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USACE / NAVFAC / AFCEC **UFGS-34 11 00 (May 2026)**

Preparing Activity: USACE **Superseding**
UFGS-34 11 00 (April 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2026
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DIVISION 34 - TRANSPORTATION

SECTION 34 11 00

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SECTION 34 11 00

RAIL TRACKS
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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, for example.

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.

i. Transition points between rail operated on by commercial railroads and owned by commercial railroads.

Unit Prices can be used for Army and Air ForceProjects. The Navy does not use unit prices. Ensure the Tailoring option of Army or Air Force is selected if the project requires a unit price breakdown.

When lump sum payment is desired in the Invitation for Bids for work covered under this section the UNIT PRICES paragraphs must be removed.

****

1.1 UNIT PRICES

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 subsidiary to the items listed. 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 feet 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 feet 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 feet 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 foot 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". Each turnout includes 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"

a. "Replace Switch Stand" - Each
b. "Replace Switch Points" - Each
c. "Install or Replace Heel Fillers" - Each
d. "Install or Replace Heel Filler Bolt Assembly" - Each
e. "Install or Replace Switch Plates" - Each
f. "Install or Replace Switch Braces" - Each
g. "Remove and Respike Braces and Plates" - Each
h. "Adjust Adjustable Braces" - Each
i. "Install or Replace Switch Rods and Clips" - Each
j. "Replace Connecting Rod" - Each
k. "Grind and Dress Switch Point and Adjacent Stockrail" - Each
l. "Clean, Adjust, and Lubricate Switch" - Each
m. "Rebuild Switch Point Protector" - Each
n. "Rebuild Switch Point" - Each
o. "Paint Switch Stand

1.1.4.2.2 "Frog Repair"

a. "Replace Frog" - Each
b. "Install or Replace Frog Plates or Hook Plates" - Each
c. "Rebuild Frog" - Each
d. "Grind and Dress Frog, Install or Replace Frog Bolt Assembly" - Each

1.1.4.2.3 "Guard Rail Repair"

a. "Replace Guard Rail" - Each
b. "Install or Replace Guard Rail Plates" - Each
c. "Install or Replace Guard Rail Bolt Assembly" - Each
d. "Install or Replace Guard Rail Fillers" - Each
e. "Install or Replace Clamp Assembly including Fillers and Wedges" - Each
f. "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 will not be paid for separately. For payment purposes, installed geotextile will be measured in place to the nearest square meter square yard of placement area. Only material 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-foot for each track-meter track-foot of raise of each type or fraction thereof, acceptably performed. Payment will be at the contract unit price per track meter feet for each item given below:

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

1.1.9 Subballast

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

Measure subballast based 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 meter feet
Timber Pile Replacement	Linear meter feet
Shotcrete Repair	Square meter feet
Bridge Tie Replacement (Open-deck)	Each
Rivet Replacement	Each
Gabion and Gabion Mattress	Cubic meter 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 will be 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 lbs 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 m 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, excluding the 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 m yd 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 m 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 m 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

TYPE	DESCRIPTION
2	TIMBER: FULL DEPTH
2A	TIMBER: FULL DEPTH, PREFABRICATED TIMBER SECTIONAL
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 is 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	(2025) Structural Welding Code - Steel

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA M2	(2025) Standard for the Inspection of Preservative Treated Products for Industrial Use
AWPA M6	(2024) Brands Used on Preservative Treated Materials
AWPA P1/P13	(2024) Standard for Creosote Preservative

AWPA P2	(2024) Standard for Creosote Solutions
AWPA P25	(2026) Standard For Inorganic Boron (SBX)
AWPA T1	(2025) Use Category System: Processing and Treatment Standard
AWPA U1	(2025) Use Category System: User Specification for Treated Wood

ASTM INTERNATIONAL (ASTM)

ASTM A242/A242M	(2024a; E 2025) 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	(2025) 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	(2025) 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; R 2024) Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C702/C702M	(2024) 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	(2023) 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	(2020) 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. ARMY (DA)	
DA AR 56-3	(2024) Army Rail Operations
DA TM 4-14.21	(2015) Rail Safety
U.S. ARMY CORPS OF ENGINEERS (USACE)	
EM 385-1-1	(2024) Safety -- Safety and Occupational Health (SOH) Requirements
U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)	
MUTCD	(2023) Manual on Uniform Traffic Control Devices
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
49 CFR 214	Railroad Workplace Safety
UL SOLUTIONS (UL)	
UL 651	(2011; Reprint Apr 2026) 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.

When, "COMMERCIAL RAILROAD INTERFACE" is selected as a tailoring option, submittals and additional sections in Part 1 and Part 2 are provided for DOR to modify based on individual project requirements. Typically this is required only when constructing track on railroad company land or connecting to commercial railroad companies.

****

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-01 Preconstruction Submittals

Accident Prevention Plan; G, [_____]

Accident Prevention Plan Rail Specific; G, [_____]

Railroad Safety Training; G, [_____]

Contractor's Right Of Entry; G, [_____]

Stormwater Management; G, [_____]

Railroad Work Plan; G, [_____]

Temporary Crossing; G, [_____]

Railroad Shoring; G, [_____]

SD-02 Shop Drawings

Bridge Repair; G, [_____]

SD-03 Product Data

Wood Ties; G, [_____]

Engineered Polymer Composite Ties; G, [_____]

Steel Ties; G, [_____]

Concrete Ties; G, [_____]

New Jointed Rail; G, [_____]

Relay Rail; G, [_____]

Joint Bars

Compromise Joint Bars

Miscellaneous Track Materials

Geotextiles

Crossing Material or Surface

Acceptable Replacement Materials; G, [_____]

Traffic Maintenance and Detour Plans; G, [_____]

Thermite Welding Procedures; G, [_____]

Electric Arc Welding; G, [_____]

Materials and Samples

Jump Span Materials; G, [_____]

SD-04 Samples

Geotextile

Ballast

Subballast

SD-05 Design Data

Jump Span Design; G, [_____]

Jump Span Designer Selection; G, [_____]

Track And Ground Monitoring Plan; G, [_____]

Walkways; G, [_____]

SD-06 Test Reports

Sampling and Testing

Wood Ties; G, [_____]

Engineered Polymer Composite Ties; G, [_____]

Concrete Ties

Geotextiles

Ultrasonic Test

Ballast Aggregate Test Report

Subballast Aggregate Test Report

Track And Ground Monitoring Report; G, [_____]

Jump Span Testing Results; G, [_____]

SD-07 Certificates

Wood Ties; G, [_____]

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

****
NOTE: Coordinate with project manager to provide contractor with allowable timeline for removal of disapproved materials. Adjust brackets based on decision.
****

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 in the schedule. The Contracting Officer will notify the Contractor of the materials approved or disapproved. Disapproved materials that have already been delivered to the project site, must be segregated from the approved materials and removed from the premises within [1][_____] week. 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.

1.5.3 Storage on Commercial Railroad Property

Only material used for construction of features on Railroad Company property will be stored within Railroad Company property limits. No material will be stored within 8 m 25 ft of the centerline of a track.

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. Drainage must be maintained, and the accumulation of water that might affect the stability of the roadbed will not be permitted.

1.6.2 Traffic Control

Traffic control devices must comply with MUTCD. Place warning signs in accordance with installation traffic management to alert 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

Welding must not be performed in rain, snow, or other inclement weather without adequately protecting the weld from the elements.

1.7 COMMERCIAL RAILROAD

****
NOTE: The Designer should assess the need to include this section and its subsections in the project specifications. This section may require heavy editing based on project scope and agreements with railroads. Each railroad may have different requirements or processes. Consider adding Agreements, Rights of Entry applications, or training information as attachments. Remove tailoring option, "COMMERCIAL RAIL INTERFACE" if not applicable.
****

1.7.1 Railroad Identification

****
NOTE: If ownership and operational limits are not identified in the drawings, add a description below.
****

Work on this contract includes coordination with the following railroad(s): [BNSF] [UPRR] [CPKC] [CN] [CSX] [NS] [Class 2] [Class 3] [Department of Defense] [AMTRAK] [Commuter Rail] [_____]. The general ownership and operation is [identified in the drawings] [_____].

1.7.2 License Agreement

The work under this contract is being accomplished under a [License Agreement] [Maintenance Consent Letter] [Industry Track Agreement] [_____] between the [_____] (hereinafter referred to as the Railroad Company) and the [UNITED STATES OF AMERICA][_____] executed on [_____].

1.7.2.1 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. No changes to the plans or specifications on railroad property will be made without the approval of the Railroad Company.

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

c. Do not enter the Railroad Company's premises without an executed Contractor's Right of Entry and until specifically authorized by the Contracting Officer.

d. All personnel that will be on Railroad property will complete and maintain railroad safety training identified in the Contractor's Right of Entry. Training will be completed annually. The training will be completed prior to entering railroad property and submitted to the Government and the Railroad. If multiple Railroad Companies are operating at the same location, separate training requirements will be met for each Railroad. All personnel on Railroad property must carry proof of compliance & must wear visible identification cards. Personnel without completed training and identification will be removed from the property.

