RFP-DOT-14-15-5016-LLSW Exhibit A

Introduction:

This document describes all of the technical requirements including but not limited to material description, delivery, certification, quality control, execution, testing, warranty, etc. for the Request For Proposal Central Florida Rail Corridor (CFRC) Commodities – Special Track Work.

The provided Special Track Work will be used in the construction of the next phase (Phase 2 South) of the Central Florida Commuter Rail Transit system.

Scope of Services:

The Contractor shall furnish and deliver all Special Track Work in accordance with the Special Track Work Technical Requirements included in this Exhibit A. All provided material shall be new. The required types and quantities of Special Track Work are summarized in the following table:

Special Trackwork

Item Description	Quantity
#10 LH Rail Bound Manganese Turnout, Straight Split Switch, Uniform Risers, 16’-6” Switch Points,	3
#10 RH Rail Bound Manganese Turnout, Straight Split Switch, Uniform Risers, 16’-6” Switch Points	1
#15 LH Rail Bound Manganese Turnout, Curved Split Switch, Uniform Risers, 26’-0” Switch Points	1
#15 RH Rail Bound Manganese Turnout, Curved Split Switch, Uniform Risers, 26’-0” Switch Points	1
#15 LH Rail Bound Manganese Crossover, Curved Split Switch, Uniform Risers, 26’-0” Switch Points, 15' Track Centers	1
#15 LH Rail Bound Manganese Crossover, Curved Split Switch, Uniform Risers, 26’-0” Switch Points, 20' Track Centers	1
#20 LH Rail Bound Manganese Turnout, Curved Split Switch, Uniform Risers, 39’-0” Curved Points	1
#20 RH Rail Bound Manganese Turnout, Curved Split Switch, Uniform Risers, 39’-0” Curved Points	1
#20 LH Rail Bound Manganese Crossover, Curved Split Switch, Uniform Risers, 39’-0” Curved Points , 15' Track Centers	2
#20 RH Rail Bound Manganese Crossover, Curved Split Switch, Uniform Risers, 39’-0” Curved Points, 15' Track Centers	1

All deliveries of the Special Track Work shall be coordinated with the Department. A separate Department Contractor shall receive, unload and coordinate the unloading efforts associated with the delivery of the Special Track Work. The Department shall provide delivery locations no less than sixty (60) days prior to delivery. The Contractor shall anticipate delivery locations within Orange and Osceola Counties located generally near the CFRC corridor between Mileposts MP 796.63 and MP 813.82. The earliest allowable delivery of commodities shall be January 4, 2016.

Special Track Work Technical Requirements:

1. General Requirements:

a. Panelize all turnouts and crossovers.

2. Execution:

Design and manufacture all Special Track Work in accordance with the following requirements included in this Exhibit A:

a. Technical Special Provision Section T-24580 – Special Trackwork
b. Technical Special Provision Section T-24520 – Running Rail
c. Technical Special Provision Section T-24534 – Other Track Materials
d. Technical Special Provision Section T-24521 – Rail Welding
e. CFRC Maintenance of Way Instructions (MWI)
    1. CFRC MWI 401 – Timber Crosstie and Switch Tie Requirements
    2. CFRC MWI 2411 Hook Flange Guard Rails for 115RE, 122CB, 132RE, 136RE, 140RE, and 141RE Rail
    3. CFRC MWI 2412 Bolted Adjustable Guardrails for 115RE, 122CB, 132RE, 136RE, 140RE, and 141RE Rail
    4. CFRC MWI 2413 Guard Rails, Usage and Location
    5. CFRC Common Drawing No. 135010 Bar Stock Anchor for 5-1/2” and 6” Base Rail
f. AREMA Portfolio of Trackwork Plans:
    1. Plan No. 100-08 Specifications
    2. Plan No. 101-10 Definitions of Terms
    3. Plan No. 111-08 16'-6" Straight Split Switch with Uniform Risers for Track Spikes or Screw Spikes
    4. Plan No. 123-08 19'-6" Curved Split Switch with Uniform Risers for Track Spikes or Screw Spikes
    5. Plan No. 125-08 26'-0" Curved Split Switch with Uniform Risers for Track Spikes or Screw Spikes
    6. Plan No.127-08 39'-0" Curved Split Switch with Uniform Risers for Track Spikes or Screw Spikes
    7. Plan No. 190-10 Diagram Illustrating Preferred Names of Parts for Switches
    8. Plan No. 220-08 Manganese Steel Points for Split Switch
    9. Plan No. 221-08 Details for Switch Points
    10. Plan No. 222-08 Switch Rods and Clip
    11. Plan No. 223-08 Gage Plates
    12. Plan No. 224-08 Switch Plates and Adjustable Boltless Rail Braces
    13. Plan No. 241-03 Details and Typical Applications of Hook Twin Tie Plates
    14. Plan No. 325-12 Steel Frog Fillers and Reinforcing Bars
    15. Plan No. 350-03 Tee Rail Flares for Frog and Crossing Flangeways
    16. Plan No. 502-03 Setting for Guard Rails - Tee Rail and Adjustable Designs
    17. Plan No. 504-03 Guard Rails - Tee Rail Design with Planed Flares and Flat Plates

18. Plan No. 505-01 Specifications for Guard Rail Clamps
19. Plan No. 510-01 Manganese Steel One Piece Guardrail
20. Plan No. 590-03 Diagram Illustrating Preferred Names of Parts for Guard Rails
21. Plan No. 600B-03 Point and Flangeway Dimensions for Manganese Frogs and Crossings
22. Plan No. 621-09 Data and Sections for Rail Bound Manganese Steel Frogs
23. Plan No. 623-09 No. 9, No. 10 and No. 11 Rail Bound Manganese Steel Frogs
24. Plan No. 624-09 No. 12, No. 14, and No. 15 Rail Bound Manganese Steel Frogs
25. Plan No. 625-09 No. 16, No. 20, and No. 24 Rail Bound Manganese Steel Frogs
26. Plan No. 690-01 Diagram Illustrating Preferred Names of Parts for Rail Bound Manganese Steel Frog
27. Plan No. 790-02 Data for Gages and Flangeways at Frogs and Crossings Showing Limits
28. Plan No. 901-03 Turnout Geometries and Nomenclature
29. Plan No. 910-12 Turnout and Crossover Data for Straight Split Switches
30. Plan No. 911-02 Location of Joints for Turnouts with Straight Split Switches
31. Plan No. 912-12 Bills of Switch Ties for Turnouts and Crossovers
32. Plan No. 920-12 Turnout and Crossover Data for Curved Split Switches
33. Plan No. 921-02 Location of Joints for Turnouts with Curved Split Switches
34. Plan No. 1001-03 Rail Sections – In Use Since About 1900, Light Density and Short Line Railway
35. Plan No. 1005-03 Beveling of Rail Ends for Special Trackwork
36. Plan No. 1012-03 Radiographic Testing of Rail Bound Manganese Steel Frog Casting, Internal Soundness Severity Levels
37. Plan No. 1017-03 Radiographic Testing of Rail Bound and Solid Manganese Steel Knuckle, Internal Soundness Severity Levels
38. Plan No. 1020-03 Permissible Variations in Completed Switch Points
39. Plan No. 1021-03 Permissible Variations in Completed RBM Steel Frogs
40. Plan No. 1024-08 Permissible Variations in Completed Switch Clip, Plate and Switch Rod

The following changes to CFRC MWI 2411, CFRC MWI 2412, CFRC MWI 2413 & CFRC Common Drawing No. 135010 for this project apply:

- The terms listed in the left side column of the following table are deleted in every instance they appear in the CFRC Maintenance of Way (MWI) for this project. Replacement terms are provided in the right side column.

Deleted Term	**Replacement**
Bethlehem Boltless	Boltless Adjustable Rail Brace
e-Clip Support Block	Positive Restraint Fastener Support Block
Ekoslide	Switch Point Roller
Evergrip Spikes	Screw Spikes
Gage Plates For Use With Bethlehem Style Rail Braces Must Meet Bethlehem Design Standards	Gage Plates For Use With Adjustable Rail Braces Must Meet Manufacturer's Design Standards
Gage Plates For Use With Pandrol Rail Fasteners Must Meet Pandrol Design Standards	Gage Plates For Use With Positive Restraint Rail Fasteners Must Meet Manufacturer's Design Standards
Huck Bolt Series C50L, 90 Flush Head, Bolt BR24 - 32, Collar 3LC - 2R 24.	Lock Bolt
Huck Bolts	Lock Bolts
Pandrol Braces	Positive Restrain Fastener Braces
Pandrol Clip, Left Hand	Positive Restraint Fastener Clip, Left Hand
Pandrol Clips	Positive Restraint Fastener
Pandrol Clips for Insulated Joints	Positive Restrain Fastener for Insulated Joints
Pandrol Clips, Regular	Positive Restraint Fastener Clips, Regular
Pandrol Rail Fasteners	Positive Restraint Rail Fasteners
Pandrol Shoulders	Positive Restraint Fastener Shoulder
Pandrol Style Braces	Positive Restrain Fastener Braces
Pandrol Style Plates	Positive Restraint Fastener Style Plates
Pandrol Tie Plates	Positive Restraint Fastener Tie Plates
"Special Switch Ties Required For One Switch Layout" Table	Switch Ties to follow manufacturer's recommendations
"Switch Machine Ties Required For One Switch Layout" Table	Switch Ties to follow manufacturer's recommendations

SECTION T-24580
SPECIAL TRACKWORK

PART T1 - GENERAL

T1.01 DESCRIPTION

A. Work specified in this Technical Special Provision consists of designing, manufacturing, testing, shop assembly, inspecting, packaging, shipping and delivery of special trackwork materials.

1. Provide all special trackwork components delivered to the site ready for installation. Coordination of all special trackwork components with proposed rail size, proposed fastening methods/systems, and conditions of abutting trackwork is considered to be part of providing special trackwork.

B. The special trackwork fabricator shall be responsible for designing all special trackwork components for use with 115RE. Special trackwork design shall meet the gage and alignment geometry as indicated in the Reference Standards.

T1.02 QUALITY ASSURANCE

A. Comply with the Manufacturer's Quality Control Program requirements.

B. Comply with industry quality control and quality assurance practices and conform to requirements for the special track components, and as follows:

1. American Railway Engineering & Maintenance of Way Association (AREMA), Portfolio of Trackwork Plans

a. Plan No. 100-08, Specifications, applicable sections.

b. Plan No. 1012-03, Radiographic Testing of Railbound Manganese Steel Frog Casting Internal Soundness Severity Levels

c. Plan No. 1020-03, Permissible Variations in Completed Switch Points

d. Plan No. 1021-03, Permissible Variations in Completed RBM Steel Frogs

e. Plan No. 1024-08, Permissible Variations in Completed Switch Clip, Plate and Switch Rod

2. American Railway Engineering & Maintenance of Way Association (AREMA), Recommended Practices, Manual for Railway Engineering

a. Manufacture of Rail, Chapter 4, Part 2

T1.03 SUBMITTALS

A. Comply with the project submittal procedure.

B. Shop Drawings for special trackwork components:

1. Provide scaled, detailed shop drawings for each rail, component and casting to be provided.

a. Prepare layout drawings for single crossovers and double crossovers as a complete assembly from extreme points on each end of the location, and represent all dimensions and components in the form of a single large assembly.

2. Insulated curved split switches, including stock rails for both right- and left-hand switches.

3. Insulated straight split switches, including stock rails for both right- and left-hand switches.

4. Insulated switch rods, including clip assemblies.

5. Railbound manganese steel frogs.

6. Closure rails.

7. Crossover connecting rails.

8. Frog guard rails.

9. Special plates for special trackwork, including details of components, and fasteners.

10. Switch Point Mounted Rollers: Include catalog cuts, product data, and manufacturers written installation instructions.

T1.04 REFERENCE STANDARDS

A. Central Florida Rail Corridor (CFRC) MWI:

1. MWI 401 Timber Crosstie and Switch Tie Requirements

2. MWI 2411 Hook Flange Guard Rails for 115RE, 122CB, 132RE, 136RE, 140RE, and 141RE Rail

3. MWI 2412 Bolted Adjustable Guardrails for 115RE, 122CB, 132RE, 136RE, 140RE, and 141RE Rail

4. MWI 2413 Guard Rails, Usage and Location

5. Common Drawing No. 135010 Bar Stock Anchor for 5-1/2" and 6" Base Rail

B. AREMA Portfolio of Trackwork Plans:

1. Plan No. 100-08 Specifications

2. Plan No. 101-10 Definitions of Terms

3. Plan No. 111-08 16'-6" Straight Split Switch with Uniform Risers for Track Spikes or Screw Spikes

4. Plan No. 123-08 19'-6" Curved Split Switch with Uniform Risers for Track Spikes or Screw Spikes

5. Plan No. 125-08 26'-0" Curved Split Switch with Uniform Risers for Track Spikes or Screw Spikes

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40. Plan No. 1024-08 Permissible Variations in Completed Switch Clip, Plate and Switch Rod

C. American Railway Engineering & Maintenance of Way Association (AREMA):

1. Manual for Railway Engineering, Volume 1.

2. Portfolio of Track Plans

3. American National Standards Institute, Inc. (ANSI):

a. ANSI B1.1: Unified Inch Screw Threads (UN and UNR Thread Form)

b. ANSI B1.3M: Screw Thread Gaging Systems For Dimensional Acceptability - Inch and Metric Screw Threads (UN, UNR, UNJ, M and MJ)

c. ANSI B18.22.1. Plain Washers

4. ASTM International (ASTM):

a. ASTM A307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

b. ASTM D257: Standard Test Methods for DC Resistance or Conductance of Insulating Materials

c. ASTM E162: Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source

5. Association of American Railroads (AAR):

a. AAR: Manual, Assembly and Test of Insulated Track Part 16, Signal Section

6. SAE International (SAE):

a. SAE J429: Mechanical and Material Requirements for Externally Threaded Fasteners

b. SAE J995: Mechanical and Material Requirements for Steel Nuts

T1.05 REFERENCE SECTIONS

A. Technical Special Provisions:

1. Technical Special Provision T-24520 Running Rail

2. Technical Special Provision T-24521 Rail Welding

3. Technical Special Provision T-24534 Other Track Materials

T1.06 PRODUCT DELIVERY HANDLING AND STORAGE

A. Transport and store material in accordance with this Exhibit A.

T1.07 QUALIFICATIONS OF THE MANUFACTURER

A. The Special Trackwork Manufacturer or its predecessors shall have a minimum of 10 years' experience in the large scale manufacture and supplier of special trackwork, to Class 1 Railroads and Transit Properties.

B. The Switch roller Manufacturer or its predecessors shall have a minimum of 5 years' experience in the large scale manufacture and supplier of special trackwork switch rollers, to Class 1 Railroads and Transit Properties.

PART T2 - MATERIALS

T2.01 GENERAL

A. Fabricate all Special Trackwork materials to be compatible with 115RE rail.

B. Provide elastic fasteners, cut spikes and high strength screw spikes as indicated in the Reference Standards.

C. Mark, using painted stencils, each component prior to shipment. Use white paint on a background of black paint. Place markings onto both sides near the end of the piece, with letters and numerals not less than 2 inches high. Place markings in an area that will not subsequently be covered by joint bars, heel blocks, or other components.

1. Provide a permanent, high-quality exterior-grade paint used for stencil paint marking of rail that is designed for application on steel. Show proposed type of paint on the special trackwork Shop Drawings.

T2.02 SPECIAL TRACKWORK

A. Switch Points and Stockrails:

1. Materials and configuration shall be per all applicable Reference Standards.

a. Provide floating heel block assemblies.

2. Bevel switch and stock rail ends in accordance with AREMA Portfolio of Trackwork Plans, Plan No. 1005-03.

3. Remove rail brands in reinforcing bar area and within 1 ft. 8 in. of the rail end.

4. Identification:

a. Identification markings for switch and stock rails - Provide the following information:

i. Component installation location

ii. Component identity number

iii. Turnout number and turnout hand

b. Attach aluminum tag to the web of the gauge side of the switch point rail. Include switch length, rail section, right hand or left hand, switch number, and date of manufacture on tag.

B. Turnout Frogs:

1. Provide materials and configuration per all applicable Reference Standards.

2. Assure the manganese steel castings for the railbound manganese frogs conform to AREMA Portfolio of Trackwork Plans, Plan No. 100-08, Article M2.

3. Manufacture:

a. Depth harden the impact areas of the manganese steel castings for turnout and crossing frogs by explosive, press, or hammer hardening procedure in accordance with AREMA Portfolio of Trackwork Plans, Plan 100-08, Section M2.7, Depth Hardening.

b. Bevel rail ends in accordance with AREMA Portfolio of Trackwork Plans, Plan No. 1005.

c. Remove rail brands in reinforcing bar area and within 1 ft. 8 in. of rail end.

4. Identification:

a. Identification marking for frogs – provide the following information:

i. Frog number with angle

ii. Frog hand, if applicable

b. Attach aluminum tag to the web of the frog. Include frog length, rail section, and frog number, and date of manufacture on tag.

C. Special Trackwork Rails:

1. Provide special trackwork rails, including closure rails and turnouts rails, and crossover connecting rails, at the lengths required to satisfy the design indicated on the Plans and Reference Standards.

2. Drill special trackwork rails for insulated joint, or frog guard rail installation as specified on Reference Standards. All joints within special trackwork, with the exception of insulated joints shall be welded.

3. All special trackwork rail shall be premium rail for closure, buffer, and crossover connecting rails conforming to 115RE high strength rail per Technical Special Provision 024520 Running Rail.

4. Manufacture:

1. Drill and cut special trackwork rails which are not otherwise indicated as continuous welded rail (CWR) in the Reference Standards.
2. Bevel special trackwork rail ends in accordance with AREMA Portfolio of Trackwork Plans, Plan No. 1005-03.
3. Remove rail brands within 1 ft. 8 in. of the rail end.
4. Supply rails to the maximum lengths indicated in the Reference Standards without the need for additional rail joints.

5. Identification:

a. Identification markings for special trackwork rails to provide:

i. Component installation location

ii. Component part name

D. Frog Guard Rails:

1. Provide materials, braces, lengths, and configurations per all applicable Reference Standards.

2. Provide hook flange and adjustable designs as identified for "Primary Guard Rail Design" in CFRC Standard Drawing 2413, "Guard Rails Usage and Location".

3. Identification

a. Identification markings for frog guard rails shall provide:

i. Component part name

ii. Centerline of guard rail

E. Switch Rods:

1. Provide materials, insulation, number of rods, lengths, and configurations for switch rods per all applicable Reference Standards.

2. Assure switch rods are compatible with the operating rod, switch machines and switch and lock mechanisms utilized for the project.

3. Materials:

a. Switch rod assemblies: Conform to AREMA Specifications for Special Trackwork, Rolled Mild Steel.

b. Fiberglass insulation: Provide in accordance with AAR Signal Manual, Part 116, Signal Section Specification 216, Assembly and Test of Insulated Track Fittings. Fabricate fiber angles, plates, and channels of 3/16 inch thick fiberglass mat reinforced polyester, GPO-1 Sheet Stock, NEMA Grade 10 epoxy glass fabric.

i. Manufacture: Seal cut edges of fiberglass with two part coatings and before assembly, paint contact metal surfaces with insulating enamel. During assembly, fill areas between

outside edge of bolts and inside edge of holes with clear silicon rubber paste, Devon Silite 100, General Electric RTV 108 or accepted equivalent.

4. Identification: Stamp assembled in according with Reference Standards.

F. Special Plates and Fasteners:

1. Provide materials, sizes, lengths, and configurations per all applicable Reference Standards.

2. Assure all special trackwork fastener plates are rolled mild steel in accordance with AREMA Portfolio of Trackwork Plans, Plan 100-08, Article M7.

3. Switch and turnout plates shall be designed to use resilient fasteners, clips and welded rail shoulders.

a. Assure rail clips are fabricated, supplied by, and proprietary to the special trackwork tie plate manufacturer.

b. For special plates located under rail joints, provide special rail clips designed to accommodate joint bars.

c. Provide rail clips that are mechanically galvanized with zinc coatings in a room temperature process, without electricity and without heat, by the rail clip manufacturer.

d. Rail clip shoulders: One-piece carbon-steel designed to match the rail clip. Shoulder: Welded onto the top of the special plates.

4. Gage Plates:

a. Provide plates that are rolled mild steel in accordance with AREMA Portfolio of Trackwork Plans, Plan 100-08, Article M7.

b. Provide fiberglass insulation in accordance with AAR Signal Manual, Part 116, Signal Section Specification 216, Assembly and Test of Insulated Track Fittings. Fabricate fiber angles, plates and channels using 3/16 inch thick fiberglass mat reinforced polyester, GPO-1 Sheet Stock NEMA Class B. Fabricate fiber bushing using NEMA Grade 10 epoxy glass fabric.

5. Special trackwork plates shall provide no rail cant.

6. 39’-0” switch plates on ties 4, 10, 16, and 19 shall accommodate switch point mounted rollers.

G. Switch Point Mounted Rollers:

1. 26’-0” and 39’-0” switch points shall include gage side switch point mounted rollers on both switch points.

a. Roller shall consist of a point mounted bracket holding a hardened steel roller that includes an elastomeric bushing to absorb some impact associated with rail traffic.

b. The roller shall roll on the switch plate and be capable of raising the switch point up to 2 millimeters above the stock rail.

c. No part of the roller assembly shall be higher than 2 inches below top of rail.

d. Switch rollers for 39’-0” switch shall fasten to the switch point and be applied at tie numbers 4, 10, 16 and 19.

e. Switch rollers for 39’-0” switch shall fasten to the switch point and be applied at tie numbers 4, 10, 16 and 19.

f. Roller assembly shall be adjustable with a standard wrench.

T2.03 TIMBER TIES

A. Provide new timber ties in accordance with CFRC MW 99001, Rev A, Timber Crosstie and Switch Tie Specifications

1. Provide Grade 5 standard ties, sized in accordance with the Reference Standards.

2. White Oak ties are not permitted.

T2.04 TRACK SPIKES

A. Provide new square head screw spikes as indicated in Reference Standards.

1. Provide screw spikes that comply with AREMA Manual for Railway Engineering, Figure 5-10-2, Plan S2-12 "AREMA Square Head Screw Spike (2102)".

B. Provide new cut spikes in accordance Technical Special Provision T-24534 Other Track Materials.

T2.05 INSULATED JOINTS

A. Provide new epoxy bonded insulated joints in accordance with AREMA Manual for Railway Engineering, Chapter 4, Part 3 and Technical Special Provision T-24534 Other Track Materials.

PART T3 - EXECUTION

T3.01 GENERAL

A. Notify the Engineer a sufficient time before starting the work so that adequate arrangements can be made to progress the Work.

B. Do not commence the special trackwork until the manufacturer submits, and receives the Engineer's approval of fully developed shop drawings.

T3.02 SHOP ASSEMBLY

A. Special Trackwork Fabrication:

1. Provide fabrication in accordance with indicated requirements, Reference Standards, and accepted shop drawings.

2. Shop Welding:

a. Perform any required welding on plates in accordance with American Welding Society D1.1, except as modified herein.

b. Preheat carbon steel to 200 degrees F minimum, when either the thickness of the base material exceeds 1-1/4 in. or the maximum specified carbon content exceed 0.30 %.

c. Determine preheat and inter-pass temperatures by temperature indicating crayons or other equally suitable means.

B. Shop Assembly:

1. Completely shop-assemble all special trackwork layouts so as to verify fit and conformance with requirements prior to delivery to the installation site. Match mark all items and develop a subcomponent numbering system keyed to shop drawings for field assembly. Assembly shall include all switch ties and rail fastenings, so as to completely replicate the track as it will be assembled in the field.

2. Complete shop assembly using the actual rails that will be employed in field installation.

C. Provide an accurate survey reference line that duplicates the track geometrics and which has been laid out with a transit and tape or other accurate surveying methods. Demonstrate that the rails accurately follow the design alignment within indicated tolerances.

D. Verify dimensions during shop assembly. Do not brace, spike to the floor, or perform other such methods to hold the track in final alignment during shop assembly.

E. Verify proper track gages and flangeway dimensions.

F. Provide all rails, frogs, etc. with identification painted on the web, clear of joint bar area, at both ends according to the rail layout details shown. Paint rail joint members on the head of each rail at every joint. Carefully stencil-paint markings in two contrasting colors (e.g. white letters on a black background) with different color-codes corresponding to each special trackwork layout. Do not confuse installation identification numbers with the internal shop

work order numbering system. Paint only installation numbers on track items. Paint markings are in addition to the permanent identification plates required by Part 2.02 D of this Technical Special Provision.

G. Painting:

1. Other than identification markings, do not paint special trackwork items prior to shop assembly and inspection. Items that are painted will be rejected on the premise that the paint is concealing a defect.

2. After special trackwork has been inspected and accepted by the Engineer's inspector, paint or coat items so as to protect items from corrosion during shipment. Do not conceal identification markings and inspector's marks by such painting or coating.

T3.03 SHOP ASSEMBLY INSPECTION

A. Present all products furnished under this Contract for inspection at the place of manufacture and final shop assembly.

B. Manufacturer's Inspection:

1. Primary responsibility for inspection of the shop assembled special trackwork resides with the Manufacturer.

2. Verify the fit and finish of all components.

3. Note deviations from Contract requirements. Make corrections and re-inspect as required to confirm that corrections have been acceptably completed.

4. Inspect all turnout switches. Confirm the proper alignment and operation of the switches and switch toggles in all switch positions.

C. Engineer's Inspection:

1. Subsequent to the Manufacturer's in-house acceptance of the special trackwork assemblies, the Department will inspect 1 or each unique turnout and cross-over.

2. Notify the Department a minimum of 24 days in advance of the dates that the special trackwork will be ready for inspection. Reconfirm that the assembly will actually be complete and ready for inspection not later than 48 hours prior to the promised date and time for the commencement of inspection.

3. Material shall be presented for inspection in a safe area, protected from the elements, away from manufacturing activities and any noise in excess of 75 dBA.

4. Provide the Engineer all necessary facilities, tools, lighting, and other assistance as may be required to conduct an inspection to whatever level he deems appropriate at that time.

5. Provide labor and equipment as may be required to facilitate inspection of the top, sides, and bottoms of all materials, and to disassemble components as may be required to inspect concealed surfaces.

6. Provide templates to check flangeways, rail end drilling, and switch rail planning. Design the templates such that using the templates will be quick and easy, requiring only one person for the operation.

7. Provide a minimum of 8 hours during normal daylight working hours for the Department to inspect each completely assembled layout before disassembly for shipment is scheduled to commence. Do not commence disassembly before the Engineer has provided conditional acceptance of the material and released it for shipment. Provide a covered area for the inspector to conduct the inspection.

8. The Engineer has the absolute authority to reject any material, work-in-progress, or finished work that fails to meet the requirements of these specifications. The development of the details of how corrective work will be accomplished is the responsibility of the Manufacturer, however the Department will have the authority to accept or reject the proposed corrective methods.

9. Assume final responsibility for accepting the Work.

10. The results of shop inspection notwithstanding, final acceptance of special trackwork products by the Engineer will not occur until after they have been delivered, unloaded installed, tested and successfully placed in revenue service.

T3.04 SHOP DISASSEMBLY AND SHIPMENT

A. Once the fully shop assembled special trackwork item has been inspected and accepted, dismantle them only to the level necessary to permit shipment of the item. Items that must be disassembled for shipment shall be crated or bundled as indicated on accepted working drawings and shipped with other parts of the same assembly. All parts or packing boxes shall be suitable for handling by a forklift with a capacity of 6000 pounds.

B. Shop curved rail shall be shipped in preassembled sections together to the maximum degree feasible for transportation. Loose items such as rail clips, insulators, joint bars, bolts etc. shall be securely bundled, crated, or palletized; identified as to the turnout or crossing where they are to be used; and shipped together with the layout to which they belong. Rails shall be wedged and blocked as required so as to prevent accidental bending of the rail.

PART T4 - MEASUREMENT AND PAYMENT

T4.01 MEASUREMENT

A. No separate measurement shall be made for Work required under this Technical Special Provision.

T4.02 PAYMENT

A. No separate payment shall be made for the Work required under this Technical Special Provision. All costs in connection therewith will be considered Included in the lump sum bid for the Project.

SECTION T-24520
RUNNING RAIL

PART T1 - GENERAL

T1.01 DESCRIPTION

A. Work specified in this Technical Special Provision consists of manufacturing, heat treating, inspecting, testing, shipping, unloading and stockpiling running rail and inner bridge guard rail.

T1.02 QUALITY ASSURANCE

A. Comply with the manufacturer's Quality Control Program.

B. Perform Work in accordance with the most current American Railway Engineering and Maintenance of Way Association's (AREMA) Manual for Railway Engineering, Volume 1, Chapter 4, Part 2, Specification for Steel Rails, except as modified in this Technical Special Provision.

C. Test Report:

1. The rail mill's standard, computer-generated, test reports for the specific rail to be delivered must be submitted for review by the Engineer prior to shipment of the rail. Supplemental reports may be required by the Engineer, to provide additional information.

2. If rail is being supplied by a distributor, all testing and Quality Control documentation from the rail mill is to be submitted. Distributor's records will not be accepted.

D. Notify the Engineer in writing not less than 14 days in advance of dates scheduled for any tests or inspections of the rail at the manufacturer's plant. The Engineer retains the right to witness the tests.

T1.03 SUBMITTALS

A. All submittals shall comply with the project submittal procedure. Provide submittals to the Engineer a minimum of five calendar days before starting manufacturing process, or shipping rail. If the rail has been previously manufactured, provide submittals 30 days prior to shipping. Submit the following information:

1. Method for hydrogen elimination.

2. Method for head hardening premium rail.

3. Description of the ultrasonic testing procedures, certifications for the testing personnel, and hard copy results for rails with rejectable discontinuities.

4. Method of identifying the weight and type of rail.

5. Method of handling, loading, shipping, unloading and stockpiling the running rail not later than 30 days before shipment. Include Working drawings showing the rail stocking arrangement.

6. Method for heat treating rail.

7. Mill certificates for rail.

8. Test reports as specified in Part T1.02 of this Technical Special Provision.

T1.04 REFERENCE SECTIONS

A. Technical Special Provisions:

1. Technical Special Provision T-24521 Rail Welding

2. Technical Special Provision T-24534 Other Track Materials

T1.05 REFERENCE SECTIONS

A. American Railway Engineering & Maintenance of Way Association (AREMA):

1. Manual for Railway Engineering Chapter 4, Parts 1 and 2.

T1.06 QUALIFICATIONS OF THE MANUFACTURER

A. The Rail Manufacturer or its predecessors shall have a minimum of 10 years' experience in the large scale manufacture of AREMA (former AREA) running rail, as indicated in this Technical Special Provision, and as a supplier of rail to Class 1 Railroads and Transit Properties.

PART 2 - MATERIALS

T2.01 RUNNING RAIL

A. Provide new mainline quality 115RE running rail that conform with the dimensional and quality requirements of AREMA Manual, Chapter 4, Part 1, Design of Rail; Part 2, Manufacture of Rail, et all.

1. All running rail shall be new. No IQ rails will be accepted.

2. Mainline relay rail may be used for inner bridge guard rail.

B. Running Rail Types:

1. Standard Rail: Standard Chemistry Rail Steel

a. Standard running rail shall have a minimum Brinell Hardness Number of 310.

b. Premium (High-Strength) Rail; Carbon steel in line head hardened rail. Provide premium rail of the same rail type, and from the same mill. No mixture of type and source will be accepted.

i. Premium running rail shall have a minimum Brinell Hardness Number between 370 and 400.

C. Interior Condition:

1. In accordance with AREMA Manual, Chapter 4, Section 2.1.9, Interior Condition/Macroetch Standards.

D. Surface Condition:

1. In accordance with AREMA Manual, Chapter 4, Section 2.1.10, Surface Classification.

E. Rail Length:

1. Fabricate rail length in accordance with AREMA Manual, Chapter 4, Section 2.1.11, Length.

2. In areas adjacent to Special TrackWork, or when necessary to join sections where physical constraints preclude using the minimum length, rail length may be reduced to a minimum of 19 ft. 6 in.

F. Rail Ends:

1. Furnish rails with blank ends unless otherwise noted.

G. Tensile Properties:

1. In accordance with the AREMA Manual, Chapter 4, Section 2.1.4.1c., Tensile Properties of Standard Chemistry Rail Steel.

PART 3 - EXECUTION

T3.01 MANUFACTURING

A. Conform with AREMA Manual, Chapter 4, Part 2, Manufacture of Rail.

B. Conform with AREMA Manual, Chapter 4, Section 2.1.7, Hydrogen Elimination.

T3.02 HEAT TREATING

A. Heat treat rail in accordance with the process submitted and reviewed, in accordance with this Technical Special Provision.

T3.03 TESTING

A. Perform the following testing of all rail:

1. Brinell Hardness Test: Perform in accordance with AREMA Manual, Chapter 4, Section 2.1.3.2, Surface Hardness and 2.1.3.3, Internal Hardness of Premium Rail.

a. Brinell Hardness Transverse Test: Test premium rail, per AREMA Manual, Section 2.1.3.3

2. Ultrasonic Testing: Determine the internal condition of the rails by nondestructive testing in accordance with AREMA Manual, Chapter 4, Section 2.1.8, Ultrasonic Testing,

a. Manual Ultrasonic Testing: In accordance with the AREMA Manual, Chapter 4, Section 2.1.17.2, Manual Ultrasonic Testing

3. Tensile Test: Per AREMA Manual, Chapter 4, Section 2.1.3.4

4. Macroetch Test: Per AREMA Manual, Chapter 4, Section 2.1.9

B. Defective Rail: ReWork, retreat, cut-back or reject rails failing to meet the requirements of these Specifications in accordance with the AREMA Manual.

T3.04 IDENTIFICATION

A. Stamp and brand rails in accordance with AREMA Manual, Chapter 4, Section 2.1.6, Branding and Stamping.

B. Mark rails in accordance with AREMA Manual, Chapter 4, Section 2.1.15, Markings.

T3.05 LOADING AND SHIPPING

A. Handle rail in a manner that prevents damage during loading, unloading and shipping.

B. Do not drop or strike rails sharply.

C. Loading:

1. Load rails head up, with separators between tiers and with the branding on all rails facing in the same direction. Do not intermix rails of different rail type and rail length category, but keep segregated so that each rail type and rail length category can be easily identified and separated at their destination. If there are not enough rails of one type and length category for a full car, load smaller groups consisting of tiers of different types or length categories onto one car.

2. Adequately prepare rail shipments to preclude damage during shipment.

D. Load and ship rails in accordance with Association of American Railroads (AAR) requirements.

E. Replace rail damaged during loading, shipping and unloading with new rail at no additional cost to the Department.

PART 4 - MEASUREMENT AND PAYMENT

T4.01 MEASUREMENT

A. No separate measurement shall be made for Work required under this Technical Special Provision.

T4.02 PAYMENT

A. No separate payment shall be made for the Work required under this Technical Special Provision. All costs in connection therewith will be considered included in the lump sum bid for the Project.

SECTION T-24534
OTHER TRACK MATERIALS

PART T1 - GENERAL

T1.01 DESCRIPTION

A. Work specified in this Technical Special Provision consists of manufacturing, inspecting, testing and shipping of other track materials including:

1. Bonded Insulated Joints

2. Double Shoulder Tie Plates

3. Track Cut Spikes

4. Rail Anchors

B. Bonded Insulated Joints shall be fabricated in a shop facility by a fabricator with at least 10 continuous years of experience in fabrication of insulated joints for freight railroads and transit rail agencies.

T1.02 QUALITY ASSURANCE

A. Comply with the Project Quality Control Program.

T1.03 SUBMITTALS

A. Comply with the project submittal procedure.

B. Provide submittals to the Engineer a minimum of one week before starting manufacturing process or shipping rail. If the rail has been previously manufactured, provide submittals 30 days prior to shipping. Submit the following information:

1. Provide Shop Drawings for:

2. Bonded Insulated Joints

3. Provide Product Data for:

4. Insulated Joints

5. Tie Plates

6. Cut Spikes

7. Rail Anchors

8. Provide Test Results for:

9. Insulated Joint qualification testing as indicated in this Technical Special Provision.

10. Provide Manufacture's Qualifications as indicated herein.

T1.04 REFERENCE STANDARDS

A. Central Florida Rail Corridor (CFRC) Common Standards:

1. DWG NO: 135010 Bar Stock Anchor For 5-1/2" and 6" Base Rail.

B. American Railway Engineering & Maintenance of Way Association (AREMA):

1. Manual for Railway Engineering, Volume 1.

2. Portfolio of Track Plans

C. ASTM International (ASTM):

1. ASTM A330 Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service

2. ASTM B26 Standard Specification for Aluminum-Alloy Sand Castings

3. ASTM D1002 Strength Properties of Adhesives in Shear by Tension Loading (Metal-to-Metal)

4. ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control

D. Association of American Railroads (AAR):

1. AAR Signal Manual Assembly and Testing of Insulating Track Fittings, Part 14.5.1

T1.05 BONDED INSULATED JOINT TESTING

A. General:

1. Before permanently installing bonded insulated joints, pre-qualify each crew and its foreman by testing two samples of each type of bonded joint in accordance with the longitudinal compression test specified in this Technical Special Provision. Except as allowed in this Section, prepare the test samples in track. Perform the bonded insulated joints tests with one sample using premium rail and the other sample using standard rail. Use premium rail for both bonded standard joint samples.

2. Failure of a test sample disqualifies the responsible foreman for permanent installation Work. Assign a new foreman and repeat procedure and test.

3. Use equipment that is specifically designed to fasten proprietary bolts in bonded joint installation. Use the same equipment for field installation of bonded joints and for assembling test samples.

B. Testing:

1. Prior qualification tests: If the bonded joints proposed have previously passed testing at least as rigorous as those indicated in this Technical Special Provision, submit certified test reports from the independent testing laboratory that performed the tests. If the test data is complete and acceptable, the Engineer will waive further qualification testing requirements.

2. The test specimens:

a. Bonded insulated joint fully assembled with 115RE rail

3. Test sequences:

a. For test specimens using bonded insulated joints, of the number and per the testing sequence identified in the AREMA Manual, Chapter 4, Section 3.8.7, "Qualification Testing".

4. Electrical Resistance Test:

a. Perform electrical resistance testing in accordance with the AREMA Manual, Chapter 4, Section 3.8.7.3.

i. Test acceptance criteria shall be a minimum resistance of ten megaohms.

5. Rolling Load Test:

a. Perform rolling load test in accordance with the AREMA Manual, Chapter 4, Section 3.8.7.4.

i. Test acceptance criteria: At all times the deflection of the bonded insulated joint shall not exceed 0.065 inches.

6. Longitudinal Compression Test:

a. Perform longitudinal compression test in accordance with the AREMA Manual, Chapter 4, Section 3.8.7.2.

i. Test acceptance criteria shall be per the AREMA Manual, Chapter 4, Section 3.8.7.2d

T1.06 QUALIFICATIONS OF THE MANUFACTURER

A. The Bonded Insulated Joint Fabricator shall have a minimum of 10 years' experience in the large scale fabrication of Bonded Insulated Joints as indicated in this Technical Special Provision, and as a supplier of rail to Class 1 Railroads and Transit Properties.

1. Bonded Insulated Joints shall be fabricated in a shop facility by the Insulated Joint fabricator.

PART T2 - MATERIALS

T2.01 BONDED INSULATED JOINTS

A. Provide insulated joints of the plug type sized and configured with the requirements of AREMA Manual for Railway Engineering, Chapter 4, Part 3 and this Technical Special Provision.

1. All bonded insulated joints shall be factory bonded insulated IJ plugs. The use of field fabricated or "kit" insulated joints are not acceptable.

B. Provide 36 inch long, toeless joint bars of head free design, compatible for use with 115RE rail.

1. Joint bar material shall be heat-treated carbon steel, quenched carbon steel, in accordance with the AREMA Manual, Chapter 4 Rail, Part 3 Joining of Rail, Section 3.2 Joint Bars and Assemblies, and Section 3.3 Rail Drillings, Bar Punchings, and Bolts.

C. Provide joint bars to receive six 1-1/8 inch diameter bolt holes.

D. Provide joint bars that make full web contact.

E. Make inside face of bars having prebonded insulating material smooth with no stamping or branding.

F. Provide 3/16 inch insulated end posts that project at least 1/4 inch below the base of the rail.

G. Provide heat treated carbon steel track bolts, lock washers and nuts in accordance with the insulated joint bar manufacturer's recommendations, and in accordance with AREMA Manual, Chapter 4 Part 3.

H. Quench and Temper joint bars of carbon steel in accordance with AREMA specifications.

I. Insulating Material: High pressure, laminated design, impervious to oil, grease, and water, and having electrical characteristics equal to or greater than fiber insulation meeting requirements of the AAR Manual, Part 14.5.1, and electrical resistance test as specified.

J. Bonded Joint Adhesive: A minimum lap shear strength of 3,500 psi at 75ºF when tested in accordance with ASTM D1002, with a shelf life of one year when stored at a location where temperature may vary from 40ºF to 110ºF.

K. Tolerances: Bonded insulated joint bar and bonded standard joint bar to conform to:

1. Fishing height: Plus or minus 1/64 inch

2. Length: Plus or minus 1/8 inch

3. Straightness, as determined by a 36 inch straightedge: Plus or minus 1/32 inch

4. End post thickness: Plus or minus 1/64 inch

5. Projection below base of rail: Plus or minus 1/16 inch

6. Bolt hole location: As indicated.

T2.02 TIE PLATES

A. Provide new double shoulder tie plates in accordance with AREMA Manual, Chapter 5, Part 1:

1. Figure 5-1-6. Plan No. 8 – AREMA 14 Inch Tie Plate for 5-1/2 Inch Rail Base Width

2. Figure 5-1-10. Plan No. 20 – AREMA 15 Inch Tie Plate for 5-1/2 Inch Rail Base Width

B. Manufacture tie plates in accordance with AREMA Manual, Chapter 5, Part 1.

T2.03 CUT SPIKES

A. Provide new cut spikes in accordance with the AREMA Manual, Chapter 5, Part 2.

1. Provide 6 inch track spikes

T2.04 RAIL ANCHORS

A. Provide new rail anchors in accordance with CFRC Common Standards DWG NO: 135010 Bar Stock Anchor For 5-1/2" and 6" Base Rail.

B. Provide anchors to match rail size used.

PART T3 - EXECUTION

T3.01 LOADING AND SHIPPING

A. Handle transport and store material in a manner which does not damage the material. Replace material damaged at no additional cost to the Department.

PART T4 - MEASUREMENT AND PAYMENT

T4.01 MEASUREMENT

A. No separate measurement shall be made for Work required under this Technical Special Provision.

T4.02 PAYMENT

A. No separate payment shall be made for the Work required under this Technical Special Provision. All costs in connection therewith will be considered Included in the lump sum bid for the Project.

SECTION T-24521
RAIL WELDING

PART T1 - GENERAL

T1.01 DESCRIPTION

A. Work specified in this Technical Special Provision consists of fabricating continuous welded rail (CWR) by electric flash butt welding process and connecting CWR strings by either flash butt welding method or exothermic thermite welding method.

T1.02 QUALITY ASSURANCE

A. Develop and maintain a quality control program for fabrication, handling, and installation of CWR that regulates methods, procedures, and processes to ensure compliance with the project quality program.

B. Welding Products Quality:

1. Check quality of gas used for thermite welding pre-heating to insure even temperatures are maintained during pre-heating.

2. Use only welding products which have passed the manufacturer's quality programs, have been handled and stored in accordance with the manufacturer's recommendations, and have not passed their expiration date.

C. Welding Supervisor Qualifications:

1. Perform thermite rail welding under the direct supervision of a welding foreman who has been qualified by the manufacturer of the products used to perform thermite rail welding, and who has a minimum of 5 years' experience in producing thermite type rail welds.

2. Perform flash butt welding under the direct supervision of a welding foreman qualified by the management of the welding service, and who has a minimum of 5 years' experience in the operation and maintenance of the specific equipment to be utilized for the Work.

D. Qualification Welds:

1. At the Manufacturer's expense, a certified independent laboratory acceptable to the Engineer will test sample flash butt and thermite welds and will provide the certified test results as indicated in this Technical Special Provision.

