welds as indicated. Ultrasonically test replacement welds made in track.

3.13.5 Electric Arc Weld Testing

Inspect the welds visually and check the contours after completion and later test by the ultrasonic method. The [Government will] [Contractor must] have the welds tested by the ultrasonic method. The testing will determine whether or not each weld meets the quality criteria. Defective welds will be removed and the item rewelded at the Contractors expense.

3.13.6 Inspection of Geotextile

At the direction of the Contracting Officer, remove the cover material from the geotextile at 3 locations per km mile so that the geotextile may be inspected for damage. At each location, remove the cover material to expose a 1.2 by 1.2 m 4 by 4 feet section of the geotextile. If punctures, tears, improper installation, other impairment or damage are found within this section, excavate additional sections to determine the extent of the damage. Repair or replace damaged geotextile and recover with ballast/subballast at the Contractor's expense.

3.13.7 Testing Relay Rail

3.13.7.1 Testing for Wear

Check each relay rail for wear by the Contractor's quality control representative in the presence of the Contracting Officer after the material is delivered to the construction site. Monitor the installation of track for defects in rail and joint bars being installed. Do not

install rail and joint bars that are found to be defective in track.

3.13.7.2 Testing for Defects

Upon completion of the track construction, have the rail tested by ultrasonic methods. Ultrasonic testing must be done by a Contractor normally engaged in this type of testing with a minimum of 5 years of experience. Submit results of the ultrasonic rail testing. Results must list defects and rail stationing. Schedule a rail testing machine and notify the Contracting Officer of the type of machine and schedule. Remove and replace Contractor furnished rails which are found to have any detectable defect at that time at no additional cost to the Government. Remove and replace Contractor furnished joint bars and compromise joint bars that are found to be cracked or broken at no additional cost to the Government. Submit Data package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

TABLE VII
RECORD OF ITEMS REPAIRED OR REBUILT BY THE
ELECTRIC ARC WELDING METHOD AND GRINDING

[enter date]	[enter Installation name]			Turnout Number:	
[enter time (24hr)]	Air Temp (C*) and Weather Conditions:				
ITEM REBUILT	DESCRIPTION	WEIGHT	LENGTH	LH RH	REINFORCED
Switch Point					
Frog					
Railroad Crossing					
Guard Rails					
Switch Point Protector					
Rail (Ends)					
Rail-Engine Burns					
[_____]					
*NOTE: Temperature to the nearest 1/2 degree.					

INSTALLATION_____ WELD NUMBER _____

FINAL INSTALLED
LOCATION _____ TRACK _____
STATION _____ RAIL Left Right (Circle)

DATE _____ TIME _____ AM PM (Circle)

AIR TEMPERATURE _____ F*. WEATHER _____
RAIL TEMPERATURE _____ F*. _____

WELD KIT MANUFACTURER _____
RAIL GAP
NEAREST 1.6 MM 1/16 IN _____
RAIL CUT REQUIRED? YES NO (Circle)
BACK RAIL
MANUFACTURER _____ USED RAIL? YES NO (Circle)
YEAR/MONTH ROLLED _____ HEAT NUMBER _____
_____

AHEAD RAIL
MANUFACTURER _____ USED RAIL? YES NO (Circle)
YEAR/MONTH ROLLED _____ HEAT NUMBER _____
_____

REMARKS_____
_____
_____

ULTRASONIC TEST DATE & RESULTS _____

KIT MFG. REPRESENTATIVE
PRESENT _____ WELDING FOREMAN _____
(Initial) (Signed)

CONTRACTING OFFICER'S
REPRESENTATIVE
PRESENT _____ RECORDER _____
(Initial) (Signed)

_____ RECORDER _____
(Initial) (Signed)

FOR GOVERNMENT USE ONLY

ULTRASONIC TEST DATE AND RESULTS _____

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*NOTE: Determination will be made to the nearest 1/2 degree.

-- End of Section --