1.7.2.2 Contractor's Right Of Entry

Obtain a Contractor's Right of Entry Agreement from the Railroad Company to perform work on Railroad Company property. The Contractor's Right of Entry process will be followed and is found on the Railroad Company's Public Project Page [Insert webpage reference] [List multiple if required]. Submit the executed Contractor's Right of Entry to the Government and the Railroad Company.

a. Pay all fees and maintain all insurance requirements specified in the Contractor's Right of Entry. Railroad insurance requirements include additional Commercial General Liability [of $X,000,000 per occurrence]and Railroad Protective Liability limits[of $X,000,000 per occurrence]. Separate insurance policies and certificates are required when more than one Railroad is operating on the same right of way, or when several Railroads are involved and operate on their own separate right of ways. The following railroads require insurance policies within the project footprint: [_____]

b. Provide Railroad Protective Liability policy that name the Railroad Company, Contractor, and Government as the named insured 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. Include a provision that cancellation of the insurance cannot be accomplished unless at least

10 days notice is given to the Railroad Company.

c. Plan for [6] [_____] weeks for execution of the Right of Entry after a complete and accurate application is completed.

d. The Railroad Right of Entry templates will not be modified by the contractor.

e. Obtain and maintain all training requirements required in the Right of Entry.

1.7.3 Commercial Rail Construction

****

NOTE: Use this section only if the railroad will perform track construction work or utility relocation work. Either include a description of the work performed by the railroad OR reference the drawings that indicate the Railroad scope. Obtain durations for lead times from the railroad.

If the railroad scope limits are not identified in the drawings, add a description below.

****

This project includes work that will be executed by the railroad in support of the work in this contract. The work [identified in the drawings] [_____] will be performed by the Railroad with its own forces at no cost to the Contractor. For this scope, coordinate [90] [180] [365] [_____] calendar days in advance of the work to allow for railroad planning and material procurement. This work will be scheduled around railroad operations.

1.7.4 Coordination

Construction on Railroad Company property requires advanced planning and detailed coordination. Information will be shared regularly with the commercial railroads and include safety, schedule, administrative and submittal information.

a. Notify the railroad [_____] calendar days prior to commencing work on railroad property or near railroad tracks. The point of contact will be included as part of the completed Contractor's Right of Entry.

b. Attend a formal Pre-construction meeting with the Railroad Company after execution of the Contractor's Right of Entry and prior to any submittals to the railroad or physical work on railroad property.

c. The Contractor will lead and maintain recurring meetings every [2] [_____] weeks with the Railroad and Government to coordinate review and construction efforts. Provide weekly schedule updates to the railroad.

d. Notify the railroad in writing of the planned completion date [30] [_____] calendar days, for the purpose of making final inspection of the Project.

e. Railroad inspection will be planned for and included in the construction schedule.

f. Any documented spill information on railroad property will be shared with the railroad.

g. The railroad will have staff or consultants that are allowed access to the site to observer and inspect work on behalf of the railroad. The Contractor will coordinate with the railroad's inspectors, signal department, operational staff, and/or additional flagging company prior to any construction on railroad property to ensure they have access and proper notification to perform their duties. [For construction on military installations, the Railroad may enter Government property to inspect rail that the Railroad Company will operate on.]

1.7.5 Utilities

In addition to public "Call before you dig" processes, also call the railroad's private utility locate call number [_____]. Railroad private utility crews will be notified [_____] days ahead of construction to allow for railroad crews to field locate and mark private utilities. Refresh the utility locates every [2] [_____] weeks until work is complete. Maintain documentation demonstrating completion of the private utility locates at the construction site. Verify the location of all utilities marked on the drawings through potholing and surveying. The Contractor is responsible for the coordination of any relocation that interferes with construction.

1.7.6 Stormwater Management

Submit the SWPP and Erosion Control Plans to the railroad for review and approval for the portion of scope on their property. The plans will identify means to prevent fouling of ballast. Keep the right of way and ditches of the railroad open and clean from any deposits or debris resulting from its operations. The Contractor will be responsible for the cost to clean and restore ballast of the railroad which is disturbed or becomes fouled with dirt or materials when such deposits or damage result from the Contractor's operations.

1.7.7 Survey

The elevation of existing top-of-rail profile will be verified before beginning construction. All permanent features on railroad right-of-way will be surveyed and shown on red line drawings. Add dimensions to the center line of track for all features within 15.25 m 50 ft of track. All discrepancies will be brought to the attention of Government and the railroad prior to starting construction on railroad property.

1.7.8 Railroad Operations and Flagging

****

NOTE: Specify requirements here based on the operating/owning railroad. This will change depending on the railroad and will also change over time. Per 49 CFR Part 214 Subpart C, every roadway work group whose duties require fouling a track must have one roadway worker in charge (RWIC) (also known as flagger) to provide on-track safety for all members of the group. Delete if no flagging is required. Safety standards and procedures are delegated down to the railroads to establish and

enforce. This is in 49 CFR 214 Subpart C.

****

Flagging on this project is expected. [Night and weekend flagging is expected.] Coordinate all flagging service needs. Flagging services will be obtained by the [Contractor][Railroad Company]. The Contractor will hold any flagging agreements and pay for all flagging services. Provide daily notification if work is occurring on Railroad Company property that does not require flagging.

1.7.8.1 Flagging

****

NOTE: If you are unsure of fouling offsets, default to 25 feet.

****

Provide track protection when activities or materials will foul or have the potential to foul the tracks. The designated person must be qualified under the rules of, and approved by the railroad that conducts train operations on those tracks to provide the protection necessary for on-track safety.

a. A Form B, derail, fencing, or other methods are allowed to change the status of a track and remove clearance and other restrictions at a construction site. Unless identified in the plans, this will be at the operating railroad's discretion and contingent on rail operations.

b. Fouling a track means the placement of an individual or equipment in proximity to the track that it could be struck by a train or fall/swing within fouling distances. Fouling for equipment will be based on height, reach, and offset distance.

c. Fouling distances will be determined by the flagger. Assume a minimum of [1.25] [3.1] [7.7] [_____] m [4] [10] [25] [_____] ft from the centerline of track for a minimum foul distance. The flagger has discretion to reduce fouling distances based on railroad operations and if additional methods are employed to eliminate hazards.

d. Construction crews will follow the safety direction and orders from the designated flagger when a train is passing and yield to rail traffic. This could include stopping some or all construction activities near the active track and moving away from active tracks during rail movements.

e. Identify and incorporate flagging into the construction schedule. The Railroad requires a [30] [45] [60] [_____] day notice is their flaggers will be utilized.

1.7.8.2 Stop Work

Work around active railroad tracks requires coordination with external groups to ensure safe passage of trains through or around active construction sites. Failure to follow communication requirements, clearance distances, or other safety standards can lead to derailments and endanger construction personnel, train operators, and passengers. Failure to follow safety procedures will lead to stop work orders and temporary removal from the project site until assurance that proper safety procedures can be followed. If Government staff are not present at the

site, and there is an immediate and significant threat to life or rail safety, railroad staff and representatives have the authority to issue stop work orders and remove personnel from the site. Before reentry to Railroad property is allowed, rectify the safety issue to the satisfaction of Government and railroad representatives.

1.7.8.3 Walkways

Maintain [1.25] [_____] m [4] [_____] ft wide walkable paths along both sides of active rail for railroad personnel to operate trains. If jump spans, excavations, shoring, or other construction activity impedes the path, the contractor will construct a temporary walkway to maintain a path for rail operation personnel. Any constructed walkways will be submitted to Government and the Railroad Company for review and approval.

1.7.8.4 Horizontal and Vertical Clearances

All shoring, false-work, supports and any other project features must meet minimum [4.6] [7.75] [_____] m [15] [25] [_____] ft horizontal and [7] [_____] m [23][_____] ft vertical clearances. Identify clearances in technical and planning submittals and maintain clearances during construction. Failure to meet maintain proper clearances can result in stop work orders and removal of conflicts.

a. Variances to clearances can be submitted to the railroad for consideration in special circumstances. Variances are subject to railroad approval and will be submitted [8] [12] [_____] weeks prior to construction. Plan for and maintain means and methods to deliver the project with the specified clearances until a variance is granted.

b. At no time will features restrict the absolute minimum AREMA Eng Man 2.75 m 9 ft horizontal 7 m 23 ft vertical clearances for active tangent track. Horizontal distances are measured from the centerline of the nearest active track. The AREMA minimum clearances increase on a curve. The absolute minimum horizontal clearance will be adjusted based on AREMA Eng Man Chapter 28 formulas.

1.7.9 Railroad Work Plan

Develop and submit a detailed work plan for phased and non phased construction identified in the plans that meets specified time restrictions. In the plan, identify positioning of equipment, material, and personnel during construction operations; clearance envelops and dimensions; fouling of adjacent tracks including when trains can pass; and access paths for equipment and personnel.

1.7.10 Track Outage Phasing

****

NOTE: This section is specific to when tracks are taken out of service for the purpose of Government construction activities. In addition, identify in the drawings or elsewhere in the specifications when features like demolition, pile driving, or testing will be performed and any restrictions associated with that scope on railroad property.

****

The efforts for this project requires taking operational tracks out of

service to facilitate construction. Taking active tracks out of services requires significant planning and careful execution to minimize impacts.

1.7.10.1 No Railroad Operations Interruptions

Construction within the railroad's right of way will be sequenced and staged to cause no interruptions to the railroad's operations, enabling the tracks to remain open to traffic, unless specifically noted in the project plans and specifications. Allowable operational impacts were coordinated with the railroad and are noted in the phasing plans. For all phases with tracks out of service, work 24 hours a day 7 days a week without stoppage to complete the work for each phase within the allowable track windows.

1.7.10.2 Non Outage Scope

****

NOTE: Best practice to identify in the drawings if applicable: Pile driving/drilled shafts installation will occur prior to track removal under temporary track closures. Where in conflict, track ties will be removed and replaced by the railroad, to facilitate construction and minimize down times. These project features are identified on the drawings.