2. Prepare and test samples of rail welds in accordance with the requirements specified in this Technical Special Provision.

a. The Engineer may waive sample weld testing provided that the Manufacturer presents information that documents that the welding processes and crews proposed for this Work have passed such testing within a 12 month period immediately preceding the commencement of rail welding operations. Such waivers will be granted at the Engineer's sole discretion.

3. To qualify the welding process prior to beginning welding, prepare six qualification weld samples for each machine and crew using the flash butt welding machine, and four qualification welds for each process and crew using the field thermite welding process. Include documentation procedures, and operators proposed to perform the Work in this Technical Special Provision.

a. In each qualification weld sample, join two pieces of rail each a minimum of 30 inches in length. Manufacturer shall furnish rail.

b. To qualify the welding process, provide the number of qualification weld samples for each of the following combinations:

i. Two qualification weld samples joining standard rail to standard rail.

ii. Two qualification weld samples joining premium rail to premium rail (flash butt process only)

iii. Two qualification weld Samples joining premium rail to standard rail

4. Rail Straightness: Check the rail for end straightness before welding. Straight edge both ends and tops of rail using a 36 inch straightedge and a metal taper gage. Do not use rails which exceed the tolerances identified in the AREMA Manual, Chapter 4, Part 2, Section 2.1.3.

5. Make test welds in the presence of the Manufacturers Quality Staff, using the same method and procedure proposed for production welding, including methods and procedures for cut out and re-welding of rejected welds.

6. Once a welding machine has successfully completed qualification testing, no further qualification testing is required for additional mobilizations providing that the welds are performed using the same calibration, settings and operator or supervisor as was used for successful qualification testing.

7. Each welder operator shall make a test weld in the presence of the Manufacturers quality staff, using the same procedure proposed for welding. Welds shall pass production weld inspection criteria, as described in this Technical Specification. Lead welders and welding foreman must have a minimum of 5 years' experience performing the welding types that are to be utilized.

8. When a welding machine is returned to production after a period of malfunctioning or major repair, or when welding crew is replaced, six additional test welds will be required. Acceptance of the welding machine or the new crew shall be after six acceptable qualification welds have been produced.

9. If any of the qualification weld tests for qualification weld samples are found to be unacceptable, make necessary alterations to the procedure and equipment and repeat the qualification weld testing procedure.

10. Do not begin production welding with a machine and crew until all three types of qualification weld samples made by that machine and crew at the same time produce acceptable test results.

E. Qualification Weld Testing:

1. Visually examine all of the test welds for cracks.

2. Ultrasonic testing:

a. Ultrasonically test each weld using a weld technician holding an ASNT NDT, Level II certification to ultrasonically test each weld in accordance with ASTM E164.

b. Scan the rail in a zigzag pattern to scan the full rail weld at a scanning level of plus 20dB minimum, twisting the probe on one side of the weld only, and at a rate not exceeding 6 inches per second.

c. When a reflection of greater amplitude than the acceptance criteria listed in Table T1.02-1 is found, scan the full perimeter of the weld from both sides to ensure full weld coverage and determination of the discontinuity size, type, and location.

Table T1.02-1					
Minimum Acceptance Levels (Decibels) Weld Thickness (in.) and Transducer Angle					
Reflector	5/16" To 3/4"	3/4" to 1-1/2 "	1-1/2" to 2-1/2"	2-1/2" to 4"	4" to 6"
Severity	70 degrees	70 degrees	70 to 45 degrees	70 to 45 degrees	70 to 45 degrees
Large Reflectors	plus 8	plus 3	plus 1 to plus 4	minus 4 to plus 1	minus 7 to minus 2
Small Reflectors	plus 9	plus 4	plus 1 to plus 6	minus 2 to plus 3	minus 5 to 0
Minor Reflectors	plus 10	plus 5	plus 3 to plus 8	0 to plus 5	minus 3 to plus 2

3. Magnetic Particle testing:

a. Perform magnetic particle testing using the coil method (longitudinal magnetization) and applying the dry powder method described in ASTM E709.

b. Acceptance criteria:

i. The weld must be homogeneous and free from defects, surface irregularities, and internal discontinuities as indicated by particles forming a regular longitudinal pattern.

4. Brinell Hardness testing:

a. Longitudinally section the rail along the centerline of rail web for a distance of 6 inches on each side of the weld and test for Brinell Hardness.

b. Test the longitudinal sectioned face for hardness at points on a grid pattern commencing 1/4 inch below top of rail in 1/2 inch increments for 2 inches on each side of the centerline of the weld, and on a grid pattern of 1 inch increments beyond the heat affected weld zone until the hardness is that of the original parent metal. Test each weld for hardness in accordance with ASTM E10.

c. Acceptance criteria:

i. The acceptable hardness range shall be plus or minus 30 BNH of the parent rail.

5. Slow Bend testing:

a. From each of the three different combinations of qualification weld samples, select one of the two samples made for that combination after it has passed the ultrasonic testing and subject it to the slow bend test described in the AERMA Manual, Chapter 4, Part 3, Section 3.10.3.6 Slow Bend Test.

b. All welds shall meet or exceed the appropriate requirements shown in the AREMA Manual, Chapter 4, Section 3.10, Table 4-3-15, "Weld Requirements".

6. Should any sample welds fail to satisfy the specified requirements, the Engineer reserves the right to reject either the welding process and/or the welding crew, for use on the project. Should any supervisor of the welding crew be replaced during the Work, the welding crew shall be re-qualified under the new supervisor.

F. Production Weld Testing:

1. All welds shall also be visually inspected for surface cracks at the time of welding by the Manufacturers QC staff in accordance with AREMA Manual procedures. Any welds with surface cracks shall be rejected.

2. All welds shall be ultrasonically tested in accordance with ASTM E164.

a. At the Manufacturer's expense, all welds shall be tested by a certified independent laboratory acceptable to the Engineer, and the certified test results submitted to the Engineer.

b. Testing shall be performed once the rail has been laid in track and after there will be no further handling of the rail.

c. The following equipment shall be used for ultrasonic testing:

i. Ultrasonic, pulsed echo, instrument normally used for inspection of rails with calibrated decibel gain control of minimum 2 dB increments, operating in the range 1.0 to 5.0 MHz, with CRT screen and scale. Equipment shall be capable of detecting a 3/64 inch discontinuity 6-1/2 inch below top of rail.

ii. Calibrated paper tape recording attachments to record accurately the CRT screen display when a non-complying weld is located.

iii. 2.25 MHz angle beam transducers 1/2 inch x 1 inch at 70 degrees and 45 degrees.

iv. Suitable high viscosity couplants of good wetting characteristics.

v. Standard IIW calibration blocks of rail steel for primary reference response and to construct distance amplitude correction curve, and DSC Blocks of rail steel for calibration checks.

vi. A calibration rail approximately 18 inches long with a 3/64 inch diameter round bottom hole 6-1/2 inches below top of rail and in which other 1/8 inch diameter flat bottom hole patterns have been drilled.

d. Incorporate the following in the test procedure:

i. Scanning level shall be plus 20 dB minimum.

ii. Scan the rail in a zigzag pattern twisting probe, on one side of the weld only at a rate not exceeding 6 inches per second, so that the full weld is scanned. Each pass will overlap a minimum 10% as the scanning is carried out longitudinally to the rail.

iii. Calibrate the equipment at the start and end of each day's work, and at least every four hours during examination, and hourly checks with DSC blocks. If any point on the distance amplitude curve has been changed by more than 20%, all results since last calibration check shall be void and all welds re-examined. If the curve has moved on the sweep line by more than 5%, all non-complying welds since last calibration check shall be re-examined.

iv. When a reflection of greater amplitude than the acceptance criteria is found, scan around the full perimeter of the weld from both sides, to ensure full weld coverage and determination of size, type, and location of discontinuity.

v. Make permanent trace recording of discontinuity indications.

vi. Paint the rail web on both sides, across the weld, to denote weld not conforming to acceptance criteria.

e. All welds shall be free from defect or flaw giving a reflected display of greater than 20% of distance amplitude correction curve at calibration level, and shall be free

from defect or flaw larger than those allowed by Table T1.02-1 of this Technical Special Provision.

f. Use an ultrasonic test results reporting form that includes:

i. The location of the weld in track

ii. The results of the ultrasonic inspection including size of defects found in the head, web, or base of rail

iii. Shape, identity, and location of all reflections

iv. Trace identity

v. The results of the visual inspection

vi. Name of inspector

vii. Other information as needed including date, weather at time of inspection, unusual conditions, etc.

T1.03 SUBMITTALS

A. Comply with the project submittal procedure.

B. Provide submittals to the Engineer a minimum of one week before starting welding. Provide the following:

1. Project Quality Plan

2. Proposed welding plant site submissions

a. Prepare a plan showing the proposed location and layout of flash butt welding plant including methods of transporting materials and equipment to the site, types and locations of environmental controls, and duration of welding operations.

b. Present the method of handling CWR strings from the welding plant to the track including intermediate storage requirements.

3. Submit a schedule of lengths of rail strings to be fabricated as specified in Technical Special Provision T-24530 Construct Welded Rail Track on Timber Ties.

a. Assign each CWR string an alphanumeric identification that designates its final location in finished track. Indicate which strings or which portions of strings will be premium rail on the CWR schedule. If any strings are to be cut in the field, indicate the locations of the proposed cuts on the schedule. Indicate the location of insulated joints and the location of welds between insulated joint plug rails and CWR strings. Indicate whether individual welds will be a thermite weld or flash butt weld. Illustrate that welds in opposite rails will not occur at prohibited locations.

b. Design the CWR schedule to minimize the number of thermite welds and minimize the generation of short rails. Assure minimum rail length is not less than as specified in Technical Special Provision T-24520 Running Rail.

i. Include summary of information recorded on tape, description of irregularities, if any, in rail and welds, and whether welds satisfy the requirements of this Technical Special Provision.

4. Submit flash butt welding machine performance standards as provided by the manufacturer.

a. During production, attach a recorder to each welding machine to record platen movement and current impulses.

b. Submit a record of machine performance for each weld. If the record indicates performance which is not in conformance with the accepted standards, the weld will be considered defective and will be rejected.

5. Flash Butt Weld Submittals:

a. Submit the following:

i. Procedure for welding rail.

ii. Procedure for finishing welds.

iii. Certificate of qualification from flash butt welding machine manufacturer that welding crews are qualified to perform flash butt welding and production Quality Control inspection and testing.

iv. Complete records of flash butt welding including reports of magnetic particle testing conducted. Identify in reports any defective welds that were found and cut-out.

6. Thermite Weld Submittals:

a. Submit a detailed specification of the proposed method and procedure. Incorporate the requirements and recommendations of both the weld kit manufacturer and the specific requirements of this Technical Special Provision in the method and procedure specified. Submittals that include manufacturer's literature only will be rejected. Include details of the following operations in the procedure:

i. Certificate of qualification from thermite welding kit manufacturer that the thermite welding foreman is qualified to perform the thermite welding and production Quality Control inspection. Submit a written description of welding abilities, showing compliance with the requirements of Part T1.02 of this Technical Special Provision, including a list of similar completed projects with references.

ii. Record of thermite welds: Maintain a complete and current record of all thermite welds and their locations. Show all information required in this Technical Special Provision in the record and submit it on forms similar to the exhibit at the end of this Technical Special provision. Submit only original field records and not data that has been transcribed onto clean sheets back in the office. Forms shall be initialed by the welding foreman and by the Engineer if present at the time of welding.

iii. Preparation for rail welding.

iv. Rail end spacing, tolerances, and procedures to maintain rail gap during the welding operation.

v. Method and equipment for maintaining rail alignment during welding.

vi. Placing and bolting of prepared molds.

vii. Preheating of rail, including method, temperature, and time.

viii. Crucible tapping and procedures including duration of weld and cooling time.

ix. Trimming and grinding of the weld.

x. Method for removing gates and risers.

xi. Manufacture's data concerning the welding process.

7. Testing and Inspection Submittals required:

a. Results of qualification welds as described in Part T1.02 of this Technical Special Provision.

b. Certification of the qualifications of the testing laboratory service that will conduct ultrasonic testing.

c. Ultrasonic inspection procedure, quality control procedures equipment description and calibration methods.

d. Method of dry powder magnetic particle inspection, including calibration methods and quality programs.

e. Magnetic movement and current impulses for each weld.

f. Magnetic particle inspection records

g. Ultrasonic inspection records of each weld for inspections conducted prior to installation.

h. Inspection records of each weld for straightness as per AREMA requirements.

i. Records documenting daily calibration of ultrasonic inspection equipment.

j. Methods for testing rail alignment and quality.

8. Miscellaneous Submittals required:

a. Description of method of rail end alignment

b. Method of straightening any rails that do not comply with AREMA straightness criteria identified in the AREMA Manual, Chapter 4 Rail, Part 3 Joining of Rail, Section 3.11, Specification for Fabrication of Continuous Welded Rail.

c. Procedure for defective weld cut out and re-welding.

d. Qualification for ultrasonic test personnel.

e. Test results for qualification tests as specified in Part T1.02 of this Technical Special Provision.

T1.04 REFERENCE STANDARDS

A. American Railway Engineering & Maintenance of Way Association (AREMA):

1. Manual for Railway Engineering, Chapter 4, Part 3.

B. ASTM International (ASTM):

1. ASTM E10 Standard Method for Brinell Hardness of Metallic Materials

2. ASTM E164 Standard Practice for Contact Ultrasonic testing of Weldments

3. ASTM E709 Standard Guide for Magnetic Particle Testing

C. American Welding Society:

1. AWS D1.1/D1.1M Structural Welding Code - Steel - 22nd Edition; Incorporates Errata: 10/2011; Second Printing

T1.05 REFERENCE SECTIONS

A. Technical Special Provisions:

1. Technical Special Provision T-24520 Running Rail

PART T2 - MATERIALS

T2.01 RUNNING RAIL

A. Provide running rail in accordance with Technical Special Provision T-24520 Running Rail

T2.02 FIELD RAIL WELDING KITS

A. Furnish thermite welding kits in accordance with CFRC MWI 801 Welding Manual Section B.

1. Furnish welding kits for joining standard strength rail sections and standard strength rail sections to premium rail sections.
    a. The Brinell Hardness Number (BHN) in the weld area and the adjacent heat affected zones at the 1/4 inch depth shall be within a range of plus or minus 30 BHN of the parent rail. Where premium rail is present, the premium rail BHN shall be the determining factor.

T2.03 TRACK TOOLS

A. The Manufacturer shall utilize the following tools which represent the standard of quality expected for selected tools used in this Work:
    1. Taper Gauge
    2. Straightedge: Steel, 3 feet long and 14 inches long
    3. Rail Saw
    4. Rail Shear
    5. Rail Alignment Beam
    6. Ultrasonic Tester
    7. Rail Profile Grinder for Finishing Rail Profile at Welds

PART T3 - EXCECUTION

T3.01 GENERAL

A. Do not commence production welding until the test welds have been successfully completed and approved by the Engineer.

B. Unless otherwise indicated by approved shop drawings or by the Engineer, weld all rail joints in the final condition.

C. Provide CWR in minimum lengths of 1,400 feet.

D. Construct CWR with the rail stamping on the same side.
    1. The side selected shall be consistent throughout the entire Contract.

E. Identify each string of CWR in accordance with Part T1.03 of this Technical Special Provision. Reference track name, rail type, engineering stationing of CWR ends, and location of rail - left hand or right hand position as determined by the direction of increasing stationing.
    1. Make markings with a paint that is suitable for application to steel and is weather resistant.
    2. Mark the location of planned field cuts in CWR.
    3. Identify welds where rails of different strengths were joined.

F. Cut all rail square with a rail saw. Cutting rail with a torch is not permitted.

G. Align adjoining rail ends to match the top of rail heads at the gage of face of rail.

H. Perform and submit testing as indicated in Parts T1.02 and T1.03 of this Technical Special Provision.

T3.02 CONSTRUCT CWR

A. Construct individual CWR strings using the flash butt method.

B. Use flash butt welding or thermite welding to construct strings of CWR.

T3.03 FLASH BUTT WELDING

A. Construct CWR using either electric flash-butt welding plant or a mobile rail welding machine such as that operated by Holland Co., Rail Weld Division. Perform flash butt welding in accordance with AREMA Manual, Chapter 4, Section 3.11 Specification for Fabrication of Continuous Welded Rail except as modified by this Section.

B. Preparation work for flash butt welding

1. Immediately prior to welding, wire brush all rail ends as necessary to remove mill scale or other dirt which might hinder the flow of electric current. Grind rail areas in contact with electrodes to remove mill scale and raised rail brands.

2. Assure rail ends show no steel defects, dents, or porosity before welding.

3. Saw or cut mismatched or jagged rail ends with an abrasive rail cutter. Do not mating rail ends by flashing.

4. Remove scale on rails down to bright metal in areas where the welding current carrying electrodes contact the rail. Reject the weld and adjacent rail for a distance clearing the electrodes if in the areas of electrode contact there is not more than 95 percent of the mill scale removed. Examine electrode contact areas for evidence of electrode burn. Where metal is displaced or where the oxidized areas exhibit checks or small cracks, reject the weld and cut back the rail clear of the electrode burn.

C. Alignment of rail in the welding machine shall be at the head of the rail.

1. Vertical alignment shall provide for a flat running surface. Any difference of height of the rail shall be in the base.

2. Horizontal alignment shall normally be accomplished in such a manner that any difference in the width of heads of rails shall be divided equally on both sides of the head. Where the difference, when divided, exceeds 0.040 inches the gauge side will be aligned allowing any differences in the width of heads to occur on the field side.

3. In any case horizontal offsets shall not exceed 0.040 inch at the end and 1/8 inch at the base.

D. Flash Butt Welding:

1. Forge welds to point of refusal to further plastic deformation and shall have a minimum upset of 1/2 inch, with 5/8 inch as standard. Shear off the upset weld metal while weld is still hot.

2. If flashing on electric flash butt pressure welds is interrupted with less than 1/2 inch of flashing distance remaining before upsetting due to malfunction or external reason, re-clamp the rails in the machine and initiate flashing again.

3. Post-straightening may be permitted if surface of weld is above 500ºF.

4. Do not quench weld metal.

5. Use a chart recorder to monitor all significant welding parameters. Identify each weld in each string on the recording. In addition, number each string at both ends with paint and include this number on the recording to indicate the beginning and ending of each CWR string. Calibrate each recorder employed daily. Submit recordings to the Engineer at the time the welded rail is released for installation.

6. Re-welds shall be cut out by saw or by an abrasive rail cutter. Torch cutting of rail ends shall not be permitted.

E. Finish Grinding:

1. Do not exceed plus or minus 0.005 inch of the lowest rail for a finishing deviation of the parent section of the rail head surface.

2. Finish the sides of the rail head weld to plus or minus 0.010 inch of the parent section. Finish the top and bottom of the rail base to within 0.010 inch of the lowest rail.
3. Finish the web zone including the underside of the head, the web, and both fillets on each side to within plus 0.090 inch to minus 0.010 inch of the parent section. Finish grind to eliminate all cracks.
4. Whenever possible, grind immediately following welding at an elevated temperature. When grinding must be done at ambient temperature, take care to avoid grinding burns and metallurgical damage.
5. Eliminate notches created by minor offset conditions, twisted or misshapen rails by minimum grinding to blend the variations.
6. Remove fins on the weld due to grinding or shear drag prior to final inspection.
7. Surface Misalignment Tolerance
    a. Do not exceed 0.040 inch per foot of combined vertical offset and crown camber at ambient temperature as required by the AREMA Specification. Neither component shall exceed 0.020 inch.
    b. Welds displaying dip camber as indicated by the AREMA Specification will be rejected.
    c. If, at any time, 7 or more of a series of 12 consecutive welds made on one machine exceed 75 percent of the stated surface misalignment tolerances, shut down that machine and adjust before Work continues.
    d. Gauge Misalignment Tolerance: Do not exceed 0.040 inch per foot combined horizontal offset and horizontal kink camber at ambient temperature as required by the AREMA Specification.
8. Hardness:
    a. The hardness of the weld measured on the head of the rail in the center of the weld shall be equal to the Brinell hardness of the parent metal with a tolerance of plus or minus 30 Brinell hardness numbers. One pressure weld out of each 30 will be selected at random by the Construction Manager for Brinell Hardness testing by the Manufacturer's testing laboratory.
9. Identifying Flash Butt Welds in Rail Strings:
    a. At the completion of welding each string of CWR, submit a record documenting production of the string. Include the sequential heat numbers of each piece of rail in the string, the number of welds in the string, a clear identification of welds which have been cut out and re-welded, a record of machine performance for each weld, and reports for all magnetic particle testing. Bind reports in pad or notebook form for ease of handling and retention as permanent record.

T3.04 THERMITE RAIL WELDING

A. Perform thermite rail welding in accordance with CFRC MWI 801 Welding Manual Section I.
    1. Only weld premium rail to a premium rail by the flash butt method.

T3.05 WELD TESTING AND INSPECTION

A. Test and inspect all welds in accordance with Part 1.02 F of this Technical Special Provision.
    1. Replace all defective welds at no additional cost to the Department.

2. Cut out and re-weld welds rejected during inspection or testing if possible, or replaced with at least 19 foot 6 inches (nominal) plug rail welded in place by two welds as specified herein.

PART T4 - MEASUREMENT AND PAYMENT

T4.01 MEASUREMENT

A. No separate measurement shall be made for Work required under this Technical Special Provision.

T4.02 PAYMENT

A. No separate payment shall be made for the Work required under this Technical Special Provision. All costs in connection therewith will be considered Included in the lump sum bid for the Project.

Central Florida Rail Corridor

Maintenance of Way Instructions

Central Florida Rail Corridor

MWI 401-02

Timber Crosstie and
Switch Tie Requirements
Issued: 12/9/13
Revised: 3/6/15

PURPOSE: To provide uniform Timber Crosstie and Switch Requirements.

LOCATION: All CFRC tracks.

I. DISCUSSION

The CFRC Timber Crosstie and Switch Tie Requirements have been revised and redesigned as MW-99001 and attached.

Prepared by: RMW

Approved by: Miguel Torres
Miguel Torres - CFRC Chief Operating Officer

Timber Crosstie and Switch Tie

Procurement Requirement

1.0 **Scope** – This procurement requirement establishes the minimum detailed technical requirements for Timber Crossties and Timber Switch Ties for use by the Department. It is the Department's desire to enter into a long-term contract with suppliers of quality timber crossties and timber switch ties. The suppliers governed by this requirement, shall have or establish a quality system that complies with and is certified to the requirements set forth in the AAR Specification for Quality Assurance, M1003 (AAR M-1003), or International Quality Standard ANSI 9000 Series (ISO 9001).

1.1 **Crosstie & Switch Tie Description** – Timber crossties and switch ties are used to secure, anchor and support rail, switch, and other track equipment. As such, the consistent quality of crossties and switch ties is of the utmost importance to the Department for safety and track reliability. The crossties and switch ties acquired under this requirement shall be used to meet CFRC field requirements for initial installation at new construction locations, replacement at existing sites, and also for modification at existing locations. Crossties and switch ties acquired for use by the Department shall as a minimum meet the material quality, dimensional, and processing requirements of sections 3, 4, and 5 of this requirement as directed and applied by the contract.

1.2 **Requirements Rating Criteria** – Assignment of requirement importance shall be designated by one of the following:

(C) – Critical Characteristic

(M) – Major Characteristic

(I) – Incidental Characteristic

This requirement covers two types of ties, timber crossties and timber switch ties. As such, in certain instances, functional requirements specified herein may not be applicable to a particular product. In those cases, the supplier shall respond to the requirement as being not applicable, and explain why it is not. In other instances, in lieu of a defined requirement, this requirement may ask for data, or a description for relative comparison.

2.0 **Applicable Documents** – The latest issue of the following document forms a part of this requirement to the extent specified herein:

- Applicable Federal, State, and local Regulations

In the event of a conflict between the document referenced here and the detailed content of section 3, 4, and 5, the detail requirements of sections 3, 4, and 5, shall be considered the superseding requirements.

3.0 **Requirements (C)** –

3.1 **General (I)** – The information and requirements included in this section are applicable to timber crossties and switch ties as specified in sections 3.2 and 3.3 respectively of this document.

3.1.1 **Definitions** –

a) **Decay** – Decay is the disintegration of wood substance material due to the action of destroying fungi. "Blue Stain" shall not be considered as decay and is permissible in any wood used for ties.

b) **Rot** – Is the decomposition of wood, which occurs due to age, decay, or chemical disintegration.

c) **Holes** – Within the rail bearing area, a large hole is one more than 1/2 inch in diameter and 3 inches deep. Outside the rail bearing area, a large hole is one which is 1/4 the width of the surface on which it appears and 3 inches deep. Numerous holes are any number equaling a large hole in damaging effect. Such holes may be caused in manufacture or otherwise.

d) **Knots** – Within the rail bearing area, a large knot is one having an average diameter more than 1/3 the width of the surface on which it appears; but such a knot will be allowed if it is located outside the rail bearing area. Numerous small knots equaling the diameter of a large knot in damaging effect shall equate to a large knot and shall have the same limitations.

e) **Shake** – A shake is a separation along the grain, most of which occurs between the rings of annual growth (see Figures A, B, & C below).

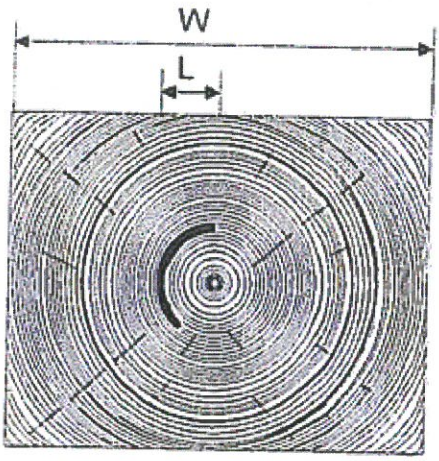


Fig. A

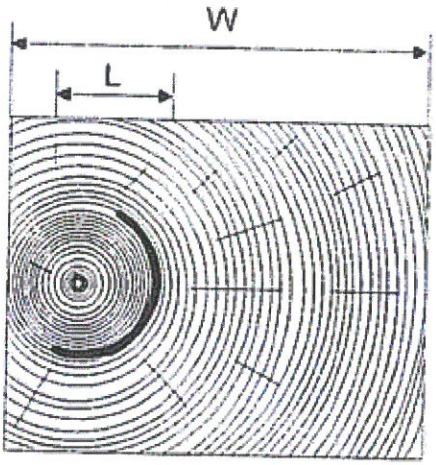


Fig. B

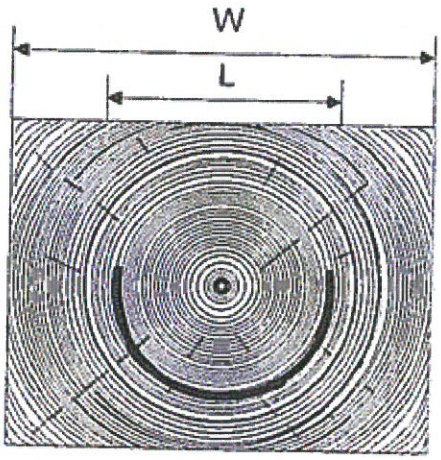


Fig. C

The procedure illustrated in the above diagrams shall be used in determining the length of the shake. One which is not more than 1/3 the width of the tie shall be allowed, provided it does not extend nearer than 1 inch to any surface. Multiple ring shakes shall not be allowed.

f) **Split** – A split is a separation of the wood extending from one surface to an opposite or adjacent surface.

1) In unseasoned ties, a split no more than 1/8 inch wide and/or 4 inches long is acceptable when antisplitting devices have been applied and the tie is brought back to its original sawn dimensions.

2) In a seasoned tie, a split no more than 1/4 inch wide and/or longer than the width of the face across which it occurs is acceptable when antisplitting devices have been applied and the tie is brought back to its original sawn dimensions.

3) Multiple splits of no more than a three way split are acceptable.

4) In no instance will a tie be considered acceptable when a split extends into the rail bearing area.

g) **Checks** –

1) **For procurement of seasoned ties:** A check is a "V" shape groove in a tie similar to a cut made with an ax. A check is acceptable provided it is not more than 3/8 inch wide, the depth not greater than 1/2 the thickness of the tie, and does not extend into the rail bearing area.

2) **For treatment of seasoned ties:** A check is acceptable provided it is not more than 1/2 inch wide, the depth not greater than 1/2 the thickness of the tie, and does not extend into the rail bearing area.

h) **Bark Seams** – Bark seams will not be acceptable if they appear in the rail bearing area. A bark seam or pocket is a patch of bark partially or wholly enclosed in the wood. Bark seams will be allowed provided they are not more than 2 inches below the surface and/or 10 inches long.

i) **Wood Destroying Insect Infestation** – A wood destroying insect infestation is the presence of insects known to destroy wood and other cellulose materials, such as termites, carpenter ants, etc. If an infestation exists, the type of insect will be identified. If termites are detected, the identification must distinguish between Formosan Subterranean termites, and other termite species.

1) All ties shall be inspected for and protected from infestation.

2) If an infestation is found, the tie is not acceptable for use on CFRC.

3) Ties infected with other than Formosan Subterranean Termites will be disposed of in an appropriate manner determined by the supplier.

4) Ties infested with Formosan Subterranean Termites shall be treated to kill the termites and disposed by burning in an environmentally appropriate facility.

j) **Slanting Grain** – Except in woods with interlocking grain, a slant in grain in excess of 1 in 15 will not be permitted, and/or if present in rail bearing area.

k) **Excessive Wane** – Examples of this defect have been

termed in the industry as "Saddlebacks" and "Sledruners". These conditions in ties shall not be considered acceptable and are illustrated and further defined below.

1) **Saddlebacks** – Saddlebacks between the rail base area will not be accepted if lack of face is more than 1/2 the width (see Fig. D, below).

2) **Sledrunner** – A sledrunner appearing on the end of a tie will not be accepted if lack of face is more than 1/2 the thickness and more than 3 inches from end of tie (see Fig. E, below).

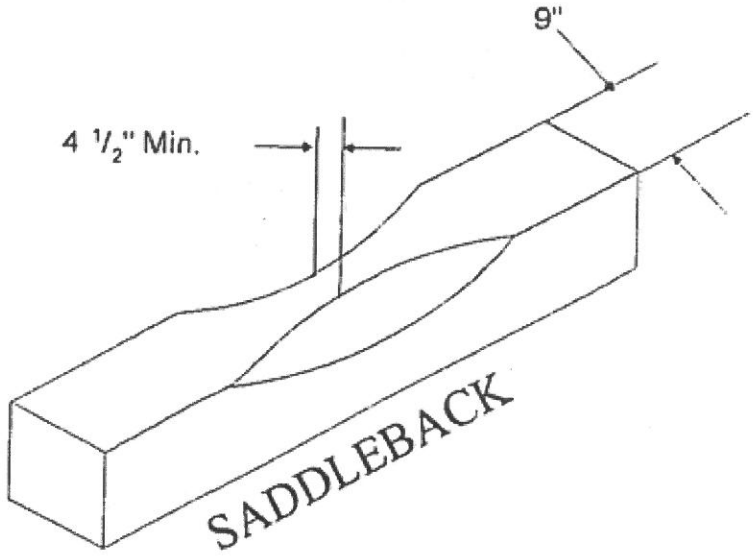


Fig. D

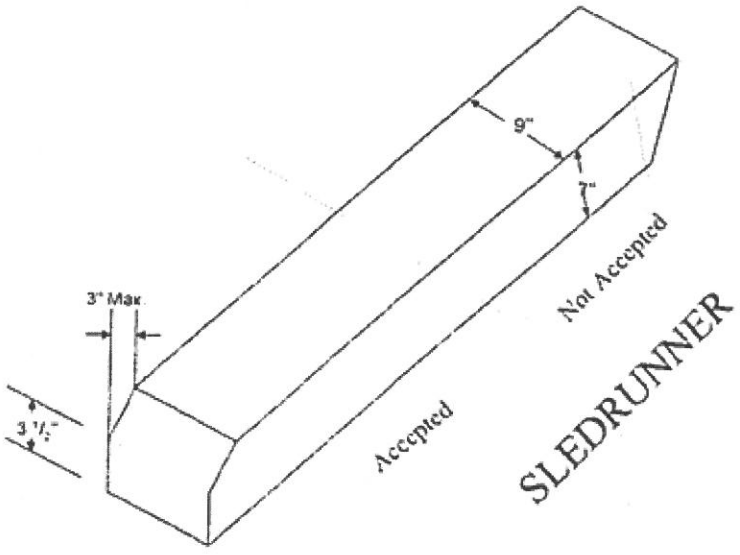


Fig. E

3.2 **Timber Crossties Requirements (C)** –

3.2.1 **Acceptable Materials (C)** - The following types of wood shall be acceptable for the manufacture of timber crossties:

a) Ash
b) Beech
c) Birch
d) Cherry
e) Elm
f) Gum
g) Hackberry
h) Hickory
i) Locust
j) Maple
k) Mulberry
1) Oak {see 3.4.1, b) , 5) }
m) Sassafras
n) Walnut

3.2.2 **Physical Requirements(C)** – Except as hereinafter provided, all crossties shall be free from any defects that may impair their strength or durability as crossties, such as decay, rot, large splits, large shakes, slanting grain, large or numerous holes, or knots.

3.2.2.1 **Manufacture** –

a) All timber crossties shall be straight, well hewed or sawed, cut square at the ends, have bottom and top parallel and the bark entirely removed.

b) Alltimber crossties (see 3.2.2.2 for normal dimensions) shall be considered straight when:

1) A straight line along the top from the middle of one end to the middle of the other end lies more than two inches from either side, **and**

2) A straight line along a side from the middle of one end to the middle of the other end lies more than two inches from the top and the bottom of the tie.

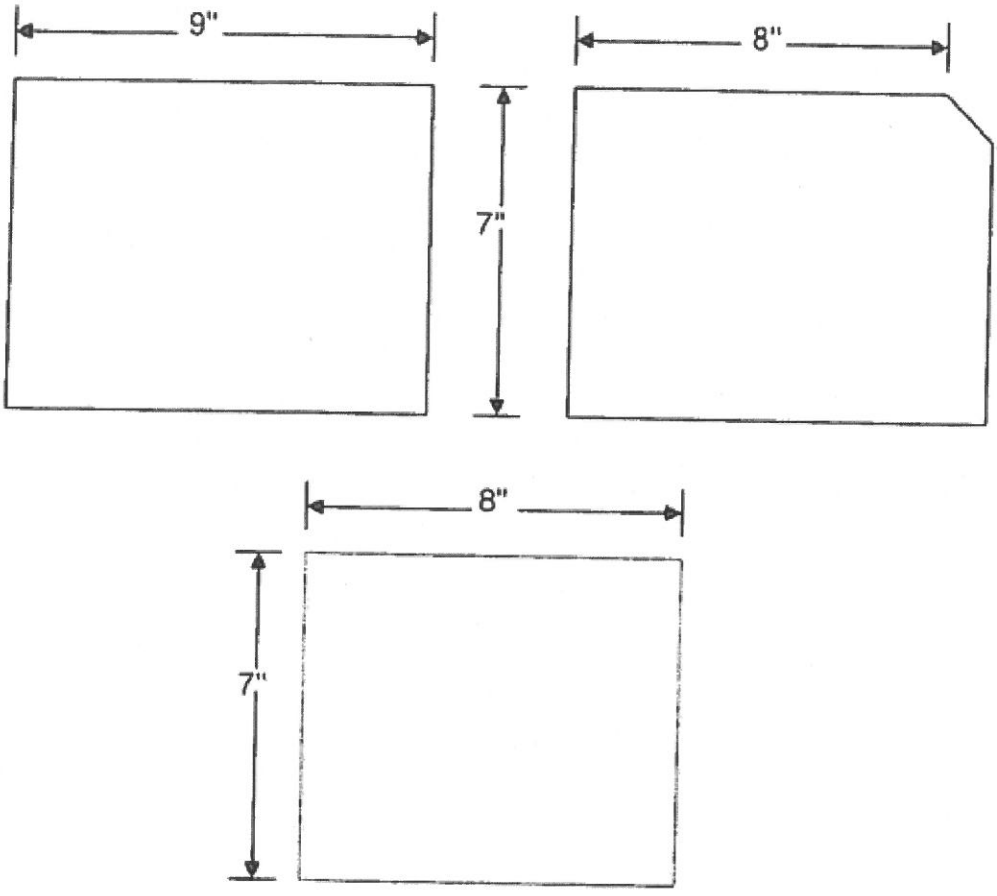
c) A tie is not well hewed or sawed when its surfaces are cut into with score marks more then 1/2 inch deep or when its surfaces are not even.

d) The top and bottom of a tie will be considered parallel

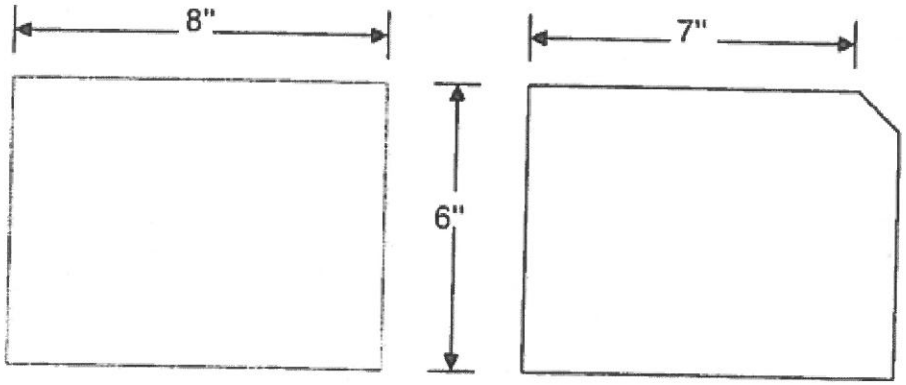
if any difference in the thickness at the ends does not exceed 1/2 inch.

e) The following size categories shall apply for 7" and 6" crossties :

7" GRADE CROSSTIES



6" GRADE CROSSTIES



1" OF WANE ALLOWED - 20% SQUARE

7" X 8" ALLOWED

3.2.2.2 **Dimensions** –

a) Except as hereinafter provided, crossties shall measure as follows throughout the rail bearing area. The rail bearing areas as used here and hereafter are defined as those sections of the tie between 20" and 40" from the middle (11" and 31" from its end):

   1) Grade 5 – 7" x 9" x 8' 6" Minimum 8" face

   2) Grade 4 – 7" x 9" x 8' 6" Minimum 7" face

   3) Grade 4 – 7" x 8" x 8' 6" Minimum 7 – 1/2" face – Maximum 2 %

   4) Grade 3 – 6" x 8" x 8' 6" Minimum 7" face

b) Ties more than 1 inch longer or shorter than required shall be rejected.

c) The thickness and widths specified are minimums for the required sizes.

d) Ties over 1 inch longer, thicker, or wider than the required size ordered shall be rejected.

e) All thickness and widths shall apply to the sections of the tie between 20 inches and 40 inches from the middle of the tie.

f) All determinations of widths shall be made on the top of the tie, which is the narrower of the horizontal surfaces, or the one with no heartwood if both horizontal surfaces are of the same width.

g) In seasoned ties, thickness and width requirements shall be considered met if not more than 1/4" scant of those specified.

3.2.2.3 **Malformation Tolerances** –

3.2.2.3.1 **Decay** – Crossties with decay shall not be acceptable for use or purchase by the Department (See para. 3.1.1, a).

3.2.2.3.2 **Rot** – Crossties with rot shall not be acceptable for use or purchase by the Department (see para. 3.1.1, b).

3.2.2.3.3 **Holes** – Crossties with large holes or several small holes with diameters equaling a large hole shall not be acceptable for use or purchase by the Department (see para. 3.1.1, c).

3.2.2.3.4 **Knots** – Crossties with large knots or several small knots equaling to a large knot within the rail bearing area shall not be acceptable by the Department (see para. 3.1.1, d).

3.2.2.3.5 **Shakes** – Crossties with a shake no greater than 1/3 the width of the tie and not nearer than 1 inch to any surface shall be allowed. Multiple ring shakes shall not be allowed (see para 3.1.1, e).

3.2.2.3.6 **Splits** – Crossties with acceptable splits as defined in para. 3.1.1, f) shall be allowed.

3.2.2.3.7 **Checks** – Crossties with acceptable splits as defined in para. 3.1.1, g) shall be allowed.

3.2.2.3.8 **Bark Seams** – Crossties with acceptable bark seams as defined in para. 3.1.1, h) shall be allowed.

3.2.2.3.9 **Slanting Grain** – Crossties with acceptable slanting grain as defined in para. 3.1.1, i) shall be allowed.

3.2.2.3.10 **Excessive Wane** – Crossties with acceptable saddlebacks as defined in para. 3.1.1, j) shall be allowed. Crossties with acceptable sledrunners as defined in para. 3.1.1, j) shall be allowed.

3.2.2.3.11 **Wood Destroying Insect Infestation** – Crossties with wood destroying insect infestation shall **not** be acceptable for use or purchase by the Department. See para. 3.1.1, i) for disposition instructions.

3.3 **Timber Switch Tie Requirements (C)** –

3.3.1 **Acceptable Materials (C)** – The acceptable types of wood for switch ties are:

a) Oak {see 3.4.1, b), 5)}

b) Black gum

c) Red gum – provided heartwood does not exceed 50%.

3.3.2 **Physical Requirements (C)** – Except as hereinafter provided, all switch ties shall be free from any defects that may impair their strength or durability as switch ties, such as decay, rot, large splits, large shakes, slanting grain, large or numerous holes, or knots.

3.3.2.1 **Manufacturing** -

a) All timber switch ties shall be straight, clean sawed, cut square at the ends, have bottom and top parallel, and the bark entirely removed except as hereinafter provided.

b) A timber switch tie less than 15 foot long shall be considered straight:

1) When a straight line along the top from the middle of one end to the middle of the other end lies more than two inches from either side, and

2) When a straight line along a side from the middle of one end to the middle of the other end lies more than two inches from the top and the bottom of the tie.

c) A timber switch tie 15 foot long or more shall be considered straight:

1) When a straight line along the top from the middle of one end to the middle of the other end is entirely within the tie, and

2) When a straight line along a side from the middle of one end to the middle of the other end lies more than two inches from the top and the bottom of the tie.

d) A timber switch tie is not well hewed or sawed when its surfaces are cut into with score marks more then 1/2 inch deep or when its surfaces are not even.

e) The top and bottom of a timber switch tie will be considered parallel if any difference in the thickness at the ends does not exceed 1/2 inch.

f) Timber switch ties shall be sawed on four sides.

g) Except as hereinafter provided, timber switch ties shall not be less than 9 inches wide throughout the section between 12 inches from each end of the tie.

3.3.2.2 **Dimensions** –

a) Switch ties shall be 7 inches thick.

b) Switch ties shall be provided in the quantities ordered from the following lengths:

1) 9'– 0"

2) 10'– 0"

3) 11'– 0"

4) 12'– 0"

5) 13'– 0"

6) 14'– 0"

7) 15'– 0"

8) 16'– 0"

9) 16'– 6"

10) 23'– 0"

c) The rail bearing area shall be defined as "the section of the switch tie between 12" from each end of the tie."

d) The lengths, thickness and widths specified are minimums for the required sizes.

e) Switch ties over 1 inch longer, thicker, or wider than the required size ordered shall be rejected.

f) All thickness and widths requirements are minima and apply to the rail bearing area, which is that section of the tie between 12 inches from each end of the tie.

g) A maximum of 1 inch wane is allowed in the rail bearing area on top or bottom of the tie.

h) All determinations of widths shall be made on the top of the tie, which is the narrower of the horizontal surfaces, or the one with no heartwood if both horizontal surfaces are of the same width.

i) In seasoned ties, thickness and width requirements shall be considered met if not more than 1/4" scant of those specified.

3.3.2.3 **Malformation Tolerances** –

3.3.2.3.1 **Decay** – Switch ties with decay shall not be acceptable for use or purchase by the Department (See para. 3.1.1, a).

3.3.2.3.2 **Rot** – Switch ties with rot shall not be acceptable for use or purchase by the Department (see para. 3.1.1, b).

3.3.2.3.3 **Holes** – Switch ties with large holes or several small holes with diameters equaling a large hole shall not be acceptable for use or purchase by the Department (see para. 3.1.1, c).