****

Phasing notes regarding outage times are during track removal windows only. Shorter term construction windows will be required for additional track impacts for features outside of formal outages with track removal. Capture those time frames in the work plan for railroad review.

1.7.10.3 No Outage Restriction

No construction on railroad property is allowed during [October, November,and December] [_____].

1.7.10.4 Phasing Variances

Variances to the phasing can be submitted to the railroad for consideration. Variances will be considered only if they provide alternative execution methods to reduce operational impacts. Variances are subject to railroad approval and will be submitted [8] [16] [_____] weeks prior to construction. Plan for and maintain means and methods to deliver the project with the specified phasing in the contract until alternative phasing is approved.

1.7.10.5 Back Up Equipment

All material, equipment, and crews will be on site prior to any shutdown of rail operations. Back up equipment will be available on site or nearby to prevent extended outage time for the railroad should construction equipment break down. A back up equipment plan will be included in the Railroad Work Plan and approved by the Railroad.

1.7.11 Temporary Crossings

****

NOTE: Coordinate with the local railroad if

additional crossings will be allowed or if existing crossings will be sufficient to support construction needs. Add specific railroad requirements if applicable. BNSF and UPRR have theirs published. CSX and NS have application processes published.

****

Temporary crossings [are][are not] allowed as part of the project.

a. If the Contractor elects to use a temporary crossing, they will apply for a private temporary crossing permit and meet all design and construction requirements from the owning railroad.

b. Unless specified in the drawings, any temporary crossings are subject to railroad approval and are not guaranteed. Until approved, maintain means and methods to construct the project without additional temporary crossings.

c. Design, apply, and pay for all costs associated for temporary crossings. Include all steps for a temporary crossing in the schedule.

1.7.12 Railroad Shoring

****

NOTE: Add references to railroad guidelines if applicable and available.

****

All shoring systems that impact the railroad operations and/or supports the railroad embankment will be designed and constructed to meet railroad guidelines for temporary shoring. Shoring will be designed for a Cooper E-80 loading according to the AREMA Eng Man. Shoring trench box systems are not allowed on railroad property. Shoring will be submitted to and approved by the railroad prior to commencing work.

1.7.13 Falsework

Falsework over or on railroad property is subject to railroad review. In addition to other specification requirements, falsework submittals on railroad property will include additional dimensioning to centerline of track for all components of the falsework and the duration it will be installed. It will include locations and dimensions for equipment positioning, material staging, and movements for installation.

1.7.14 Demolition

****

NOTE: Add references to railroad guidelines if applicable and available.

****

All demolitions within the railroads right of way or demolition that may impact the railroad's tracks or operations will comply with the railroad's demolition guidelines. The Contractor will submit the demolition plan to the Railroad for review and approval.

1.7.15 Excavated Material

****

NOTE: Consult with the Railroad Company on this specification section. Specific requirements for sampling, excess material, and disposal can differ between Railroad Companies and locations.

****

Unless otherwise specified, any excavated material from pits, poles, bores, etc. will remain on railroad property. If necessary, the railroad will be consulted before any soils are removed from railroad property.

1.7.16 Railroad Company Submittals

****

NOTE: Adjust required submittals based on individual project requirements and interfacing commercial railroad.

Adjust submittals based individual project requirement. If the Commercial railroad requires other submittals include in the blank section.

****

The railroad has approval authority for all submittals that could impact railroad current or future rail operations. The Government will review and approve each construction submittal to ensure it meets all railroad requirements prior to submission to the railroad for review and approval. Required submittals are [Accident Prevention Plan Rail Specific,][Railroad Safety Training,][Contractor's Right Of Entry,][Stormwater Management,][Railroad Work Plan,][Temporary Crossing,][Railroad Shoring,][Jump Span Materials,][Jump Span Design,][Jump Span Designer Selection,][Track And Ground Monitoring Plan,][Walkways,][Track And Ground Monitoring Report,][Jump Span Testing Results][_____]. The contractor must receive railroad approval on submittals prior to construction. The contractor will plan on [30] [45] [_____] calendar days for railroad reviews of submittals unless otherwise noted. If a submittal is returned unapproved and then resubmitted, additional review time for each subsequent resubmittal is required. These durations are in addition to Government submittal review times.

1.8 SAFETY

Safety is primarily covered in 01 35 26[and EM 385-1-1]. In addition, railroad specific safety requirements must be followed. Local operations groups must always be consulted when working around active tracks.

1.8.1 Military Rail Safety Requirements

For work on or around Department of Defense railroad tracks, follow the safety requirements in [DA AR 56-3,] [DA TM 4-14.21,][EM 385-1-1,] [_____,] General Code of Operation Rules and FRA safety standards. Where there are conflicts, the more stringent safety standard applies.

1.8.2 Commercial Rail Requirements

****

NOTE: Add references to railroad safety guidelines if applicable and available. The scope of the project should dictate how much of the APP to send to the railroad. If the railroad feature is on a

small portion of the overall project, a pared down version of the APP is more appropriate to send.
****

For work on or around commercial owned or operated railroad tracks, follow the safety requirements in [EM 385-1-1,] FRA safety standards in 49 CFR 214 and Commercial rail corporate safety standards. Where there are conflicts, the more stringent safety standard applies. Safety vest color on Railroad Company operated track has specific indications. Comply with the Railroad Company safety vest color requirements specified by the operating railroad.

Include a section in the Accident Prevention Plan (APP) that identifies emergency phone numbers, risks, and procedures for railroad property activities. If there is an emergency, accident or near miss that is near or will impact rail, the railroad will be notified immediately. The APP [or a portion that is relevant to the work performed on railroad property] will be submitted to the railroad for review and approval. It will include the following applicable information - Railroad, Emergency phone number, Mile Post, Crossing ID, and Subdivision.

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 gradation size number 4, 4A, or 5 are acceptable. Gradations size number 4 and 4A are typically mainline ballast materials. Gradation 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 is not permitted as a ballast material. 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.

Based on the size of the project, a ballast sample may not be required. Brackets provide the designer the option to require a sample. If a sample is required, the designer can choose to have the contractor store the sample, or have the sample delivered to the Government. A blank bracket is left for additional sampling requirements. This blank can include project location and storage procedures.

****

Provide prepared ballast consisting of crushed stone 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, provide crushed gravel containing 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, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Perform flat particle test and elongated particle test in accordance with ASTM D4791, Method A, for a dimensional ratio of 1:3. Submit certificates of compliance for the ballast materials to be installed in this project. Provide ballast materials meeting 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	--	2.60	ASTM C127
Absorption	2.0 percent	--	ASTM C127
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.

Based on the size of the project, a subballast sample may not be required. Brackets provide the designer the option to require a sample. If a sample is required, the designer can choose to have the contractor store the sample, or have the sample delivered to the Government. A blank bracket is left for additional sampling requirements.This blank can include project location and storage procedures.

****

Provide subballast consisting of aggregate-soil materials conforming to an ASTM D1241 Type I, Gradation [B] [C] mixture. Submit certificates of compliance for the subballast materials to be installed in this project.

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.

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

****

2.3.1 Physical Property Requirements

Provide a nonwoven, pervious sheet of polymeric material geotextile 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 containing stabilizers and/or inhibitors to make the filaments resistant to deterioration from ultraviolet light and heat exposure, particularly prior to placement and coverage. The fibers must be formed into a network which will be dimensionally stable. The edges of the geotextile must be finished in a way to prevent the outer fibers from being pulled away from the geotextile. Provide geotextile exceeding 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
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 degradation at 500 hours	50 percent strength retained	ASTM D4355/D4355M

*These property requirements are Minimum Average Roll Values in the weaker principal direction.

**Select geotextile not be limited 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 at least 3.6 m 12 ft.

2.4 JOINT BARS

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

2.4.1 New Joint Bars

Provide new joint bars to be used with new rail of the "toeless" and "head free design" to match rail section. Provide new joint bars conforming to the requirements of "Specifications For Quenched Carbon-Steel Joint Bars, Microalloyed Joint Bars, and Forged Compromise Joint Bars" found in Chapter 4, Part 3 of AREMA Eng Man for the joint bar and assemblies recommended in Chapter 4, Part 3 of AREMA Eng Man.

2.4.2 Used Joint Bars

****

NOTE: Long toe joint bars are not recommended and the sentence in brackets should typically be deleted.

****

Provide used joint bars in good condition to be used with relay rail only. Provide the "toeless" type joint bar.[Due to the tie plate punching pattern, do not use the "long toe" type joint bar where the spike slots are used to spike the rail to alignment at the joints.] Provide used joint bars that are straight, free from cracks, breaks, and other visual defects. Excessive rust, dirt, and other foreign materials on the joint bars are not permitted. Provide used joint bars 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 which show excessive wear that would prevent use of the oval neck track bolt normally used with that joint bar are not permitted. Joint bars that have been flame-gouged, flame cut, or otherwise altered will be considered scrap and must not be used.

2.4.3 Compromise Joint Bars

Provide compromise joint bars of the size, shape, and punching pattern to fit the rail sizes and sections being joined. Use 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, Microalloyed Joint Bars, and Forged Compromise Joint Bars" found in Chapter 4, Part 3 of AREMA Eng Man.