3.3.2.3.4 **Knots** – Switch ties with large knots or several small knots equaling to a large knot within the rail bearing area shall not be acceptable by the Department (see para. 3.1.1, d).

3.3.2.3.5 **Shakes** – Switch ties with a shake no greater than 1/3 the width of the tie and not nearer than 1 inch to any surface shall be allowed. Multiple ring shakes shall not be allowed (see para 3.1.1, e).

3.3.2.3.6 **Splits** – Switch ties with acceptable splits as defined in para. 3.1.1, f), shall be allowed.

3.3.2.3.7 **Checks** – Switch ties with acceptable splits as defined in para. 3.1.1, g), shall be allowed.

3.3.2.3.8 **Bark Seams** – Switch ties with acceptable bark seams as defined in para. 3.1.1, h), shall be allowed.

3.3.2.3.9 **Slanting Grain** – Switch ties with acceptable slanting grain as defined in para. 3.1.1, i), shall be allowed.

3.3.2.3.10 **Wood Destroying Insect Infestation** – Switch ties with wood destroying insect infestation shall **not** be acceptable for use or purchase by the Department. See para. 3.1.1, i) for disposition instructions.

3.4 **Tie Processing (C)** –

3.4.1 **Unloading and Inspection (I)** – Ties shall be unloaded and passed through a double-end trim saw, which shall expose

interior defects and assures uniform length for mechanical handling at the plant and subsequently in the field.

a) The inspection shall include both ends and all four sides for possible defects.

b) Either a manual or semi-automatic unloading/ inspection system shall record the grade and specie and route the ties into bays designated as follows:

1) Oak Main Line {see 3.4.1, b) , 5)}

2) Oak Branch Line {see 3.4.1, b), 5)}

3) Mixed Hardwood Main Line {see 3.4.1, b), 5)}

4) Mixed Hardwood Branch Line {see 3.4.1, b), 5)}

5) White Oak – It is the intent of the Department to prohibit the use of white oak ties for both Crosstie and Switch Tie application. This prohibition is being made to minimize and eliminate the occurrence of accelerated deterioration of ties made of white oak in this region. Either mixed hardwood ties or red oak ties shall be shipped to those locations. Red oaks shall be separated from mixed oaks in quantities as directed by the Department.

6) Culls – All ties not meeting minimum requirements for mainline or branchline ties.

c) Ties, which do not meet this requirement, are separated as rejects or culls and handled as directed by the Department.

3.4.2**Incising (I)** –

a) Ties shall be incised on four sides not less than $^{1}/_{2}$ inch in depth.

b) Incising shall cover from **end-to-end** on each side of the tie.

c) At least 90% of the teeth contacting the tie shall be in place in each incisor head.

d) **All** ties shall be incised.

3.4.3**Stacking (I)** – Grade ties shall be stacked to provide proper air seasoning.

a) Two to four inches of space shall be left between the ties so as to make continuous flues through the pile or stack.

b) The foundation shall be stacked a minimum of 14" off the ground on treated or other suitable material to prevent transfer of decay.

c) No more than ten stacks or piles shall be placed side by side in a continuous row.

d) A space of at least three feet shall be left between the rows of ties, except where shed drying is used.

e) Firebreaks shall be maintained in accordance with the fire protection plan as established by plant management and approved by local government.

f) The grounds and storage area shall be clear of debris, vegetation, and well drained (No standing water).

g) When possible, rows shall be placed with the open side in the general direction of the prevailing wind.

h) Each row shall carry information painted on the outside of the stack for the purpose of inventory record. Information shall include:

1) pile or row number

2) quantity

3) specie

4) date

5) ownership

3.4.4**Seasoning (C)** – Ties being air seasoned shall be held in stack until the amount of moisture in the wood will permit acceptable penetration and retention of preservative. In general, oak seasons in ten months and mixed hardwoods in six months.

a) The maximum acceptable moisture content in oak shall be 50% using two inch increment borings.

b) The maximum acceptable moisture content in mixed hardwood shall be 40% using two inch increment borings.

3.4.5**Boring and Branding (C)** –

a) Seasoned ties to be treated shall be re-inspected before treatment.

b) Ties that are damaged or split beyond the limitations of this requirement shall be removed.

c) Ties shall be branded for identification using $1\ ^{1}/_{2}$ inch lettering, having cutting edges 1/8 inch wide, and impregnated $^{1}/_{4}$ inch into the end of each tie.

d) Branding shall include ownership, origin and year treated.

e) Ties shall have a visible saw kerf mark or some other approved marking to designate the sap side of the crosstie. For creosote only treated ties, apply one kerf mark. For dual treated boron/creosote tries, apply two kerf marks.

3.4.6**Selective End Plates (C)** –

a) Seasoned ties which are split no more than $^{1}/_{4}$ inch wide and with the split extending from one surface to another, shall be clamped and end-plated back to its original sawn dimensions, then returned to the material flow.

b) Unseasoned ties, which are split no more than 1/8 inch wide and/or 4 inches long, shall be clamped and end plated back to its original dimensions, then returned to the material flow.

c) Ties, which cannot be returned to acceptable dimensions, shall be rejected.

3.4.1**Tramming (I)** –

a) Prepared ties shall be loaded on trams and secured with wire banding or chains and counted.

b) The number of ties on each tram shall be counted, verified, and recorded on a tram ticket or plant order.

3.4.8**Treatment (C)** – Ties shall be dual treated with Boron and Creosote, in accordance with American Wood Preservers' Association (AWPA) Standard U1, Commodity Specification C, to the requirements of Use Category 4C (UC4C). Use SBX Pre-Treatment or Creosote SBX-O One Step Treatment with appropriate creosote preservatives as required by the specification. Governing treating requirements are as follows :

3.4.8.1**Rueping Process (AWPA-C-6) (C)** – Properly air seasoned ties (crossties, switch ties, and crossing panels) that meet the moisture content requirements shall be treated using the Rueping process.

a) The creosote shall be maintained at a minimum average of 180° F during the pressure period and pressurized to a maximum of 200 psi for mixed hardwood and 220 psi for oak.

b) The specific treating parameters will vary with the age and construction of the treating plant. The supplier shall have available for the Department's inspection the parameters for his operations. For acceptance the set up parameters must comply with the following:

1)	Hot Oil Treatment:	Oak 180° F/6 hour minimum MHW 180° F/4 $^{1}/_{2}$ hour minimum
2)	Creosote Pressure:	180 - 220 PSI
3)	Temperature:	180 ° - 210 ° F
4)	Vacuum:	Not less than 22"

3.4.8.2**Boulton Drying (C)** – This process shall only be used for ties produced from trees felled within the previous ninety days (three months) and do not meet the moisture content specified in 3, 4, 4 above.

a) Ties shall be trammed with each layer separated by 3/8 inch minimum sticker placed at each end of the ties.

b) The ties shall be heated and boiled in oil under vacuum in the treating cylinder until the moisture content of the wood is low enough to allow proper treatment and meet the requirements of AWPA Standard U1.

3.4.8.3**Inspection of Treating Sheets and Graph (C)** –

a) When the ties are being treated, the plant operator shall maintain a log and a graph, or a graph only if treating controls are automatic, of the following parameters :

1) time (no greater than 15 minute intervals)
2) temperature
3) pressure
4) vacuum
5) creosote tank contents

In the event graph equipment becomes inoperable, inaccurate, or graph becomes illegible, Contractor must cease treatment of ties for the Department until equipment is repaired.

b) The contractor shall upon request from the Department provide the log and graph, and the tram ticket for review and inspection.

c) For all crossties, switch ties, and crossing timbers, a net retention meeting the requirements of AWPA Standard U1, unless refusal takes place.

3.5 **Nail Plates (C)** – Nail Plates shall be the approved method used to control splitting in ties for the Department.

3.5.1**Nail Plate application** –

a) Ties shall be selectively nail plated prior to treatment.

b) Nail plates shall be applied to both ends of any tie plated.

c) Application of nail plates shall be subject and limited to ties with the maximum split dimension per paragraph 3.1.1, f), of this requirement.

d) Ties to be end plated shall have flat, smooth, sawn ends with no spurs.

e) Nail end plates shall be applied by a mechanical device capable of exerting sufficient pressure to close splits bringing the tie back to its original sawn dimensions and with capacity to drive a nail end plate into the end of the tie using a pressure plate.

f) Nail end plates shall be centered on the split (s) as practicable and securely applied against the end of the tie .

g) No part of the nail end plate shall protrude beyond the edge of the tie. The nail end plate shall be positioned to avoid projecting over the edge of tie having the maximum permissible wane. If this is not practical, the protruding edge of the nail end plate shall be ground off, bent over and hammered into the tie, or otherwise treated to remove the potential for hand injuries.

h) Exposed edges of installed nail end plates shall be checked for any burrs and snags made during application, and if found, removed by grinding, filing, or other means to eliminate potential hand injuries when installing the ties.

3.5.2 **Nail Plate Design (C)** – (see Figures 3.5.2-1 and 3.5.2-2).

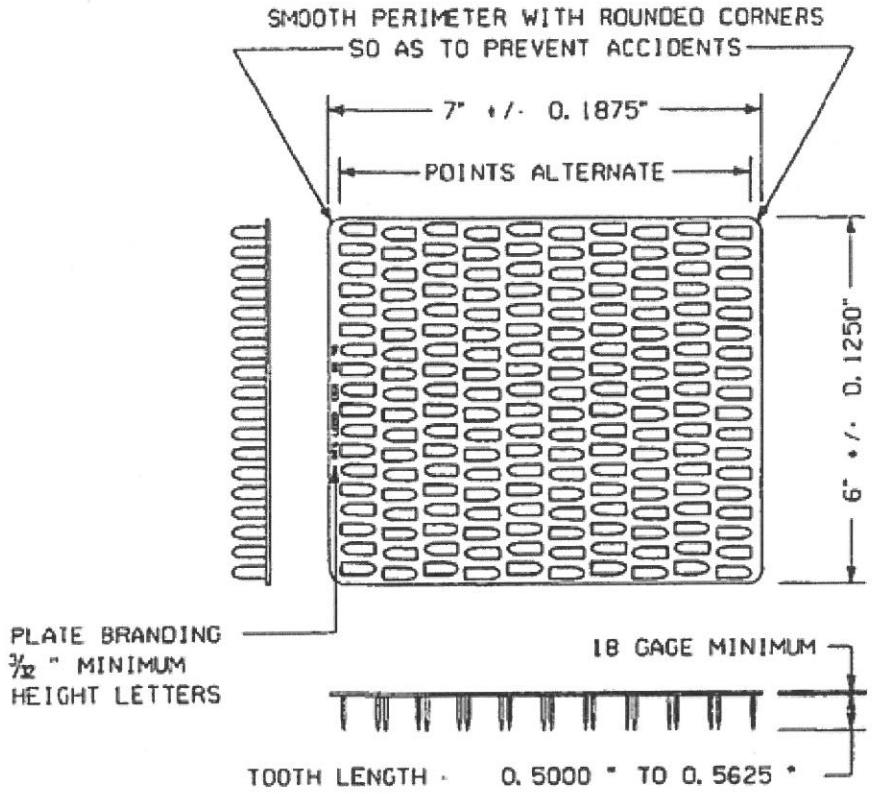
a) The material for nail plates shall be structural steel, ASTM A653, grade 40, 18-gage minimum and hot dipped galvanized, ASTM A924, coating designation G60.

b) The size of the plates and number of teeth per plate shall be as shown on the attached drawings, "Nail Plates for Main Track Ties" and "Nail Plates for Side Track Ties".

c) Nail end plates shall be branded in 3/32 inch minimum height letters to include plate manufacturers name or symbol, CFRC, plant (two letters), and year (two digits).

Examples of Plant Location Designations:

Florence	*CFRC*	*FL*	*99*
Green Springs	*CFRC*	*GS*	*99*
Guthrie	*CFRC*	*GU*	*99*
Montgomery	*CFRC*	*MO*	*99*



NOTES.

MATERIAL REQUIREMENTS, STRUCTURAL STEEL. ASTM A653, GRADE 4, 18 GAGE MINIMUM. AND HOT DIPPED GALVANIZED IN ACCORDANCE WITH ASTM A924. COATING DESIGNATION G60.

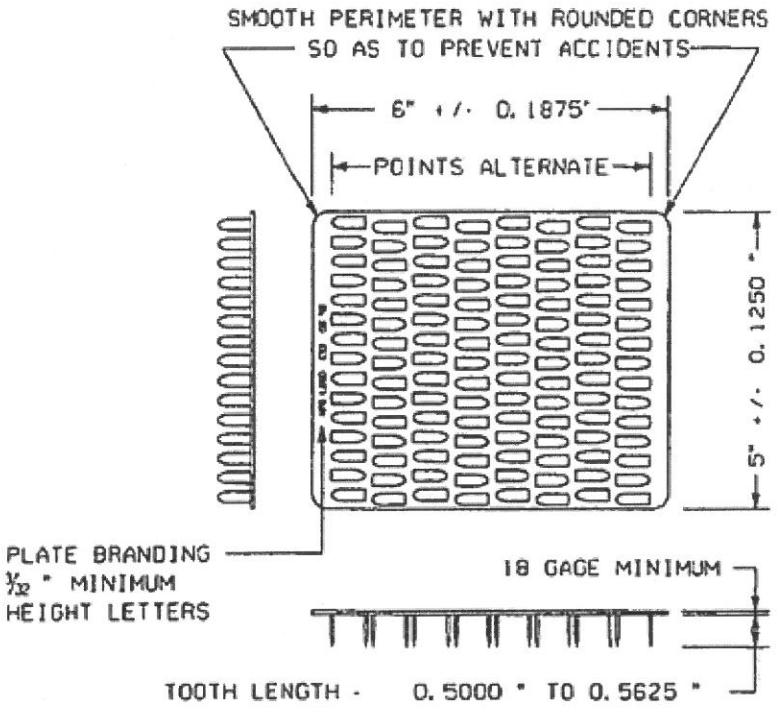
NUMBER AND ALIGNMENT OF ROWS TO BE DETERMINED BY THE PLATE MANUFACTURER. A MINIMUM OF 180 TEETH OR A MINIMUM DENSITY OF 4. 1 TEETH PER SQUARE INCH OF MEASURED PLATE AREA. WHICHEVER PROVIDES THE GREATEST NUMBER OF TEETH, IS REQUIRED.

PLATE FLATNESS, CONCAVITY OR CONVEXITY MEASURED WITH A STRAIGHT EDGE AND TAPER GAGE ACROSS EITHER THE WIDTH, LENGTH OR DIAGONALS ON THE TOOTHLESS SIDE SHALL NOT EXCEED 0.03125".

BRAND LOCATION TO BE SELECTED BY MANUFACTURER OF PLATE.

NAIL PLATE
FOR MAIN TRACK TIES

Figure 3.5.2-1



NOTES.

MATERIAL REQUIREMENTS, STRUCTURAL STEEL, ASTM A653, GRADE 4, 18 GAGE MINIMUM, AND HOT DIPPED GALVANIZED IN ACCORDANCE WITH ASTM A924, COATING DESIGNATION G60.

NUMBER AND ALIGNMENT OF ROWS TO BE DETERMINED BY THE PLATE MANUFACTURER. A MINIMUM OF 120 TEETH OR A MINIMUM DENSITY OF 4. 0 TEETH PER SQUARE INCH OF MEASURED PLATE AREA, WHICHEVER PROVIDES THE GREATEST NUMBER OF TEETH, IS REQUIRED.

PLATE FLATNESS, CONCAVITY OR CONVEXITY MEASURED WITH A STRAIGHT EDGE AND TAPER GAGE ACROSS EITHER THE WIDTH, LENGTH OR DIAGONALS ON THE TOOTHLESS SIDE SHALL NOT EXCEED 0.03125".

BRAND LOCATION TO BE SELECTED BY MANUFACTURER OF PLATE.

NAIL PLATE
FOR SIDE TRACK TIES

Figure 3.5.2-2

3.6 **Environmental (C)** –

3.6.1 **Environmental Regulations** – All material shall comply with current environmental regulations.

3.6.2 **Disposal Hazards** – Material posing a possible disposal hazard, such as preservatives, insecticides or other sensitive disposables, shall be indicated in documentation and presented at the supplier vendor forum.

3.7 **Safety (C)** – The supplier shall observe all applicable Federal, State, and Local safety and operating rules and regulations.

3.8 **Workmanship (C)** – All ties and related components shall be manufactured, finished and comply with all AAR, and FRA standards for workmanship and/or certification.

4.0 **Quality Assurance Provisions (C)** –

a) The supplier shall be responsible for insuring that the delivered ties meet the requirements as identified in the applicable paragraphs of this requirement and as directed in the contract agreement.

b) The Department also reserves the right to perform ad-hoc no notice inspections at the manufacturing plant or in the field to evaluate ties for quality and conformance with this requirement.

c) Final acceptance of ties shall be based on destination inspection by the Department at the location designated by the Department in the agreement.

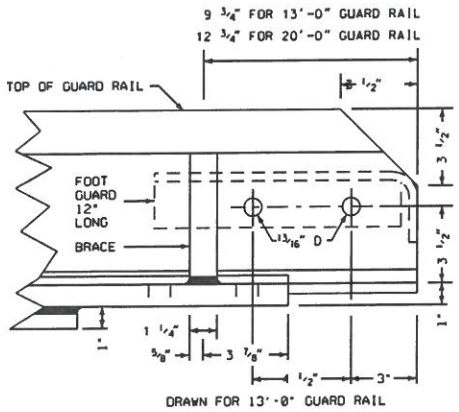
5.0 **Transportation (M)** – The Department shall provide transportation direction with each order. The supplier shall ship via truck or rail to destinations as directed by the Department with each order.

6.0 **Notes** – This section not used.

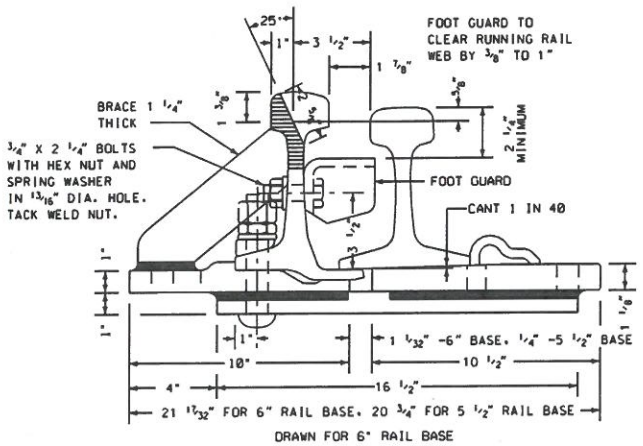
Prepared by: RMW

Approved by: Miguel Torres

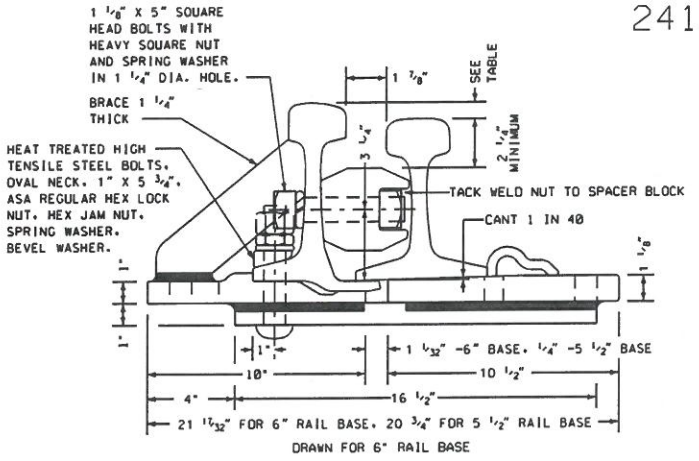
Miguel Torres –
CFRC Chief Operating Officer



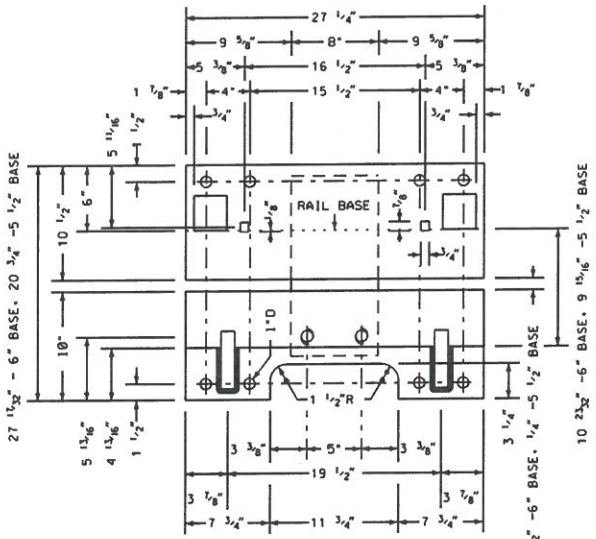
DETAIL OF BEVELED ENDS



CROSS SECTION AT END OF GUARD RAIL



CROSS SECTION AT SPACER BLOCK

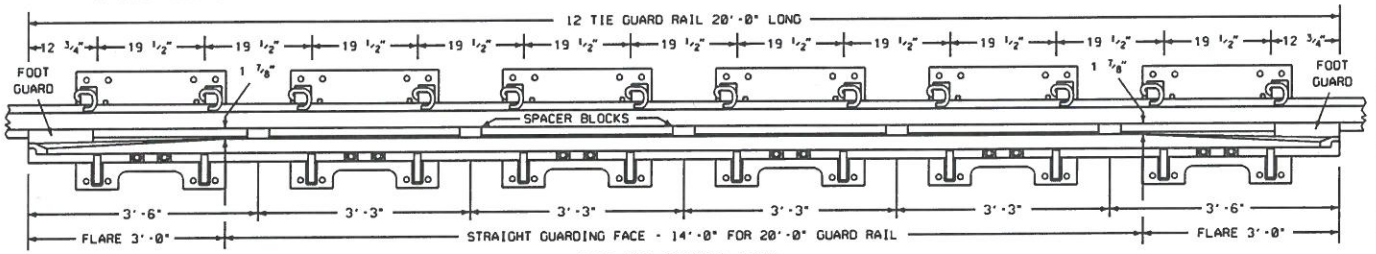


SPIKE HOLES TO BE 1" DIAMETER FOR 15/16" DIAMETER BY 6" OR 6 1/2" LONG SCREW SPIKES.

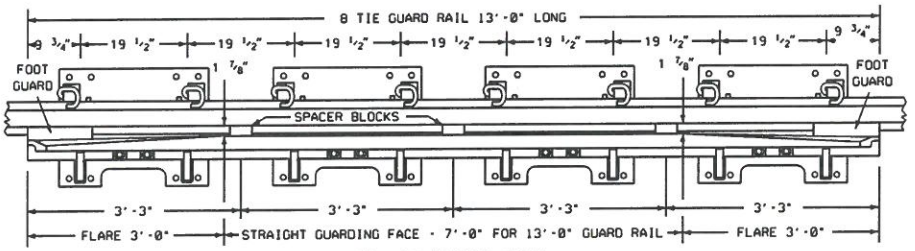
SPIKE HOLES CONTRACTING RAIL BASE ARE 3/4" X 7/8" WITH 1/8" UNDER RAIL BASE.

BOLT HOLES FOR FASTENING GUARD RAIL ARE 1 1/8" DIAMETER IN BASE OF GUARD RAIL AND IN BRACE PLATE. 1 7/16" X 1 1/8" OVAL IN CONNECTING PLATE.

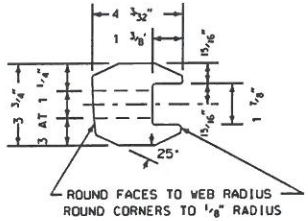
TIE PLATE



20'-0" GUARD RAIL



13'-0" GUARD RAIL



SPACER BLOCK

NOTES:

CENTER PUNCH AND PAINT MARK BOTH ENDS OF NON-PLANED SIDE OF GUARD RAIL TO INDICATE END OF FLARE.

PANDROL SHOULDERS MUST MEET PANDROL DESIGN STANDARDS.

RUNNING RAIL SECTION	RUNNING RAIL HEIGHT	GUARD RAIL SECTION	GUARD RAIL HEIGHT	HEIGHT ABOVE RUNNING RAIL	GUARD RAIL USAGE	
					FROG	LENGTH
141LB	7 7/16"	GT140RE	8 1/8"	11/16"	NO. 8 RBM	2 AT 13'-0"
140RE	7 5/16"	GT140RE	8 1/8"	13/16"	NO. 10 RBM	
136RE	7 5/16"	GT140RE	8 1/8"	13/16"	NO. 10 SPG	1 AT 13'-0" 1 AT 20'-0"
132RE	7 1/8"	GT140RE	8 1/8"	1 "	NO. 15 RBM	
122CB	6 23/32"	GT140RE	8 1/8"	1 1/32"	NO. 16 RBM	2 AT 20'-0"
115RE	6 5/8"	GT126RE	7 3/8"	3/4"	NO. 20 RBM	

GUARD RAIL ITEM NUMBERS	
	DESCRIPTION
010 6450033	BOLT, BUTTON HEAD, OVAL NECK, 1 X 5-3/4" HEX LOCK NUT, HEX JAM NUT, SPRING WASHER, BEVEL WASHER

ORDERING INFORMATION		
LENGTH	5 1/2" BASE	6" BASE
13'-0"	010 6420010	010 6450010
20'-0"	010 6420020	010 6450020

NOVEMBER 28, 11 INCLUDE SCN FOR BOLTS FOR GUARD RAIL BASE

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Central Florida Rail Corridor

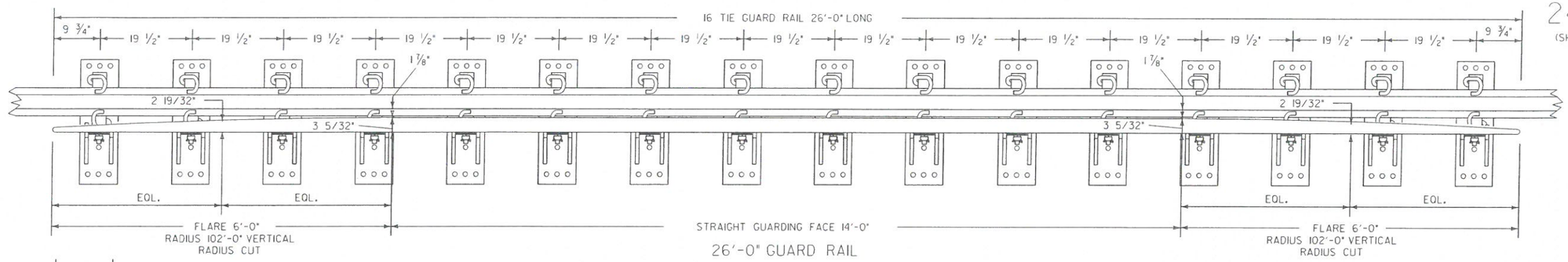
HOOK FLANGE GUARD RAILS FOR 115RE, 122CB, 132RE, 136RE, 140RE, AND 141LB RAIL

Miguel Torres

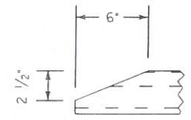
APPROVED - MIGUEL TORRES
CFRC CHIEF OPERATING OFFICER

PREPARED BY: RMW ISSUED: 9/9/2015 REVISED: 4/2/2015

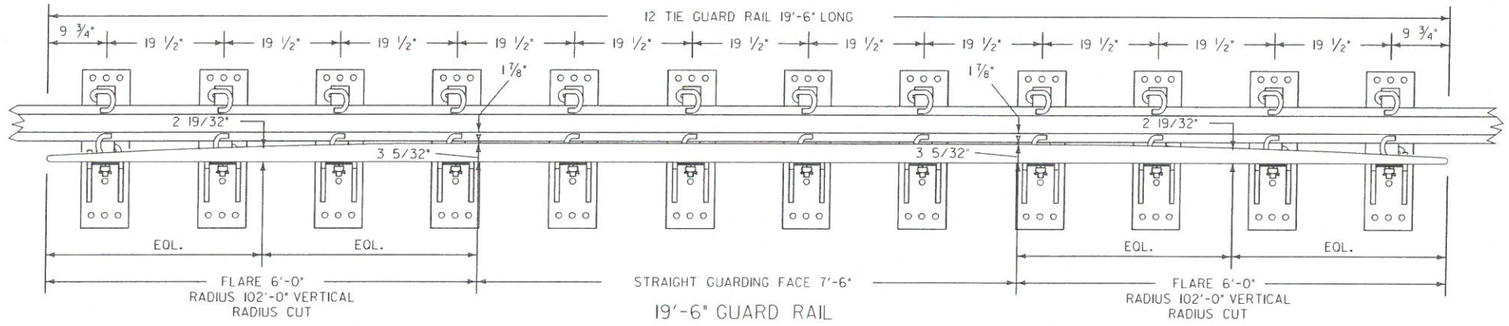
2/5/13 - ADDED WEARING BAR SCN



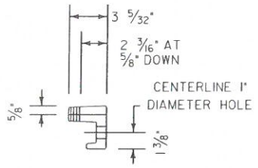
26'-0" GUARD RAIL



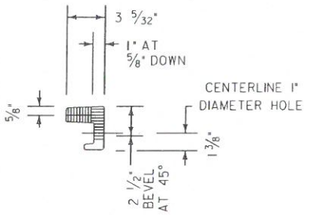
BEVEL AT END OF GUARD RAIL



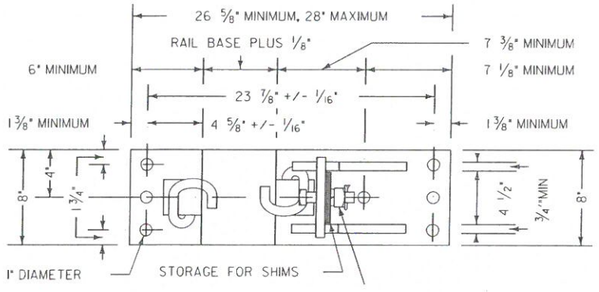
19'-6" GUARD RAIL



CROSS SECTION 24" FROM END OF GUARD RAIL



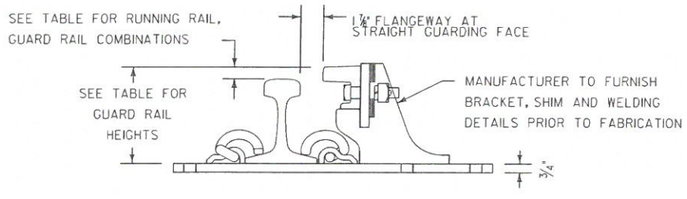
CROSS SECTION AT END OF GUARD RAIL



7/8" X 4" SQUARE HEAD BOLT, SPRING WASHER
HEAVY SQUARE NUT, DRILLED FOR 3/16" MIN. COTTER

RUNNING RAIL AND GUARD RAIL NOT SHOWN ABOVE

PLATE AND BRACKET



CROSS SECTION THROUGH STRAIGHT GUARDING FACE

GUARD RAIL USAGE	
FROG	LENGTH
NO. 8 RBM NO. 10 RBM	2 AT 19'-6"
NO. 10 SPG	1 AT 19'-6" 1 AT 26'-0"
NO. 15 RBM NO. 16 RBM NO. 20 RBM	2 AT 26'-0"

RUNNING RAIL SECTION	RUNNING RAIL HEIGHT	GUARD RAIL HEIGHT	HEIGHT ABOVE RUNNING RAIL	GUARD RAIL ITEM NUMBERS	
				LENGTH	WEARING BAR, REPLACEMENT
141RE	7 7/16"	8 1/4"	13/16"		
140RE	7 5/16"	8 1/4"	15/16"		
136RE	7 5/16"	8 1/4"	15/16"		
132RE	7 1/8"	8 1/4"	1 1/8"	19'-6"	010 6420025
122CB	6 25/32"	8 1/4"	1 15/32"		
115RE	6 5/8"	7 3/8"	3/4"	26'-0"	010 6420030

THE STRAIGHT GUARDING FACE IS TO BE IN THE SAME LOCATION WHEN EITHER A HOOK FLANGE OR AN ADJUSTABLE GUARD RAIL IS INSTALLED IN A TURNOUT.

MANUFACTURING NOTES:

THE 26'-0" AND 19'-6" GUARD RAILS ARE A COMMON STANDARD WITH NS, UP AND BNSF RAILROADS.
GUARD RAIL SECTION: U.I.C. 33CI. (U69) UIC 860-0 GRADE 90A. GUARD FACE MINIMUM OF 319 BRINELL.
BASEPLATE, BRACKET AND SHIMS: MILD STEEL PER AREMA SPECIFICATION M.7.
GUARD RAIL BOLT AND NUT: PER AREMA SPECIFICATION MII.
SPRING WASHER: PER AREMA SPECIFICATION MI2.
WORKMANSHIP AND TOLERANCES PER AREMA SPECIFICATIONS FOR SPECIAL TRACKWORK.
WELDING: PER LATEST REVISION OF ANSI/AWS DI.I.
PANDROL SHOULDERS MUST MEET PANDROL DESIGN STANDARDS.
MINIMUM ADJUSTMENT USING SHIMS: 1/2" IN 1/16" INCREMENTS (3 SHIMS AT 1/8", 2 SHIMS AT 1/16" OR EQUIVALENT).
CENTER PUNCH AND PAINT MARK BOTH ENDS OF NON-PLANED SIDE OF GUARD RAIL TO INDICATE END OF FLARE.

INSTALLATION NOTE:

THE VARIATION IN RAIL HEAD WIDTHS AND THE TOLERANCES ALLOWED IN THE MANUFACTURE OF GUARD RAILS MAY REQUIRE THE USE OF SHIMS WITH THE INSTALLATION OF A NEW GUARD RAIL. MEASURE THE GUARD CHECK GAGE AND WIDTH OF THE FLANGEWAY OPENING AFTER INSTALLATION AND ADJUST OPENING TO 1 7/8" WHEN NECESSARY.

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BOLTED ADJUSTABLE GUARD RAILS FOR 115RE, 122CB, 132RE, 136RE, 140RE, AND 141RE RAIL MAINTENANCE ONLY

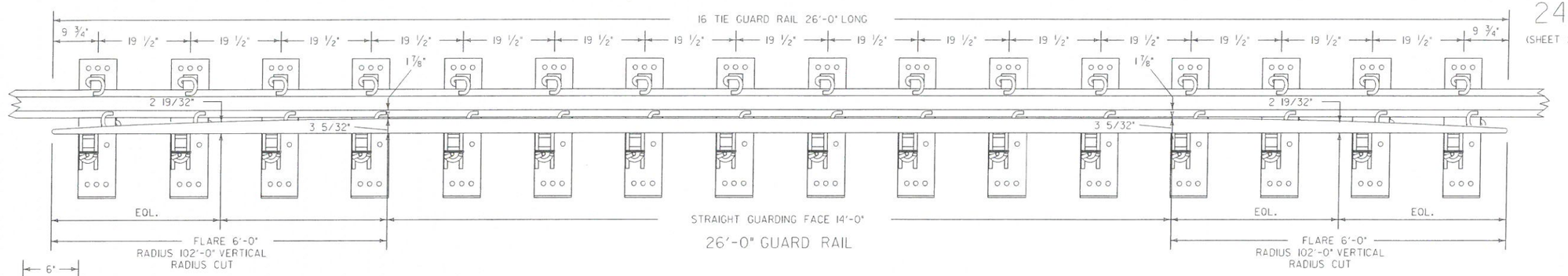
Miguel Torres

APPROVED – MIGUEL TORRES
CFRC CHIEF OPERATING OFFICER

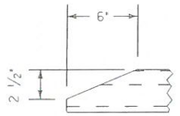
PREPARED BY: RMW ISSUED: 9/9/2015 REVISED: 4/2/2015

REV: CURVED FLARE

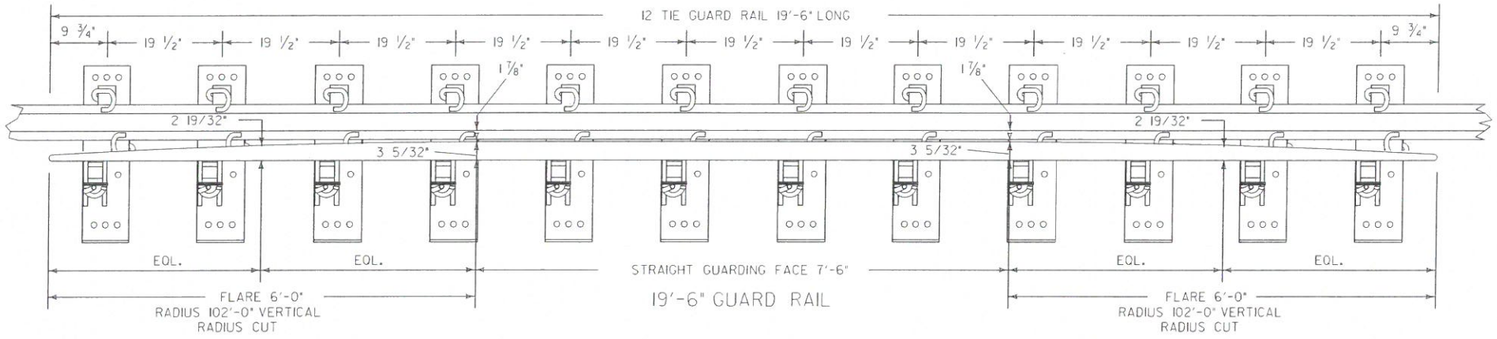
2/5/13 - ADDED WEARING BAR SCN
2/25/13 - REVISED SCN FOR ORDERING GUARD RAILS



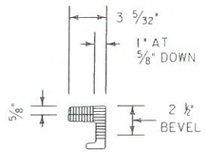
26'-0" GUARD RAIL



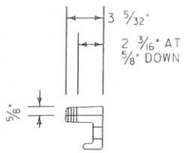
BEVEL AT
END OF GUARD RAIL



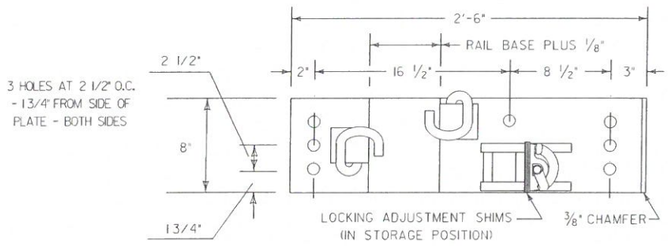
19'-6" GUARD RAIL



CROSS SECTION AT
END OF GUARD RAIL

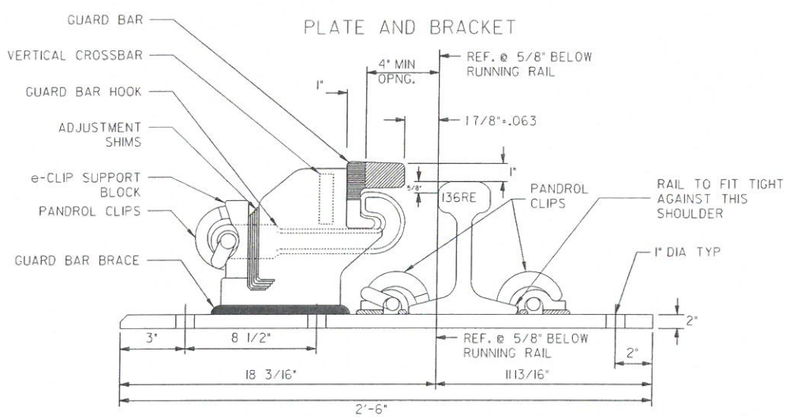


CROSS SECTION 24" FROM
END OF GUARD RAIL



RUNNING RAIL AND GUARD RAIL NOT SHOWN ABOVE

PLATE AND BRACKET



CROSS SECTION THROUGH STRAIGHT GUARDING FACE

THE STRAIGHT GUARDING FACE IS TO BE IN THE SAME LOCATION WHEN EITHER A HOOK FLANGE OR AN ADJUSTABLE GUARD RAIL IS INSTALLED IN A TURNOUT.

MANUFACTURING NOTES:

BOLTLESS DESIGN, USING PANDROL E-CLIP.

THE 26'-0" AND 19'-6" GUARD RAILS ARE A COMMON STANDARD WITH NS, UP AND BNSF RAILROADS.

GUARD RAIL SECTION: U.I.C. 33CI. (U69) UIC 860-0 GRADE. GUARD FACE MINIMUM OF 350 BRINELL.

BASEPLATE, BRACKET AND SHIMS: MILD STEEL PER AREMA SPECIFICATION M.7.

PANDROL SHOULDERS MUST MEET PANDROL DESIGN STANDARDS.

WELDING: PER ANSI/AWS D1.1-92 OR LATEST REVISION.

WORKMANSHIP AND TOLERANCES PER AREMA SPECIFICATIONS FOR SPECIAL TRACKWORK.

MINIMUM ADJUSTMENT USING SHIMS: 3/16" IN 1/16" INCREMENTS (4 SHIMS AT 1/8", 1 SHIM AT 1/16").

CENTER PUNCH AND PAINT MARK BOTH ENDS OF NON-PLANED SIDE OF GUARD RAIL TO INDICATE END OF FLARE.

INSTALLATION NOTE:

THE VARIATION IN RAIL HEAD WIDTHS AND THE TOLERANCES ALLOWED IN THE MANUFACTURE OF GUARD RAILS MAY REQUIRE THE USE OF SHIMS WITH THE INSTALLATION OF A NEW GUARD RAIL. MEASURE GUARD CHECK GAGE AND WIDTH OF FLANGEWAY OPENING AFTER INSTALLATION AND ADJUST OPENING TO 1 7/8" WHEN NECESSARY.