2.4.3.2 Used Compromise Joint Bars

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

2.5 GREASE

Provide grease for lubricating moving parts in turnouts and other

trackwork with the following 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. Provide weight, section, lengths, and the name of the supplier for relay rail. Provide the maximum allowable vertical wear on the rail head and the maximum allowable horizontal wear on the side of the rail. 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 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 and 67 kg 136 lbs rail and a 6-hole joint bar would be:

RAIL	DRILLING
115RE	89-152-152 mm (3-1/2, 6, 6 inch)
136RE	89-152-152 mm (3-1/2, 6, 6 inch)

****

2.7.1.1 General Requirements

Provide new jointed rail complying with the following:

2.7.1.1.1 Rail Lengths

Provide a [115][136][_____] kg/m lbs/yd or heavier new rail section 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 uniformly drilled to the patterns specified.

RAIL	DRILLING
[_____]	[_____]

2.7.1.2 New Industrial Grade Rail

Provide steel that is produced in an electric furnace, continuous cast, and free of hydrogen. Cull out and eliminate all injurious hot marks or surface imperfections. Control cool rail to AREMA Eng Man specifications. Roll rail in accordance with the general physical dimensional requirements of AREMA Eng Man design 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 GUIDELINES	
Head	2.4 mm 0.10 inch Flat bottom Hole
Web	3.2 mm 0.13 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. Provide end straightness meeting 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

Provide used rail for spot rail replacement of defective rails (relief rail) of the same weight, section, drilling, and length as the rail being replaced. Provide relief rail meeting 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. If it is unlikely that there is an economic benefit for relay rail, it is recommended to remove this option for a contractor. This will simplify quality processes for the project and eliminate disputes over acceptable material.

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 is 5 mm 3/16 inch for the top and 3 mm 1/8 inch for the side.

UFC 4-860-01 recommends the use of 115RE or 136RE

rail sections. Other sections should only be used when projects are tying into existing rail of the same section.

****

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

2.7.2.2.1 Rail Drilling

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

RAIL	DRILLING
[_____]	[_____]

2.7.2.2.2 Length

Provide relay rail with 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

The average top wear of each rail is to meet the requirements of Table IV, except rail in turnouts which is to 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 less Less than 115	3.21/8	6.41/4
Greater than 57.0 115 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. Provide rail that is straight from line and surface and free from any kinks or bends. Provide rail bases that 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. Completely remove bond wire heads from the gage side.

2.7.2.2.4.1 Maximum Allowable Lip

Lip or overflow exceeding 3 mm 1/8 inch on either side of the rail head will not be permitted.

2.7.2.2.4.2 Engine Burns

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

2.7.2.2.4.3 End Batter and Chipping

Rail end batter exceeding 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 will not be permitted. Chipped or broken rail ends will not be accepted.

2.7.2.2.4.4 Running Surface Damage

Running surface damage exceeding 6 mm 1/4 inch long by 13 mm 1/2 inch wide and greater than 1.5 mm 1/32 inch deep will not be permitted. 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 are 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 Continuously 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, [_____] 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. Provide welded relay rail meeting 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. Provide both flat and canted plates that 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

Used tie plates in good condition and of the dimensions specified by AREMA Eng Man may be used with relay rail. Used tie plates are not to be smaller than 190.5 by 254 mm 7-1/2 by 10 inch for use with relay rail having nominal weights less than 49.6 kg/m 100 lbs/yd, or not 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. Provide used tie plates free from excessive rust, pitting, mechanical damage, and dirt and other foreign materials. Do not use cracked or broken plates. Shoulders on the tie plates are to project a minimum of 6 mm 1/4 inch above the plane of the rail seat. The thickness of the tie plate is to be at least 13 mm 1/2 inch when measured anywhere in the rail seat area. Spike holes are to be square and 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.

Dual treatment (Boron) of crossties is recommended for any location with high humidity or high termite populations. It is recommended for white oak, hickory, ash, beech, douglas fir, and gum species. The designer should weigh the increase in cost and availability when deciding. Full dual step treatment is required if dual treating ties. (Borate is applied to the green ties before air seasoning).

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. Provide new ties species: Red Oak, White Oak, Hickory, Ash (Must comply with USDA Regulations), Beech, Gum, or Douglas Fir. Provide new switch ties species: Ash (Must comply with USDA Regulations) or Red Oak.

a. Conditioning and seasoning must conform to the requirements of AWPA U1 (Commodity Specification C and Use Category UC4) for the individual wood species. Prior to preservative treatment, wood ties are dried to the oven dry moisture content, or less, as specified in AWPA U1 (T1-21 Section C - 1. Seasoning). Artificial drying methods, boultonizing and vapor dried, are not permitted, all wood must be air dried. [Provide Air-dried Full Two-Step dual treated ties. Inorganic boron, AWPA P25, must be applied before air seasoning of crossties.]

b. Pressure treat in accordance with Chapter 30, Part 3 of AREMA Eng Man by the empty cell process and AWPA P2 to a minimum retention of 112 kg/cu m 7 lbs/cu ft of wood. Treatment with creosote in accordance with AWPA P1/P13 is an acceptable alternative to AWPA P2 Treatment.

c. Record treatment as specified in AWPA M2. Permanently mark or brand treated ties in accordance with AWPA M6. Ties must be produced by a member of the Railway Tie Association. Incised ties on all four sides in the pattern specified in AREMA Eng Man, Chapter 30, Part 3, prior to treatment. Any required adzing and drilling for spikes must be performed prior to treatment.

d. 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 shipment. The Contractor is responsible for any additional cost of inspection or test when prior rejection makes reinspection or retesting necessary.

e. 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. Provide Test and inspection reports containing the information required by Part 6 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. Quality standards for decay, holes, knots, shakes, splits, checks, slope of grain, cross or spiral grain, bark seams, and manufacturing defects are required to conform to Chapter 30 Part 3 Section 3.1 of AREMA Eng Man.

2.9.1.1 Except at Road Crossings

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

2.9.1.2 At Road Crossings

****

NOTE: Remove section if crossing does not require manufacturer recommended crossties spacing or if crossing required in plans requires specifications already listed.

****

Provide sawed wood ties no less than 178 mm thick and 229 mm wide 7 inch thick and 9 inch wide. Provide sawed wood ties with length of 2.75 m 9 ft. [Use manufacturers recommended crosstie spacing provided in Crossing Material or Surface submittal.]

2.9.2 Switch Ties

Provide switch ties conforming to Chapter 30, Part 3 of AREMA Eng Man that are sawed 178 mm 7 inch thick and 229 mm 9 inch wide. Provide the length and quantities shown. Quality standards for decay, holes, knots, shakes, splits, checks, slope of grain, cross or spiral grain, bark seams, and manufacturing defects are required to conform to Chapter 30 Part 3 Section 3.2 of AREMA Eng Man.

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.

Designer needs to verify contract drawings include bridge tie dimensions.

****

Treat bridge ties in accordance with AWPA U1. Base the treatment standards on the type of deck on the bridge. Drill bolt holes prior to treatment. Saw ties to dimensions indicated on the contract drawings, and furnish quantities as 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

Provide standard crossties for use in track over ballasted deck bridges.

2.9.3.2 Open-Deck Bridge Ties

Size bridge ties for open-deck bridges on two sides and of adequate size to distribute the track load to all stress-carrying stringers. Provide preservative treatment for above-ground exposure in accordance with AWPA U1.

2.9.4 Tie Plugs

Provide tie plugs that comply with AREMA Eng Man and that fit holes from which spikes are drawn. Treat plugs 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 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. Provide creosote preservative treatment in accordance with AWPA U1 for above ground exposure and provide 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.
****

Treat 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. Provide preservative treatment 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.
****

Provide preservative treatment for piles conforming to AREMA Eng Man, Chapter 7, Part 1, Section 1.9 for piles. Use First-Class piles as friction or end-bearing piles 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: Delete if Engineered polymer composite (EPC) ties are not required. EPC ties may be preferred for certain locations.

Reference UFC 4-860-01 for guidance when EPC ties should be used.

Update brackets to install EPC with screw or cut spikes. screw spikes are recommended. However, manufacturer's recommendations should be considered by the DOR.

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 details, such as which fasteners work best, size of pre-drill holes, for example, must 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. Experience 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. Provide engineered polymer composite ties conforming to Chapter 30, Part 5 of AREMA Eng Man. Provide ties that 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. In additional, EPC ties must meet the laboratory performance requirements recommended in AREMA Eng Man Table 30-5-1, EPC Tie Design Considerations. 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 in the test reports. EPC ties are to be installed with [cut] [screw] spikes. Manufacture installation requirements regarding predrilling and temperature adjustments for setting gage must be followed. Remove and replace any EPC ties installed incorrectly with new EPC ties. 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, not less than [_____] mm inch thick, [_____] mm inch wide, and [2.44] [2.6] [2.75] m [8.0] [8.5] [9.0] ft long.

2.13.1.2 At Road Crossings

****

NOTE: Remove brackets if crossing does not require manufacturer recommended crossties spacing or if crossing required in plans requires specifications already listed.

****

Provide engineered polymer composite crossties at road crossings not less than 178 mm thick and 229 mm wide 7 inch thick and 9 inch wide. Provide engineered polymer composite crossties at road crossings with a length of 2.75 m 9 ft.[Use manufacturers recommended crosstie spacing and provided in Crossing Material or Surface and Engineered Polymer Composite Ties submittals.]

2.13.2 Switch Ties

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

2.13.3 Ballasted-Deck Bridge Ties

Provide standard crossties for use in track over ballasted deck bridges.

2.13.4 Tie Plugs

Tie plugging must follow manufacture requirements. Remove and replace any EPC ties plugged incorrectly with new EPC ties. Polymer-based plugging compounds (for instance, polyurethane) are recommended.

[2.14 STEEL TIES

****

NOTE: Delete if steel ties are not required. Steel ties may be preferred for certain locations.

Reference UFC 4-860-01 for guidance when steel ties

should be used.
****

Submit name of the tie manufacturer, dimensions, type of fixation and the chemical analysis of the steel. Provide steel ties conforming to Chapter 30 Part 6 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 E clips or safelock, or an approved equal. Indicate the section and manufacturer of ties by a brand rolled into the material. Provide steel ties with the following minimum section:

Steel Ties	
Length	2540 mm 100 inch
Width	260 mm 10.2 inch
Thickness	10 mm 0.4 inch
Section Depth	100 mm 3.9 inch
Moment of Inertia	316 cm^4 7.6 in^4

Manufacture ties from steel free of injurious segregation with a minimum tensile strength of 312 MPa 45,000 psi. Provide steel with a 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 in compliance with the material and strength requirements specified in Chapter 30 of AREMA Eng Man for [monoblock] [reinforced two-block] [prestressed two-block] ties. Provide concrete ties that 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. Provide concrete ties furnished 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 in the test reports.

]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.

****

Obtain component parts for turnouts from manufacturers regularly engaged in the manufacture of such products, which 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 provide turnouts produced by 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. Provide rail and miscellaneous track materials used in turnout and track crossing construction with 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 is to be 3 mm 1/8 inch or less. Gage side head wear is not to exceed 3 mm 1/8 inch] [Install new rail in turnouts].

2.16.3 Frogs, Switches, Guardrails and Appurtenances

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

****

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

a. Provide new switch points. Use switch point detail conforming to AREMA Eng Man, Plan No. 221, Detail 4000 or 6100.[Provide one manganese tipped switch point in each turnout 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 the manganese tipped switch point on a left hand turnout).]

b. Provide new switch rods and connecting rods.

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

d. Provide new or used, in good condition, cast or forged steel heel blocks. Provide and heat treat new heel block bolt assemblies. Provide new or used in good condition heel joint bars manufactured for the purpose. If floating heel blocks are used, provide special no. 5 double shoulder plates to maintain 160 mm 6.25 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. Cracked or broken used frog castings are not permitted. Do not use cracked or broken frog castings that have been repaired by welding. Provide remanufactured frogs meeting the following wear requirements:

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

(2) Provide used or reconditioned frogs with the following maximum allowable wear:

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) Provide used frogs with a minimum flangeway depth of 45 mm 1-3/4 inch. Provide minimum flangeway width of 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

Provide new or replacement guard rails that are a minimum of 4.6 m 15 ft in length and new or used in good condition. Use 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. Provide a smooth and not worn more than 3 mm 1/8 inch from its new condition guard face for used guard rails. Equip guard rails bolted to the running rails with fillers. Use new bolt assemblies when fillers are installed or repaired. Provide new bolts, nuts, and associated hardware. Equip clamped guard rails with block wedges, filler wedges, and cotter keys. Provide new or acceptable replacements for guard rail plates. 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

Provide new or acceptable used material hook plates 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 and new or fully reconditioned, low-stand type with model number [Bethlehem Steel model 51A][_____]. Provide [automatic-action][semi-automatic action (spring)] [positive-action (rigid)] with [adjustment from the top with shims through a moveable cover][spring connecting rods][adjustable connecting rods][_____] switch stand.

2.16.3.5.2 Existing Switch Stands

Recondition by cleaning to bare metal and paint with one coat of metal primer existing switch stands, staffs and targets not designated for replacement.[Clean and re-lubricate the interior portion, including mechanisms, of the stands.] Paint the switch stand staff with two coats of black enamel paint. 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. [_____]. Provide [_____] rail weight and section. Provide tie layout in accordance with AREMA Eng Man, Plan No. [_____].

2.16.5 Rail Braces

Provide fixed or adjustable, standard manufactured rail braces.

2.17 GRADE CROSSINGS

Use recyclable materials in Grade Crossings conforming to EPA requirements in accordance with Section 01 33 29 SUSTAINABILITY 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. Indicate the roadway width on the contract drawings. Provide crossing material or surface complying with the following:

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

b. Construct permanent aggregate crossing 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. [Construct-in-place] [Prefabricate] full-depth timber crossings. Provide [oak] [acceptable hardwood] timber road crossing materials. Provide seasoning and treatment conforming to the requirements of AWPA U1 and paragraph WOOD TIES.

d. Provide 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. Provide [oak] [acceptable hardwood] bond timbers. 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. Construct premanufactured, precast concrete panels for grade crossings of reinforced concrete having a minimum 28-day compressive strength of 34.5 MPa 5,000 psi. Manufacture each panel 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. Provide precast crossing panels produced by 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. Provide elastomeric systems with or without steel composition grade crossing panels produced by 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 115 RE or 136 RE rail through crossings and for 6 m 20 ft on either side of the crossing is recommended. A minimum rail weight of 57 kg/m 115 lbs/yd 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 [136 RE] [115 RE] [_____] rail within the road crossing and for at least 6 m 20 ft on either side of the crossing as specified in paragraph Rail and Joint Bars.

2.17.3 Ties

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

2.17.4 Track Materials

Provide premanufactured crossing surfaces or systems, 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.

****

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

2.17.6 Pipe for Subdrains

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

2.17.7 Cable Conduit

Use Schedule 80, 102 mm 4 inch diameter PVC pipe conforming to UL 651 for cable conduit under grade crossings.

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 49.6 kg/m 100 lbs or heavier rail with track spikes size 152 by 16 mm 6 by 5/8 inch. 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 inch 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. Provide the largest possible bolt diameters for rail drilling and joint bar punching. Provide track bolts and nuts conforming to Chapter 4, Part 3 of AREMA Eng Man. Provide track bolts 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. Use spring washers sized to fit the bolt and nut conforming to Chapter 4, Part 3 and Section 3.6 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, commercial rail requirements, 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 that conform to the various sizes of rail on the project and conform to "Specifications for Rail Anchors" in Chapter 5, Part 7 of AREMA Eng Man. Provide either drive-on or spring type anchors.

2.18.3.2 Salvaged Rail Anchors

Salvaged rail anchors from the track being removed are the property of the Contractor. Remove salvaged rail anchors 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. Provide clip or fastener design that anchors 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. Use insulated joints for the following rail sections, rail drilling, and number of joints, unless otherwise directed by the Contracting Officer:

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 and manufactured by a company regularly engaged in the manufacture of these products.

2.18.5.1 Bumping Posts

Provide bumping posts made of all-steel construction, that bolt firmly onto the rail, and 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 not less than 15 X 10^6 mm^4 37 $inch^4$ of A36 steel and capable of withstanding a yield load of 2450 kN 550,000 pounds.

2.18.5.2 Cushion Heads

Provide cushion heads made of all steel construction, that firmly bolt, attach, or clamp onto the bumper or end dock (platform or ramp). Provide cushion heads that resist 356 kN 80,000 lbs of compression.

2.18.5.3 Wheelstops

Provide wheelstops made be of all-steel construction, that firmly bolt or clamp onto the rail, designed for general service.

2.18.6 Used Bumping Posts and Wheelstops

****

NOTE: Adjust brackets based on if used bumping posts/wheelstops are to be installed. If they are, adjust brackets based on source. If used bumping posts/wheelstops are not used, select, "Do not furnish used bumping posts and wheelstops."

****

[Do not furnish used bumping posts and wheelstops.][Provide used bumping posts and wheelstops [salvaged from existing tracks which are removed or rebuilt under this Contract] [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

Provide Class IV or better used rails for inner guard rail as indicated in Part 2, Chapter 4, "Inspection Classification of Second Hand Rail for Welding", of AREMA Eng Man. Provide rail that is 36 kg/m 80 lbs/yd or greater. All rails used at any one inner guard rail location are to be the same weight and section. Provide joint bars matching the rail provided and 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 threaded on both ends and equipped with four malleable steel casting clamps to rigidly hold both sides of the base of both rails.

2.18.8.2 Used Gage Rods

****
NOTE: Adjust brackets based on if used gage rods are to be installed. If they are, adjust brackets based on source. If used gage rods are not used, select, "Do not furnish used gage rods."
****

[Do not furnish used gage rods.][Used gage rods will be provided by the Government.] [Salvage used gage rods 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 made of all-steel construction and designed to be permanently spiked to a crosstie. Provide one-way or two-way derails as indicated. Provide sliding type or hinged type derails as indicated. Provide the derail and all necessary components as a unit when the type of derail indicated requires a derail stand, connecting rod, and operating mechanism for proper operation. Indicate the locations, sizes, and directions of the derails on the contract drawings.

2.18.9.2 Used Derails

****
NOTE: Adjust brackets based on if used derails are to be installed. If they are, adjust brackets based on source. If used derails are not used, select, "Do not furnish used derails."

****

[Do not furnish used derails.][Used derails will be provided by the Government.] [Salvage used derails 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

Provide pallets, sills, and other material used for packaging and stacking salvaged track items that are clean, free of decay or other defect, and sufficiently sturdy for the service intended.

2.19.2 Marking Paint

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

2.19.3 Salvaging Rail

****

NOTE: When the project interfaces with commercial rail owned rail. Commercially owned track salvaging can vary. DOR should coordinate with commercial rail owner for salvaging requirements. Remove tailoring option if project does not remove commercially owned 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. Inspect rails to ensure that rails which contain critical defects such as transverse defects, head-web separations, vertical split heads, pipe, split webs, are not incorporated in the work. Inspect loose rails located along the right-of-way and use as directed.

c. The commercial railroad will have the right, but not the obligation, to salvage all or any portion of the tracks or other material owned by the commercial railroad. The contractor will properly dispose of all removed materials, whether removed by the contractor or by the commercial railroad in support of the project, to an approved offsite location as directed by the commercial railroad. Prior to the removal of any materials, the contractor will verify the commercial railroads desire to salvage materials. If the commercial railroad chooses to salvage materials, the contractor will move the salvage materials to a location designated by the commercial railroad within the project limits.