GUARD RAIL USAGE	
FROG	LENGTH
NO. 8 RBM NO. 10 RBM	2 AT 19'-6"
NO. 10 SPG	1 AT 19'-6" 1 AT 26'-0"
NO. 15 RBM NO. 16 RBM NO. 20 RBM	2 AT 26'-0"

RUNNING RAIL SECTION	RUNNING RAIL HEIGHT	GUARD RAIL HEIGHT	HEIGHT ABOVE RUNNING RAIL	GUARD RAIL ITEM NUMBERS		
				LENGTH	5 1/2" BASE	6" BASE
141RE	7 7/16"	8 1/4"	13/16"			
140RE	7 5/16"	8 1/4"	15/16"			
136RE	7 5/16"	8 1/4"	15/16"			
132RE	7 1/8"	8 1/4"	1 1/8"			
122CB	6 25/32"	8 1/4"	1 5/32"	19'-6"	010 6420015	010 6450015
115RE	6 5/8"	7 3/8"	3/4"	26'-0"	010 6420050	010 6450050

GUARD RAIL ITEM NUMBERS	
LENGTH	WEARING BAR, REPLACEMENT
19'-6"	010 6420027
26'-0"	010 6420032

GUARD RAIL HAS CURVED FLARES

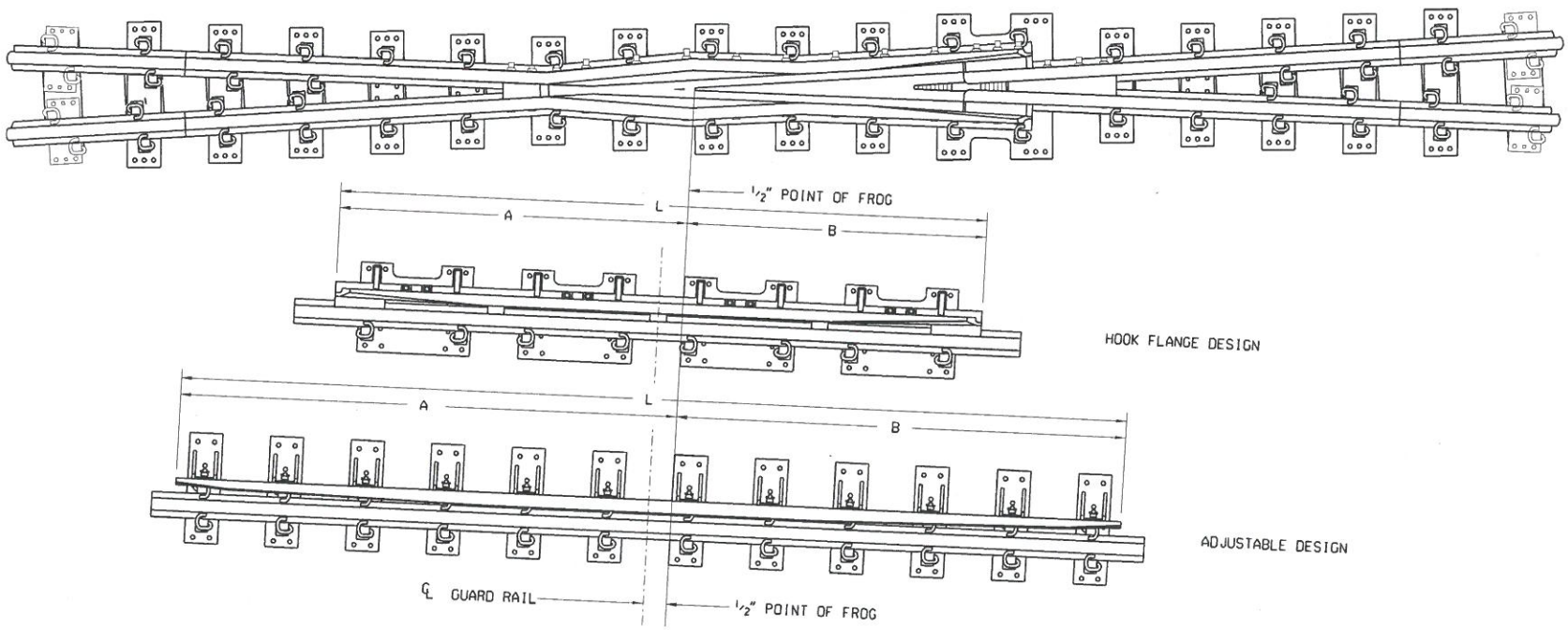
SHIM PACK CORRECTED TO 9/16" TOTAL THICKNESS

CFRC
Central Florida Rail Corridor

BOLTLESS ADJUSTABLE GUARD RAILS FOR
115RE, 122CB, 132RE, 136RE, 140RE AND 141RE RAIL

APPROVED – MIGUEL TORRES
CFRC CHIEF OPERATING OFFICER

PREPARED BY: RMW ISSUED: 9/9/2015 REVISED: 4/2/2015



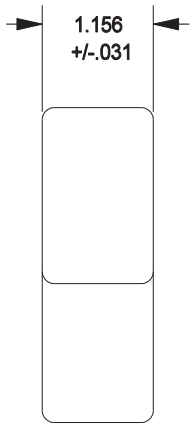
TURNOUT AND FROG	PRIMARY GUARD RAIL DESIGN						ALTERNATE GUARD RAIL DESIGN					
	STRAIGHT SIDE			DIVERGING SIDE			STRAIGHT SIDE			DIVERGING SIDE		
	L	A	B	L	A	B	L	A	B	L	A	B
NO. 8	HOOK FLANGE			HOOK FLANGE			ADJUSTABLE			ADJUSTABLE		
RBM	13'-0"	6'-11 3/4"	6'-0 1/4"	13'-0"	6'-4 5/8"	6'-7 3/8"	19'-6"	9'-7 5/8"	9'-10 3/8"	19'-6"	9'-7 5/8"	9'-10 3/8"
NO. 10	HOOK FLANGE			HOOK FLANGE			ADJUSTABLE			ADJUSTABLE		
RBM	13'-0"	6'-11 3/4"	6'-0 1/4"	13'-0"	6'-6 1/8"	6'-5 7/8"	19'-6"	10'-2 3/4"	9'-3 1/4"	19'-6"	9'-9 1/8"	9'-8 7/8"
NO. 10	HOOK FLANGE			HOOK FLANGE			ADJUSTABLE			ADJUSTABLE		
SPRING	20'-0"	12'-1 1/4"	7'-10 3/4"	13'-0"	6'-6 1/8"	6'-5 7/8"	26'-0"	16'-9 3/4"	9'-2 1/4"	19'-6"	9'-9 1/8"	9'-8 7/8"
NO. 15	ADJUSTABLE			ADJUSTABLE			HOOK FLANGE			HOOK FLANGE		
RBM	26'-0"	13'-5 3/4"	12'-6 1/4"	26'-0"		12'-9 3/4"	20'-0"	9'-6 1/8"	10'-5 7/8"	20'-0"	9'-2 5/8"	10'-9 3/8"
NO. 20	ADJUSTABLE			ADJUSTABLE			HOOK FLANGE			HOOK FLANGE		
RBM	26'-0"	11'-7 1/4"	14'-4 3/4"	26'-0"	11'-4 1/2"	14'-7 1/2"	20'-0"	8'-7 1/4"	11'-4 3/4"	20'-0"	8'-4 1/2"	11'-7 1/2"

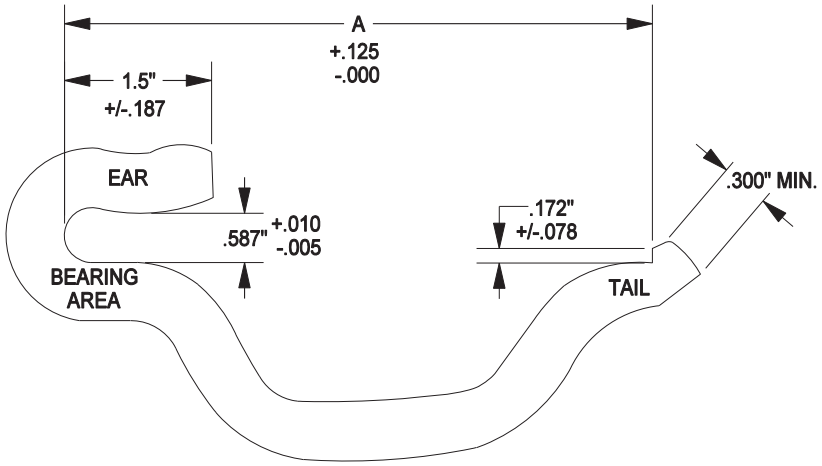
CFRC
Central Florida Rail Corridor

GUARD RAILS USAGE AND LOCATION

Miguel Torres

APPROVED – MIGUEL TORRES
CFRC CHIEF OPERATING OFFICER
PREPARED BY: RMW ISSUED: 9/9/2015 REVISED: 4/2/2015





RAIL BASE SIZE	A	WEIGHTS
5 1/2"	5.625"	1.96 LBS.
6"	6.125"	2.094 LBS.

NOTES:
1. MATERIAL: HIGH CARBON STEEL

2. HEAT TREAT TO Rc 34-47
   TARGET RANGE Rc 39-44

3. ALL DIMENSIONS ARE MINIMUM UNLESS OTHERWISE SPECIFIED.

4. TYPICAL CHEMISTRY: CARBON .58-.90, MANGANESE .7-1.1, SILICON .5 MAX

CFRC
Central Florida Rail Corridor

BAR STOCK ANCHOR FOR 5 1/2" AND 6" BASE RAIL

	FILE OWNER: CFRC	DATE: SEPT 25, 2014
	REV. NO.: 1	DWG NO: 135010

135010

American Railway Engineering & Maintenance of Way Association (AREMA)

Portfolio of Trackwork Plans

1 Scope

1.1 This Specification covers general instructions, testing and workmanship requirements and detailed material specifications relating to the purchase and manufacture of special trackwork for tee rails weighing 115 lb. per yard and heavier.

2 Applicable Documents

2.1 The latest specifications in the AREMA Manual for Railway Engineering, the American Society for Testing and Materials (ASTM) Book of Standards, the Society of Automobile Engineers (SAE) specifications, the American National Standards Institute specifications (ANSI), where indicated, covering a particular component or material shall apply.

2.2 The trackwork plans in the Portfolio shall be part of these specifications

2.3 Requirements not shown on the drawings, but which are mentioned in the specifications, or vice versa, or anything not expressly set forth in either, but which is specified in the order or contract, shall apply. Should anything be omitted from the drawings or specifications that is necessary for a clear understanding of the work, or should any error appear in either the drawings or specifications affecting the work, the manufacturer shall notify the purchaser and shall not proceed with the work until instructed to do so.

2.4 Any variations from the requirements established in 2.1, 2.2 and 2.3 shall be detailed in the inquiry contract and order.

3 Definition of Terms

3.1 The AREMA definition of terms relating to trackwork switches, frogs, guard rails, crossings and turnouts appear in the Foreword.

4 Basis of Purchase

4.1 The purchaser will furnish the manufacture specifications and drawings giving rail sections, joint drilling, angles, alignment, general dimensions and such special details as may be required.

5 Manufacture

5.1 Construction, design and details shall conform to the specified Portfolio Plan adopted by AREMA as recommended practice.

5.2 For track structures for which no plans have been adopted, or for proprietary trackwork items, the manufacture shall, when requested, submit detail drawings for approval.

6 WORKMANSHIP

6.1 Workmanship shall be in accordance with good commercial practice.

6.2 Accuracy of workmanship for completed frogs and switches shall be within the permissible variations prescribed in Plans No. 1020 to 1029.

6.3 Bends shall be made accurately in arcs of circles and without injury to the material.

6.4 Heating of the rails for bending shall be done in a manner so as to have a minimal adverse effect on the metal. When the nature of the bend permits, rails shall be bent cold.

6.5 Machining shall be true and all abutting surfaces shall fit accurately.

6.6 All sharp edges and corners shall be eliminated by grinding or machining to a suitable chamfer or radius wherever the rail section is altered by a machining.

6.7 A radius of 5/8” (15.9 mm) shall be provided (where possible) at the gage corners where wheel contact will occur.

6.8 All grinding shall be carefully performed, in a manner that will not develop grinding cracks.

6.9 Running surfaces of manganese steel parts shall be ground to a surface comparable to that of rolled rail. Manganese steel portions fitting into rails or other parts shall be ground or machined to a suitable fit.

6.10 Drilling shall be done accurately, at an angle where necessary.

6.10 1 All holes in carbon steel shall be drilled.

6.10.2 The burrs, fins and sharp edges of trackwork components, formed, sheared or cut by machine, shall be removed by grinding or machining a chamfer.

6.10.3 All holes for turned pins or bolts and for tight fit of rough bolts in other than rail steel parts shall also be drilled.

6.11 Punching shall be permitted only in mild steel parts for rivets, loose rough bolts and spikes, except where such bolts come so close together or close to the edge of the piece that the metal between the holes or between hole and edge is less in width than the thickness of the material, in which case holes shall be drilled.

6.12 All bolt holes in all trackwork components regardless of how manufactured (drilled, punched, cut or forged) must be chamfered. Trackwork requires a minimum 1/32" (0.8 mm) chamfer. Rail hole drilling requires a minimum 1/16" (1.6 mm) chamfer +1/32" (0.8 mm) - 0" (0 mm).

7 PERMISSIBLE VARIATIONS IN DIMENSIONS, FITS AND OTHER PHYSICAL ATTRIBUTES

7.1 Fit of Bolts

7.1.1 Main bolts in bolted frogs and bolted rail crossings shall have a tight fit in properly aligned holes.

7.1.2 Where a tight fit of bolts in the hole is not required, drilled or punched holes shall be not more than 1/16" (1.6 mm) greater in diameter than the bolts, except that bolts in rail at an angle are to have their holes drilled per Section X-X, Plan 1021, Part II.

7.1.3 Cored holes in other than manganese castings shall not be more than 1/8" (3.2 mm) greater in diameter than the bolts.

7.1.4 Holes in manganese castings for frogs and crossings may be up to 5/16" (8 mm) greater in diameter than the bolts except that the holes for body bolts in rail bound frogs and crossings, and for the internal joints of solid manganese crossings shall be oval; the larger or horizontal dimension shall not be more than 3/4" (19 mm) greater than the diameter of the bolts.

7.1.5 Bolt heads and nuts shall have square bearings.

7.2 Pins

7.2.1 Pins shall be of the full diameter called for on the plans, and the holes for them shall be 1/16" (1.6 mm) greater in diameter.

7.2.2 Rivets shall have standard button or cone heads of uniform size for the same size rivet.

7.2.3 Rivet heads shall be concentric with the holes.

7.2.4 Countersunk rivets shall be flush with the surface and fill the counter sink, except that rivets through base plates and tie plates may have a crown of not more than 1/8" (3.2 mm) below the lower surface of the plate.

7.3 Spike Holes

7.3.1 Spike holes shall be punched 3/4" (19 mm) square except those holes at rail base edges which shall be 3/4" (19 mm) wide by 13/16" (20.6 mm) long. These holes shall be located nominally 1/16" (1.6 mm) (1/8" (3.2 mm) maximum, 0" minimum) under the edge of the rail base or into the rail seat at the plate shoulder.

7.3.2 The edge of the spike holes shall not be less than the thickness of the plate plus 1/4" (6.4 mm) from the ends or sides of plates, except for hook twin tie plates, or where necessary to match spike holes in fittings or to clear structural members.

7.4 Gage, Track and Guard Face

7.4.1 All gage measurements shall be made at the level of the gage line 5/8" (16 mm) below the tread surfaces.

7.4.2 Track gage in completed crossings may be 1/16" (1.6 mm) under or 1/16" (1.6 mm) over that specified.

7.4.3 Guard face gage in completed crossings will be in accordance with Plans 790, 791, 792A, 792B and 793.

7.5 Flangeways

7.5.1 All flangeway measurements, except depth, shall be made at the level of the gage line 5/8" (16 mm) below the tread surfaces.

7.5.2 Flangeways in completed frogs shall not vary more than plus or minus 1/16" (1.6 mm) from the specified width.

7.5.3 Flangeways may be widened, either in design, or as a permissible variation in manufacture by machining not more than 1/8" (3.2 mm) from the side of the guard rail head.

7.5.4 Flangeways in completed crossings will be in accordance with Plans 790, 791, 792A, 792B and 793.

7.5.5 Flangeways shall be not less than 1-7/8” (47.6 mm) deep, as measured from the top of tread surfaces.

8 Marking

8.1 Finished trackwork units shall be plainly marked as indicated in 8.2 through 8.5. Only hot stamping shall be permitted on rail or rail components.

8.2 The manufacturer’s name or initials, section, weight of rail, and month and year of manufacture shall be stamped in letters of appropriate size on a separate rust proof plate secured to the web of the rail.

8.3 Letters and figures 3/4” (19 mm) in height may be stamped on a portion of the structure other than the rail, in a visible location, not exposed to wear.

8.4 Loose parts or fixtures shall be similarly stamped with suitable size letters and figures.

8.5 Frogs shall be marked with the frog number.

8.6 All or part of the identity shall be cast on molded parts.

9 WELDING

9.1 Welding shall not be permitted on rails or surfaces of other parts exposed to wheel wear.

9.2 Where welding is permitted on other portions, as indicated on the drawings or in the material specifications, such welding shall be done with an approved process.

10 PAINTING

10.1 Paint, tar, or other covering shall not be applied unless specified by the purchaser in the order or contract.

10.2 Such covering, when specified, shall not be applied before final inspection.

11 MATERIALS

11.1 Selection

11.1.1 The type and/or grade of material to be used in the production of the various parts of special trackwork shall be as indicated in the particular material specifications detailed herein.

11.1.2 Should two or more types or grades of material be acceptable for production of a particular part, and a preference has not been indicated by the purchaser in the contract or order, the selection shall be optional with the manufacturer.

11.1.3 The type or grade of material used in the production of products shall be at the option of the manufacturer.

11.2 Conformance

11.2.1 Any material entering into the manufacture of special trackwork or parts thereof and which is covered by specification contained (or referred to) herein, shall conform to the requirements of such specifications, except that:

11.2.2 The paragraphs under 12, 13 and 14, cover Test, Claim and Inspection conditions for materials used in the production of special trackwork and take precedence over, or add to, any similar coverage contained in the various established specifications for material referred to in 15, Material Specifications and Details.

12 TESTS

12.1 All tests shall be performed at the place of manufacture prior to shipment, unless otherwise agreed, and shall be so conducted as not to interfere unnecessarily with the operation of the works or the progress of the work on the purchaser’s order.

12.1.1 Chemical and mechanical tests may be made at a testing laboratory outside of the manufacturer’s works and is to be agreed upon between the manufacturer and the purchaser.

12.2 The records of any test made by the manufacturer on materials used in the production of the purchaser’s order shall be made available to the inspector representing the purchaser.

12.3 For materials or parts of the order taken from stock or purchased from other producers, the trackwork manufacturer shall, when required by the order or contract, certify that the material conforms with the requirements of the specifications.

12.3.1 Should the purchaser desire any chemical or mechanical tests of these materials, the purchaser shall be responsible for the expense of such tests, unless the materials fail to meet the specifications, in which case the trackwork manufacturer shall be responsible.

12.3.2 The manufacturer shall, when required by the order or contract, supply the purchaser with a certificate of inspection from the rail manufacturer for rails used in the order.

13 CLAIMS

13.1 The acceptance of any material by an inspector shall not prevent subsequent rejection if found defective after delivery.

13.2 A claim for defective material and/or trackwork shall cover only such defects as will impair the service life of the material.

13.3 Claims for replacement of defective material and/or workmanship shall not be recognized unless made promptly and based on defects appearing within 90 days from date of installation, and in any event within two years from date of shipment.

13.4 No guarantee of specific length of service will be required.

14 INSPECTION

14.1 The manufacturer shall afford the purchaser's inspector all reasonable facilities necessary to satisfy him that the material is being produced and furnished in accordance with this specification. Mill inspection by purchaser shall not interfere unnecessarily with the manufacturer's operations. All inspections shall be made at the place of manufacture, unless otherwise agreed to.

15 MATERIAL SPECIFICATIONS AND DETAILS

15.1 Scope

15.1.1 Rails, castings, forgings, rolled shapes, washers, and fasteners used in special trackwork ordered to the plans in the Portfolio, shall be produced in conformance with specifications indicated, modified in some instances, but in any case subject to details offered herein, and to the conditions set forth in 11.2.2.

15.1.2 Trackwork to be manufactured to plans other than those in the Portfolio may be ordered produced in conformance with general conditions, material specifications and detailed requirements of the AREMA Portfolio of Trackwork Plans.

15.1.3 The specifications contained (or referred to) herein are based as far as possible on established specifications of various national associations and societies with such modifications as are necessary to adapt the material to the manufacture of special trackwork.

M1. Steel Rails

Refer to AREMA *Manual for Railway Engineering,* Chapter 4.

M2. MANGANESE STEEL CASTINGS

M2.1 Material Covered

M2.1.1 Manganese steel castings for solid steel track structures, or wearing parts of fabricated steel track structures.

M2.2 Manufacture

M2.2.1 Austenitic manganese steel castings shall be produced in conformance with the latest issue of ASTM A128, Specification for Austenitic Manganese Steel Castings, Grade A, except that the chemical requirements shall be modified as follows:

Element	Percent	
	Minimum	Maximum
Carbon	1.00	1.30
Manganese	12.00	-
Silicon	-	1.00
Phosphorus	-	0.07

M2.2.2 All castings shall be heat treated as prescribed in the ASTM Specification A128.

M2.3 Heat or Cast and Product Analysis

M2.3.1 Heat or cast analysis shall be made by the manufacturer, either chemically or spectrographically, as required by the specifications, to determine the percentages of the elements specified in M2.2.1.

M2.3.2 Product analysis may be made by the purchaser of a sample obtained from a casting representing each heat cast in accordance with the conditions in the specification.

M2.4.1 When specified in the purchase order or contract, one bend test shall be made from each heat of steel in each heat treatment charge.

M2.4.2 The bend test specimens shall be nominally 1/2“ by 3/4” (13 by 19 mm) in cross section and 12” (300 mm) long, pored in a separate mold, from the same heat or cast of steel as the lot of castings it represents.

M2.4.3 The bend test specimen shall be heat treated with the castings it represents. When heat treated with castings of comparatively heavy section, the test bar may be protected from oxidation by enclosing it in a pipe or container with a small amount of carbonaceous material, suitably sealed or luted to limit test bar contact with the furnace gases.

M2.4.4 The bend specimen shall be tested without being machined or ground except as may be necessary to remove decarburization or surface irregularities, or to separate it from the runner or sprue through which it was poured.

M2.4.5 The test specimen shall withstand cold bending by any method preferred by the manufacturer, through 150° around a pin I” (25.4 mm) in diameter without breaking. Surface cracking that does not go deeper than halfway through the test specimen midway between the edges shall be acceptable.

M2.4.6 If any test specimen reveals internal defects during bending and does not conform to the requirement, it shall be discarded and another specimen from the same lot of castings substituted for testing.

M2.4.7 If the bend test representing any lot of castings fails to meet the requirement specified, the lot of castings may be reheat treated, but not more than twice. Bend test specimens shall not be reheat treated, but new specimens shall be substituted. Retests shall be performed in the manner prescribed for the original test, but two specimens representing the lot of castings shall be tested, both of which shall meet the requirements of M.2.4.5.

M2.5 Workmanship

M2.5.1 The castings shall be true to the pattern and conform to the shape and sizes indicated by the Purchaser’s drawings in accordance with good foundry practice.

M2.5.2 Large protrusions, sharp fins, sand holes and chills outside of the casting shall be removed.

M2.5.3 Castings shall be free from hot tears, cracks and other injurious defects. Castings shall be free of cold shuts that impair serviceability.

M2.5.4 When specified, radiographic testing and/or sectioning will be used to qualify castings for acceptance of internal soundness, by the manufacturer. To verify radiographic testing, the qualification process may include sectioning of the castings.

M2.5.4.1 Internal soundness of castings shall comply to radiographic testing quality standard levels as specified in Plans 1012, 1013, 1014, 1015, 1016 and 1017.

M2.5.4.2 Radiographic testing shall be done in conformance with the latest issue of the following ASTM specifications:

E – 94 Recommended Practice for Radiographic Testing
E – 446 Reference Radiographs up to 2 inches in Thickness, (0“–2”)
E – 186 Reference Radiographs for Heavy Wall Steel Castings, (2”-4-1/2”)
E – 280 Reference Radiographs for Heavy Wall Steel Castings, (4-1/2”- 12”)

M2.5.4.3 The continued frequency of radiographic testing and surface area coverage of components for castings meeting soundness qualification standards will be specified by the purchaser.

M2.5.5 Where testing, in accordance with M2.5.4 through to M2.5.4.3 is not specified, castings shall be free from sand holes, gas pockets, and other imperfections, unless these imperfections are in locations where they will not appreciably weaken the casting or impair its wearing qualities.

M2.5.6 Where testing, in accordance with M2.5.4 through to M2.5.4.3 is not specified, castings shall be free from all shrinkage cracks unless they are of the size and in such locations that they will not adversely affect the service life of the casting. Shrinkage cracks will not be permitted at any part of the tread surface.

M2.5.7 As cast tread surfaces within 2-1/2 (63.1 mm) of the gage line and flangeway walls 1" (25.4 mm) down from the tread surface shall be free of imperfections unless they are so small that they will be practically removed by the finish grinding.

M2.5.8 Castings shall be free from twist and reasonably true, both as to general surface and alignment, and shall not show signs of straining or undue denting from the straightening operation.

M2.5.9 The bottom part of the casting which rests on plates or ties shall be reasonably straight and without twist, and shall be free of surface irregularities or imperfections that would prevent a good bearing.

M2.5.10 Castings shall be without sharp corners at the base, having minimum radii of 1/4" (6.4 mm) at the intersection of the inside vertical wall and the bottom, and 1/8" (3.2 mm) at the intersection of the outside vertical wall at the bottom.

M2.5.11 Bolt holes in castings shall not be enlarged by cutting or reaming with an oxy-acetylene torch, unless specifically approved by the purchaser.

M2.6 Repair by Welding

M2.6.1 Defects that will not ultimately impair the strength of the casting may, with the consent of the purchaser's inspector, be welded by an approved process which meets the requirements of M2.6.2.

M2.6.2 Only electric arc repair welding utilizing the proper technique and electrodes or semi-automatic wire shall be employed as provided under "Welding of Manganese Castings in Special Trackwork", Chapter 5 of the AREMA Manual for Railway Engineering.

M2.7 Depth Hardening

M2.7.1 When specified, the impact areas described on the Trackwork Plans shall be hardened to a minimum surface Brinell hardness number of 352 for areas within 1" (25.4 mm) of the gage lines and minimum Brinell hardness number 321 for the balance of the hardened area.

M2.7.2 The hardening method to be employed, if not otherwise specified, shall be at the option of the manufacturer.

M2.7.3 Unless otherwise specified, one hardness reading only shall be required on each hardened area. This reading shall be taken at the intersection of lines 1" (25.4 mm) from, and parallel to, the gage or guard lines.

M2.7.4 In case any hardening measurement does not meet the specified requirements, two additional measurements shall be made, one on either side of the original impression, about 1" (25.4 mm) distant and parallel with the gage or guard line. If both of these measurements meet the requirements, the original reading shall be discarded, and these reading are to be recorded in its place.

M2.7.5 Castings failing to meet the hardness requirement will be acceptable provided the fee for the hardening process is not assessed.

M3. CARBON STEEL CASTINGS

M3.l Material Covered

M3.1.1 Carbon steel castings for solid track structures, or parts of track structures exposed to wheel wear, which are required to be heat treated and mechanical properties are specified, including yokes for guard rail clamps, operating parts for switch stands, special joint bars, and blocks in toe and heel joints. These were formerly designated as Grade H-1 or Class "B" Hard castings.

M3.1.2 Steel castings for general service in trackwork for which mechanical properties and heat treatment are not specified, including appurtenances and fittings, corner braces, rail braces, washers, spring housings, separator and end blocks for guard rails, adjusting wedges, for guard rail clamps, parts for switch stands, and other parts not exposed to wheel wear. These were formerly designated as Grade N-3 castings.

M3.2 Manufacture

M3.2.1 Heat treated carbon steel castings described in M3.1.1 shall be produced in conformance with the latest issue of ASTM A148 Specification for High Strength Steel Castings for Structural Purposes, Grade 80-40.

M3.2.2 Carbon steel castings described in M3.1.2 shall be produced from AISI/SAE number 1040 steel prescribed in M3.4.1, but as an alternate may be produced from steel of lesser carbon content at the option of the manufacturer, unless otherwise specified in the order or contract. In the absence of a standard specification covering the requirements for this particular group of castings, the castings shall conform in workmanship, finish and general character to the requirements of the latest issue of ASTM A148 specification.

M3.3 Heat Treatment and Stress Relieving

M3.3.1 Grade 80-40 steel castings shall be heat treated by full annealing, normalizing, quenching, tempering or combinations of these heat treatments, at the option of the manufacturer in accordance with ASTM A148 specification.

M3.3.2 Castings of 1040 steel and those with carbon content over 0.30 percent shall be stress relieved, but may be annealed, normalized or otherwise heat treated at the option of the manufacturer, in accordance with ASTM A148 specification. Castings with carbon content over 0.30 percent need not be treated unless otherwise specified in the order or contract.

M3.4 Chemical Requirements

M3.4.1 The steel shall conform to the following as to chemical composition:

Material	Percent			
	Carbon	Manganese	Phosphorus	Sulphur
A148 Grade 80-40	See M3.4.2		0.050 Max.	0.060 Max.
AISI/SAE Number 1040	0.37–0.44	0.60-0.90	0.040 Max.	0.050 Max.
Other	-	-	0.050 Max.	0.060 Max.

M3.4.2 The content of carbon, manganese, silicon, and other alloying elements shall be selected by the manufacturer to obtain the mechanical properties specified for the grade 80-40 steel heat treated castings.

M3.4.3 An analysis of each heat of steel shall be made by the manufacturer to determine the percentages of the elements specified.

M3.4.4 An analysis may be made by the purchaser from a test specimen or from a casting. The chemical composition thus determined shall conform to the specified requirements.

M3.5 Mechanical Requirements

M3.5.1 Mechanical property requirements are not specified for other than the grade 80-40 steel castings.

M3.5.2 The tensile properties for the grade 80-40 steel castings, determined in accordance with the test coupon, method of test, number of tests, and retest conditions established in the ASTM A148 or ASTM 214 specification, shall meet the following specified values:

Property	psi	Percent
Tensile Strength, Minimum	80,000	
Yield Point, Minimum	40,000	
Elongation in 2” (50 mm), Minimum		18
Reduction of Area, Minimum		30

M3.5.3 Bend tests shall not be required for carbon steel castings.

M3.6 Workmanship and Finish

M3.6.1 The castings shall conform substantially to the shape and sizes indicated on the patterns and drawings.

M3.6.2 The castings shall be free from injurious defects.

M3.7 Welding Repairs

M3.7.1 Minor imperfections which do not impair the strength or wearing qualities of the castings, except those located on the tread surface within 1.5” (38.1 mm) of the gage line may be welded with an approved method.

M3.7.2 Imperfections shall be considered minor when the depth of the cavity prepared for welding is not greater than 20 percent of the actual wall thickness, but in no case greater than 1" (25.4 mm).

M3.7.3 With the consent of the purchaser, imperfections other than minor may be repaired by welding with an approved process.

M3.7.4 All minor welds shall be given a suitable stress relief or heat treatment

M5. MALLEABLE AND DUCTILE IRON CASTINGS

M5.1 Material Covered

M5.1.1 Malleable or ductile iron castings for fittings and appurtenances for trackwork, braces, washers, switch clips, spring housings, and foot guards which may be produced from either type of iron at the option of the manufacturer.

M5.2 Manufacture

M5.2.1 Malleable iron castings shall be produced in conformance with the latest issue of ASTM A47, Specification for Malleable Iron Castings, Grade 32510.

M5.2.2 Ductile iron castings shall be produced in conformance with the latest issue of ASTM A536, Specification for Ductile Iron Castings, Grade 65-45-12.

M5.3 Heat Treatment

M5.3.1 Malleable iron castings shall be properly annealed. Any casting rejected for improper annealing may be re-annealed.

M5.3.2 Ductile iron castings shall generally be as-cast, but may be heat treated at the option of the manufacturer.

M5.4 Chemical Requirements

M5.4.1 It is the intent of the specification to subordinate chemical composition to mechanical properties. The quantities of any chemical elements in either the malleable or ductile iron shall be at the option of the manufacturer, except where the elements may be specified by special agreement between the purchaser and the manufacturer.

M5.5 Mechanical Requirements

M5.5.1 Mechanical property tests are not normally required for malleable or ductile iron castings.

M5.5.2 At the option of the purchaser or his representative, a casting may be tested to destruction, or otherwise broken up to determine the presence of any manufacturing condition which may be detrimental to the serviceability of the casting.

M5.5.3 When so specified by the purchaser in the order or contract, the castings shall be subject to the tensile test prescribed in the particular ASTM specifications referred to in M5.2.1 and M5.2.2.

M5.5.4 The iron as represented by tensile test specimens obtained, prepared and tested in accordance with the applicable specifications, shall conform to the following minimum requirements as set forth in the specification:

Mechanical Property	Malleable Iron, ASTM A47 Grade 32510			Ductile Iron, ASTM 536 Grade 65-45-12		
	psi	MPa	Percent	psi	MPa	Percent
Tensile Strength, Min.	50,000	345		65,000	448	
Yield Strength, Min.	32,000	224		45,000	310	
Elongation in 2" (50 mm), Min.			10.0			12.0

M5.6 Workmanship and Finish

M5.6.1 The castings shall conform substantially to the dimensions on the drawings or to the patterns supplied by the purchaser.

M5.5.2 The castings shall be reasonably smooth and free from injurious imperfections.

M6. STEEL FORGINGS

M6.1 Material Covered

M6.1.1 Mild carbon steel forgings for corner braces, fillers, and other parts of trackwork and track specialties not exposed to wheel wear.

M6.1.2 Higher carbon steel forgings for riser blocks, switch tongues, and other parts of trackwork which are exposed to wheel wear, as well as parts of trackwork and track specialties not exposed to wheel wear if produced to this class at the option of the manufacturer.

M6.2 Manufacture

M6.2.1 Mild steel forgings described in M6.1.1 shall be produced in conformance with the latest issue of ASTM A668, Specification for Forging, Carbon and Alloy Steel, for General Industrial Use, Grade B.

M6.2.2 Higher carbon steel forgings described in M6.1.2 shall be produced in conformance with the latest issue of ASTM A668, Specification for Forging, Carbon and Alloy Steel, for General Industrial Use, Grade C.

M6.2.2.1 Forgings in Grade C may also be produced from rail steel which meets the requirements of M1.2.1 and M1.3.1.

M6.3 Heat Treatment

M6.3.1 Mild steel, Grade B trackwork forgings need not be heat treated unless so specified in the order or contract.

M6.3.2 After forging and before reheating for heat treatment, Grade C forgings shall be cooled below the transformation temperature or to approximately 1000°F (538°C), and must not be permitted to cool below 500°F (260°C), without slow cooling.

M6.3.3 Higher carbon, Grade C trackwork forgings may be annealed, normalized, normalized and tempered, or quenched and tempered to meet the mechanical requirements in ASTM A668 and as indicated in M6.5.2.

M6.4 Chemical Requirements

M6.4.1 The steel shall conform to the following chemical requirements, except when rail steel is utilized (see M6.2.2 and M6.2.2.1):

ASTM A668 Grade	Composition, Percent				
	Carbon	Manganese	Phosphorus	Sulphur	Silicon
Grade B	0.15-0.25	0.30-0.60	0.045 Max.	0.050 Max.	--
Grade C	0.40-0.55	0.60-0.90	0.045 Max.	0.050 Max.	0.15

6.5 Mechanical Requirements

6.5.1 Grade B trackwork forgings are generally not specified to mechanical property requirements.

6.5.2 When specified by the purchaser in the order or contract, higher carbon, Grade C, trackwork forgings shall be tested in accordance with the ASTM A668 specifications, and the properties shall conform to the specified following requirements:

Mechanical Property	psi	MPa	Percent
Tensile Strength, Minimum	75,000	515	
Yield Strength, Minimum	37,500	260	
Elongation in 2” (50 mm), Minimum			20
Reduction in Area, Minimum			33

M6.5.3 Any testing in addition to that prescribed in M6.5.2 shall be a matter of agreement between the manufacturer and the purchaser and shall be required only when specified in the order or contract.

M6.6 Workmanship and Finish

M6.6.1 The forgings shall conform to the sizes and shapes specified by the purchaser.

M6.6.2 The forgings shall be free from injurious imperfections.

M7. ROLLED MILD STEEL

M7.1 Material Covered

M7.1.1 Rolled mild steel bars, bar size and structural shapes, and plates hammered, pressed, cut or machined for fittings and appurtenances, reinforcements, switch rods, clips, braces, slide and turnout plates, base and special tie plates, hold down housings, stops, heavy joint bars for internal joints of solid manganese steel crossings, corner braces, etc., but not including standard tie plates.

M7.2 Manufacture

M7.2.1 Bar and bar size shape stock shall be produced in conformance with the latest issue of ASTM A663, Specification for Merchant Quality Hot-Rolled Carbon Steel Bars, Grade 60 or ASTM A36, Specification for Structural Steel.

M7.2.2 Structural shape and plate stock shall be produced in conformance with the latest issue of ASTM A36, Specification for Structural Steel.

M7.3 Chemical Requirements

M7.3.1 The steel shall conform to the following chemical requirements:

Element	Percent
Phosphorus	0.04 Max.
Sulphur	0.05 Max.
Copper (when copper steel is specified)	0.20 Min.

M7.4 Tensile Requirements

M7.4.1 When specified in the order or contract, one tensile test representing the material employed shall be made in accordance with the test specimen and procedure set forth in the respective specifications.

M7.4.2 The material represented by the tensile test specimen shall conform to the following requirements:

Tensile Strength of:	Minimum		Maximum	
	psi	MPa	psi	MPa
A663 Grade 60	60,000	415	72,000	495
A36	58,000	400	80,000	550

M7.5 Workmanship and Finish

M7.5.1 Permissible variations in the size and the dimensions of as rolled finished bars, shapes and plates shall be as provided in the specifications referred to in M7.2.

M7.5.2 Completed articles shall be accurately finished for the purpose intended, and shall be free from injurious imperfections.

M8. ROLLED STEEL FROG FILLER

M8.1 Material Covered

M8.1.1 Rolled steel bars of a shape to be fitted as a spacer into the fishing area between two standard tee rail sections.

M8.2 Manufacture

M8.2.1 Filler bars shall be hot rolled from steel produced by any acceptable steel making process.

M8.3 Heat Treatment

M8.3.1 When specified in the order or contract, the bars shall be heat treated to provide the minimum hardness specified in M8.5.1.

M8.4 Chemical Requirements

M8.4.1 The steel shall conform to the following chemical composition:

Element	Percent	
	Minimum	Maximum
Carbon	0.35	0.60

M8.5 Hardness Requirement

M8.5.1 When the filler bars are specified in the order or contract to be heat treated, they shall have a minimum Brinell hardness of 277 after heat treatment.

M8.6 Workmanship and Finish

M8.6.1 The bars shall be smooth, straight and within the dimensions specified in M8.6.2 through M8.6.4. It may be necessary to machine as rolled filler bars to meet these requirements in the case of certain rail sections.

M8.6.2 The fishing height of the as rolled bars shall not vary from that called for by the rail section specified by more than 1/64” (0.4 mm) over or 1/32” (0.8 mm) under the nominal dimensions.

M8.6.3 The width of the as rolled filler bars between the rail web contact faces shall not vary more than 1/16” (1.6 mm) over or under the dimensions specified.

M8.6.4 The depth of the flangeway groove shall not vary by more than 3/16” (4.8 mm) over or 1/16” (1.6 mm) under the dimension specified.

M9. HELICAL SPRINGS

M9.1 Material Covered

M9.1.1 Helical springs for spring rail frogs and spring switch operating mechanisms.

M9.2 Manufacture

M9.2.1 Springs hot-coiled from hot-rolled steel bars 3/8” (9.5 mm) and larger in diameter shall be produced in conformance with the latest issue of ASTM A125, Specification for Heat Treated Steel Helical Springs.

M9.2.1.1 As provided in ASTM A125 specification, the springs shall be made from carbon steel bars conforming to the requirements of the latest issues of ASTM A689, Specification for Carbon and Alloy Steel Bars for Springs, and ASTM A29, General Requirements for Steel Bars Carbon and Alloy, Hot–Rolled and Cold-Finished.

M9.2.2 Springs may also be made from cold-drawn or oil-tempered wire less than 1/2" (12.7 mm) in diameter and produced in conformance with the latest issue of ASTM A228, Specification for Steel Wire, Music Spring Quality, or ASTM A229, Specification for Steel Wire, Oil-Tempered for Mechanical Springs, respectively.

M9.3 Heat Treatment

M9.3.1 Hot-coiled springs produced in accordance with Specification A125 must be quenched and tempered after forming to meet the hardness requirements of the specification.

M9.3.2 Springs manufactured from pre-hardened wire produced in accordance with Specifications A228 or A229 are not heat treated after forming.

M9.4 Chemical Requirements

M9.4.1 Unless otherwise specified, ASTM A125 specification provides that the springs shall be made from hot-rolled carbon steel bars conforming to the chemical composition requirements of the latest issue of ASTM A689, Specification for Carbon and Alloy Steel Bars for Springs. AISI grade designation 1095 steel is most commonly used.

M9.4.1.1 Due to hardenability limitations of carbon steel, it is suggested that the bar diameter be limited to 1-5/8" (41.8 mm) maximum in order to withstand the maximum test stress requirements of ASTM A125 specification.

M9.4.2 The chemical composition for cold-drawn and oil-tempered wire for springs shall conform to the requirements provided in the respective ASTM A228 and A229 specifications.

M9.5 Mechanical Requirements

M9.5.1 The mechanical requirements, number of tests, and test procedures are detailed in ASTM A125 specification for hot-coiled and heat treated spring steel, and in ASTM A228 for cold-drawn, and ASTM A229 for the oil-tempered spring steel wire.

M9.6 Physical Requirements

M9.6.1 Measurements, permissible variations from drawings, and physical tests on finished springs shall be as detailed in ASTM A125 specification.

M9.7 Workmanship and Finish

M9.7.1 The surface of hot-coiled springs shall be in the as-quenched and tempered condition.

M9.7.2 The surface of all springs shall be free from injurious imperfections.

M10. JOINT BARS

Refer to AREMA *Manual for Railway Engineering*, Chapter 4.

M11. BOLTS AND NUTS

M11.1 Material Covered

M11.1.1 For steel track bolts refer to AREMA *Manual for Railway Engineering*, Chapter 4.

M11.2 Manufacture

M11.2.1 Heat treated steel bolts as defined in M11.1.2 and M11.1.3 shall be produced in conformance with the latest issue of SAE J429, Specification for Mechanical and Material Requirements for Externally Threaded Fasteners, to a Grade 5 designation.

M11.2.2 Where specified by the purchaser, heat treated steel bolts as defined in M11.1.2 and M11.1.3 shall be produced to a Grade 8 designation, in conformance with the latest issue of SAE J429, Specification for Mechanical and Material Requirements for Externally Threaded Fasteners.

M11.2.3 Medium carbon steel nuts as defined in M11.1.2 and M11.1.3 shall be produced in conformance with the latest issue of SAE J995, Specification for Mechanical and Material Requirements for Steel Nuts, to a Grade 5 designation.

M11.2.4 Where specified by the purchaser, medium carbon heat treated steel nuts as defined in M11.1.2 and M11.1.3 shall be produced to a Grade 8 designation, in conformance with the latest issue of SAE J995, Specification for Mechanical and Material Requirements for Steel Nuts.

M11.2.5 The Grade of steel of the nut shall correspond to the Grade of steel of the bolt.

M11.3 Chemical and Mechanical Requirements

M11.3.1 Chemical and mechanical requirements, and tests when specified by the purchaser in the order or contract, shall be in accordance with those indicated in the specifications for the particular Grade of material utilized, except that the minimum carbon content of medium carbon steel nuts shall be 0.40 percent.

M11.4 Dimensions and Other Physical Attributes

M11.4.1 The heat treated bolts and medium carbon steel nuts, other than track bolts, shall conform to the details of M11.4.

M11.4.1.1 Main bolts or bolts through the body and filers of frogs, guard rails, and crossings of special trackwork and applicable nuts shall be 1-3/8” in diameter.

M11.4.1.2 The diameter of bolts and applicable nuts, other than those defined in M11.4.1 and M11.4.1.1, shall be as specified in the detail plans.

M11.4.2 The dimensional data for bolts for special trackwork as defined in M11.1.2 and M11.1.3 shall conform to the latest issue of ANSI B18.2.1 specification, for square head bolts, except where otherwise shown on detail plans.

M11.4.3 The dimensional data for nuts for special trackwork, shall conform to the latest issue of ANSI B18.2.2 specification, for heavy square nuts.

M11.4.4 The bolt and nut threads shall conform to the latest issue of the ANSI B1.1, Unified Screw Thread Requirements, Course Thread Series, UNC, with tolerances and allowances in accordance with Class 2A for external threads (bolts) and Class 2B for internal threads (nuts).

M11.4.5 The bolts shall have unthreaded shanks within the limits of ANSI B18.2.1, for Square Head Bolt Requirements, but not less than the minimum major diameter of the threads.

M11.4.6 Bolts shall be equipped as shown on the detailed plans with head locks, spring washers and flat or beveled washers to provide proper bearing and to permit tightening of the nuts with a standard track wrench. Bearing shall be as defined in ANSI B18.2.1 specification.

M11.4.6.1 Torque values to be applied to grades of bolt defined by this specification shall be as per the appropriate table below. Values shall be selected from the tables depending upon the steel grade of the bolt, the diameter of the bolt and the surface condition of the bolt (i.e. lubricated or non-lubricated).

Recommended Torque Values in ft.-lb. to Produce the Minimum Specified Tension in SAE Grade 5 Bolts			
Bolt Diameter	**Min. Tension - lb.**	**Lubricated Condition**	**Non-Lubricated Condition**
1/2”	12,000	80	105
5/8”	19,000	155	210
3/4”	28,000	275	370
7/8”	39,000	450	600
1”	51,000	670	890
1-1/8”	56,000	825	1100
1-1/4”	71,000	1165	1550
1-3/8”	85,000	1535	2040

Recommended Torque Values in ft.-lb. to Produce the Minimum Specified Tension in SAE Grade 8 Bolts			
Bolt Diameter	**Min. Tension - lb.**	**Lubricated Condition**	**Non-Lubricated Condition**
1/2”	15,000	100	130
5/8”	24,000	195	265
3/4”	35,000	345	460
7/8”	49,000	565	750
1”	64,000	840	1120
1-1/8”	80,000	1180	1575
1-1/4”	102,000	1675	2230
1-3/8”	121,000	2185	2910

Note: Lubricated torque values shall be achieved by applying a metal based lubricant to the bolt threads.