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") rail bonds applied to the field side of the rail head[, or [1154] mm [46] inch bonds welded to the rail web]. Provide flexible bare copper stranded 1/0 AWG cables with preformed ends bond cables conforming to applicable requirements of AREMA Eng Man Vol. 3.

2.20.2 Grounding Rods

Provide grounding rods that are [19 mm 3/4 in diameter copper clad steel rods] [25 mm 1 inch diameter zinc-coated steel rods] with a minimum length of 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 made 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

Use kits approved by the Contracting Officer before use for thermite type rail welds. 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. Thoroughly dry coating on low-hydrogen type electrodes when the electrode is provided. Use electrodes taken from hermetically sealed packages within one hour of the time the package is opened. When electrodes are not used within this one-hour period and electrodes are taken from non-hermetically sealed packages, dry 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 re-dry before use if not stored and not used within one hour after this drying is completed. Do not use electrodes which have been wet.

2.22 JUMP SPAN

2.22.1 Jump Span Design

****

NOTE: Add references to railroad guidelines if applicable and available.

****

Design and detail temporary jump spans in accordance with the [_____] AREMA Eng Man. The jump span will be designed as if it were a permanent railroad structure. No reductions to design loads will be considered. The design will include analysis of fatigue. The design will include considerations for deflection and clearance to construction features. The design and details will only use bolted connections.

2.22.2 Jump Span Phasing

Design the jump span to be installed with the approved railroad track construction windows. Final approval of the jump span design is contingent on compliance with this requirement.

2.22.3 Jump Span Designer Selection

The contractor is encouraged to use an approved Railroad Company design consultant that is familiar with current Railroad Company and AREMA Eng Man design standards. The contractor may request a list of design consultants from the Railroad Company. The designer will be submitted and approved by the Railroad. If a designer is used that is not on the Railroad Company's list of approved design consultants, they will meet the following minimum requirements:

a. The design consultant must have designed a minimum of 10 non-standard Class 1 railroad bridges.

b. The design consultant must have designed a minimum of 5 open deck superstructures for Class 1 railroad bridges.

c. Non-standard railroad bridge designs are structures that do not contain standardized railroad bridge components such as prestressed concrete beams, precast caps, or similar items that are derived from a current or past railroad bridge standard.

2.22.4 Jump Span Submittal Package

Submit the jump span submittal package, including design plans and calculations, a minimum of [12] [_____] months prior to the anticipated use of the jump span. The submittal must include each location and geometry configuration that the span will be used for. Jump span foundations and supporting structures are considered part of the jump span design and will be included as part of the submittal.

2.22.5 Jump Span Materials

Procure all material required for the jump span, including deck materials. Items specific to the deck will be procured from a material supplier approved by the Railroad Company. These materials will be detailed on the jump span plans. Request the approved material supplier list from the railroad. Submit materials to the railroad for review and approval.

2.23 TRACK AND GROUND MONITORING

****
NOTE: Add references to published Railroad Company standards if applicable. Monitoring and safety requirements for blasting is covered in 31 23 00.00 or 31 23 06.00.
****

Develop and submit a track and ground monitoring plan for Government and Railroad approval. The plan will detail all requirements to monitor for settlement or heave of the railroad facilities to prevent adverse effects to rail operations. The plan will detail the types of settlement points that will be installed and monitored as well as the frequency of monitoring and the reporting mechanism. The monitoring plan will include checking for settlement or heave at a depth below the track and independent movement of the track.

2.23.1 Contingency Plan

The monitoring plan will include a contingency plan for the scenario if the top of rail deflects more than the alert and maximum thresholds. The alert threshold limit is the value intended to bring attention to the movement so that it can be managed without reaching the maximum level. The maximum level is the highest allowable movement value. The following information will be included in the plan:

a. Prepare contingency plans that anticipate reaching the threshold and shut down values for all construction activities which may result in horizontal and/or vertical track deflection. Include means and methods and multiple options in all the contingency plans.

b. Include the required materials, equipment, and personnel in each

contingency plan.

c. The alert threshold value is [6.5] [13] [19] [_____]mm [1/4] [1/2] [3/4] [_____] inch permanent vertical or horizontal deflection.

d. The maximum threshold value is [13] [19] [25.5] [_____]mm [1/2] [3/4] [1] [_____] inch permanent vertical or horizontal deflection

e. The monitoring plan will include the survey of all monitoring points daily once construction activities begin and until they are completed. Survey points will be collected hourly when construction activities are active near the tracks.

2.23.2 Contingency Implementation

If the threshold value is met, determine the appropriate contingency plan and immediately discuss this plan with and receive approval from Government and the Railroad. Once the shutdown value is exceeded, all project work will stop, and the chosen contingency plan will commence. Construction will not resume until the source of deflection is identified and rectified to the satisfaction of the Railroad Company and Government.

2.23.3 Monitoring Locations

Establish a benchmark in the vicinity of construction. Establish locations for shooting elevation on the top of rail at each area of construction. At a minimum, elevations will be taken at the centerline of an under track crossing, both outside edges of a temporary or permanent crossing, every 3 m10 ft parallel to open excavations or shoring systems, both ends of a jump span, and every 3 m 10 ft from an excavation edge up to 15.25 m 50 ft from the impacted location.

2.23.4 Targets

Adhesive backed reflective targets may be attached to the side of the rail temporarily. Remove targets once monitoring is complete. Track monitoring will not require track access other than to place track monitoring equipment or targets. Monitoring targets and equipment will be placed so that monitoring is possible when a train is present. Monitoring during the passing of a train is not required as the train will temporarily deflect the track.

2.23.5 Surveying

The monitoring system will be installed a minimum of [3] [_____] weeks prior to the start of construction to establish the baseline elevations. Establishment of the baseline will be completed 2 weeks prior to the start of construction. Accomplish surveying of the monitoring points by traditional means or an automated system. Record data in a field logbook dedicated for this purpose. Copies of the field log will be made available to all parties upon request. Submit a weekly track and ground monitoring report to Government and the Railroad Company which summarizes all the monitoring and survey data. The report will take into consideration the specific construction activities carried out during the week and how the tracks were affected.

[2.24 COMMERCIAL RAIL CONSTRUCTION

****

NOTE: Only use this if we are constructing track for commercial rail use. Commercial rail design standards differ from DOD specifications due to the fundamental difference in use. Typically, Commercial railroads will construct their own track with their own forces or contractors. It is most likely that this is needed for shoofly construction if the railroad defers that scope to Government.

****

Insert Railroad Company construction requirements and standards. Add supplemental compaction requirements if needed.

]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. [_____].

Remove other materials from the project and make property of the Contractor.

3.1.2 Methods and Procedures

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. Remove existing tracks without causing damage to adjacent sidewalks or paved roadways. Restore damage to these facilities 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 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 to determine their suitability for further use.

3.1.4.1 Cleaning By Hand or Mechanical Means

Clean, by hand or mechanical means, rail, joint bars, gage rods, tie plates, rail anchors, and other materials 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 in sections 4.1 and 4.2 of Chapter 4 Part 4 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 as scrap, 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 bars 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. Scrap bent, cracked, or broken gage rods, mark with bright red paint and stack 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. Scrap track material with these defects, 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 to the maximum extent possible salvaged gage rods that have been inspected and cleaned.

3.1.4.7 Grade Crossing Materials

Salvaged as indicated, or as designated by the Contracting Officer existing premanufactured grade crossing panels, rail and other track materials. All salvaged materials remains the property of the Government, and reinstall as indicated or transport to the military installation

storage yard. Remove, 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 salvaged grade crossing materials.

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 inches 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 rail 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 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. Do not exceed 680 kg 1,500 lbs on any pallet. Wire together in pairs, stack on pallets, and separate from other bars all compromise joint 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] [_____] to be scrapped becomes the property of the Contractor.

3.2 PLACEMENT OF BALLAST [AND SUBBALLAST]

Place ballast [and subballast] to the lines and grades indicated. Provide

an average thickness within 6 mm 0.25 inch of the thickness indicated. Provide subgrade that conforms 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 not 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 compact thoroughly.

3.2.1.2 Subballast Compaction

Compact each subballast lift using approved compaction equipment. Use roller weights, vibration frequencies (where applicable), tire pressures (where applicable), and number of passes sufficient to obtain in-place densities across the full width of the subballast and throughout the entire depth of the layer of not 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, if necessary, the calibration curves 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. Check the calibration curves furnished with the moisture gages along with density calibration checks as described in ASTM D6938. Make the 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. Use AREMA Number [4] [4A] ballast for all other areas.

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 .

****

Do not distribute 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 to the depth indicated, from either trucks or railroad cars. [If available, the Government will furnish a locomotive with qualified crew to transport ballast from the interchange yard for unloading 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, provide additional ballast 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, place the last 100 mm 4 inches ballast below the tie, 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

Provide track construction not covered specifically herein in accordance with AREMA Eng Man 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 [_____]. Approve 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 reapprove the roadbed surface 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 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 is not 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.

****

Provide [50][53] mm [19.5][21] inch standard center-to-center spacing of crossties. 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. Lay the ends of ties on one side of the track parallel to the rail with the center of the tie 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. Use the top surface of ties to provide full bearing for the tie plates. Restrict adzing of wood ties to that necessary to provide a sound true bearing for the tie plate. Adzing in excess of 5 mm 0.2 inch will not be 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.

****

Provide fully tie-plated tracks. Install tie plates that are free of dirt and other foreign material. 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

Provide rail with the base and the surface of the tie and tie plate that 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

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.
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. Provide gaps between rail ends in insulated joints only 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 left there long enough to accurately record the temperature. Check rail temperature frequently to ensure that proper rail expansion shims are used. Calibrate all thermometers against the Contracting Officer's rail thermometer which is accurately calibrated and considered the standard.

d. Except through turnouts and at insulated joints, 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 replacement. However, rails not 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. Do not provide rail joints 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 the joints in opposite rails one-half the rail length but not 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. Install joint no 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. Weld joints required in these areas.

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 with the thickness shown in TABLE VI. Determine the temperature of

the rail by placing a thermometer 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 km 160 Joints per Mile		11.9 m 39-Ft. Rail 84 Joints per km 135 Joints per Mile		24.4 m 78-Ft. Rail 42 Joints per km 68 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 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 which cause lipped or uneven joints are not permitted. Weld any mismatched rail ends to provide proper match. Provide rail end mismatch with a maximum of 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. Out-of-face rail replacement is the replacement of more than 30 m 100 ft of contiguous rails.

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. Provide tread portion (vertical) or gage side (horizontal) rail end mismatch 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, inventory, and stack reclaimer materials 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 Replacement

Replace existing rail with the designated new or used rail between designated limits in a continuous operation. Complete replacement of one rail of a given track 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

Provide replacement rail of equal length or longer than the rail it replaces. Use rail with a minimum length of 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, spot rail replacement which result in joint staggers less than 1.33 m 4 ft are not permitted.

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)(lb-ft)
19 3/4	340 250
22 7/8	408 300
25 1	476 350
29 1-1/8	544 400
*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 corrosion resistant lubricant to the bolt threads prior to application of nuts. Tighten bolts to a torque of approximately [_____] N-m lb-ft, 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 and retighten all bolts to a torque of approximately [_____] N-mlb-ft.[Connect rail of different sections by properly fitting compromise joint bars. Provide maximum mismatch of 3 mm 1/8 inch for compromise joints for either tread surface or on the gage side]. Replace defective joint bars designated on the contract drawings, discovered 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 in 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 or straighten spikes 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 thereby making all four spikes rail-holding spikes next to the base of the rail. Use this consistent pattern. On curves 4 degrees or greater, but not 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. Use rail anchors that 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. Install guard rails 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 inward and bevel the ends. Provide fully bolted guard rails. Guard rails higher than the running rail and more than 25 mm 1 inch lower than the running

rail are not permitted. Spike each guard rail with two spikes to each tie but do not be tie-plate. Unfit track rail in short lengths may be used for guardrails.

3.3.12 Derails

Properly install derails where indicated. Do not foul other tracks with derailed equipment. Install derails in accordance with the manufacturer's instructions. Where no specific installation instructions are available for salvaged derails, reinstall derails 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 the inside rail at grade. The maximum superelevation is [_____] mm inch. Carry full superelevation throughout each curve, unless otherwise directed or shown on the drawings. Provide superelevation runoff at a uniform rate and extend at least the full length of the spirals. The normal rate of superelevation runoff is 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

Perform preliminary alignment and surfacing gangs after ballast unloading. 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. Tamp the ballast after each lift. 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 not less than 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 maximum rise in skin lift areas is 25 mm 1 in and usually will not require that additional ballast be placed.

c. Use a 50 mm 2 inch rise to provide an average 50 mm 2 inch raise in the track being surfaced.

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

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

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. Provide two or more full insertions of the tamping heads for every tie in the track. 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 tamping tools opposite each other at 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. Provide uniform and smooth track surface and alignment. Tamping of track in snow or frozen ballast conditions is not permitted.

3.3.14.3 Replacement of Ties

After tamping has been completed and the jacks removed, replace all loose ties 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

For track off the ends of open deck bridges, 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 to meet established track grades. Do not exceed 13 mm in 9.4 m 0.5 inches in 31 ft of track.

3.3.14.5 Runoff of Track Raises

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

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, thereby decreasing 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

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

3.3.15.3 Final Dressing

Dress the ballast to the section indicated after the final alignment. Final dressing ballast is not to cover the tops of the ties. Leave the portion of the subgrade outside the ballast line with 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 or otherwise dispose surplus ballast remaining after final surfacing and dressing of the ballast section 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 work areas, 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

Remove 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

Provide completed track that meets 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

Provide track gage 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. For alignment on tangents do not deviate from uniformity more than 13 mm 1/2 inch. For alignment on curves do not deviate from uniformity more than 10 mm 3/8 inch.

3.3.18.3 Track Surface

Meet the following track surface requirements:

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

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

c. Do not exceed 13 mm 1/2 inch deviation from design elevations on spirals.

d. Do not exceed 13 mm 1/2 in deviation from zero cross level at any point on tangent or from designated superelevation on curves or spirals.

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

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. Provide guard face gage 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. Provide guard check gage 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. Bend stock rails accurately. Changes in rail weight or section are not permitted within the limits of the switch ties. Place headblocks sat right angles to the main track and securely spike in place. Except where directed otherwise, install switch so that when the switch is set for the normal position, the connecting rod keeps the points closed with a pulling force. Properly adjust switches. 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 compacted.][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. Indicate dimensions, details, and configuration of each turnout on AREMA Eng Man, Plans Nos. 910 and 911. Place switch ties as indicated on AREMA Eng Man, Plans Nos. 112 and 912, except that even meter foot increments in length of switch ties may be substituted for 150 mm 6 inch increments in length of switch ties. The end of a switch tie are not allowed within 355 mm 14 inch of a spike. Shift connecting tracks to their new alignments as shown on the contract drawings and all tracks connected to the replacement turnout. Place tracks within 30 mm 1.2 inch 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. Match both rail ends at all rail joints throughout the turnout and at the joints at the frog 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 bring the turnout to proper grade in a minimum of three lifts. Do not exceed 100 mm 4 inch for the initial lift. Do not exceed 50 mm 2 inch for the final lift and bring all tracks into final alignment at that time. Provide tamping, ballast dressing requirements, and alignment tolerances as indicated in paragraph TRACK CONSTRUCTION AND OUT-OF-FACE RELAY. Provide ballast level in cribs beneath the connecting rod, switch point rails, and switch rods 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 are to remain in their existing location but require repairs in the "Schedule of Turnout Repairs" on the contract drawings and repair as specified below.

3.4.2.1 Switch Ties

Remove and replace defective switch ties. Let existing nondefective switch ties remain in place. Install replacement switch ties at a uniform spacing, but not greater than 530 mm 21 inch center to center. The end of a switch tie within 36 mm 14 inch of a spike is not permitted. Interlaced switch ties, where one tie penetrates the crib area of another tie are not permitted.

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

Rebuild switch points, 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 compacted to at least 90 percent ASTM D1557 maximum dry density for cohesive materials or 95 percent ASTM D1557 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 and slope away drainage areas 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. If fixing of the geotextile is critical and adverse conditions exist, for instance, steep slopes or high winds, the specification can detail anchoring requirements, for instance, 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 are to be placed in accordance with the applicable portions of this specification. Provide surfaces 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 are installed in an existing track following removal of the ballast by undercutting or ploughing remove large ballast particles that remain on the roadbed surface that could puncture the geotextile.

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

] c. 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 placing in track. The maximum exposure time of the geotextile to sunlight, from removal of the protective shipping cover to placement of the ballast or subballast cover materials, is 2 consecutive days.

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

e. Provide geotextile free of any contamination such as mud, dust, sediment, debris, that impair its function. Remove contamination without damage to the geotextile or to the prepared surface. 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 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 to ensure 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. Do not turn equipment on cover material over a geotextile.

3.5.2.5 Minimum Ballast Depth

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

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

Do not place double layers of geotextile, except for splicing overlaps at seams.

3.5.3 Ballast Placement and Surfacing

Place and tamp ballast in accordance with paragraph TRACK CONSTRUCTION AND OUT-OF-FACE RELAY except that in crossings, compact the ballast between the ties with a vibratory compactor, or other approved means, after each raise. Tamp the ballast for the entire length of the crossties for highway crossings. Align and surface the track prior to placement of the crossing surface. Bring the track to the final grade and alignment as indicated on the contract drawings. Where the crossing involves two or more tracks, use the top of the rail for all tracks to form a plane with the adjacent roadway surface. Provide top of rail elevation of 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

****
NOTE: Update section with tie material used.
****

Use [hardwood][concrete][polymer composite][steel]. Provide a maximum spacing 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

****
NOTE: Crossings can be anchored with traditional spikes or premium fasteners "clips". Either option is acceptable for crossings. However, some commercial railroads required premium fasteners "clips." Update this section based on the system used.

If rubber tie pads are required by the designer keep the tie pad section.
****

Fully tie plate all ties within the crossing and for 6 m 20 ft beyond each end of the crossing. [Spike with 4 rail-holding spikes per tie plate and fully box anchor each tie within the crossing and for 6 m 20 ft beyond each end of the crossing] [Provide single tight fit clips with fillers as necessary to fit rail section furnished and anchors rail against longitudinal movement within the crossing and for 6 m 20 ft beyond each end of 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

****
NOTE: Update rail weight used. In some projects the rail size may be different from other track sections.

Minimum Rail weight in crossings is 115 lbs/yd (57 kg/m).
****

Provide [57][_____] kg/m [115][_____] lbs/yd of rail within the crossing area and for 6 m 20 ft beyond each end of the crossing. [Do][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. Eliminate bolted joints 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.
****

Provide a highway [in the same plane as][not 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 compacted.