M11.5 Identification Symbols

M11.5.1 Heat treated steel bolts, as defined in M11.1.2 and M11.2.3, shall be identified by marking symbols on the top of the head of the bolts. Identification markings shall be as per the appropriate SAE Grade Marking for steel bolts.

M11.5.2 Medium carbon steel nuts as defined in M11.1.2 and M11.1.3, shall be identified by markings as the manufacturer and grade in conformance with the latest issue of ANSI B18.2.2, Specification for Heavy Square Nuts.

M11.6 Workmanship

M11.6.1 All bolts and nuts shall be free of imperfections that affect their serviceability.

AREMA DEFINITIONS OF TERMS RELATING TO TRACKWORK SWITCHES, FROGS, GUARD RAILS, CROSSINGS AND TURNOUTS

GENERAL TERMS

Alignment - The horizontal location of a railway as described by curves and tangents.

Closure Rails - The rails between the parts of any special trackwork layout, as the rails between the switch and the frog in a turnout (sometimes called Lead Rails or Connecting Rails); also the rails connecting frogs of a crossing or of adjacent crossings, but not forming parts thereof.

Compromise Rails - A forged rail between the two rail ends which are of differing sections, corresponding with the sections of the rails to which they are to be joined; it provides the transition from one section to a different rail section.

Compromise Joint - A joint for uniting the abutting ends of continuous rails of differing sections, or of rails of the same section but of differing joint drillings.

Connecting Track - Two turnouts with the track between the frogs arranged to form a continuous passage between one track and another intersecting or oblique track or another remote parallel track.

Crossing (Track) - A structure used where one track crosses another track at grade, and consisting of four connected frogs.

Crossover, Single - Two turnouts with the track between the frogs arranged to form a continuous passage between two nearby and generally parallel tracks.

Crossover, Double - Two crossovers which intersect between the connected tracks.

Curve - A continuous change in direction of alignment.

Curve, Degree of - The angle subtended at the center of a simple curve by a 100 ft. chord.

Derail - A track structure for derailing rolling stock in case of an emergency (see switch point derail)

Fastenings - Joint bars, bolts, spikes, clips, and elastic fasteners.

Fastenings, Auxiliary - Nut locks, spring washers, tie plates, rail braces and anti-creeping devices.

Flangeway – The open way through a track structure which provides a passageway for wheel flanges.

Flangeway Depth – The depth of the wheel flange passageway, or the vertical distance from the top of the tread surface to the top of the filler or separator introduced between the tread portion and the guard portion of a track structure.

Flangeway Width – The distance between the gage line and the guard line of a track structure, which provides a passageway for wheel flanges.

Flare – A tapered widening of the flangeway at the end of the guard line of a track structure, as at the end of a guard rail or at the end of a frog or crossing wing rail.

Flare Opening – The distance between gage line and the guard line of a track structure at the widest end of the flare.

Foot Guard – A filler for the space between converging rails used to prevent a person's foot from becoming accidentally wedged between the rails.

Frog – A track structure used at the intersection of two running rails to provide support for wheels and a passageway for their flanges, thus permitting wheels on either rail to cross the other.

Gauge (Track Tool) – A device by which the gage of the track is established or measured.

Gage (of Track) – The distance between the gage lines, measure at right angles thereto. The standard gage is 4 ft. 8-1/2 in. (1435 mm).

Gage Line – A line 5/8" (15.9 mm) below the top of the center line of head of running rail or corresponding location of tread portion of other track structures along that side which is nearer the center of the track.

Guard Line – A line along the side of the flangeway which is nearer the center of the track and at the same elevation as the gage line.

Guard Check Gage – The distance between the guard line and the gage line, as measured across the track at right angles to the gage line.

AREMA DEFINITIONS OF TERMS RELATING TO TRACKWORK SWITCHES, FROGS, GUARD RAILS, CROSSINGS AND TURNOUTS

Guard Face Gage – The distance between guard lines, measured across the track at right angles to the guard lines.

Guard Rail – A rail or other structure laid parallel with the running rail of a track, to prevent wheels from derailing; or to hold wheels in the correct alignment to prevent the flanges from striking points of turnout or crossing frogs or the points of switches. A rail or other structure laid parallel to the running rails of a track to derailed wheels adjacent to the running rails.

Insulation – A device or material that prevents the flow of electric current in a track circuit from passing from one rail to the other, or through switches and other track structures.

Joint Bar – A steel or composite member, embodying beam strength and stiffness in its structural shape and material; commonly used in pairs for the purpose of joining rail ends together, and holding them accurately, evenly, and firmly in position with reference to both surface and gage side alignment.

Joint Drilling – The spacing of holes in the ends of rails or other track structures to receive the bolts for the fastening of joint bars (See track bolts).

Joint, Rail – A fastening designed to unite the abutting ends of contiguous rails.

Joint, Insulated – A rail joint designed to arrest the flow of electrical current from rail to rail by means of insulations so placed as to separate the rail ends and other metal parts connecting them.

Pin – A mechanical fastener such as a bolt with nuts, threaded pins with swagable collar, or rivets.

Rail, Track – A rolled steel shape, commonly a T-section, designed to be laid end to end in two parallel lines on cross ties or other suitable supports to form a track for railway rolling stock.

Rail, Tee – See Plan No. 1001. Rail sections as used in this Portfolio weighing 115 lb. or more per yard.

Rail, Girder – See Plan No. 1002. Similar to a tee-rail section, but having a wider head on one side than the other, and having a rolled-in flangeway. Generally used in street car and transit operations where the track is embedded in pavement.

Slip Switch, Single – A combination of a crossing with one right hand and one left hand switch and curve between them within the limits of the crossing, and connecting the two intersecting tracks without the use of separate turnout frogs.

Slip Switch, Double - A combination of a crossing with two right hand and two left hand switches and the curved rails between them within the limits of the crossing, and connecting the two intersecting tracks on both sides of the crossing without the use of separate turnout frogs.

Switch – A track structure used to divert rolling stock from one track to the other.

Switch, Split - A switch consisting essentially of two movable point rails with the necessary fixtures. (See Split Switch Terms.).

Switches, Spring – A switch in the operating mechanism of which is incorporated a spring device so arranged as to automatically return the points to their original position after they have been thrown over by the flanges of trailing wheels passing along the other track from that which the points are set for facing movements.

Switch Point Derail – A derail consisting essentially of one (single) or two (double) switch point(s) with the necessary fixtures.

Switch Stand – A device for manual operation of switches, or of movable center points.

Tangent – A straight portion of a railway alignment.

Tie Plate – A plate incorporated between a rail or other track structure and a tie.

Track – An assembly of rails, ties and fastenings over which cars, locomotives and trains are moved.

Track Bolt – A bolt with a button head, and oval or elliptical neck, and a threaded nut designed to fasten together rails and joint bars.

Track Center – The perpendicular distance between two parallel tracks.

Transition Rail – A rail with the railhead machined to resemble worn rail. Rail is of the same section.

Turnout – An arrangement of a switch and a frog with closure rails, by means of which rolling stock may be diverted from one track to another.

SPLIT SWITCH TERMS

SWITCH – with Uniform Risers. A switch in which the switch points have a uniform elevation on riser plates for the entire length of the switch, and therefore not having a heel slope, the point rail rise being run off back of the switch in the closure rails. (For names of detail parts see Plan No. 190.)

SWITCH – with Graduated Risers. A switch in which the switch points are gradually elevated by means of graduated riser plates until they reach the required height above the stock rail, and therefore having a heel slope. (For names of detail parts see Plan No. 190.)

MANGANESE TIPPED SWITCH – A split switch in which the head of one or both of the switch rails is cut away in the point portion and manganese steel pieces fastened to the rail to form the point.

INSULATED SWITCH – A switch in which the fixtures, principally the gage plates and the switch rods, connecting or reaching from one rail to the opposite rail are provided with insulation so that the electric track circuit will not be shunted.

Head Separation – The point a switch rail where the head of the rail attains its full width.

Heel of Switch – That location on a switch point where the head spread is equal to 6-1/4".

Heel Spread – The distance at the heel, between the gage line of a switch point and the gage line of its stock rail.

Heel Slope – The inclination produced by graduated risers in that part of the switch which reduces the elevation (as the height of the risers decreases) towards the heel of the switch.

Point of Switch (Actual) – That end of the switch rail which is farther from the frog; the point where the spread between the gage lines of the stock rail and the switch rail is sufficient for a practicable switch point.

Point of Switch (Theoretical) or Vertex – The point where the gage line of the switch point, if so produced, would intersect the gage line of the stock rail.

Point Rail, Switch Rail, or Switch Point – The tapered rail of a split switch.

Point Rail, Rise –The elevation of a switch rail to allow the overhanging part of hollowed-out treads of worn wheels to pass over the stock rail.

Planing, Bottom – The cut planed at an angle on the bottom of the base of the switch rail from the point towards the heel to allow the switch rail to rest on the top of the base of the stock rail, when the switch is closed.

Planing, Side – The cuts made on the sides of the head of the switch rail to form a taper.

Planing, Top – The cut made on the top of the head of the switch rail from the point and to approximately the head separations.

Planing, Chamfer Cut – The vertical beveling of the gage side of the switch rail to produce a sharp edge, so as to prevent wheel flanges from striking the point.

Rail Brace (Switch) – A metal shape designed to fit the contour of the side of the stock rail and extend over the switch plate, with provisions for fastening through the plate to the tie, to restrain the movement of the stock rail.

Rail Brace, Adjustable (Switch) – A rail brace which may be adjusted laterally with respect to the stock rail to compensate for variations in the dimensions of the rail and to permit adjustment for wear. (See Plan No. 224).

Stock Rail – A running rail against which the switch point operates. The stock rail may be straight or undercut depending on the design of the switch point.

Stock Rail Bend – The bend or set which must be given to the stock rail at the vertex of a switch to allow it to follow the gage line of the turnout.

Stock Rail Extension – The portion of a stock rail extending beyond and ahead of the point of switch.

Switch Angle – The angle included between the gage lines of a switch and rail at its point and the stock rail.

Switch Fixtures – The connecting and bearing parts for the rails of a split switch. (For details and names of parts see Plan No. 209, and Plan No. 221 to 224, inclusive.)

AREMA DEFINITIONS OF TERMS RELATING TO TRACKWORK SWITCHES, FROGS, GUARD RAILS, CROSSINGS AND TURNOUTS

Throw of Switch – The distance through which the points of switch rails are moved sidewise, measured along the center line of the No. 1 switch rod or head rod. (This distance has been standardized at 4-3/4".)

FROG TERMS

MOVEABLE POINT FROG – A frog with a rigid wing assembly and a point that moves between them, forming a continuous wheel path.

SPRING RAIL FROG – A frog having a movable wing which is normally held against the point rail by springs, thus making an unbroken running surface for wheels using one track, whereas the flanges of wheels on the other track force the movable wing rail away from the point rail to provide a passageway. (For names of detail parts see Plan No. 490.)

SPRING RAIL FROG, Right Hand and Left Hand – Standing at the toe end of a spring rail frog and looking towards its point, a right hand frog has the movable wing rail located on the right hand side, and a left hand frog has the movable wing located on the left hand side.

RAILBOUND MANGANESE STEEL FROG – A frog consisting essentially of a manganese steel body casting fitted into and between rolled rails and held together with bolts. (For names of details see Plan No. 690.)

SOLID MANGANESE STEEL FROG – A frog consisting essentially of a single manganese steel casting. (For names of details see Plan No. 691.)

SELF GUARDED FROG (Flange Frog) – A frog provided with guides or flanges, above its running surface, which contact the tread rims of wheels for the purpose of safely guiding their flanges past the point of frog.

Frog Angle – The angle formed by the intersecting gage lines of a frog.

Frog Number – One-half the cotangent of one-half the frog angle, or the number of units of center line length in which the spread is one unit.

Frog Point – That part of a frog lying between the gage lines extending from their intersection toward the heel end.

a) Theoretical Point – The point of intersection of the gage lines of a frog.

b) Half-Inch Point – A point located at a distance from the theoretical point towards the heel, equal in inches to one half the frog number, and at which the spread between the gage lines is one-half inch. It is the origin from which measurements are usually made.

Heavy Point – A frog point that is widened beyond nominal creating a heavier section.

Heel End of Frog – That end of a frog which is the farther from the switch; or, the end which has both point rails or other running surfaces between the gage lines.

Heel Length – The distance between the heel end and the half-inch point, measured along the gage line.

Heel Spread – The distance between gage lines at the heel end of a frog.

Throat of Frog – The point at which the converging wings of a frog are closest together.

Toe End of Frog – That end of a frog which is nearer the switch, or, the end which has both gage lines between the wing rails or other running surfaces.

Toe Length – The distance between the toe end and half inch point of frog, measured along the gage line.

Toe Spread – The distance between the gage lines at the toe end of the frog.

GUARD RAIL TERMS

GUARD RAIL (Frog) – A rail or other device to guide the wheel flanges so that it is kept clear of the point of frog.

GUARD RAIL (Switch) – A rail or other track structure laid parallel with the running rail ahead of a split switch and forming a flangeway with the running rail, to hold the wheels of rolling stock in correct alignment when approaching the switch.

GUARD RAIL, ONE-PIECE – A guard rail consisting of a single complete unit, either fabricated or cast, so designed that no auxiliary parts or fastenings other than spikes, are required for its installation.

Adjustable Separator – A metal block of two or more parts, acting as a filler between the running rail and the guard rail and so designed as to provide varying widths of flangeways.

Guard Rail Brace – A metal shape designed to fit the contour of the side of the guard rail and extend over the tie, with provisions for fastening thereto, to restrain the moving or tilting of the guard rail away from the running rail.

Guard Rail Brace, Adjustable – A guard rail brace which may be adjusted laterally with respect to the rail, to vary the distance between the guard rail and the running rail.

Guard Rail Clamp – A device consisting of a yoke and fasteners designed to engage the running rail and the guard rail and hold them in correct relation to each other.

CROSSING TERMS

BOLTED RAIL CROSSING – A crossing in which all the running surfaces are of rolled rail, the various parts being held together with bolts.

FLANGE BEARING CROSSING – A crossing where a vehicle traveling on either route travels across the crossing on the tips of its wheel flanges.

MANGANESE STEEL INSERT CROSSING – A crossing in which a manganese steel casting is inserted at each of the four intersections, being fitted into rolled rails and forming points and wings of the crossing frogs.

SOLID MANGANESE STEEL CROSSING – A crossing in which the frogs are of solid manganese steel type.

MOVABLE POINT CROSSING – A crossing of small angle in which each of the two center frogs consist essentially of a knuckle rail and two opposed movable center points with the necessary fixtures.

ONE WAY LOW SPEED (OWLS) CROSSING – A crossing where a vehicle traveling on the lower tonnage route crosses the higher tonnage route traveling on the tips of its wheel flanges.

SINGLE RAIL CROSSING – A crossing in which the connections between the end frogs and the center frogs consist of running rails only.

TWO RAIL CROSSING – A crossing in which the connections between the end frogs and the center frogs consists of running rails and guard rails.

THREE RAIL CROSSING – A crossing in which the connections between the end frogs and the center frogs consists of running rails, guard rails and easer rails.

Crossing Plates – Plates interposed between a crossing and the ties or other timbers to protect the ties and to better support the crossing by distributing the loads over larger areas. (For names and descriptions of various styles, see Plan No. 700 D.)

Center Frogs – The two frogs at the opposite ends of the short diagonal of a crossing.

End Frogs – The two frogs at the opposite ends of the long diagonal of a crossing.

Easer Rail (or Easer) – A rail placed with its head along the outside of and close up to the head of the running rail and sloped at the ends to provide a bearing for the overhang portion of hollowed-out treads of worn wheels.

Guard Point – The point formed by guards introduced or extended into the toe portion of a frog.

Guard Rail – A rail placed parallel with the running rail, with the flangeway between them.

Knuckle Rail – A bent rail, or equivalent structure, that forms the obtuse point against which the movable center points, of a movable point crossing or slip switch, rest when set for traffic.

Movable Center Point – One of the movable tapered rails of a movable point crossing or slip switch.

Reinforcing Rail – A bent rail placed with its head along the outside of and close up to the head of a knuckle rail to strengthen it and to act as an easer rail; or a piece of rail similarly applied to a movable center point.

Reversible Casting – A casting that can be rotated to provide a new running surfacing on the opposite corner.

Running Rail – The rail or surface on which the tread of the wheel bears.

AREMA DEFINITIONS OF TERMS RELATING TO TRACKWORK SWITCHES, FROGS, GUARD RAILS, CROSSINGS AND TURNOUTS

TURNOUT TERMS

TURNOUT – An arrangement of a switch and a frog connected by closure rails, by means of which rolling stock may be diverted from one track to another.

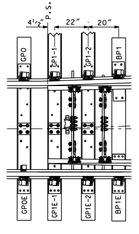
Curved Lead – The distance between the actual point of the switch and the half-inch point of frog, measured on the outside gage line of the turnout.

Lead (Actual) – The distance between the actual point of the switch and the half-inch point of frog, measured on the gage line of the parent track.

Lead (Theoretical) - The distance between the theoretical point of a uniform turnout curve to the theoretical point of frog, measured on the gage line of the parent track.

Lead Curve – The curve in the turnout interposed between the switch and the frog.

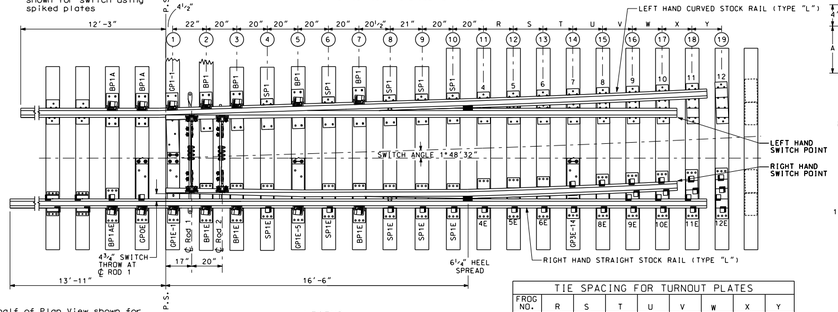
Turnout Number – The number corresponding to the frog number of the frog used in the turnout.



PLAN VIEW OF POWER OPERATED SWITCH

Note:
Top half of Plan View shown for switch using spiked plates

FOR TURNOUT CURVATURE SEE PLAN NO. 910.



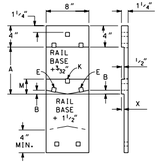
Note:
Bottom half of Plan View shown for switch using elastic fasteners and plates for wood tie screw spikes.

LEGEND
- RAIL BRACE
- ELASTIC FASTENER
- P.S. POINT OF SWITCH

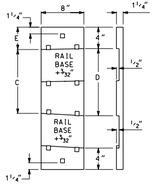
PLAN VIEW OF HAND THROW SWITCH (LEFT HAND SHOWN)

TIE SPACING FOR TURNOUT PLATES

FROG NO.	R	S	T	U	V	W	X	Y
7	19½"	19½"	19½"	19½"	19½"	19½"	19½"	19½"
8	20"	19½"	19½"	19½"	19½"	20"	20"	20"
9	19½"	19½"	20"	20½"	20½"	21"	21½"	21½"
10	21½"	22"	22"	23"	23"	23"	23"	23"



PLATES NO. 4-7



PLATES NO. 8-12

TRACK SPIKE TURNOUT PLATES

TRACK SPIKE TURNOUT PLATES No. 7 TURNOUT

NO.	DETAIL	A	B	X
4	7150	6⁹⁄₁₆"	⅛"	1¼"
5	7151	7¼"	⅛"	5⁄₁₆"
6	7152	8"	⅛"	3⁄₈"
7	7153	8¹⁵⁄₁₆"	3⁄₁₆"	7⁄₁₆"
		C	D	E
8	7158	9¹¹⁄₁₆"	10½"	4³⁄₁₆"
9	7159	10¹¹⁄₁₆"	11¼"	4³⁄₁₆"
10	7160	11¾"	12¼"	4¼"
11	7161	13"	13½"	4½"
12	7162	14¼"	14¾"	4½"

TRACK SPIKE TURNOUT PLATES No. 8, No. 9, & No. 10

NO.	DETAIL	A	B	X
4	7165	6⁹⁄₁₆"	5³²⁄₃₂"	1¼"
5	7166	7⅛"	5³²⁄₃₂"	5⁄₁₆"
6	7167	7²³⁄₃₂"	5³²⁄₃₂"	3⁄₈"
7	7168	8²⁵⁄₃₂"	3⁄₁₆"	7⁄₁₆"
		C	D	E
8	7173	9¹⁵⁄₃₂"	9²³⁄₃₂"	4³⁄₁₆"
9	7174	10⅜"	10²³⁄₃₂"	4³⁄₁₆"
10	7175	11¹⁄₁₆"	11⅝"	4³⁄₁₆"
11	7176	12⁵⁄₁₆"	12¹¹⁄₁₆"	4³⁄₁₆"
12	7177	13¹³⁄₃₂"	13²³⁄₃₂"	4⁷⁄₃₂"

NOTES FOR PLATES 4-7:
1. OMIT SPIKE HOLE "K" WHEN DISTANCE "M" IS LESS THAN 1½"
2. OMIT SPIKE HOLES "E" WHEN DISTANCE "M" IS LESS THAN ⅝"
3. FOR SIZE AND LOCATION OF SPIKE HOLES, SEE SECTION 7 PLAN NO. 100.

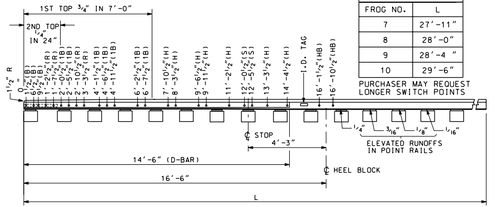
SCREW SPIKE TURNOUT PLATES No. 7 TURNOUT

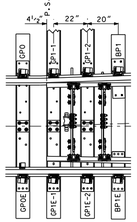
NO.	DETAIL	A	B	X
4E	6150	6⁹⁄₁₆"	1⅛"	0"
5E	6151	7¼"	1⅛"	1⁄₁₆"
6E	6152	8"	1⅛"	1⅛"
7E	6153	8¹⁵⁄₁₆"	3⁄₁₆"	3⁄₁₆"
		C	D	E
8E	6158	9¹¹⁄₁₆"	10½"	7³⁄₁₆"
9E	6159	10¹¹⁄₁₆"	11⅞"	7³⁄₁₆"
10E	6160	11¾"	12¼"	7¼"
11E	6161	13"	13½"	7¼"
12E	6162	14¼"	14¾"	7¼"

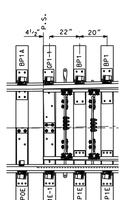
SCREW SPIKE TURNOUT PLATES No. 8, No. 9, & No. 10

NO.	DETAIL	A	B	X
4E	6165	6⁹⁄₁₆"	5³²⁄₃₂"	0"
5E	6166	7⅜"	5³²⁄₃₂"	1⁄₁₆"
6E	6167	7²³⁄₃₂"	5³²⁄₃₂"	1⅛"
7E	6168	8²⁵⁄₃₂"	3⁄₁₆"	3⁄₁₆"
		C	D	E
8E	6173	9¹⁵⁄₃₂"	9²³⁄₃₂"	7³⁄₁₆"
9E	6174	10⅜"	10²³⁄₃₂"	7³⁄₁₆"
10E	6175	11¹⁄₁₆"	11⅝"	7³⁄₁₆"
11E	6176	12⅝"	12¹¹⁄₁₆"	7³⁄₁₆"
12E	6177	13¹³⁄₃₂"	13²³⁄₃₂"	7⁵⁄₃₂"

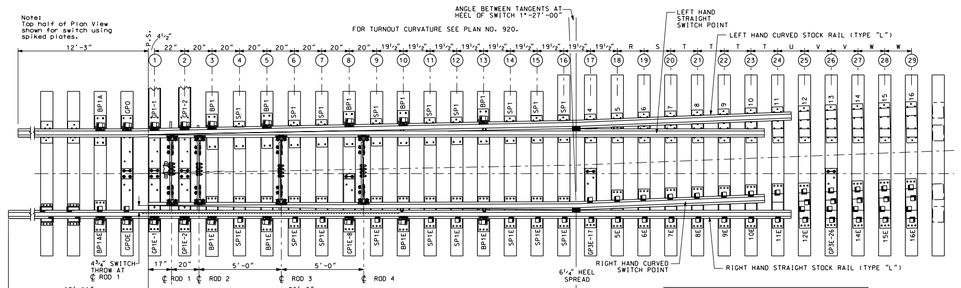
NOTES FOR TURNOUT PLATES:
1. WHEN USING GAGE PLATES, REDUCE QUANTITY OF TURNOUT PLATES BASED ON NUMBER OF GAGE PLATES IN SET.
2. TURNOUT PLATES ARE DESIGNED TO TO BE USED WITH 14" TIE PLATES. IF LARGER TIE PLATES ARE USED, EXTRA TURNOUT PLATES WILL BE REQUIRED.


1ST TOP ¾" IN 7'-0"
2ND TOP ¾" IN 24"
11½" R
1-7½"(R) 1-7½"(R) 1-7½"(R)


GPD6
GP1E-1
GP1E-2
GP1E-3
BP1E-1
GP1E-4
BP1E-2
GP1E-5
BP1E-3
GP1E-6
BP1E-4
GP1E-7
BP1E-5
GP1E-8
BP1E-6
GP1E-9
BP1E-7
GP1E-10
BP1E-8
GP1E-11
BP1E-9
GP1E-12
BP1E-10
GP1E-13
BP1E-11
GP1E-14
BP1E-12
GP1E-15
BP1E-13
GP1E-16
BP1E-14
GP1E-17
BP1E-15
GP1E-18
BP1E-16
GP1E-19
BP1E-17
GP1E-20
BP1E-18
GP1E-21
BP1E-19
GP1E-22
BP1E-20



PLAN VIEW OF HAND THROW SWITCH

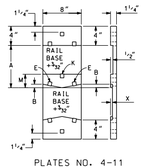


PLAN VIEW OF POWER OPERATED SWITCH (LEFT HAND SHOWN)

LEGEND
- RAIL BRACE
- ELASTIC FASTENER
- P.S. POINT OF SWITCH

TIE SPACING FOR TURNOUT PLATES

FROG No.	R	S	T	U	V	W
14	19½"	19½"	19½"	19½"	19½"	19½"
15	19½"	20"	20"	20"	20½"	20½"
16	20"	20"	20½"	21"	21"	21½"



TRACK SPIKE TURNOUT PLATES
No. 14, No. 15, & No. 16

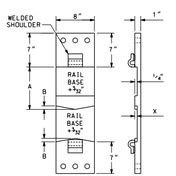
NO.	DETAIL	A	B	X
4	7450	6 15/32"	3/32"	1/4"
5	7451	7 1/16"	1/8"	9/32"
6	7452	7 9/16"	1/8"	5/16"
7	7453	8 1/8"	1/8"	11/32"
8	7454	8 11/16"	1/8"	3/8"
9	7455	9 5/16"	1/8"	13/32"
10	7456	9 15/16"	1/8"	7/16"
11	7457	10 5/8"	1/8"	15/32"
		C	D	E
12	7466	11 1/16"	11 5/16"	4 1/4"
13	7467	11 3/4"	12"	4 1/4"
14	7468	12 5/16"	12 1/16"	4 1/4"
15	7469	13"	13 1/16"	4 3/4"
16	7470	13 5/8"	14 3/16"	4 3/4"

NOTES FOR PLATES 4-11:
1. OMIT SPIKE HOLE "X" WHEN DISTANCE "M" IS LESS THAN 1¼"
2. OMIT SPIKE HOLES "E" WHEN DISTANCE "M" IS LESS THAN ⅝"
3. FOR SIZE AND LOCATION OF SPIKE HOLES. SEE SECTION 7- PLAN NO.100.

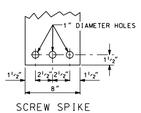
SCREW SPIKE TURNOUT PLATES
No. 14, No. 15, & No. 16

NO.	DETAIL	A	B	X
4E	6450	6 15/32"	3/32"	0"
5E	6451	7 1/16"	1/8"	1/32"
6E	6452	7 9/16"	1/8"	1/16"
7E	6453	8 1/8"	1/8"	3/32"
8E	6454	8 11/16"	1/8"	1/8"
9E	6455	9 5/16"	1/8"	5/32"
10E	6456	9 15/16"	1/8"	3/16"
11E	6457	10 5/8"	1/8"	5/32"
		C	D	E
12E	6466	11 1/16"	11 5/16"	3 1/4"
13E	6467	11 3/4"	12"	3 1/4"
14E	6468	12 5/16"	12 1/16"	3 1/4"
15E	6469	13"	13 1/16"	3 3/4"
16E	6470	13 5/8"	14 3/16"	3 3/4"

NOTES FOR TURNOUT PLATES:
1. WHEN USING GAGE PLATES, REDUCE QUANTITY OF TURNOUT PLATES BASED ON NUMBER OF GAGE PLATES IN SET.
2. TURNOUT PLATES ARE DESIGNED TO BE USED WITH 14" TIE PLATES. IF LARGER TIE PLATES ARE USED, EXTRA TURNOUT PLATES WILL BE REQUIRED.



NOTE: SHOULDERS MAY BE OFFSET IF REQUIRED.

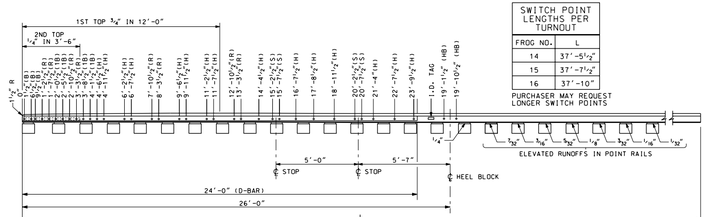


SCREW SPIKE HOLE DIMENSIONS

SCREW SPIKE TURNOUT PLATES

HOLE	DIA.	BOLTS (GRADE 5) *
B	1 1/16"	1" SQUARE THIN HEAD
1B	1 1/16"	1" SQUARE THIN HEAD
R	1 1/16"	FURNISHED WITH RODS
H	15/16"	3/4" PIN
S	15/16"	3/4" SQUARE FULL HEAD
HB	1 3/16"	1 1/8" SQUARE FULL HEAD

* BOLT HARDWARE TO INCLUDE: SPRING WASHER, HEX NUT AND ¼" COTTER



ELEVATION OF SWITCH POINT

SWITCH POINT LENGTHS PER TURNOUT

FROG NO.	L
14	37'-5½"
15	37'-7½"
16	37'-10"

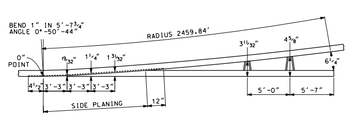
PURCHASER MAY REQUEST LONGER SWITCH POINTS

SIDE PLANING

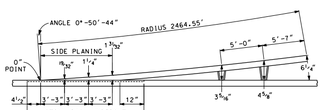
RAIL HEAD WIDTH	DETAIL 5100
2¾"	13'-11⅝"
2¾"	13'-8"
3"	14'-2⅛"

ALIGN WEB OF SWITCH POINT RAIL SAME AS ADJACENT STOCK RAIL THROUGH SIDE PLANING.

TRACK SPIKE TURNOUT PLATES



STRAIGHT SWITCH POINT
DETAIL 5100 PER PLAN NO. 221



CURVED SWITCH POINT
DETAIL 5100 PER PLAN NO. 221

DETAILS SHOWN ABOVE ARE FURNISHED UNLESS OTHERWISE SPECIFIED

Bill of Material for 26'-0" Curved Split Switch

Qty For Track Spike Plates	Qty For Elastic Fastener Plates	Description	Plan No.	Detail No.
2	2	Double Reinforced Switch Points Complete	221	5100
		Forged Stops	221	2024
1	1	Curved Stock Rail	911	-
1	1	Straight Stock Rail	911	-
2	2	Heel Block Assembly	221	1125
3	3	Insulated Back Switch Rod	222	3117, 6011
		Insulation Applied To Rods	222	3001
18	18	Adjustable Rail Braces	224	-
2	2	Turnout Plate Sets Per Table for No. 14, 15, and 16 Turnouts	125	6450-6457, 6466-6470 or 7450-7457, 7466-7470

POWER OPERATED SPLIT SWITCH WITH UNIFORM RISERS - SPEC. 1258				
Qty For Track Spike Plates	Qty For Elastic Fastener Plates	Description	Plan No.	Detail No.
1	1	Insulated Head Switch Rod With Basket	222	3117, 7017
1	1	Gage Plate No. GP0	223	3126
2	3	Gage Plate No. GP1	223	3127 or 4127
2	2	Plate No. BP1A	224	6026 or 7026
10	8	Plate No. BP1	224	4020 or 6020
18	18	Plate No. SP1	224	6021 or 7021
0	2	Gage Plate No. GP3	223	3132

HAND THROW SPLIT SWITCH WITH UNIFORM RISERS - SPEC. 1254				
Qty For Track Spike Plates	Qty For Elastic Fastener Plates	Description	Plan No.	Detail No.
1	1	Insulated Head Switch Rod	222	3117, 6010
0	1	Gage Plate No. GP0	223	3126
1	2	Gage Plate No. GP1	223	3127 or 4127
4	2	Plate No. BP1A	224	6026 or 7026
12	10	Plate No. BP1	224	4020 or 6020
18	18	Plate No. SP1	224	6021 or 7021
0	2	Gage Plate No. GP3	223	3132

NOTES:
1- BILL OF MATERIAL- This plan illustrates and includes in the following Bills of Material several designs of split switch layouts, therefore purchaser shall state which Bill of Material Specification is wanted. Purchaser to state which turnout plates to furnish.

Insulated hand-throw Split switch with uniform risers and adjustable rail braces. Spec. 1254

Power Operated Split switch with uniform risers and adjustable rail braces. Spec. 1258

RAIL AND JOINT BARS. For new installation, all switches are to be 115 lb. RE, 136 lb. RE, or 141 lb. RE.

Purchaser shall specify hand of turnout and switch points and stock rails to suit. For right hand turnouts, the right hand switch point and left hand stock rail are straight and the left hand switch point and right hand stock rail are curved. For left hand turnouts, the left hand switch point and right hand stock rail are straight and the right hand switch point and left hand stock rail are curved.

2- ALTERNATES:
(a) Any details of fittings that will apply per Plans No. 221, 222, 223, and 224.

(b) Switch rails furnished with manganese steel tips per Plan No. 220.

(c) Type "S" stock rails per Plan No. 921.

3- Switch point rollers may be added per individual customer's request.

4- SPRING SWITCH DETAILS - See Plan No. 183 for revisions in switch points, rods, plates, and Bills of Material recommended for spring switch operation.

5- SPECIFICATIONS - See Plan No. 100

6- Gage plate I.D. stamping to include:

	Plate Style (If Required)	Hand	Tie Number	Switch Length	Rail Weight
Example:	GP1			26'-0"	136
Example:	GP2E	L	12	26'-0"	136

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

26'-0" CURVED SPLIT SWITCH WITH UNIFORM RISERS FOR TRACK SPIKES OR SCREW SPIKES

PLAN NO. 125-08

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Note:
Top half of Plan View shown for switch using spiked plates.

SWITCH SHALL BE THROWN AT ROD No.5 BY AN OPERATING DEVICE WHICH MAY CONSIST OF BELL CRANKS AND THROW RODS CONNECTED TO ROD No.1. THIS DEVICE SHALL BE FURNISHED WHEN SPECIFIED. DESIGN TO BE APPROVED BY PURCHASER. ROD No.5 SHALL BE EQUIPPED WITH BASKET ADJUSTMENT UNLESS OTHERWISE SPECIFIED.

FOR TURNOUT CURVATURE SEE PLAN NO. 920.

ANGLE BETWEEN TANGENTS AT HEEL OF SWITCH 1°-04'-30"

LEFT HAND CURVED STOCK RAIL (TYPE "L")

OPTIONAL ROD NO. 6

LEFT HAND STRAIGHT SWITCH POINT

RIGHT HAND CURVED SWITCH POINT

RIGHT HAND STRAIGHT STOCK RAIL (TYPE "L")

4½" SWITCH THROW AT ℄ ROD 1

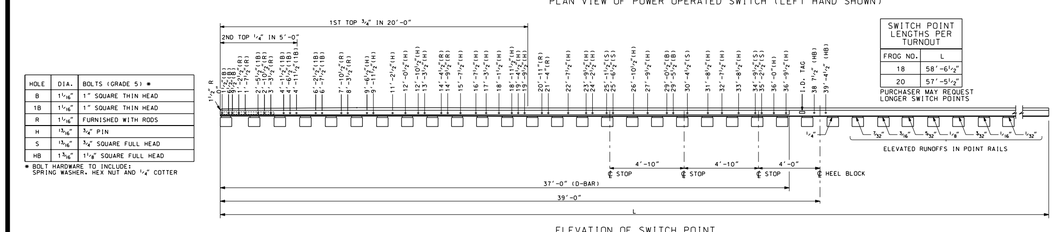
6¼" HEEL SPREAD

Note:
Bottom half of Plan View shown for switch using elastic fasteners and plates for wood tie screw spikes.

PLAN VIEW OF POWER OPERATED SWITCH (LEFT HAND SHOWN)

TIE SPACING FOR TURNOUT PLATES				
FROG No.	R	S	T	U
18	19½"	19½"	19½"	19½"
20	19½"	20"	20½"	21"

LEGEND
- RAIL BRACE
- ELASTIC FASTENER
- P.S. POINT OF SWITCH



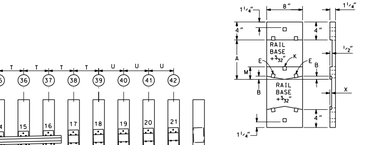
ELEVATION OF SWITCH POINT

HOLE	DIA.	BOLTS (GRADE 5) *
B	1⅛"	1" SQUARE THIN HEAD
1B	1⅛"	1" SQUARE THIN HEAD
R	1¼"	FURNISHED WITH RODS
H	⅞"	¾" PIN
S	⅞"	¾" SQUARE FULL HEAD
HB	1⅛"	1" SQUARE FULL HEAD

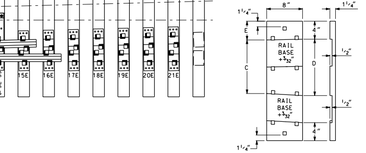
* BOLT HARDWARE TO INCLUDE: SPRING WASHER, HEX NUT AND ¼" COTTER

SWITCH POINT LENGTHS PER TURNOUT	
FROG NO.	L
18	58'-6½"
20	57'-5½"

PURCHASER MAY REQUEST LONGER SWITCH POINTS



PLATES NO. 4-11



PLATES NO. 12-21

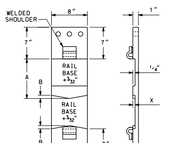
TRACK SPIKE TURNOUT PLATES

TRACK SPIKE TURNOUT PLATES No. 18 & No. 20				
NO.	DETAIL	A	B	X
4	7500	6⅞₁₆"	1¼₆"	0"
5	7501	6⅞₁₆"	1¼₆"	3/32"
6	7502	7⅜₁₆"	1¼₆"	5/16"
7	7503	7⅞₃₂"	3/32"	11/32"
8	7504	8⅛₃₂"	3/32"	3/8"
9	7505	8⅝₃₂"	3/32"	13/32"
10	7506	8²⁹/₃₂"	3/32"	1/2"
11	7507	9¹/₃₂"	3/32"	15/32"
		C	D	E
12	7516	9¹¹/₁₆"	9⅞"	4 3/32"
13	7517	10⅜₁₆"	10⅜₁₆"	4 3/32"
14	7518	10¹¹/₁₆"	10⅞"	4 3/32"
15	7519	11⅜₁₆"	11⅜₁₆"	4 3/32"
16	7520	11¹¹/₁₆"	11⅞"	4 3/32"
17	7521	12⅜₁₆"	12⅜₁₆"	4 3/32"
18	7522	12⅞"	12¹¹/₁₆"	4 3/32"
19	7523	13¹/₄"	13¹/₄"	4 1/4"
20	7524	13¹³/₁₆"	14¹/₁₆"	4 1/4"
21	7525	14⅜"	14⅜"	4 1/4"

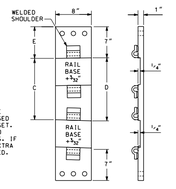
NOTES FOR PLATES 4-11:
1. OMIT SPIKE HOLE "K" WHEN DISTANCE "M" IS LESS THAN 11/16".
2. OMIT SPIKE HOLES "E" WHEN DISTANCE "M" IS LESS THAN 5/8".
3. FOR SIZE AND LOCATION OF SPIKE HOLES, SEE SECTION 7 PLAN NO.100.

SCREW SPIKE TURNOUT PLATES No. 18 & No. 20				
NO.	DETAIL	A	B	X
4E	6500	6⅞₁₆"	1¼₆"	0"
5E	6501	6⅞₁₆"	1¼₆"	1/16"
6E	6502	7⅜₁₆"	1¼₆"	1/16"
7E	6503	7⅞₃₂"	3/32"	1/16"
8E	6504	8⅛₃₂"	3/32"	1/16"
9E	6505	8⅝₃₂"	3/32"	5/32"
10E	6506	8²⁹/₃₂"	3/32"	5/32"
11E	6507	9¹/₃₂"	3/32"	5/32"
		C	D	E
12E	6516	9¹¹/₁₆"	9⅞"	3 3/32"
13E	6517	10⅜₁₆"	10⅜₁₆"	3 3/32"
14E	6518	10¹¹/₁₆"	10⅞"	3 3/32"
15E	6519	11⅜₁₆"	11⅜₁₆"	3 3/32"
16E	6520	11¹¹/₁₆"	11⅞"	3 3/32"
17E	6521	12⅜₁₆"	12⅜₁₆"	3 3/32"
18E	6522	12⅞"	12¹¹/₁₆"	3 3/32"
19E	6523	13¹/₄"	13¹/₄"	3 1/4"
20E	6524	13¹³/₁₆"	14¹/₁₆"	3 1/4"
21E	6525	14⅜"	14⅜"	3 1/4"

NOTES FOR TURNOUT PLATES:
1. WHEN USING GAGE PLATES, REDUCE QUANTITY OF TURNOUT PLATES BASED ON NUMBER OF GAGE PLATES IN SET.
2. TURNOUT PLATES ARE DESIGNED TO BE USED WITH 14" TIE PLATES. IF LARGER TIE PLATES ARE USED, EXTRA TURNOUT PLATES WILL BE REQUIRED.



PLATES NO. 4E-11E

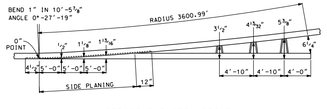


PLATES NO. 12E-21E

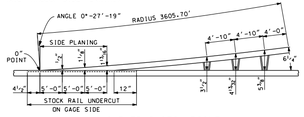
NOTE: SHOULDERS MAY BE OFFSET IF REQUIRED.

SIDE PLANING	
RAIL HEAD WIDTH	DETAIL 5100
2⅝"	21'-03⅝"
2⅝"	21'-93⅝"
3"	22'-63⅝"

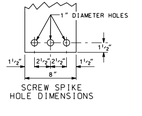
ALIGN WEB OF SWITCH POINT RAIL SAME AS ADJACENT STOCK RAIL THROUGH SIDE PLANING.