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. Use 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 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 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. Perform 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. Provide tie spacing and track materials used 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. Provide tie spacing and track materials used in the crossing in accordance with the installation instructions and manufacturer's recommendations.

3.5.9 Signs and Signals

Provide type and location of railroad-highway crossing warning signs and signals conforming to the requirements of MUTCD, Chapter 8B.

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, place sign faces 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, provide flangeways through the crossing that are 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 and resulting in drawings which are easy to revise without damage to the drawing.

3.6 BONDING AND GROUNDING TRACK

****

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, bond and ground the rails. 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 the 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 at 30.5 m 100 ft intervals along the designated tracks][Provide for each section of bonded and grounded track] one cross-bond and ground. Make connections between grounding system or ground rods and rails with bare stranded copper cable, installed 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 and place a minimum of 300 mm 12 inch below the top of the subgrade. Maximum resistance to ground from any grounded rail or structure exceeding 25 ohms is not permitted. 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

Double-bond bolted rail joints within the approach circuits to signalized highway grade crossings 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 that are damaged or destroyed 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

[Remove,][Install,][or][Reinstall][_____] bumping posts, cushion head, and wheelstops. Provide installation in accordance with the manufacturer's instructions. Where no specific installation instructions are available for salvaged bumping posts and wheelstops, reinstall 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 rod 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

****
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. Submit drawings stamped by a Professional Engineer. Perform bridge repair 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 work of this project to minimize the duration of interruptions to rail service. Schedule bridge repair work to the maximum practical extent so that 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. Achieve a bearing adequate for its design loading for any spliced pile. Splice no more than 50 percent of the piles in a single bend, and splice or shim no 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. Provide new bridge ties of the proper wood species, structural grade, and size for the intended application. Shimming of bridge ties is not 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

****
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 (for example engine burns, battered ends) 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

****
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. Ground 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, [place reinforcement strap underneath the hole.][weld reinforcement strap 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, air cool casting and then continue welding process, repeating the process as many times as necessary to prevent manganese from overheating. [Do][Do not] use flange carbons to keep welding metal out of flangeways. Build welded surface slightly higher than normal surface of casting so when ground, a sufficient weld metal is provided to grind to a level surface. Use a 600 mm 24 inch straightedge to check this work. Ground 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. Weld, ground, 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

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

Ground overflow of stock rail off of ball of rail on both sides and ground switch point to where cracks and chips are ground out. Ground all grease and rust off 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. Completely ground weld switch point 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 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 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 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, ground out ten to fifteen burns at a time, welding one pass at a time on each of the burns. Repeat process until all of the burns are completed to a surface just higher than the normal ball of the rail. Cool burn until hand can be placed on it. Ground welds to a level surface with cup wheel attachment grinder.

[3.9.7 Welding Rail Joints

****
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. Provide a straightedge with a minimum length of 450 mm 18 inches. Do not weld 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, gouged out with arcair or ground out with grinder. If cracks or chips extend below ball, replace rail. If horizontal crack in ball of rail extends more than 200 mm 8 inch, replace rail. 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 strip 25 mm 1 inch into bead; ground 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 is not 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.

Thermite welding procedures are to be performed 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

Provide weld rails meeting the requirements Section 2.2, "Specifications for Fabrication of Continuous Welded Rail" given in Chapter 4, Part 2 of AREMA Eng Man. Align rail ends in accordance with paragraph GAP AND ALIGNMENT. Remove rail ends with steel defects, dents, or porosity before welding. Do not make bolt holes in, or permit bolt holes 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. When rail is to be cut for any reason, 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. Accomplish cleaning by use of 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

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

a. Properly gap and align the ends of welded rails to produce a weld conforming to the alignment tolerances below. Align the head of the rail. Hold the rail gap and alignment without change during the complete welding cycle.

b. Perform vertical alignment to provide a flat running surface. Any difference of height of the rails occurs in the base.

c. Perform horizontal alignment so that any difference in the width of heads of rails occurs on the field side. Horizontal offsets exceeding 1 mm 0.04 in in the head and/or 3 mm 0.12 inch in the base are not permitted.

3.10.2 Surface Misalignment Tolerance

Combined vertical offset and crown camber exceeding 3 mm/m 0.04 inch/feet at 315 degrees C 600 degrees F or less are not permitted. Combined vertical offset and dip camber exceeding 1 mm/m 0.01 inch/feet at 315 degrees C 600 degrees F or less are not permitted.

3.10.3 Gage Misalignment Tolerance

Do not exceed 3 mm/m 0.04 inch/feet at 315 degrees C 600 degrees F or less combined horizontal offset and horizontal kink camber.

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. Visually inspect all welds 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. Finish 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, and cracks, for example.

3.10.6 Weld Quality

Provided completed welds that have full penetration and complete fusion and be entirely free of cracks or fissures. Provide welds that meet the acceptance criteria 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 a new sequential number to defective welds which are replaced by adding a letter to the defective weld number (for instance, 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 are not acceptable. Provide square and clean cuts. When given the option of cutting existing rail or new rail being installed, cut the existing rail. When new holes are necessary, drill holes. Holes that are punched, slotted, or burned with a torch are not

acceptable. Provide holes of the size and location as shown on the contract drawings. Peen or ground grilled 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. Include 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")in this work.

3.11.2.1 Used Bolt Assemblies

Used bolt assemblies removed from rail joints are the Contractor's property; do not reincorporate in the work. Remove existing bolt assemblies designated to be replaced without damaging joint bars or rails.

3.11.2.2 Joint Repair

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

Joint repair work is defined as the replacement of defective joint bars and correction of rail-end mismatch, as designated or directed by the Contracting Officer. 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

Examine clean rail ends 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 tie plates, inspect and classify as either relay or scrap. Mark scrap tie plates and do not reinstall in the track. Acceptable relay tie plates may be reused at that location or at other locations as required. Remove and replace old stationing tags on the new tie.

3.11.4.4 Humped Track

Where the track is not to 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 is to 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. Provide crosstie position at joints that 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, 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, with the gage after regaging 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 tie plates for existing plates.

3.11.5.2 Respiked Joints

Plug existing spike holes in all joints which are respiked.

3.11.6 Regaging

Where the existing track gage is less than 1420 mm 56 in or is equal to or greater 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; with the track gage after regaging 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. Sampling and testing is to be performed 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 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

****
NOTE: Based on size of project the DOR should evaluate the required testing of ballast and subballast material. The testing requirement is bracketed with a blank to allow the DOR to adjust sampling requirement.
****

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. Provide sample sizes 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 Aggregate Test Report[and Subballast Aggregate Test Report]

3.12.2.1 Sieve Analyses

Perform sieve analyses in conformance with ASTM C117 and ASTM C136/C136M using sieves that conform to ASTM E11.

3.12.2.2 Bulk Specific Gravity and Absorption

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

3.12.2.3 Percentage of Clay Lumps and Friable Particles

Determine 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

Perform soundness tests in conformance with ASTM C88.

3.12.2.6 Percentage of Flat or Elongated Particles

Determine percentage 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 in accordance with AWPA M6. Inspect each treated wood tie in accordance with AWPA M2, for conformance with the specified AWPA standards. Perform the 100 percent inspection using an independent inspection agency approved by the Contracting Officer. Perform the inspection at the wood treatment site. Deliver the agency's inspection report with the ties. Core and check preservative treatment once per 1000 ties delivered to the construction site. Penetration of creosote must be measured via increment borer and submitted to the contracting officer for approval. Failure to meet, "Minimum Preservative Penetration Requirements for Crossties and Switch ties" from AWPA T1 Section C standards will result in rejection of crossties.

3.12.4 Examination of Geotextile

****

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. Using an independent testing laboratory, 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. Determine conformance in accordance with ASTM D4759.] [Test geotextile seams expected to perform a reinforcement function in accordance with ASTM D4595.] Submit Geotextiles test report at

least [5] [_____] working days prior to the installation of the geotextile. The Contracting Officer may examine any geotextiles for defects, damage, or nonconformance prior to installation. Remove any geotextile not meeting the minimum property requirements of paragraph GEOTEXTILE, or 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, measurements of track gage, cross level, take and record 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

Perform quality control inspection and field testing using 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. Perform method of correction 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

[Ultrasonically test] [Dye test] each thermite weld joint following the visual inspection. Perform inspection and acceptance in accordance with AWS D1.1/D1.1M. Correct or replace defective welds, at no additional cost to the Government. Perform method of correction approved by the Contracting Officer. Ultrasonic testing is to 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 with 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. Provide replacement welds and replacement rails at the sole expense of the Contractor. Renumber replacement welds as indicated. Ultrasonically test all replacement welds made in track.

3.13.5 Electric Arc Weld Testing

Visually inspect welds and check the contours after completion and test later 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 or 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 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. Provide Ultrasonic testing performed 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. List defects and rail stationing in results. 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.

3.14 JUMP SPAN

3.14.1 Test Results

Submit Jump Span Testing Resultsincluding blow counts, CSL testing, or any other constructing testing for foundations to the Railroad Company for review.

3.14.2 Multiple Use

If a jump span will be reused, the engineer of record will inspect and certify that the jump span materials are suitable for reuse. Damaged or previously repaired materials will not be considered for reuse.

-- End of Section --