STRAIGHT SWITCH POINT
DETAIL 5100 PER PLAN NO. 221



CURVED SWITCH POINT
DETAIL 5100 PER PLAN NO. 221



SCREW SPIKE
HOLE DIMENSIONS

SCREW SPIKE TURNOUT PLATES

Bill of Material for 39'-0" Curved Split Switch				
POWER OPERATED SPLIT SWITCH WITH UNIFORM RISERS				
Qty for Track Spike Plates	Qty for Elastic Fastener Plates	Description	Plan No.	Detail No.
2	2	Double Reinforced Switch Points Complete	221	5100
		Forged Stops	221	2024
1	1	Curved Stock Rail	911	-
1	1	Straight Stock Rail	911	-
2	2	Heel Block Assembly	221	1125
3	3	Insulated Back Switch Rod	222	3117, 6011
		Insulation Applied To Rods	222	3001
2	2	Plate No. BP1A	224	6026 or 7026
24	24	Adjustable Rail Braces	224	-
2	2	Turnout Plate Sets Per Table for No. 18 and 20 Turnouts	127	6500-6507, 6516-6525 or 7500-7507, 7516-7525
2	2	Insulated Head Switch Rod With Basket	222	3117, 6010
1	1	Gage Plate No. GP0	223	3126
2	4	Gage Plate No. GP1	223	3127 or 4127
16	12	Plate No. BP1	224	4020 or 6020
28	26	Plate No. SP1	224	6021 or 7021
0	1	Gage Plate No. GP2	223	3130 or 3131
0	2	Gage Plate No. GP3	223	3132

NOTES:
1- BILL OF MATERIAL. This plan illustrates and includes in the following Bills of Material several designs of split switch layouts, therefore purchaser shall state which Bill of Material specification is wanted. Purchaser to state which turnout plates to furnish.

RAIL AND JOINT BARS. For new installation, all switches are to be 115 lb. RE, 136 lb. RE or 141 lb RE.

Purchaser shall specify hand of turnout and switch points and stock rails to suit. For right hand turnouts the right hand switch point and left hand stock rail are straight and the left hand switch point and right hand stock rail are curved. For left hand turnouts, the left hand switch point and right hand stock rail are straight and the right hand switch point and left hand stock rail are curved.

2- ALTERNATES:
(a) Any details of fittings that will apply per Plans No. 221, 222, 223, and 224.

(b) Switch points furnished with manganese steel tips per Plan No. 220.

(c) Type "S" stock rails per Plan No. 921.

3- Switch point rollers may be added per individual customer's request.

4- SPECIFICATIONS - See Plan No. 100.

5- Gage plate I.D. stamping to include:

	Plate Style	Hand (If Required)	Tie Number	Switch Length	Rail Weight
Example:	GP3E	L	5	39'-0"	136
Example:	GP5E	L	5	39'-0"	136

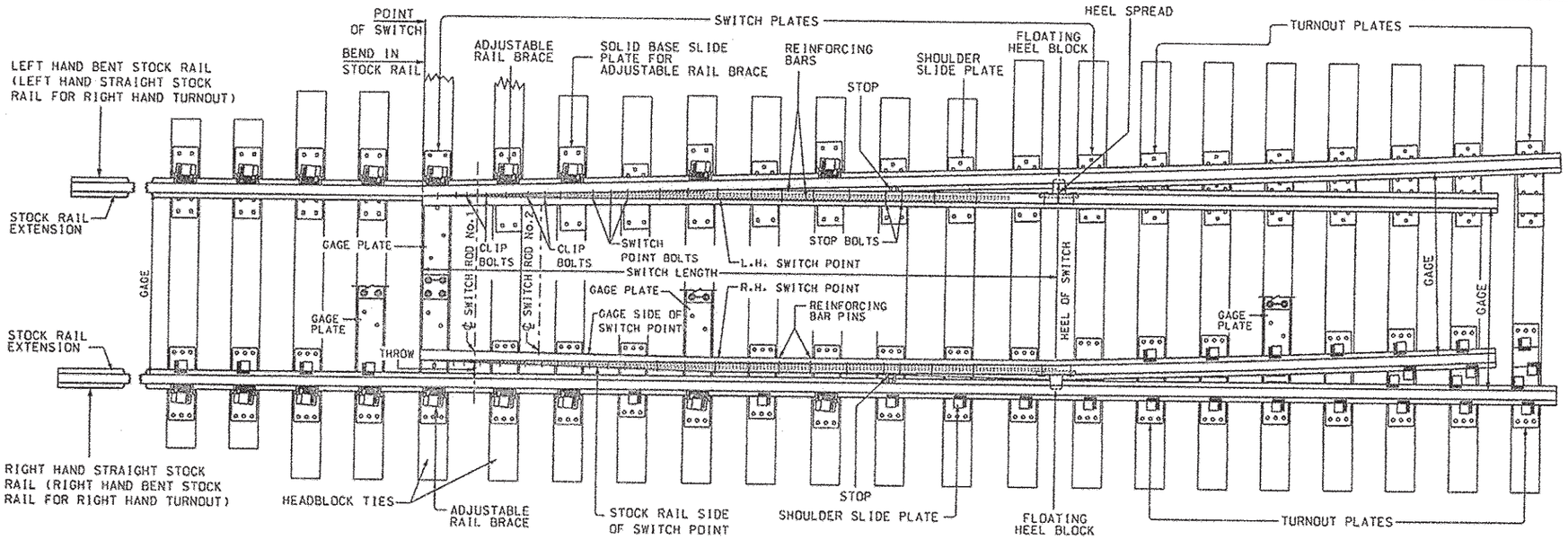
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

39'-0" CURVED SPLIT SWITCH WITH UNIFORM RISERS FOR TRACK SPIKES OR SCREW SPIKES

PLAN NO. 127-08

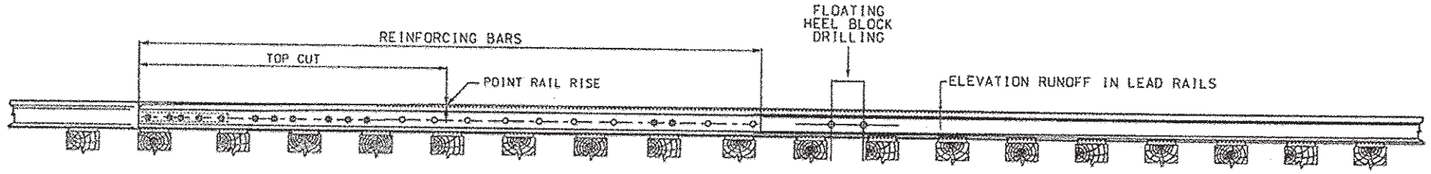
Adopted 1955. Converted to C.A.D. 1991. Revised 2008

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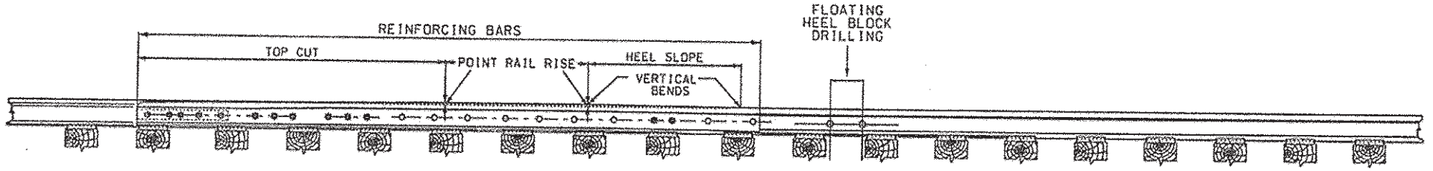


PLAN VIEW INDICATING (FOR ILLUSTRATION ONLY) VARIOUS PARTS OF SWITCH LAYOUT

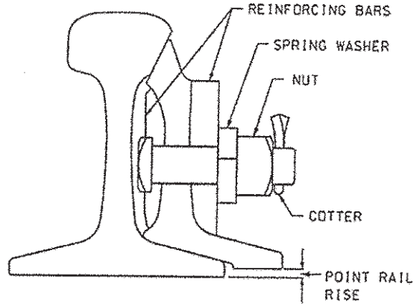
DRAWN FOR LEFT HAND TURNOUT



ELEVATION OF SWITCH POINT WITH UNIFORM RISERS



ELEVATION OF SWITCH POINT WITH GRADUATED RISERS



END VIEW OF POINT RAIL

NOTES

FOR NAMES OF ADDITIONAL PARTS SEE PLANS No.181, 182, 183, 220, 221, 222, 223, 224, 241, AND THE PLANS FOR THE VARIOUS LENGTHS OF SWITCHES.

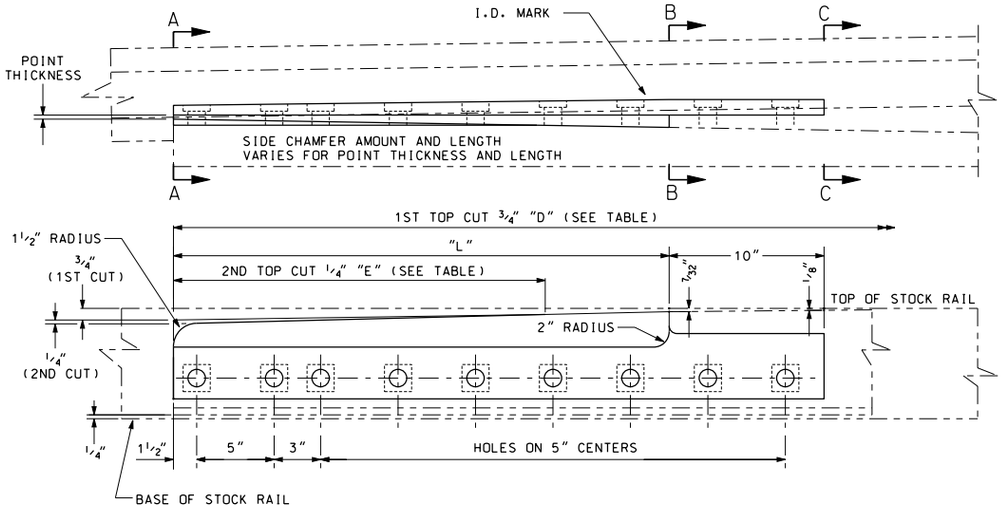
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

DIAGRAM ILLUSTRATING PREFERRED NAMES OF PARTS FOR SWITCHES

PLAN NO. 190-10

Adopted 1955. Converted to C.A.D. Feb. 1992. Revised 2010

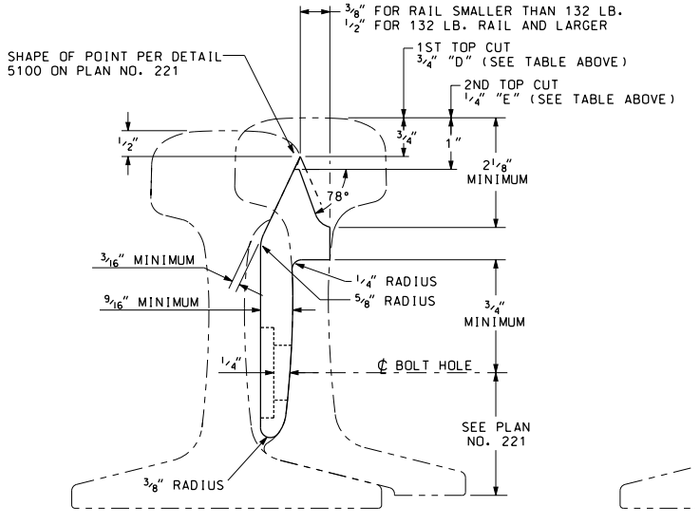
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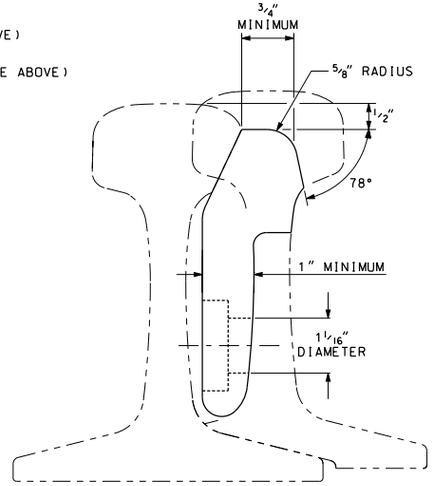
SWITCH SIZE	"L" DIM.	"D" DIM.	"E" DIM.
11'-0"	1'-10"	5'-0"	2'-0"
13'-0"	2'-8"	6'-0"	2'-0"
16'-6"	2'-8"	7'-0"	2'-0"
19'-6"	3'-6"	9'-0"	2'-0"
22'-0"	2'-8"	9'-0"	2'-0"
26'-0"	3'-6"	12'-0"	3'-6"
30'-0"	3'-6"	12'-0"	4'-0"
39'-0"	6'-0"	20'-0"	5'-0"

NOTES

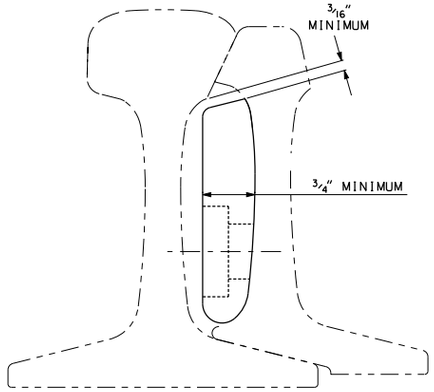
1. BOLTS: For sizes and details not shown see Plan No. 221 and other split switch plans. Manganese points shall be attached by bolts throughout.
2. SPECIFICATIONS: See Plan No. 100.



SECTION A-A



SECTION B-B



SECTION C-C

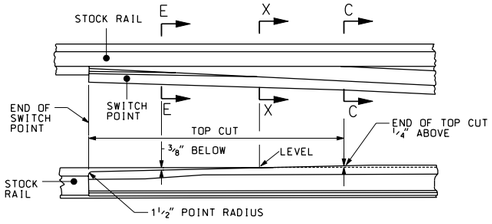
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

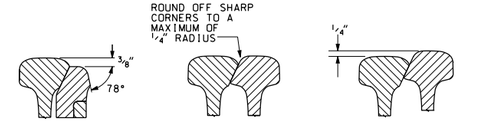
MANGANESE STEEL POINTS FOR SPLIT SWITCHES

PLAN NO. 220-08

Adopted 1955. Converted to C.A.D. 1991. Revised 2008.

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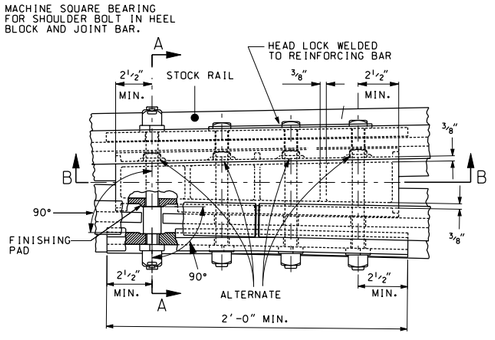




FOR SPECIFICATIONS, SEE AREMA Plan NO. 100

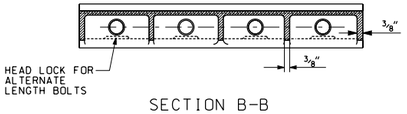
5/8" GAGE SIDE RADIUS FROM SECTION C-C TO SECTION EE REDUCING TO 0" AT POINT

CONSTRUCTION FOR CURVED AND STRAIGHT SWITCH POINTS

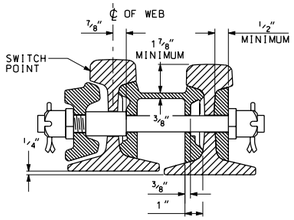


BEND JOINT BAR AT CENTER TO ALIGNMENT OF FULLY OPENED SWITCH POINT AND MACHINE TOP CORNER PARALLEL TO RAIL HEAD.

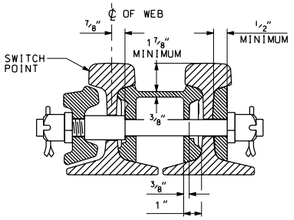
TOP VIEW



SECTION B-B



DETAIL 2125
SECTION A-A
OFFSET HEEL



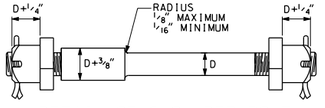
DETAIL 1125
SECTION A-A
LEVEL HEEL

HEEL BLOCK-CAST STEEL, CLASS B, HARD. FOR FIT SEE PLANS NO. 1010 AND 1011.

BOLTS-HIGH TENSILE STEEL AND GENERALLY PER PLAN NO.100, SECTION M11. DIAMETER OF BOLTS AND SPACING OF HOLES SHALL CONFORM TO JOINT BAR DETAIL SPECIFIED, EXCEPT THAT WHEN SIX HOLE BARS ARE DESCRIBED, THE BLOCK SHALL BE DESIGNED WITH FIVE HOLES, THE SIXTH HOLE TOWARD THE NARROW END BEING OMITTED AND THE JOINT BARS SHORTENED ACCORDINGLY.

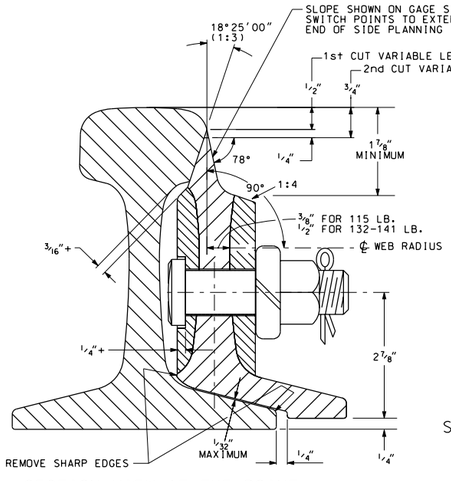
ALTERNATE-SHORTER BOLTS NOT EXTENDING THROUGH STOCK RAIL TO BE FURNISHED WHEN SPECIFIED WITH THIMBLE FOR FIRST BOLT INSTEAD OF SOLID SHOULDER MINIMUM THICKNESS OF THIMBLE 3/16" AND MINIMUM BRINELL OR EQUIVALENT HARDNESS 350.

HEEL JOINT ASSEMBLY

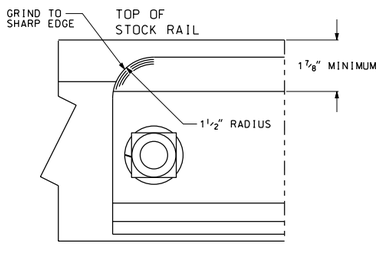


DETAIL OF SHOULDER BOLT

D = DIAMETER OF BOLTS
ALLOY STEEL S.A.E. 4130 OR EQUIVALENT HEAT TREATED - BRINELL MINIMUM 275



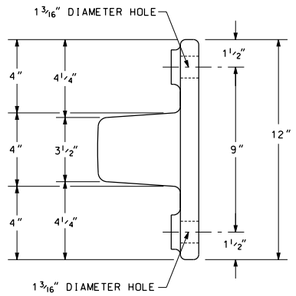
SECTION VIEW AT THE POINT



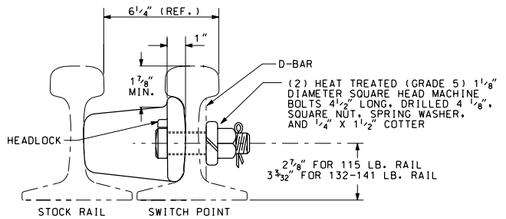
SIDE VIEW OF END OF SWITCH POINT

DETAIL 5100

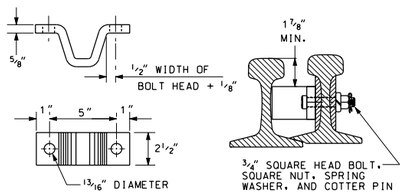
REINFORCING BARS TO BE 1/2" THICK. SECURED BY 3/4" BOLTS AND PINS IN CENTER LINE OF WEB. EXCEPT HOLES MARKED "B" ON ELEVATION OF SWITCH POINTS TO BE FURNISHED WITH BOLTS 1" DIAMETER.



DETAIL 1120
CAST STEEL OR DUCTILE
IRON FLOATING HEEL BLOCK



HEEL DETAIL USING FLOATING HEEL BLOCK



DETAIL 2024
STOP

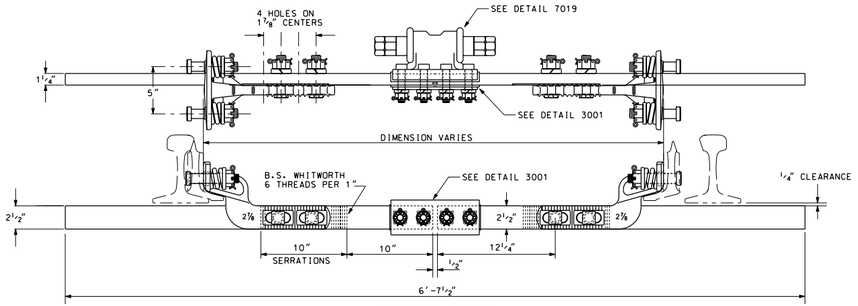
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DETAILS FOR SWITCH POINTS

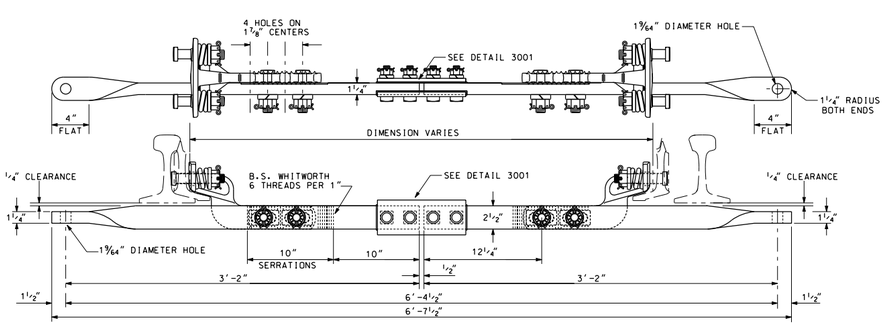
PLAN NO. 221-08

Adopted 1955. Converted to C.A.D. 1991. Revised 2008.

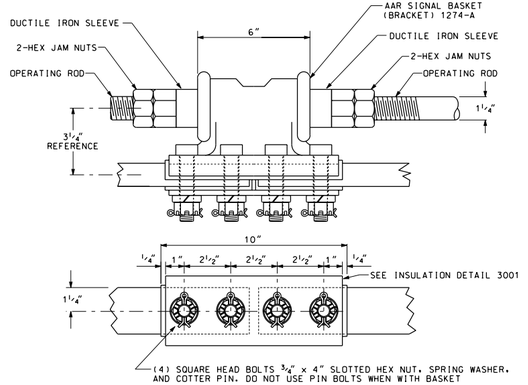
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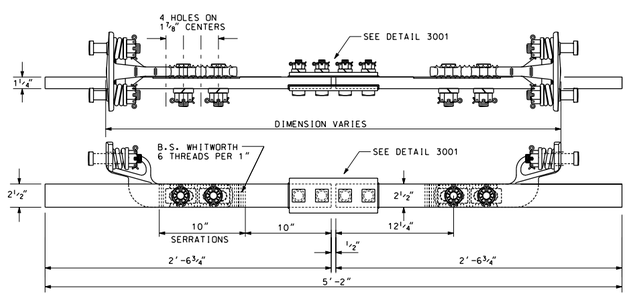
DETAIL 7017
INSULATED SWITCH HEAD ROD WITH BASKET ADJUSTMENT



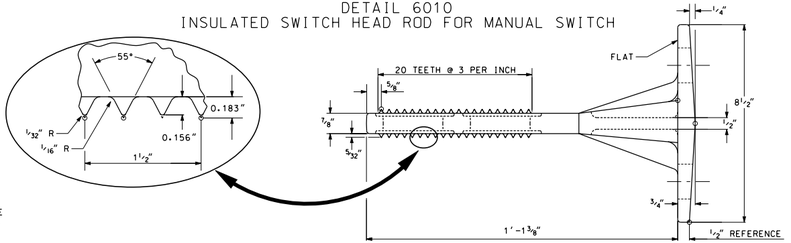
DETAIL 6010
INSULATED SWITCH HEAD ROD FOR MANUAL SWITCH



DETAIL 7019
INSULATED SWITCH HEAD ROD WITH ADJUSTMENT BASKET



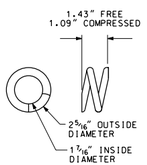
DETAIL 6011
INSULATED SWITCH RODS FOR ALL SWITCHES



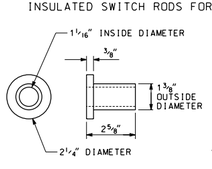
FOR ROD NO. 1 WITH STD SWITCH POINTS, USE 3/8" THIN HEAD 1" X 5 1/2" BOLTS. DRILLED 5". FOR SPRING SWITCH POINTS, USE 3/8" THIN HEAD 1" X 6 1/4" BOLTS. DRILLED 5 3/4".

FOR RODS NO. 2-4 WITH STD SWITCH POINTS, USE 3/8" THIN HEAD 1" X 5 3/4" BOLTS. DRILLED 5 1/4". FOR SPRING SWITCH POINTS, USE 3/8" THIN HEAD 1" X 6 1/2" BOLTS. DRILLED 6".

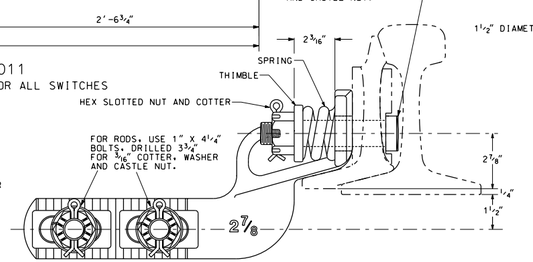
ALL SWITCH POINT BOLTS DRILLED FOR 1/4" COTTER AND CASTLE NUT.



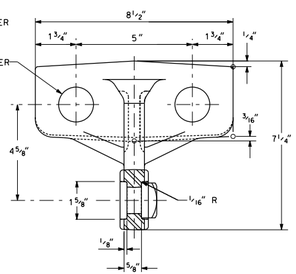
SPRING



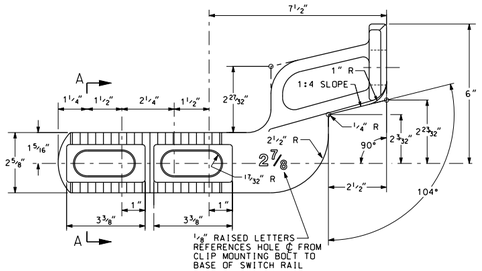
THIMBLE DETAIL



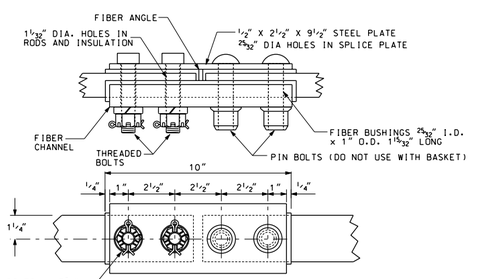
ROCKER CLIP ASSEMBLY



SECTION A-A



DETAIL 3117
ADJUSTABLE DUCTILE IRON ROCKER CLIP



DETAIL 3001
INSULATION
TO BE PLACED IN CENTER OF SWITCH ROD

Notes:

1. Chamfer all bolt holes.
2. Remove all sharp edges.
3. Prior to final assembly, insulated areas to be sprayed with insulating paint.
4. For tolerances, see Plan no. 1024

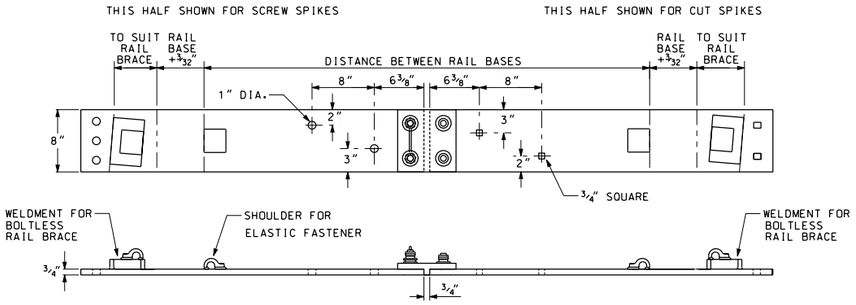
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

SWITCH RODS AND CLIP

PLAN NO. 222-08

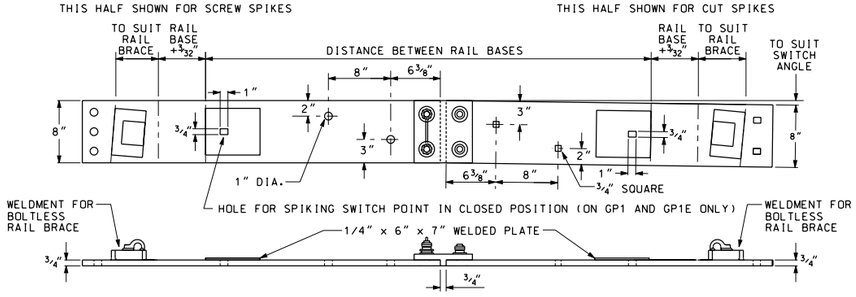
Adopted 1966. Converted to C.A.D. 1992. Revised 2008.

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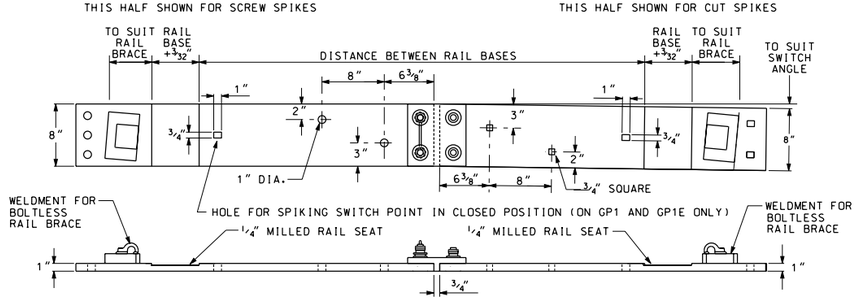
DETAIL 3126

INSULATED GAGE PLATE (FLAT) FOR TIE AHEAD OF POINTS (GPO AND GPOE)



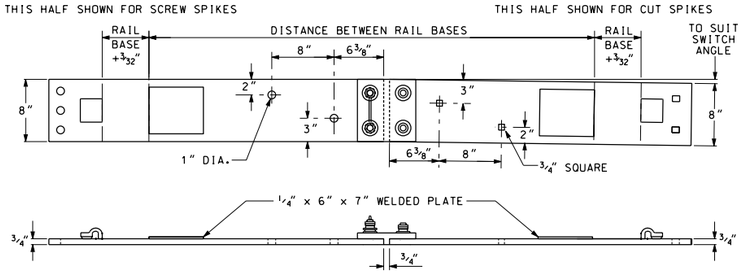
DETAIL 3127

INSULATED GAGE PLATE (WITH WELDED RISER) FOR TIE UNDER POINTS (GP1 AND GP1E)



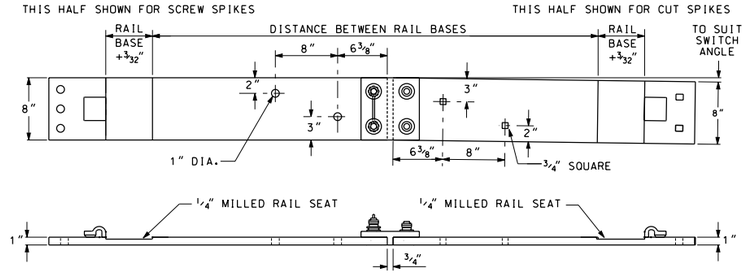
DETAIL 4127

INSULATED GAGE PLATE (MILLED) FOR TIE UNDER POINTS (GP1 AND GP1E)



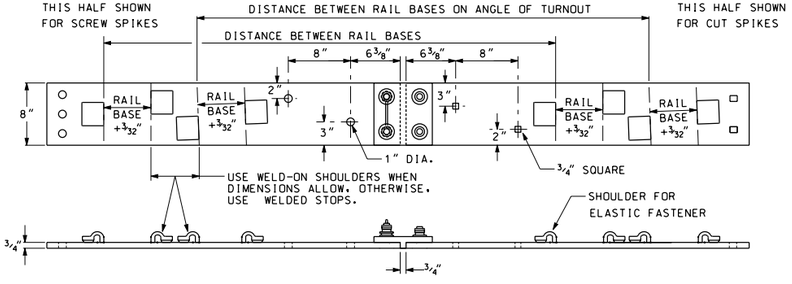
DETAIL 3130

INSULATED GAGE PLATE (WITH WELDED RISER) FOR TIE UNDER POINTS (GP2 AND GP2E)



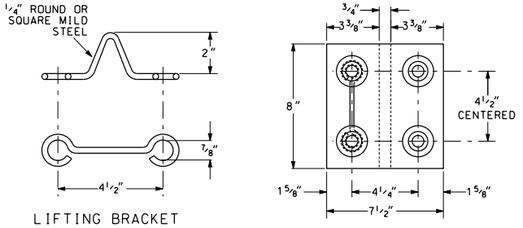
DETAIL 3131

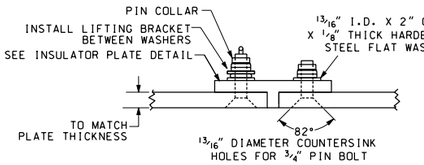
INSULATED GAGE PLATE (MILLED) FOR TIE UNDER POINTS (GP2 AND GP2E)



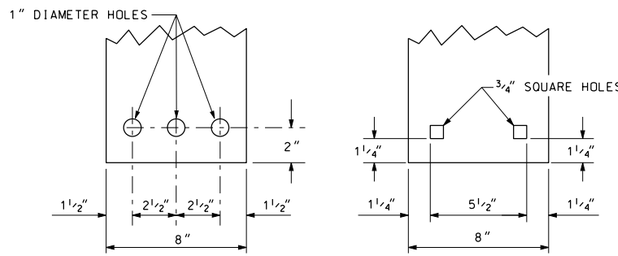
DETAIL 3132

INSULATED GAGE PLATE (FLAT) FOR TIE IN CLOSURE AREA OF TURNOUT (GP3 AND GP3E)
(LEFT HAND SHOWN)





GAGE PLATE INSULATION - DETAIL 4103



Notes:

1- Gage plate I.D. stamping to include:

	Plate Style	Hand (If Required)	Tie Number	Switch Length	Rail Weight
Example:	GP1	-	1	16'-6"	136
Example:	GP3E	L	14	16'-6"	136

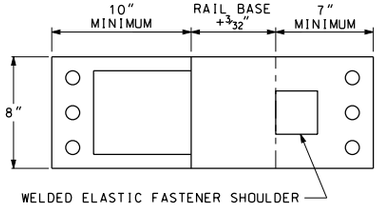
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GAGE PLATES

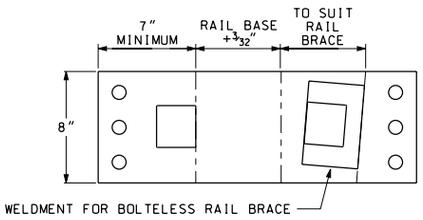
PLAN NO. 223-08

Adopted 1955. Converted to C.A.D. March 1992. Revised 2008.

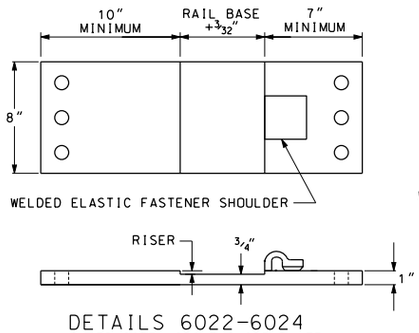
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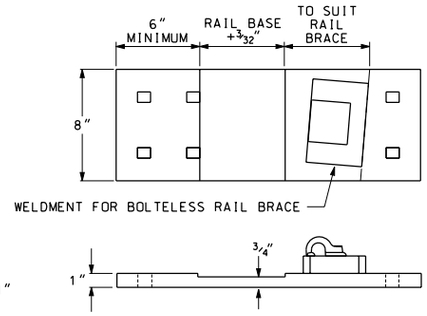
DETAIL 6021
(WELDED RISER SCREW SPIKE SLIDE PLATE)



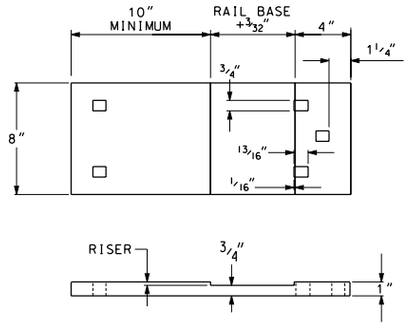
DETAIL 6026
(FLAT SCREW SPIKE BRACE PLATE)



DETAILS 6022-6024
(MILLED SCREW SPIKE SLIDE PLATE)

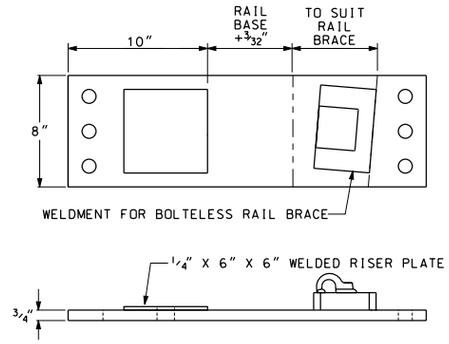


DETAIL 7026
(MILLED CUT SPIKE BRACE PLATE)

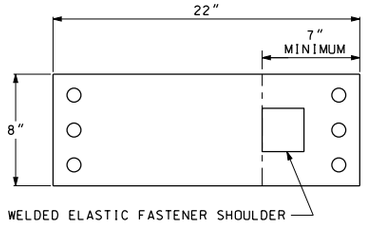


DETAILS 7021-7024
(MILLED CUT SPIKE SLIDE PLATE)

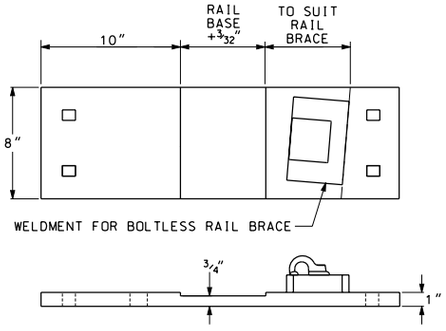
DETAIL	DETAIL	RISER
6021	7021	1/4"
6022	7022	3/16"
6023	7023	1/8"
6024	7024	1/16"



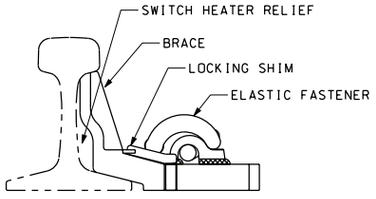
DETAIL 4020
(WELDED RISER SCREW SPIKE BRACE SLIDE PLATE)



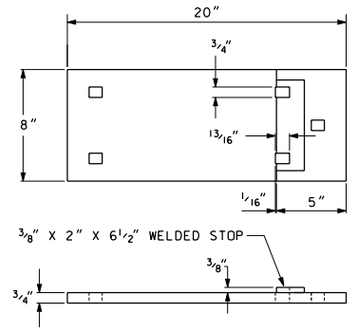
DETAIL 2140
(FLAT SCREW SPIKE SLIDE OR HEEL PLATE FOR GRADUATED RISERS)



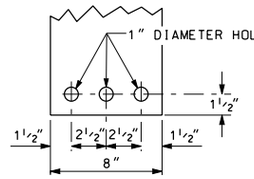
DETAIL 6020
(MILLED CUT SPIKE BRACE SLIDE PLATE)



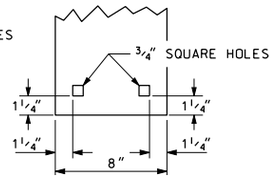
ADJUSTABLE BOLTLESS
BRACE ASSEMBLY



DETAIL 3140
(FLAT CUT SPIKE SLIDE OR HEEL PLATE FOR GRADUATED RISERS)



SCREW SPIKE
HOLE DIMENSIONS



CUT SPIKE
HOLE DIMENSIONS

SPECIFICATIONS FOR ADJUSTABLE RAIL BRACES

1- Braces shall be so designed that they can be readily applied with properly designed switch or tie plate. The wedging action shall clamp the outer flange of the rail base to the plate, with a clearance between the brace and the edge of base of rail.

2- Braces shall be provided with at least 1/4" adjustment in increments not greater than 1/16". Bearing on the rail and shoulder of plate not to be reduced by adjustment.

3- Braces shall be secured to the plate close to the edge of the base of the stock rail so as to provide a maximum hold down effect.

4- Braces shall be made of copper bearing mild steel, malleable iron, ductile iron, or cast steel.

5- The boltless Adjustable Rail Brace assembly shown is for illustration only of a design in detail that will comply with these specifications. It is recognized that there are other efficient designs that will also comply with these specifications, and design wanted shall be furnished per details supplied by purchaser, with plate seats made to suit.

6- SPECIFICATIONS - See Plan No. 100. All cut spike holes shall be 3/4" square except where otherwise shown. For other data see Section 7 Plan No.100.

7- All round holes will be 1" dia. unless otherwise shown.

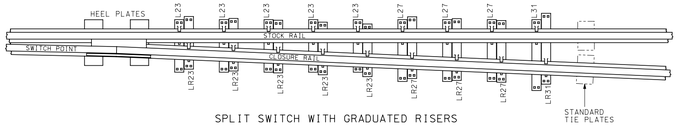
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

SWITCH PLATES AND ADJUSTABLE BOLTLESS RAIL BRACES

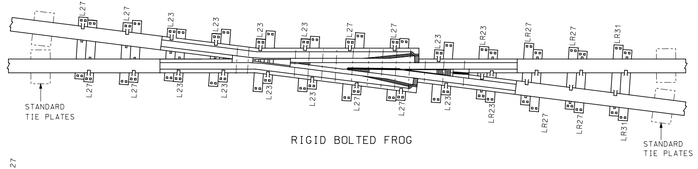
PLAN NO. 224-08

Adopted 1955. Converted to C.A.D. 1991. Revised 2008.

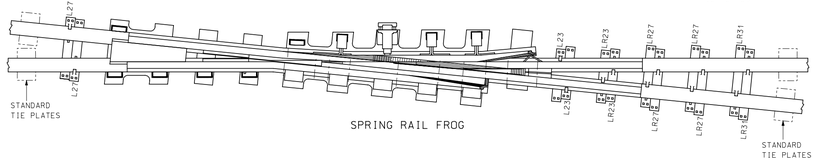
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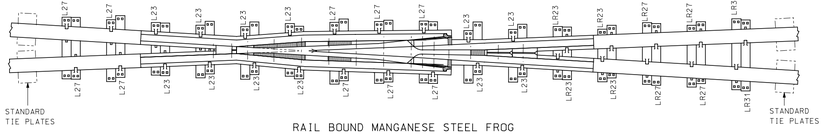
SPLIT SWITCH WITH GRADUATED RISERS



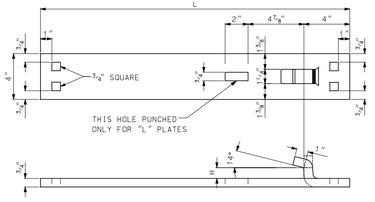
RIGID BOLTED FROG



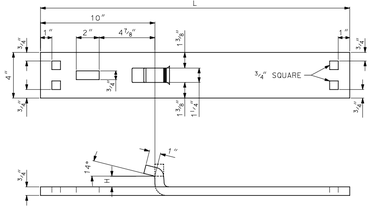
SPRING RAIL FROG



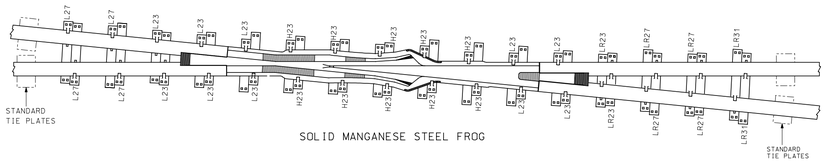
RAIL BOUND MANGANESE STEEL FROG



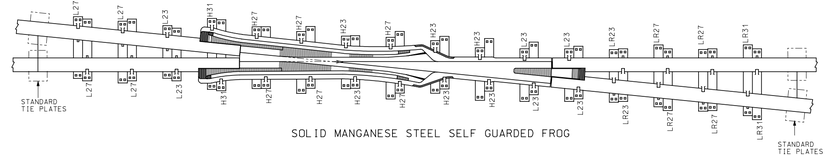
MARK	L23	L27	L31	H23	H27	H31	H35
L	23"	27"	31"	23"	27"	31"	35"
H	9/16"	9/16"	9/16"	15/16"	15/16"	15/16"	15/16"



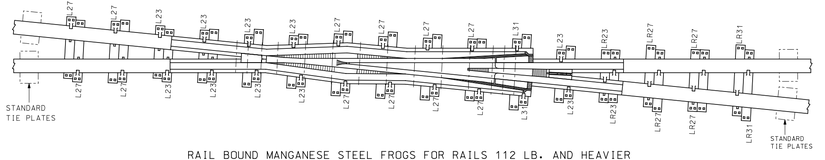
MARK	LR23	LR27	LR31
L	23"	27"	31"
H	9/16"	9/16"	9/16"



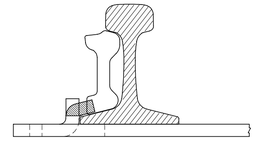
SOLID MANGANESE STEEL FROG



SOLID MANGANESE STEEL SELF GUARDED FROG



RAIL BOUND MANGANESE STEEL FROGS FOR RAILS 112 LB. AND HEAVIER



WHERE HOOK ON TIE PLATE INTERFERES WITH SPLICE BAR, BEND HOOK UP TO VERTICAL POSITION OR BURN HOOK OFF AS SHOWN BY SHADING.

NOTES

1. Hook Twin Tie Plates shown on this plan are universal and shall be applied as indicated with frogs and graduated riser switches at all locations where special plates are not required and where standard tie plates cannot be used without cutting.

2. Quantities: See plans of frogs and plans of switches with graduated risers for the quantity of hook twin tie plates to be furnished with each unit.

   Alternate – The distance (4 7/8") to the elongated spike hole and the length of this hole (2") shown on hook twin tie plates marked LR-23, LR-27, and LR-31 to be modified as specified to suit various rail sections used by purchaser.

3. SPECIFICATIONS: See AREMA Basic Plan No.100.

4. TOLERANCES: See AREMA Basic Plan No.1010.

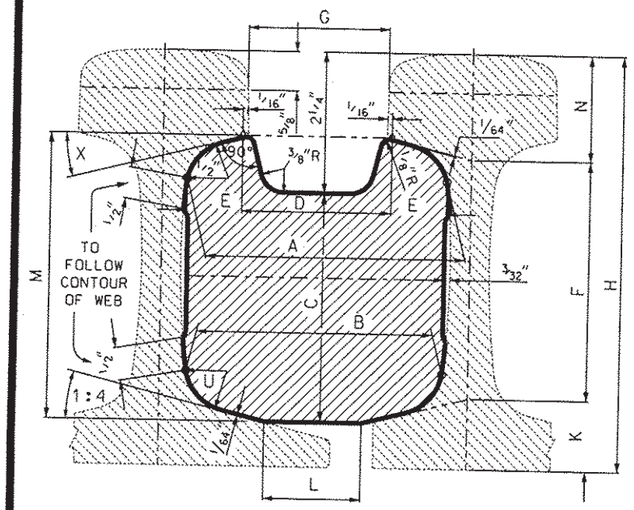
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

DETAILS AND TYPICAL APPLICATIONS OF HOOK TWIN TIE PLATES

PLAN NO. 241-03

Adopted 1955. Revised March 1985. Converted to C.A.D. Mar. 1992. C.A.D. updated June. 2003

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CROSS SECTION OF FILLER

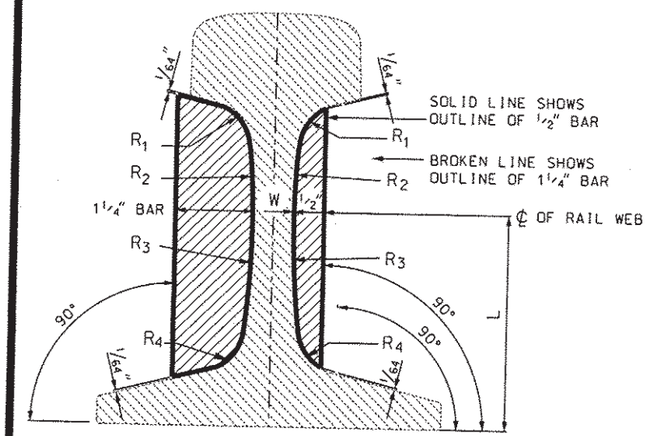
RAIL SECTION	F	K	N	H	C	M	E	U	X
115 RE	3 13/16"	1 1/8"	1 11/16"	6 5/8"	3 21/32"	4 17/32"	1 1/32"	13/16"	1:4
119 RE	3 13/16"	1 1/8"	1 7/8"	6 13/16"	3 13/16"	4 33/64"	1"	13/16"	1:4
132 RE	4 3/16"	1 3/16"	1 3/4"	7 1/8"	4 1/8"	5"	1 5/32"	15/16"	1:4
133 RE	3 15/16"	1 3/16"	1 15/16"	7 1/16"	4 1/16"	4 7/8"	1 9/64"	13/16"	1:3
136 RE	4 3/16"	1 3/16"	1 15/16"	7 5/16"	4 1/4"	4 15/16"	1 1/64"	13/16"	1:4
141 RE	4 3/32"	1 3/16"	2 5/32"	7 7/16"	4 3/8"	4 63/64"	1 3/16"	13/16"	1:3

G= 1 7/8" FLANGEWAY			
A	B	D	L
3 25/32"	3 23/32"	1 31/32"	1 7/16"
3 45/64"	3 21/32"	1 61/64"	1 3/8"
4 1/64"	3 55/64"	1 61/64"	1 7/32"
3 59/64"	3 49/64"	1 57/64"	1 1/8"
3 59/64"	3 53/64"	1 61/64"	1 21/32"
3 61/64"	3 27/32"	1 53/64"	1 11/16"

G = 2" FLANGEWAY			
A	B	D	L
3 29/32"	3 27/32"	2 3/32"	1 9/16"
3 53/64"	3 25/32"	2 5/64"	1 1/2"
4 9/64"	3 63/64"	2 5/64"	1 11/32"
4 3/64"	3 57/64"	2 1/64"	1 1/4"
4 3/64"	3 61/64"	2 5/64"	1 25/32"
4 5/64"	3 31/32"	1 61/64"	1 13/16"

G= 2 1/8" FLANGEWAY			
A	B	D	L
4 1/32"	3 31/32"	2 7/32"	1 11/16"
3 61/64"	3 29/32"	2 13/64"	1 5/8"
4 17/64"	4 7/64"	2 13/64"	1 15/32"
4 11/64"	4 1/64"	2 9/64"	1 3/8"
4 11/64"	4 5/64"	2 13/64"	1 29/32"
4 13/64"	4 3/32"	2 5/64"	1 15/16"

G= 2 1/4" FLANGEWAY			
A	B	D	L
4 5/32"	4 3/32"	2 11/32"	1 13/16"
4 5/64"	4 1/32"	2 21/64"	1 3/4"
4 25/64"	4 15/64"	2 21/64"	1 19/32"
4 19/64"	4 9/64"	2 17/64"	1 1/2"
4 19/64"	4 13/64"	2 21/64"	2 1/32"
4 21/64"	4 7/32"	2 13/64"	2 1/16"



CROSS SECTION OF REINFORCING BARS

RAIL SECTION	W	R_1	R_2	R_3	R_4	L
115 RE	5/8"	3/4"	14"	14"	3/4"	3 1/4"
119 RE	5/8"	3/4"	14"	14"	3/4"	3 1/4"
132 RE	2 1/32"	3/4"	8"	16"	7/8"	3 7/8"
133 RE	11/16"	3/4"	8"	16"	3/4"	3 3/4"
136 RE	11/16"	3/4"	8"	20"	3/4"	3 7/8"
141 RE	11/16"	3/4"	8"	20"	3/4"	3 7/8"

NOTES

1 - FILLERS
(a) The fishing height of the filler shall not vary from that called for by the nominal rail section by more than 1/64" over or 1/32" less.
(b) Width of fillers between rail webs shall not be more than 1/16" over or under the dimensions called for.
(c) Depth of the flangeway groove may be 1/16" under or 3/16" over dimensions called for.

2 - SPECIFICATIONS
See Plan No. 100.

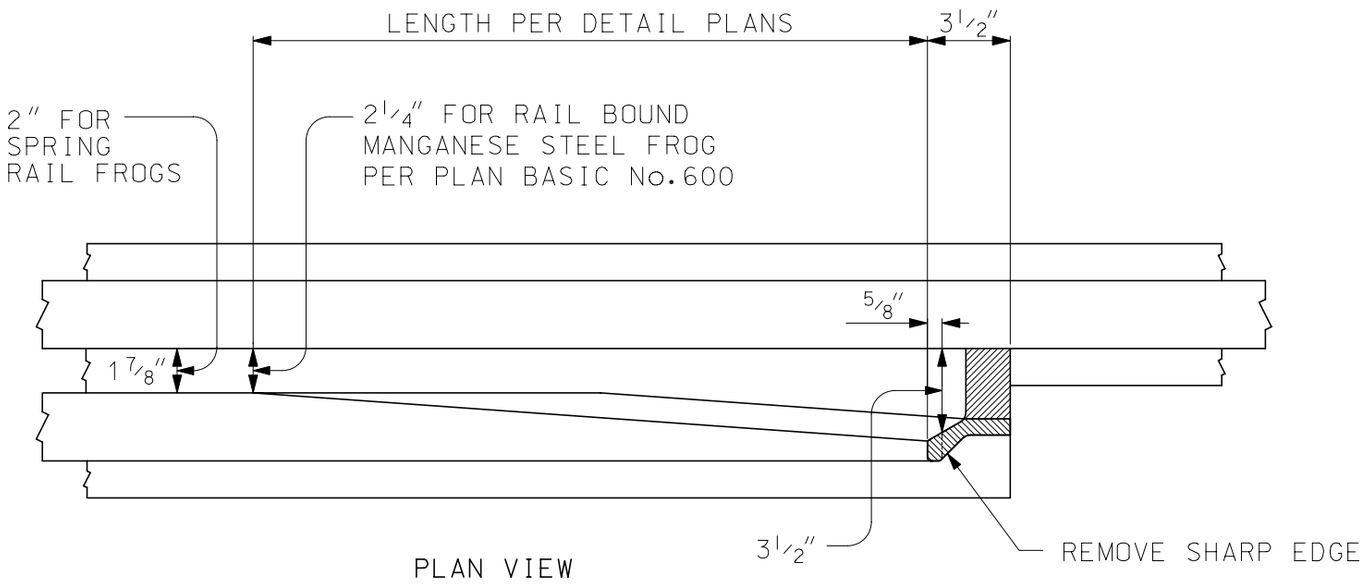
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

STEEL FROG FILLERS AND REINFORCING BARS

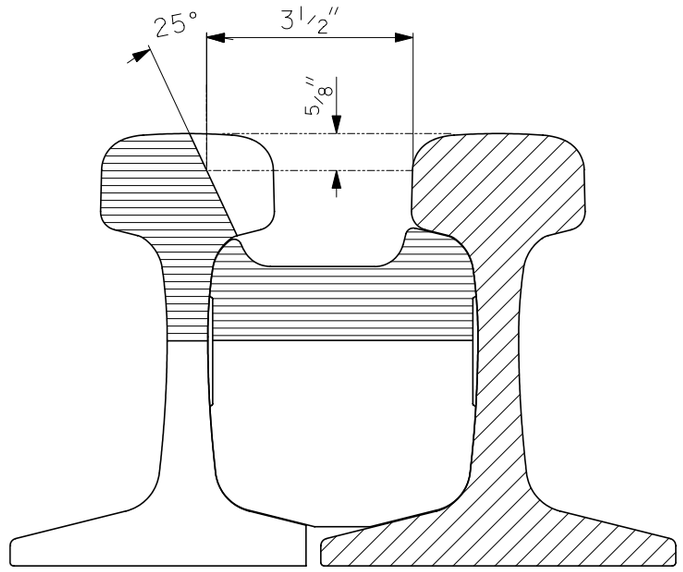
PLAN NO. 325-12

Adopted 1949. Converted to C.A.D. Apr. 1992. Revised 2012.

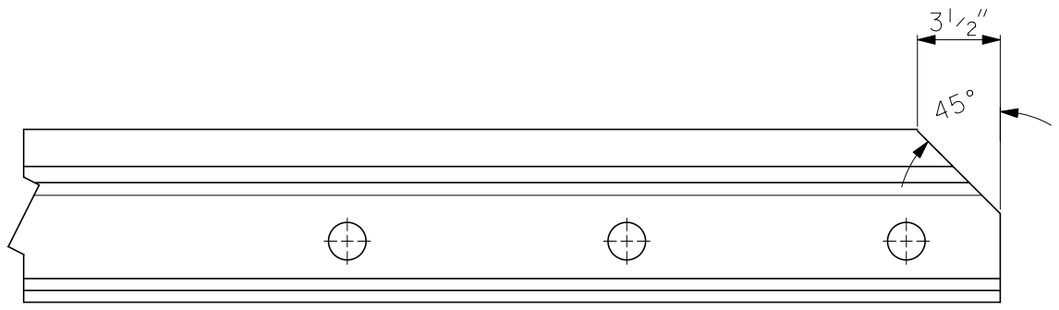
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PLAN VIEW



END VIEW OF GUARD



ELEVATION

NOTE

The $3\frac{1}{2}$" flare opening is increased when flangeway is widened for curvature per Plan Basic No.791, the angle and length of the flare remaining constant, except that $3\frac{1}{2}$" width is furnished for 2" width flangeway in rail bound manganese steel frogs per Plan Basic No.600.

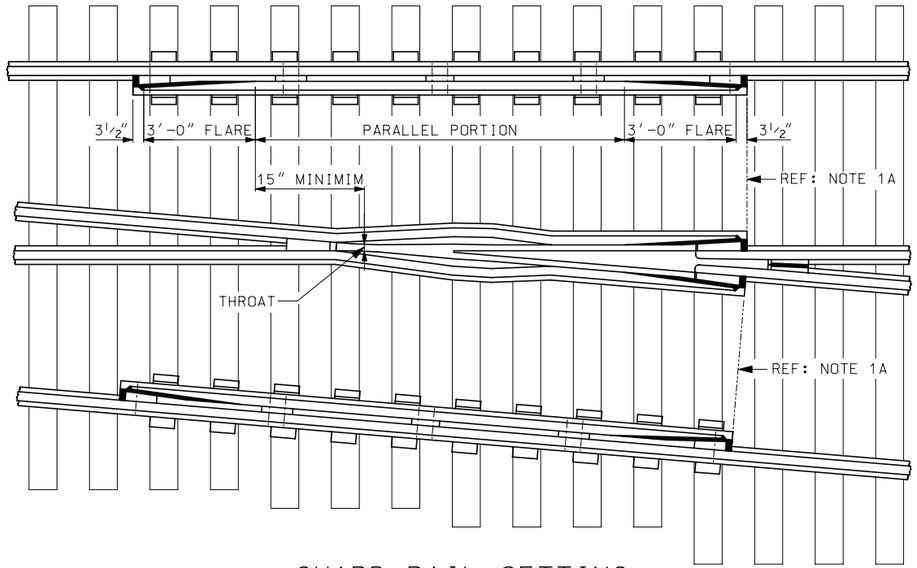
AMERICAN RAILWAY ENGINEERING
AND MAINTENANCE OF WAY ASSOCIATION

TEE RAIL FLARES FOR FROG AND CROSSING FLANGEWAYS

PLAN NO. 350–03

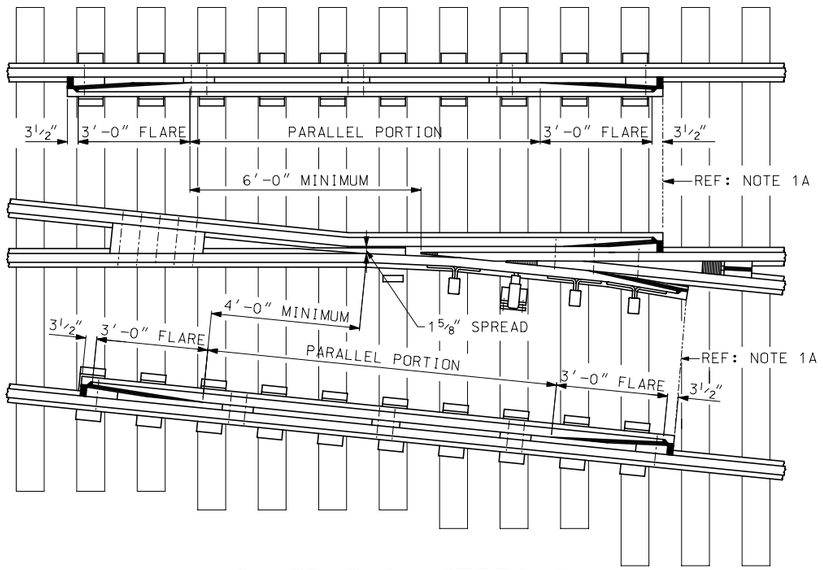
Adopted March 1955, Converted to C.A.D. Apr. 1992. C.A.D. updated July. 2003

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GUARD RAIL SETTING
FOR BOLTED & RAIL BOUND MANGANESE FROG
(DRAWN #12 RAIL BOUND MANG. FROG & 16'-6" GUARD RAIL)

NOTE: FROG PLATES NOT SHOWN



GUARD RAIL SETTING
FOR SPRING FROGS
(DRAWN #10 SPRING FROG & 16'-0" GUARD RAIL)

NOTE: FROG PLATES NOT SHOWN

NOTES

1. SETTING OF TEE RAIL GUARD RAILS, PLAN BASIC No.504

   A) Guard rail flare to be opposite the frog wing rail flare for all angles.
   B) Bolted Rigid & Rail Bound Frogs.
      The parallel portion of the guard rail is to extend 15" minimum beyond the throat.
   C) Spring Frogs.
      The parallel portion of the guard rail is to extend 6'-0" minimum beyond the 1/2" point.

2. MINIMUM LENGTH OF GUARD RAILS CONFORMING WITH THE ABOVE SETTINGS.

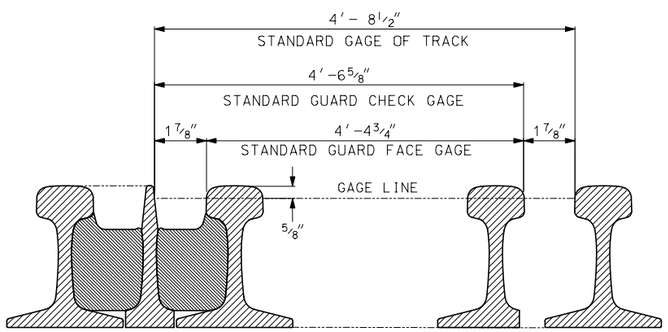
   A) BOLTED RIGID & RAIL BOUND FROGS

Length of Guard Rail	Frog No's.
13'-0"	8, 9, & 10
16'-6"	11, 12, 14 & 15
20'-0"	16 & 20

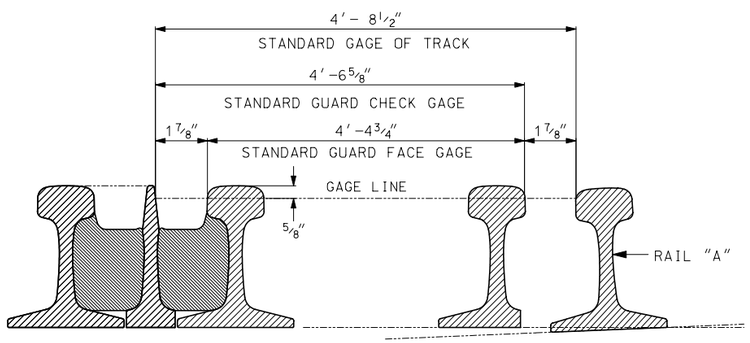
   B) SPRING FROGS
      Opposite Rigid Flangeway

16'-6"	#9, 10, 11 & 12

   C) SPRING FROGS
      Opposite Spring Flangeway
      Parallel portion of the guard rail to extend a minimum of 4'-0" beyond the 1 5/8" spread.



TRACK & GUARD RAIL GAGES
ALL RAILS VERTICAL



TRACK & GUARD RAIL GAGES
RAIL "A" CANTED

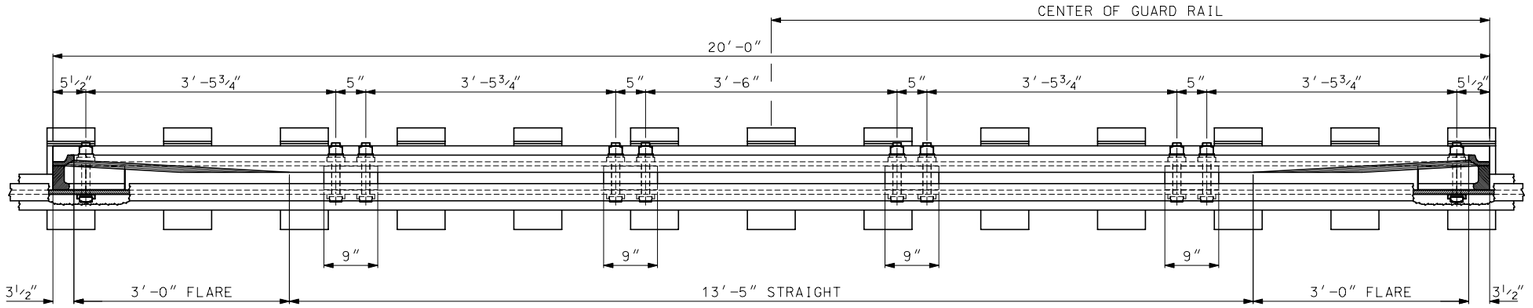
AMERICAN RAILWAY ENGINEERING
AND MAINTENANCE OF WAY ASSOCIATION

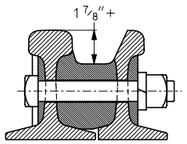
SETTING FOR GUARD RAILS
TEE RAIL DESIGN

PLAN NO. 502-03

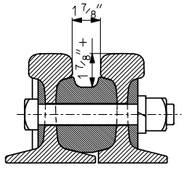
Adopted 1971, Revised 1989, Converted to C.A.D. Apr. 1992. C.A.D. updated July 2003

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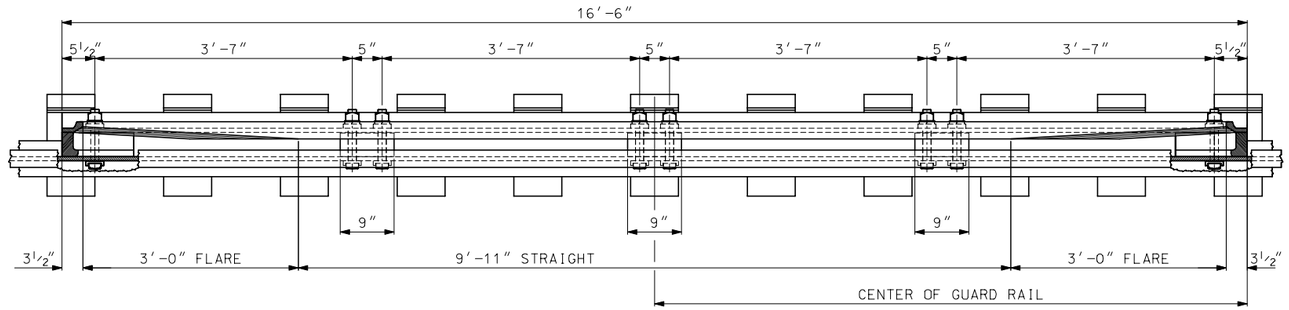


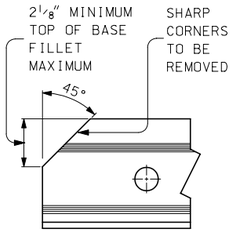


SECTION THROUGH END BLOCK

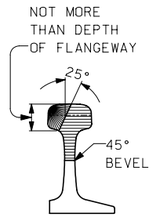


SECTION THROUGH SEPARATOR BLOCK

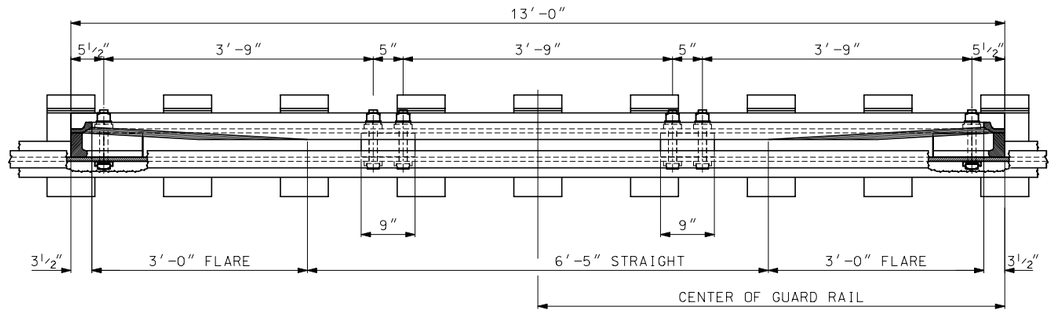


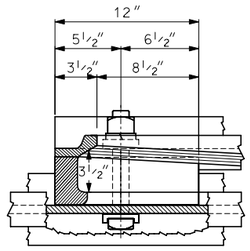


BEVELED END OF RAIL

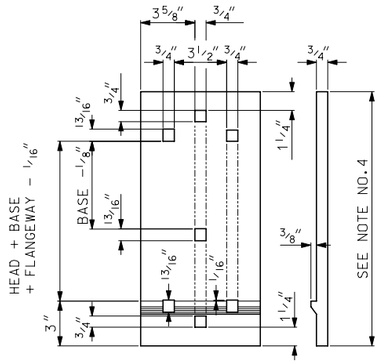


END VIEW OF GUARD RAIL SHOWING DETAIL OF SINGLE CUT FLARE





END BLOCK



GUARD RAIL TIE PLATE

NOTES

1 – GUARD RAILS shall be furnished to length called for and, unless otherwise specified with accessories as illustrated in plan views and per notes below as follows:
- Separator blocks and bolts per Note No.2
- End blocks and bolts per Note No.3.
- Tie plates per note No.4.

2 – SEPARATOR BLOCKS may be of steel, cast iron or malleable iron of suitable design.

3 – END BLOCKS may be of cast iron as shown, steel or malleable iron, of suitable design.

4 – PLATES – Shall be 7″ x ¾″ x 16″ for rails less than 100 lb. per yd., and 8″ x ¾″ x 17″ for rails 100 lb. per yd. and heavier, except when combined width of head and base exceeds 8-5/8″, plates shall be 18″ long.

5 – ALTERNATES
(a) CLAMP GUARD RAILS – Clamp per Plan Basic No.505 may be used instead of separator blocks and bolts in approximately the same locations, and shall be furnished when specified.

(b) RAIL BRACES – Approved type of guard rail braces to be furnished when required; purchaser shall specify details and state on which plates they are to be used.

6 – For setting of guard rails, width of flangeway, guard check gage and guard face gage, see Plan Basic No.502 and 790.

7 – BOLTED GUARD RAILS approved by the purchaser may be used in place of the bolted guard rail design.

8 – SPECIFICATIONS – See AREMA Plan Basic No.100. Bolt sizes and details shall be per Section M-11. Spike hole details not otherwise shown to be per Paragraph 7.3.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

GUARD RAILS
TEE RAIL DESIGN WITH PLANED FLARES AND FLAT PLATES

PLAN NO. 504–03

Adopted 1971, Revised 1989, Converted to C.A.D. Apr. 1992. C.A.D. updated July 2003

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AREMA SPECIFICATIONS FOR ADJUSTABLE GUARD RAIL CLAMPS

1. Clamps shall be so designed that they can be readily applied, and shall have a fit that provides a bearing against the web and under the head of both the running rail and the guard rail.

2. Clamps shall provide an adjustment in the width of the flangeway of at least 1/2″, in increments not greater than 1/8″; when used with unworn rails the width of the flangeway shall range from 1 5/8″ to 2 1/8″; however, the adjustment may be enlarged, but it must be possible to obtain 1 5/8″ and 2 1/8″ flangeways.

3. Clamp yokes shall be of rolled, forged or cast steel, and shall extend above the normal position of base of rail not less than 4 3/8″ for rails over 6″ high, 3 3/4″ for rails 6″ high and under but over 5″ high, and 3 3/8″ for rails 5″ high and under.

4. Clamp yokes shall be capable of sustaining a load of 60,000 pounds without taking a permanent set of more than 0.02 inch, across the jaw opening, the measurement to be taken between points marked on the normal top surface; they shall not fracture under a load of less than 90,000 pounds. The load shall be applied through pivot pins at points not less than 3 1/2″ above the normal position of base of rail for rails over 6″ high, 3″ for rails 6″ high and under but over 5″ high, and 2″ for rails 5″ high and under.

5. Separator blocks shall be of cast steel, cast iron, or malleable iron interlocking both vertically and horizontally, with suitable means for adjustment and shall be so designed that they will maintain the proper position with respect to the yoke. Separator blocks and any other parts functioning against running rail or guard rail shall be of heavy design, with ample bearings against rails.

6. Adjusting wedges shall be of forged or cast steel or malleable iron and suitable means shall be provided for holding them in position after they are driven tight.

7. For location for clamps, see data on Plan Basic No. 504 covering details for tee-rail guard rails.

AMERICAN RAILWAY ENGINEERING
AND MAINTENANCE OF WAY ASSOCIATION

SPECIFICATIONS FOR
GUARD RAIL CLAMPS

PLAN NO. 505–01

Adopted 1940, revised March 1959. Converted to C.A.D. Jan. 2001.

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NOTES

1. Broken lines are not intended to indicate design of braces and body of guard rail, as same are subject to variation.

2. The 8′-4½″ One-Piece Six-Tie Guard Rail has been designed especially for use with rigid frogs up to and including No. 14.

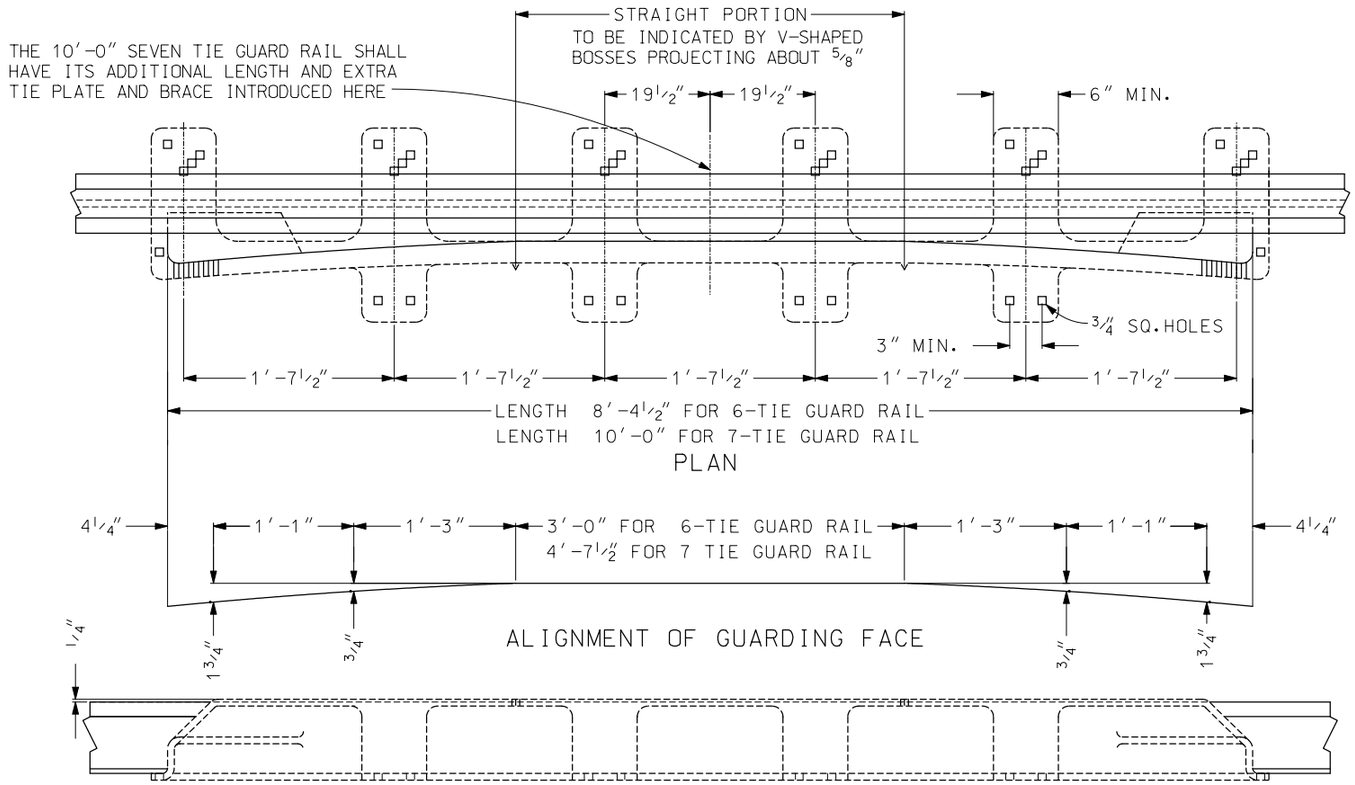
   The 10′-0″ One-Piece Seven-Tie Guard Rail has been designed especially for use with rigid frogs over No. 14, and for locations where this length will more fully meet requirements than the 8′-4½″ length.

ALTERNATES

GUARDING FACE: Curved flares of approved alignment.

LENGTH & PLATE SPACING: Tie plates to be spaced 19 ½″ centers plus or minus ½″ (19″ minimum or 20″ maximum) modifying overall guard rail length accordingly.

CANTED PLATES: Plates to be canted under running rail.



SPECIFICATIONS

1. GUARDING FACE: The alignment shall be straight in center of guard rail and the flare on each end shall be preferably a double bend, consisting of two straight portions in order to give the smallest practicable angle of contact for the wheel flange. The Guarding Face shall have a minimum depth, exclusive of top and bottom fillet, of ¾″ throughout its length. The radius at top of guarding faces shall be approximately ⅜″.

2. HEIGHT: Guard rails approximately ¼″ higher than running rail are recommended where conditions will permit, but height should be not more than 1″ above top of running rail.

3. PLATES: The tie plates shall be integral with the guard rail, have a minimum width of 6″ (7½″ width recommended), a minimum thickness of 11/16″ and shall be spaced on 19½″ centers. Each plate shall have two spike holes outside of rail. One hole shall be ¾″ square, located so spike head will clear base of rail, and the other hole shall be staggered to provide three or more positions for spiking, so as to allow leeway for gaging guard rail with frog re-spiking when worn and use with two or more sections of rail if desired.

4. BRACES: Braces shall be integral with guard rail, located for the four intermediate ties, shall be of sufficient length, have ample bearing on ties and be adequately designed to prevent overturning of guard rail. Each brace shall have two spike holes or spike notches ¾″ square spaced not less than 3″ centers. The principal member of braces shall have a minimum thickness of ½″.

5. WALLS: The walls shall have a minimum thickness of ½″.

6. REINFORCING: The guard rail shall be suitably reinforced so as to effectively resist bending between the braces.

7. FOOT GUARDS: Foot guards cast integral with guard rail are recommended, but separate foot guards of approved design, attached to guard rail or running rail, may be used

8. MARKING: The manufacturer's name or trade mark, the year cast and height of guard rail shall be legibly indicated by raised letters, on a portion of the body of the casting that is not subject to wheel wear.

9. SETTING: One-Piece Guard Rails are suitable for use with rigid frogs, and to guide the wheels when passing through the spring flangeway of spring rail frogs and must be installed with not less than 2″ of the straight portion of the guarding face of the Guard Rail back of the ½″ point of frog, and a minimum length of the straight guarding face in advance of the ½″ point of frog as shown In the following table.

Minimum length of Straight Guarding Face In Advance of ½″ Inch Point

Frog No.	
20, 18	30″
16	26″
15	24″
14, 12	18″
11	16″
10. 9. 8. 7, 6	14″
5, 4	12″

Wheels passing through the rigid flangeway of spring rail frogs should be protected by the straight portion of the guarding face of the guard rail, from the ½″ point for two-thirds of the toe length of the spring rail. For width of flangeway and guard face gage see Plan Basic No. 790.

FOR GENERAL SPECIFICATIONS SEE PLAN BASIC No. 100

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

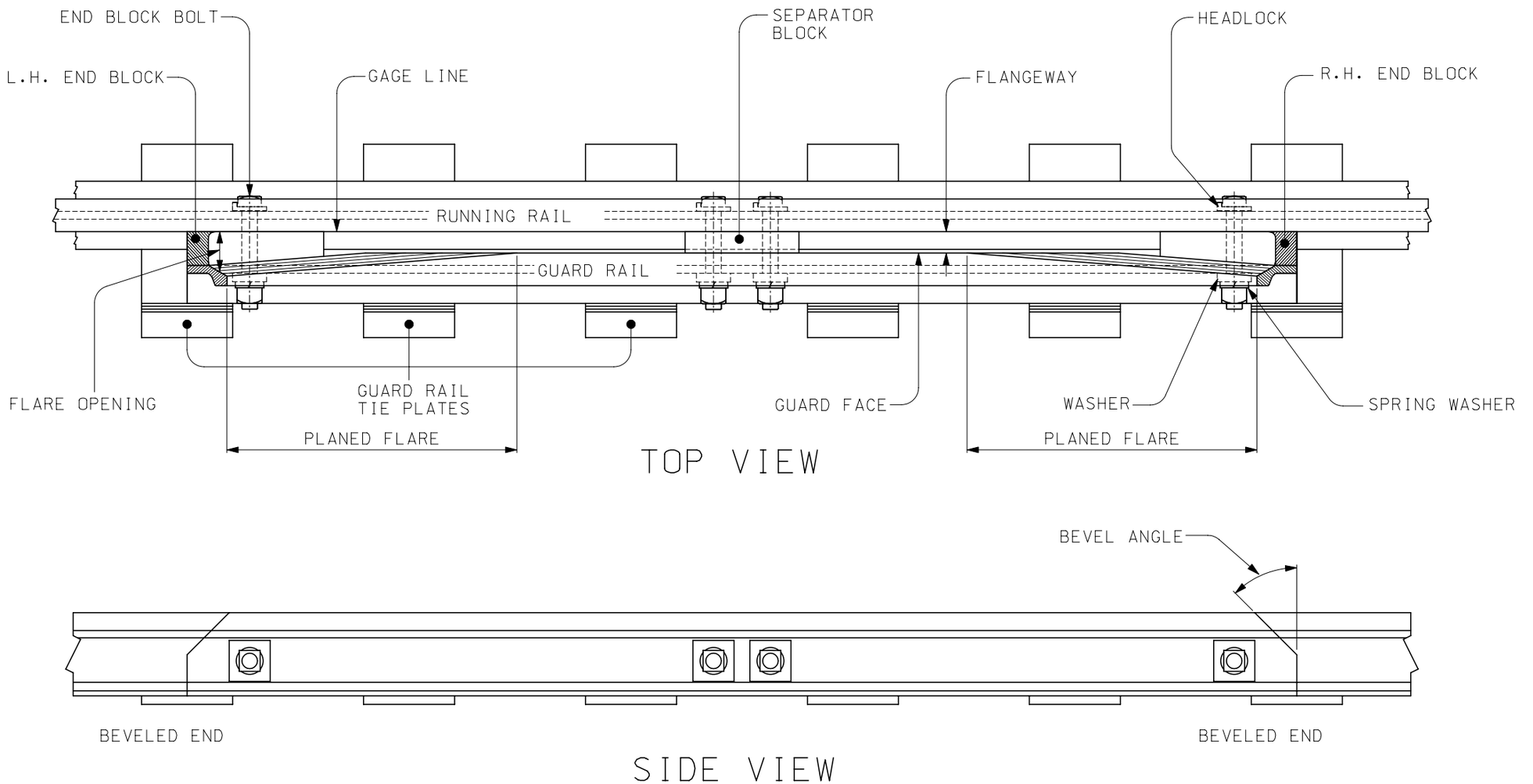
MANGANESE STEEL ONE PIECE GUARD RAIL

Length 8′–4 1⁄2″ for installation on 6 ties
Length 10′–0″ for installation on 7 ties

PLAN NO. **510–01**

Revised March 1940. Converted to C.A.D. Jan. 2001.

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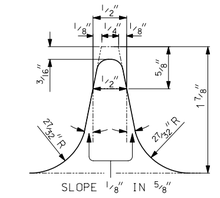
AMERICAN RAILWAY ENGINEERING
AND MAINTENANCE OF WAY ASSOCIATION

DIAGRAM ILLUSTRATING
PREFFERRED NAMES OF PARTS
FOR GUARD RAILS

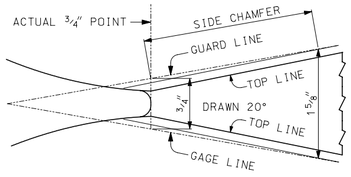
PLAN NO. 590–03

Adopted 1940, Revised 1955. C.A.D. updated July 2003

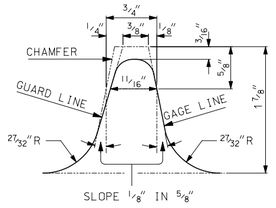
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SECTION AT POINT
CENTER FROGS – ANGLES
8°10′16" TO 9°31′38" INCL.

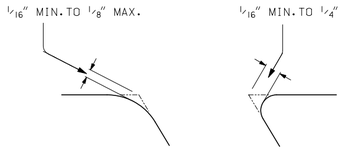


TOP VIEW OF POINT



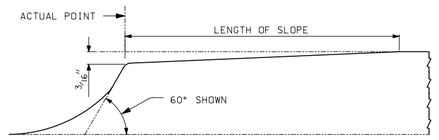
SECTION AT POINT

CENTER FROG POINTS – ANGLES ABOVE 9°31′38" AND BELOW 25°



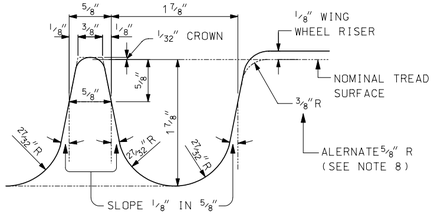
SHOWN FOR INTERSECTIONS OF SOLID MANGANESE CROSSINGS – ANGLE 45° AND ABOVE, FOR ANGLES BELOW 45° OFFSET OF OBTUSE CORNERS TO BE 1/8" MIN. TO 1/4" MAX. UNLESS OTHERWISE SHOWN ON DETAIL PLANS.

ROUNDING OF FLANGEWAY WALLS

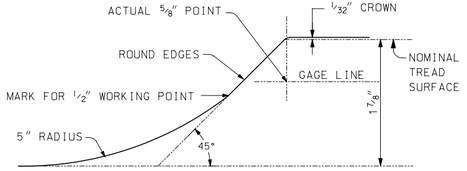


LENGTH OF SLOPE FOR ANGLES 14°15′ AND BELOW SHALL BE EQUAL TO ONE HALF FROG NUMBER IN INCHES WITH A MINIMUM LENGTH OF 5 INCHES. FOR ANGLES ABOVE 14°15′ THE TOP OF SLOPE IS LOCATED AT 1 7/8" POINT WIDTH. (SEE NOTE 7)

DEPRESSION OF FROG POINT

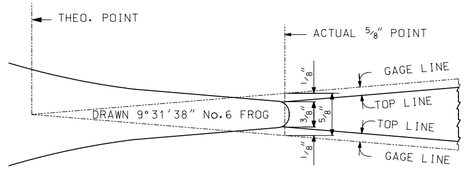


SECTION AT POINT



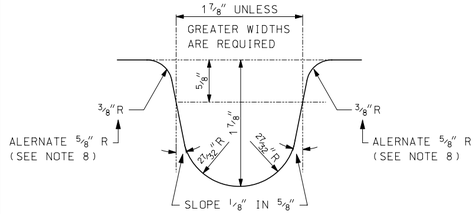
ELEVATION OF POINT

TURNOUT FROGS AND CROSSING END FROGS – ANGLES 14°15′ AND BELOW

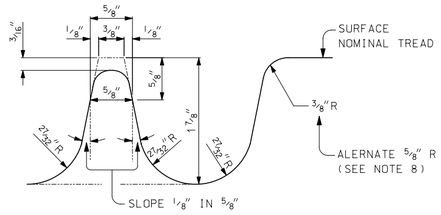


TOP VIEW OF POINT

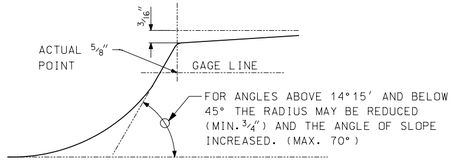
TURNOUT FROGS AND CROSSING
END FROGS – ANGLES BELOW 25°



NORMAL FLANGEWAY LAYOUT
FOR FROGS AND CROSSINGS

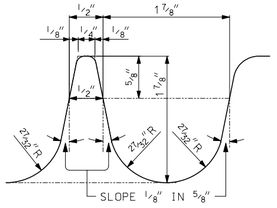


SECTION AT POINT

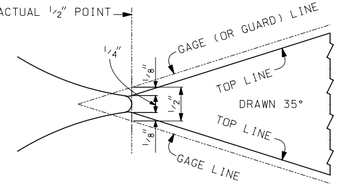


ELEVATION OF POINT

CROSSING END FROGS ANGLES 14°15′ TO 25° AND ALTERNATE (SEE NOTE 7)



SECTION AT POINT



TOP VIEW OF POINT

FROG POINTS FOR CROSSINGS – ANGLES 25° AND ABOVE

NOTES

1 – Point details shown on this plan apply to all manganese insert and solid manganese turnout frogs and all manganese insert and solid manganese crossing frogs–angles below 45°.

2 – For solid manganese crossings, angles 45° and above, the flangeway walls at gage and/or guard line intersections shall be rounded as shown.

3 – For turnout frogs and crossing end frogs, angles 14°15′ and below: wing wheel risers shall be 1/8" as shown and crown of casting shall be raised 1/32" above nominal running surface at point to run out to nothing at 8" from open hearth rail at heel.

4 – Slope of gage wall of manganese shall conform to rail section at joint for all frog and crossing castings. Transition to normal slope (1/8" in 5/8") shall be not over 12".

5 – Standard flangeway width, 1 7/8" as shown, is increased when required by gage and curvature, see Plan Basic No.790 and No.791.

6 – Depth of Flangeway, 1 7/8" as shown, is for layout contour and for minimum depth in finished casting.

7 – Alternate: When wing wheel risers are omitted for turnout frogs and for crossing end frogs, angles 14°15′ and below, the top of point shall be sloped for a distance back from the actual point equal to 1/2 the frog number in inches, with a minimum of 5" to 3/16" below nominal tread surface at the actual point.

8 – Alternate: A 5/8" radius for the top corner of the flange is recommended for frogs in rail sections, Groups 1, 1A, 1B, 1C, 3 and 3A (AREMA Plan 1001); the transition given in Note 4 is then not required.

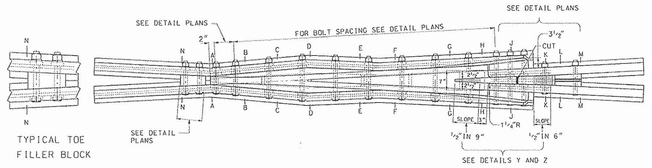
AMERICAN RAILWAY ENGINEERING
AND MAINTENANCE OF WAY ASSOCIATION

POINT AND FLANGEWAY DIMENSIONS FOR MANGANESE FROGS AND CROSSINGS

PLAN NO. 600B–03

Adopted 1971, Revised 1989, Converted to C.A.D. Apr. 1992. C.A.D. updated July 2003

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TYPICAL TOE FILLER BLOCK

TYPICAL PLAN OF RAIL BOUND MANGANESE STEEL FROG

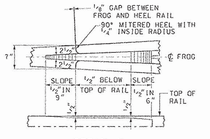
DRAWN FOR NO. 10

INDEX TO DETAIL PLANS

FROG No.	6	7	8	9	10	11	12	14	15	16	20	24
PLAN No.	622			623			624			625		

VERTICAL HEIGHT OF BOLT CENTERS FROM BASE OF RAIL

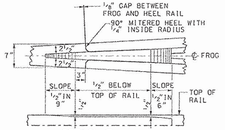
RAIL SECTION	115RE	119RE	132RE	133RE	136RE	141RE
BOLT ℄	2 15/16"	3 1/4"	3 3/32"	3 1/4"		



DETAIL Y

FROGS No. 9 AND UNDER

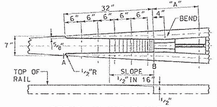
THE DEPRESSED HEEL IS PARALLEL TO THE ADJACENT GAGE LINE AS SHOWN IN DETAIL Y.



DETAIL Z

FROGS No.10 AND OVER

THE DEPRESSED HEEL IS PARALLEL TO THE ADJACENT GAGE LINE WITH THE SLOPE COMMENCING 3" FROM THE POINT RAIL JUNCTION AS SHOWN IN DETAIL Z.

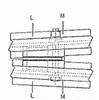


DETAIL Y AND Z ALT.

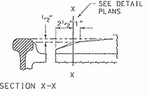
TAPERED HEEL

FOR ALL FROG SIZES

HEEL BLOCK DRILLING	
FROG No.	"A"
6-12	N/A
14	10 1/2"
15	12 1/2"
16	16 1/2"
20	35 1/2"
24	35 1/2"

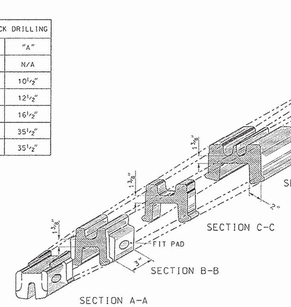


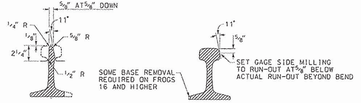
TYPICAL ONE BOLT TYPE HEEL FILLER BLOCK



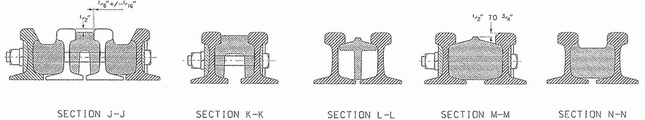
SECTION X-X

HEEL AND TOE END OF MANGANESE STEEL FROG



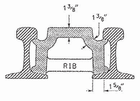


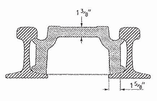
SECTION A AND SECTION B REFER TO TAPERED HEEL DESIGN











NOTES

1 - DIMENSIONS OF CASTINGS. For specific data applicable to each frog number, see detail plans listed in table.

2 - SPECIAL ANGLE FROGS. For special or fractional numbered frogs, use basic widths and other features of nearest frog number and determine lengths to suit.

3 - SPECIAL FLANGEWAY WIDTHS. Flangeways up to 2" wide shall be obtained by moving the guard line outward and modifying the throat openings for flangeways wider than 2" increase width of manganese body accordingly, in either case, the toe length and the distance from the frog point to end of manganese steel guard on wing shall be constant.

4 - FILLERS. Fillers between heel and wing rails shall be of rolled steel, per Plan No. 325, or ductile iron or steel casting

5 - CASTING. Foundry practice required to achieve casting soundness will influence the location and number of ribs. See plan 1012 for soundness requirements.

6 - GENERAL REFERENCES:
(a) POINT AND FLANGEWAY DIMENSIONS. See Plan No.6008 for details.
(b) BEVELING. See Plan No. 1005 for beveling of running rail ends.
(c) FLARES. See Plan No. 350 for details.
(d) BONDING. Per details specified by purchaser.

7 - SPECIFICATIONS - See Plan No. 100.

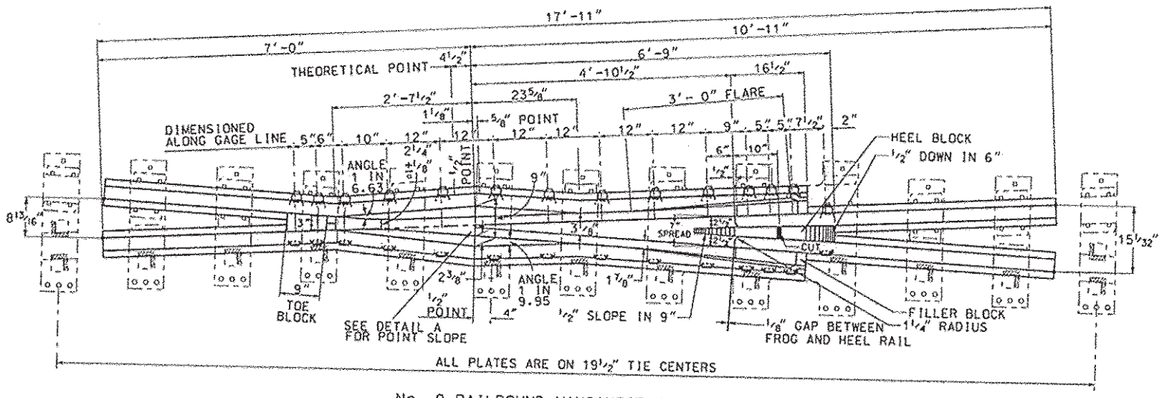
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

DATA AND SECTIONS FOR RAIL BOUND MANGANESE STEEL FROGS

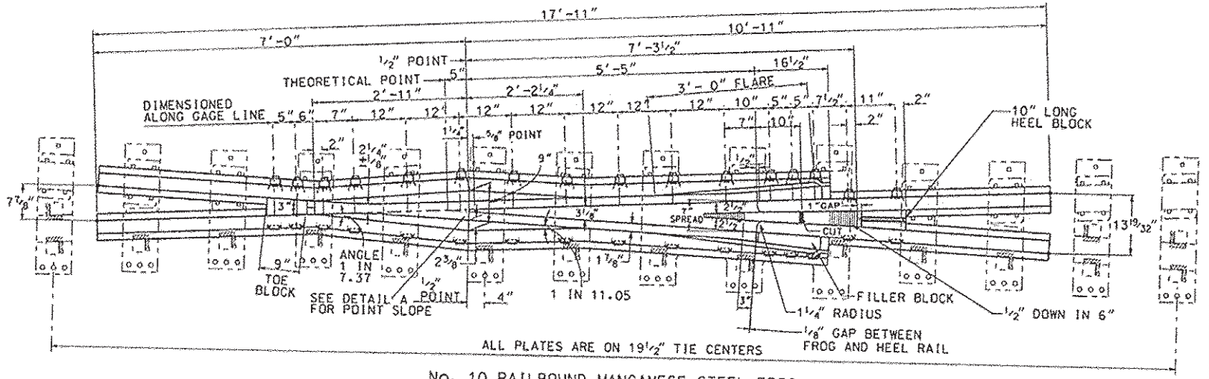
PLAN NO. 621-09

Adopted 1986. Converted to C.A.D. 1992. Revised 2009

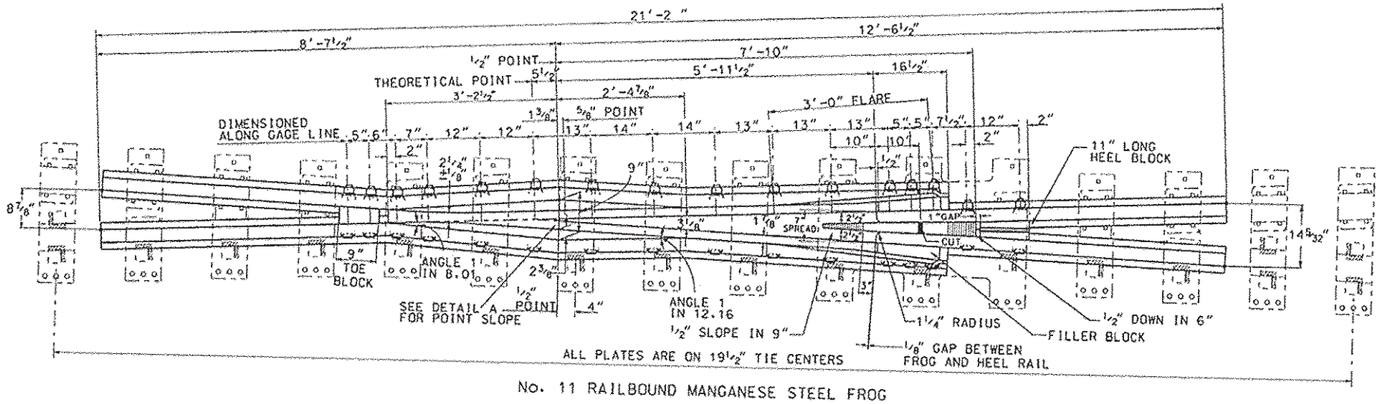
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No. 9 RAILBOUND MANGANESE STEEL FROG
ANGLE 6°-21'-35"



No. 10 RAILBOUND MANGANESE STEEL FROG
ANGLE 5°-43'-29"



No. 11 RAILBOUND MANGANESE STEEL FROG
ANGLE 5°-12'-18"

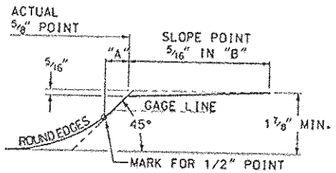
Notes:

1 - DETAILS OF JOINT BARS: Purchaser to specify if rail end drilling required. If required purchaser to provide size, location and number of holes in rail ends.

2 - PLATES: All plates shall be furnished with frog unless otherwise specified. Purchaser shall specify plate type.

3 - PLAN REFERENCE: For additional data, sections, and alternates see Plan No. 621.

4 - SPECIFICATIONS: See Plan No.100.



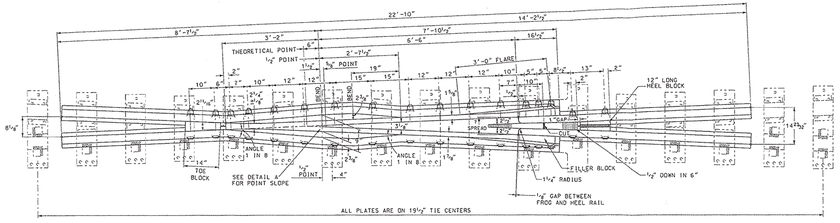
FROG	"A"	"B"
NO. 9	1⅛"	6¾"
NO. 10	1¼"	7½"
NO. 11	1⅜"	8¼"

DETAIL A
ELEVATION OF POINT

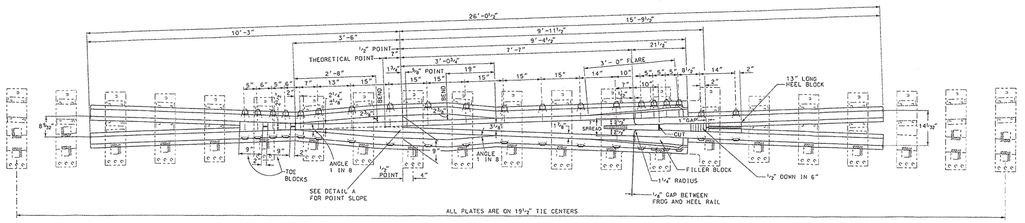
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

NO. 9, NO. 10 AND NO. 11 RAIL BOUND MANGANESE STEEL FROGS

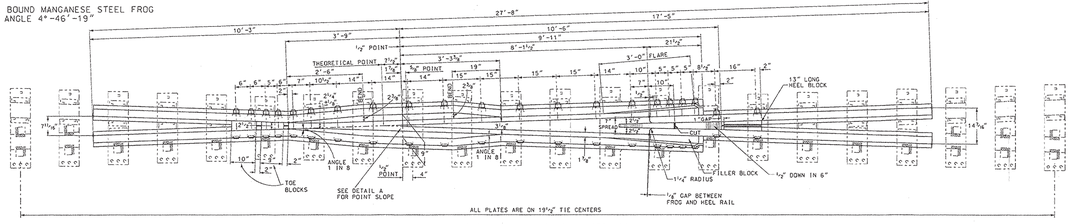
Adopted 1986. Converted to C.A.D. 1992. Revised 2009



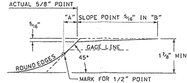
No.12 RAIL BOUND MANGANESE STEEL FROG
ANGLE 4°-46'-19"



No.14 RAIL BOUND MANGANESE STEEL FROG
ANGLE 4°-05'-27"



No.15 RAIL BOUND MANGANESE STEEL FROG
ANGLE 3°-49'-06"



FROG	"A"	"B"
NO. 12	1½"	9"
NO. 14	1½"	10½"
NO. 15	1½"	11¼"

DETAIL A
ELEVATION OF POINT

Notes:

1 - DETAILS OF JOINT BARS: Purchaser to specify if rail end drilling required. If required purchaser to provide size, location and number of holes in rail ends.

2 - PLATES: All plates shall be furnished with frog unless otherwise specified. Purchaser shall specify plate type.

3 - PLAN REFERENCE: For additional data, sections, and alternates see Plan No. 621.

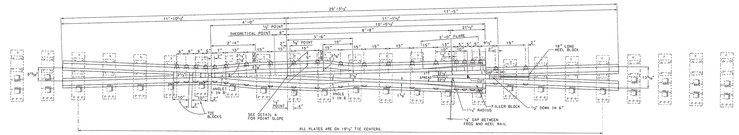
4 - SPECIFICATIONS: See Plan No. 100.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

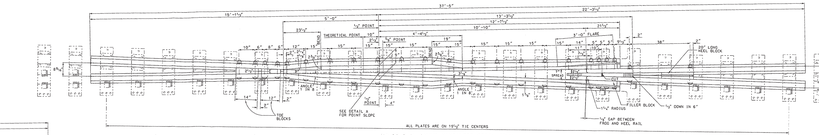
NO. 12, NO. 14, AND NO. 15 RAIL BOUND MANGANESE STEEL FROGS

PLAN NO. 624-09
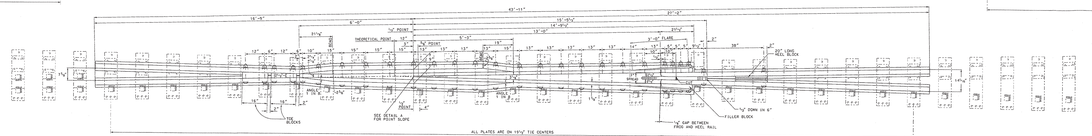
Adopted 1986. Converted to C.A.D. 1992. Revised 2009



No.16 RAIL BOUND MANGANESE STEEL FROG
ANGLE 3°-34'-47"



No.20 RAIL BOUND MANGANESE STEEL FROG
ANGLE 2°-51'-51"



No.24 RAIL BOUND MANGANESE STEEL FROG
ANGLE 2°-23'-13"



FROG	"A"	"B"
NO. 16	3"	12"
NO. 20	4"	16"
NO. 24	5"	18"

DETAIL A
ELEVATION OF POINT

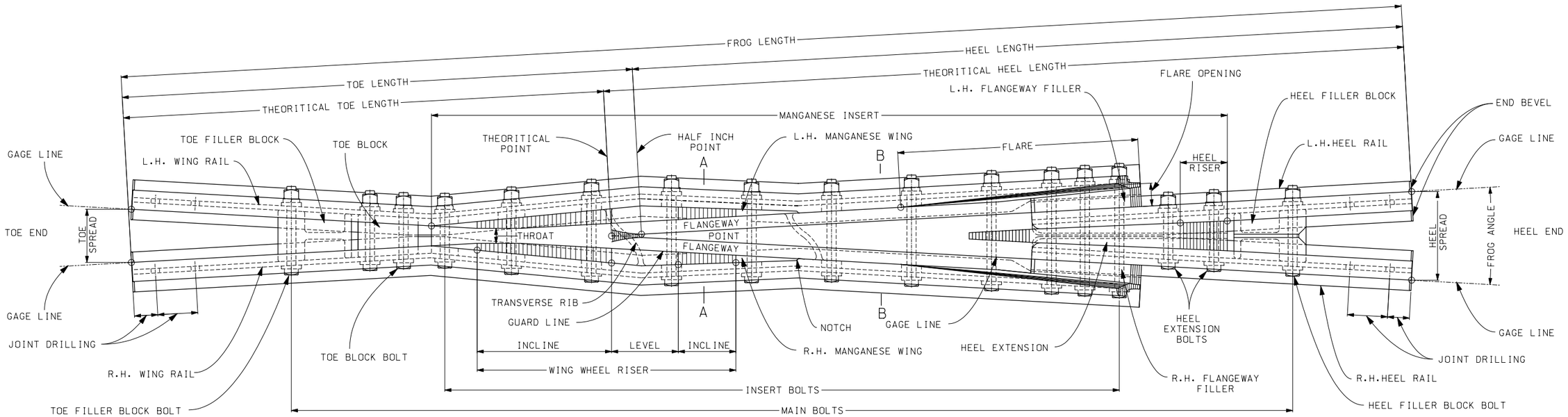
Notes:
1 - DETAILS OF JOINT BARS: Purchaser to specify if rail end drilling is required. If required, purchaser to provide size, location and number of holes in rail ends.
2 - PLATES: All plates shall be furnished with frog unless otherwise specified. Purchaser shall specify plate type.
3 - PLAN REFERENCE: For additional data, omissions, and alternates see Plan No. 521.
4 - SPECIFICATIONS: See AREMA Plan No.100.

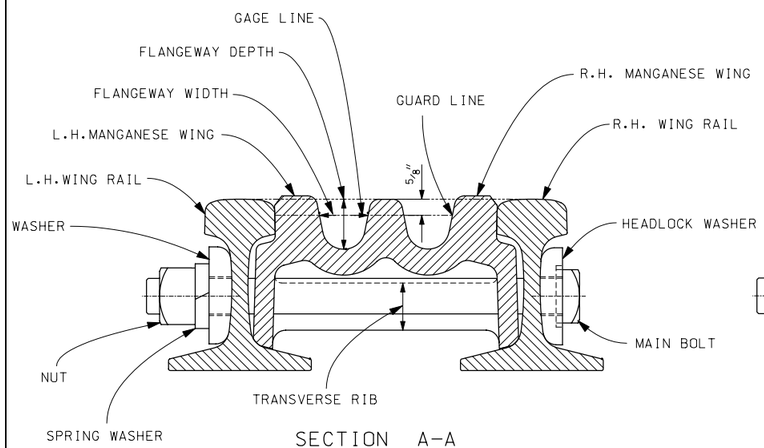
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

NO. 16, NO. 20, AND NO. 24 RAIL BOUND MANGANESE STEEL FROGS

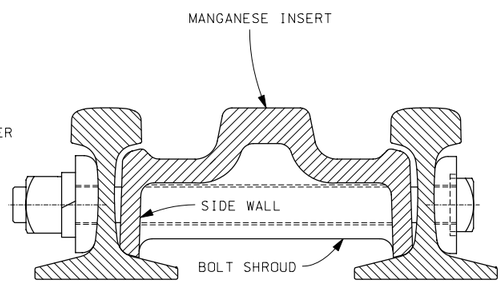
PLAN NO. 625-09

Adopted 1982; Converted to C.A.D. 1992; Revised 2009

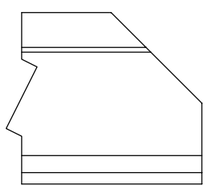




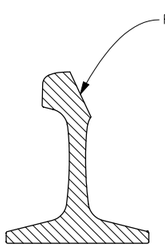
SECTION A–A



SECTION B–B



BEVELED WING RAIL END



SECTION AT WING RAIL END

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

DIAGRAM ILLUSTRATING PREFERRED NAMES OF PARTS FOR RAIL BOUND MANGANESE STEEL FROGS

PLAN NO. 690–01

Adopted 1942, revised 1952 with editorial changes (See Proceedings Vol. 54. 1953). Converted to C.A.D. Feb. 2001.

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FOR MAINTENANCE

1. Permissible variations from standard dimensions shall be as follows

	Standard	Minimum	Maximum
Flangeway width	1 7/8"	1 5/8"	See Note A
Flangeway depth	1 7/8" +	1 1/2"	See Note A
Guard face Gage	4'-4 3/4"	See Note B	4'-5"
Guard check Gage	4'-6 5/8"	4'-6 1/2"	See Note C
Track gage	4'-8 1/2"	4'-8 1/4"	See Note D

These limits must be maintained by realinement, by grinding where necessary, or by replacement.

NOTES:

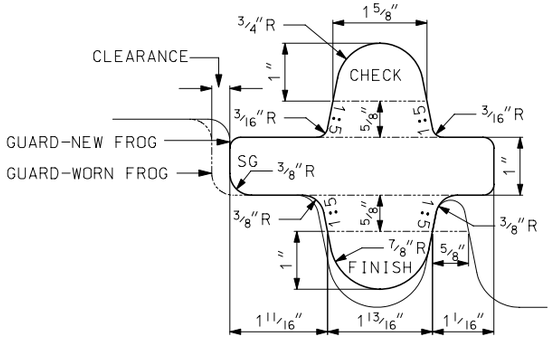
A. Maximum flangeway width and depth are not specified as these dimensions have a tendency to become smaller in service. Before extreme limits are reached they should be increased by grinding, preferably to dimensions specified for new work.

B. Minimum guard face gage is not specified as any dimension under standard consistent with other specified dimensions will give clearances.

C. Maximum guard check gage is not specified as any dimensions over standard consistent with other specified dimensions will give clearances.

D. Maximum track gage is not specified as the gage through special trackwork has a tendency to become narrow. Any dimension over standard shall not exceed allowable maximum gage as defined on Plan Basic No.791.

2. The following outline is submitted showing a check gage to test the flangeways in worn frogs and crossings for grinding or for welding repairs when necessary. It is designed for normal 1 7/8" flangeways and proper allowance should be made when used with wider flangeways.



CHECK GAGE:- APPLY IN FLANGEWAY OF FROG OR CROSSING AND
(1) GRIND TOP CORNERS AND FLANGEWAY WALLS IF NECESARY TO PERMIT ENTRY AND
(2) RESTORE TOP SURFACE IF BOTTOM OF GAGE CONTACTS FLANGEWAY FLOOR.

FINISH GAGE:- APPLY AFTER GRINDING FLANGEWAY OF FROG OR CROSSING.

FOR CHECKING MAXIMUM WEAR OF GUARDS ON SELF GUARDED FROGS, APPLY AT ACTUAL 5/8" POINT AS ILLUSTRATED ABOVE AND RESTORE SURFACE OF GUARD WHEN CLEARANCE IS GREATER THAN 1/4".

FOR NEW WORK

1. For AREMA Standard Turnout Frogs, standard flangeway width shall be 1 7/8".

2. For AREMA Standard Crossings --

   (a) For AREMA Standard Crossings of 4'- 8 1/2" Gage, standard guard face gage shall be 4'-4 3/4" and standard flangeway width shall be 1 7/8".

   (b) For AREMA Standard Solid Manganese Crossings of 90° to 70° angle on tangent track, it is good practice to design track gage 4'- 8 3/8" and flangeway width 1 13/16".

3. For curved track, see Plan Basic No.791 for track gage, guard face gage, and flangeway width.

4. For permissible variations in manufacture, see Basic Plan No.100, Section7.

AMERICAN RAILWAY ENGINEERING
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Construction and Maintenance Section
Association of American Railroads

DATA FOR GAGES AND FLANGEWAYS AT FROGS AND CROSSINGS SHOWING LIMITS WHERE GAGE IS NOT WIDENED FOR CURVATURE

PLAN NO. 790–02

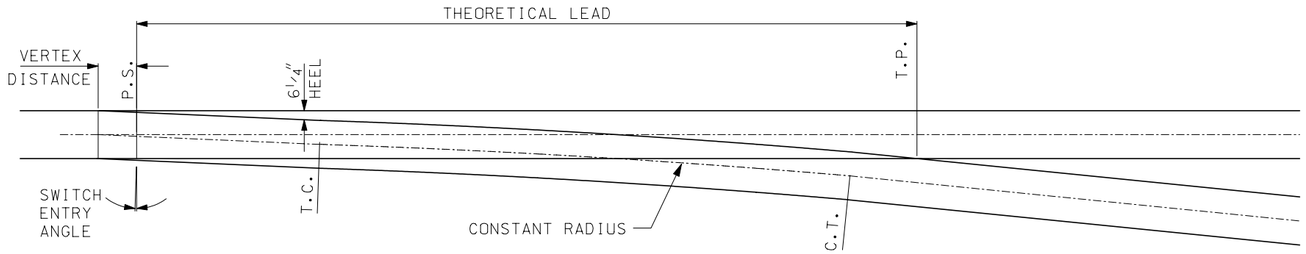
Adopted 1934, Revised October 1993. Converted to C.A.D. May 2002.
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STRAIGHT AREMA GEOMETRY

DESCRIPTION:
AREMA STANDARD GEOMETRY WITH STRAIGHT SWITCH POINTS AND STRAIGHT FROGS WITH ONE CONSTANT RADIUS CURVE.

ADVANTAGES:
1. SHORTER LEAD
2. COMMON USE IN NORTH AMERICA
3. LARGER CROSS SECTION THRU POINTS

DISADVANTAGES:
1. LARGE ENTRY ANGLE
2. HIGH LATERAL FORCES

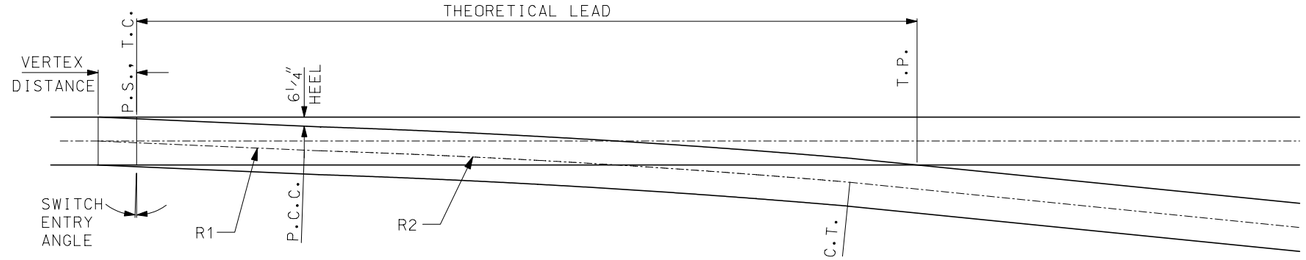


CURVED AREMA GEOMETRY

DESCRIPTION:
AREMA STANDARD GEOMETRY WITH CURVED SWITCH OF RADIUS R1,TURNOUT CENTERLINE RADIUS OF R2 AND STRAIGHT FROGS

ADVANTAGES:
1. SHORTER LEAD
2. COMMON USE IN NORTH AMERICA
3. LARGER CROSS SECTION THRU POINTS
4. SLIGHTLY LOWER ENTRY ANGLE THAN STRAIGHT AREMA GEOMETRY

DISADVANTAGES:
1. HIGH LATERAL FORCES

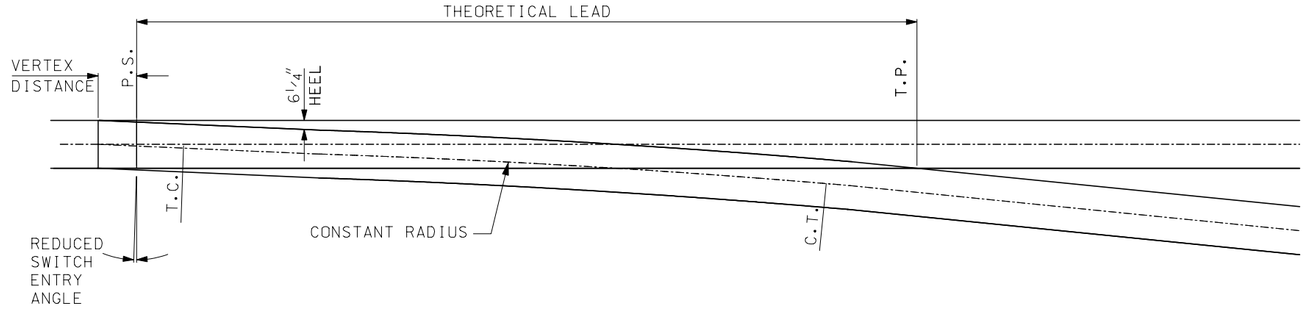


AAR GEOMETRY

DESCRIPTION:
AAR GEOMETRY WITH SHORT SECTION OF STRAIGHT SWITCH POINTS AT REDUCED ENTRY ANGLE FOLLOWED BY A CONSTANT RADIUS AND STRAIGHT FROGS.

ADVANTAGES:
1. SHORTER LEAD
2. SLIGHTLY LOWER SWITCH ENTRY ANGLE THAN CVD AREMA GEOMETRY
3. REDUCED INSTANTANEOUS LATERAL LOADS AS COMPARED TO AREMA STRAIGHT GEOMETRY

DISADVANTAGES:
1. LONGER SWITCH POINT LENGTH



GLOSSARY OF TERMS

P.S. : POINT OF SWITCH

T.C. : TANGENT TO CURVE

C.T. : CURVE TO TANGENT

P.C.C. : POINT OF COMPOUND CURVE

T.P. : THEORETICAL POINT OF FROG

C.O. : CLOTHOID ORIGIN

L1,L2.. : DISTANCE FROM CLOTHOID ORIGIN (POINT OF INFINITE RADIUS) TO INSTANTANEOUS RADIUS R1,R2..

R1,R2.. : INSTANTANEOUS RADIUS

A1,A2 : SPIRAL CONSTANT FOR CALCULATING CURVE

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

TURNOUT GEOMETRIES AND NOMENCLATURE

PLAN No. 901–03
Sheet 1 of 2

Adopted July 2003.

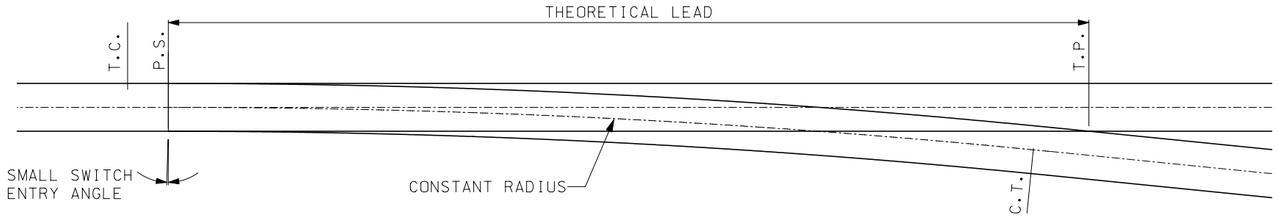
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TANGENT GEOMETRY

DESCRIPTION:
LARGE CONSTANT RADIUS CURVE WITH SMALL SWITCH ENTRY ANGLE AND THE CURVE ENDING TANGENT BEFORE THE FROG.

ADVANTAGES:
1. LOW SWITCH ENTRY ANGLE
2. LOW LATERAL FORCES

DISADVANTAGES:
1. LONG LEAD LENGTH COMPARED TO AREMA GEOMETRIES

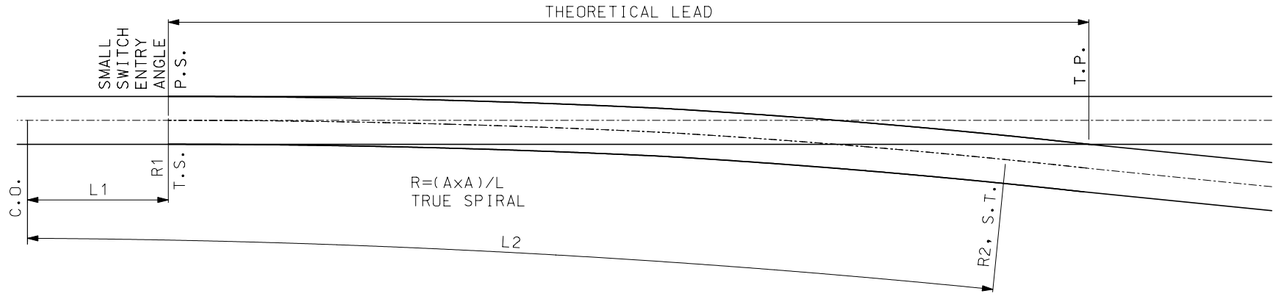


CLOTHOID GEOMETRY

DESCRIPTION:
THE CURVATURE THROUGH THE TURNOUT IS DEFINED BY THE EQUATION (AxA)=RL WHERE R IS THE INSTANTANEOUS RADIUS AND L IS THE DISTANCE FROM THE CLOTHOID ORIGIN.

ADVANTAGES:
1. SMALL SWITCH ENTRY ANGLE
2. LOW LATERAL FORCES IN SWITCH AREA
3. HIGHER SPEEDS
4. ALLOWS MORE FLEXIBILITY TO OPTIMIZE DYNAMIC FORCES

DISADVANTAGES:
1. LONGER SWITCH POINT LENGTH

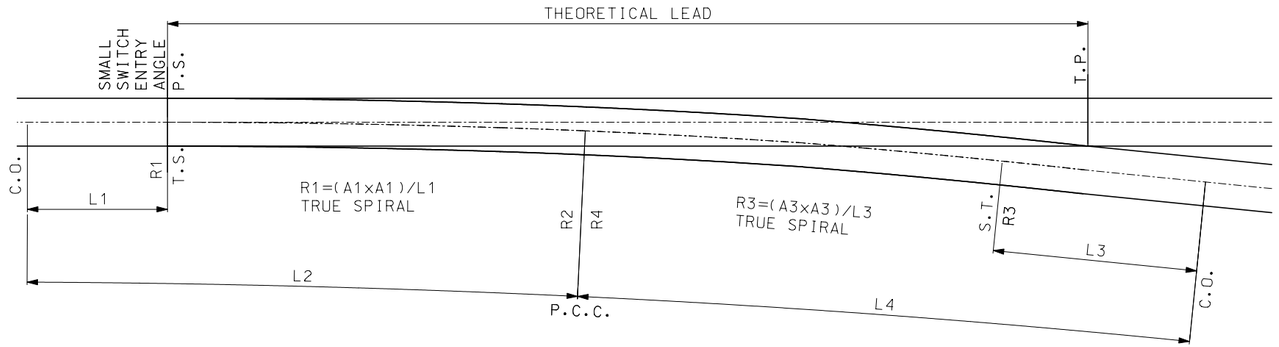


DOUBLE CLOTHOID GEOMETRY

DESCRIPTION:
THE CURVATURE THROUGH THE TURNOUT IS DEFINED BY THE TWO EQUATIONS (A1xA1)=R1L1 AND (A3xA3)=R3L3 WHERE R1 AND R2 ARE INSTANTANEOUS RADII FOR ENTRY CURVE AND R3 AND R4 ARE INSTANTANEOUS RADII FOR THE EXIT CURVE. THE 1st CURVE IS PLOTTED FROM THE CLOTHOID ORIGIN L1 DISTANCE FROM T.S. AND THE 2nd CURVE IS PLOTTED FROM THE CLOTHOID ORIGIN L3 DISTANCE FROM S.T.
THE CURVES MEET AT P.C.C.

ADVANTAGES:
1. SMALL SWITCH ENTRY ANGLE
2. LOW LATERAL FORCES IN SWITCH AREA
3. HIGHER SPEEDS
4. ALLOWS GREATEST FLEXIBILITY TO OPTIMIZE DYNAMIC FORCES

DISADVANTAGES:
1. LONGER SWITCH POINT LENGTH



GLOSSARY OF TERMS

P.S.	:	POINT OF SWITCH
T.C.	:	TANGENT TO CURVE
C.T.	:	CURVE TO TANGENT
T.S.	:	TANGENT TO SPIRAL
S.T.	:	SPIRAL TO TANGENT
P.C.C.	:	POINT OF COMPOUND CURVE
T.P.	:	THEORETICAL POINT OF FROG
C.O.	:	CLOTHOID ORIGIN
L1,L2..	:	DISTANCE FROM CLOTHOID ORIGIN (POINT OF INFINITE RADIUS) TO INSTANTANEOUS RADIUS R1,R2..
R1,R2..	:	INSTANTANEOUS RADIUS
A1,A2	:	SPIRAL CONSTANT FOR CALCULATING CURVE

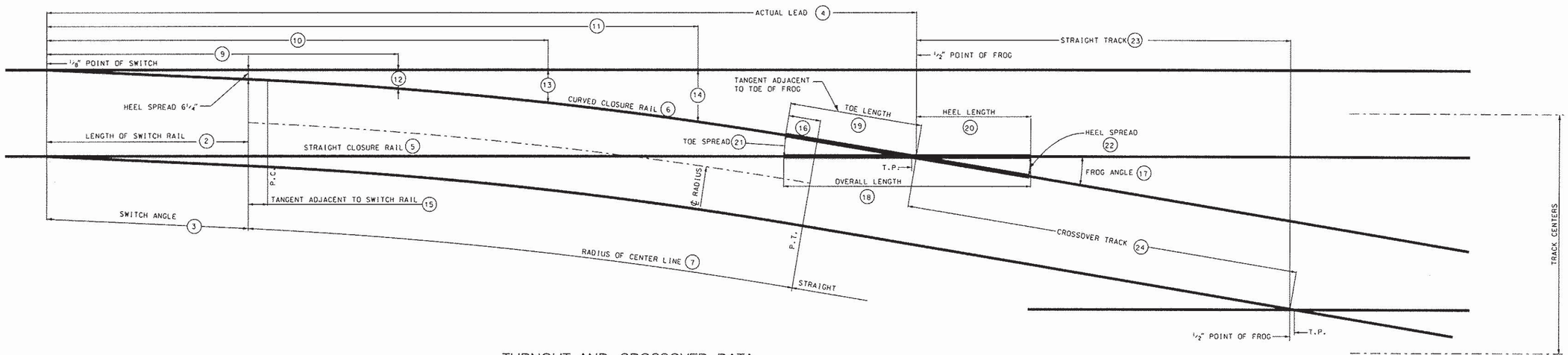
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

TURNOUT GEOMETRIES AND NOMENCLATURE

PLAN No. **901–03**
Sheet 2 of 2

Adopted July 2003.

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TURNOUT AND CROSSOVER DATA

	PROPERTIES OF SWITCHES			CLOSURE DISTANCE		LEAD CURVE		GAGE LINE OFFSETS								PROPERTIES OF FROGS							DATA FOR CROSSOVERS			
																							14'-0" TRACK CENTERS		FOR CHANGE OF 1'-0" IN TRACK CENTERS	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(1)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)		
FROG NO.	LENGTH OF POINTS	SWITCH ANGLE	ACTUAL LEAD	STRAIGHT CLOSURE RAIL	CURVED CLOSURE RAIL	RADIUS OF CENTER LINE	DEGREE OF CURVE							TANGENT ADJACENT TO SWITCH RAIL	TANGENT ADJACENT TO TOE OF FROG	FROG NO.	FROG ANGLE	OVERALL LENGTH	TOE LENGTH	HEEL LENGTH	TOE SPREAD	HEEL SPREAD	STRAIGHT TRACK	CROSSOVER TRACK	STRAIGHT TRACK	CROSSOVER TRACK
	FT. IN.	DEG. MIN. SEC	FT. IN.	FT. IN.	FT. IN.	FT. IN.	DEG. MIN. SEC	FT. IN.	FT. IN.	FT. IN.	FT. IN.	FT. IN.	FT. IN.	FT. IN.	FT. IN.		DEG. MIN. SEC	FT. IN.	FT. IN.	FT. IN.	FT. IN.	INCHES	INCHES	FT. IN.	FT. IN.	FT. IN.	FT. IN.
7	16'-6"(27'-11")	1°-48'-32"	62'-1"	28'-10"	29'-0 23/32"	365'-7 3/32"	15°-43'-17"	26'-2 1/4"	35'-10 1/2"	45'-6 3/4"	11 3/8"	1'-7 19/32"	2'-6 23/32"	1/16"	7 15/32"	7	8°-10'-16"	13'-0"	5'-4"	7'-8"	8 5/8"	13 19/32"	31'-0"	32'-0"	6'-11 9/16"	7'-0 7/16"
8	16'-6"(28'-0")	1°-48'-32"	68'-0"	34'-7 1/2"	34'-9 25/32"	487'-3 3/16"	11°-46'-44"	27'-7 1/4"	38'-8 1/2"	49'-9 3/4"	11 23/32"	1'-8 1/32"	2'-7 25/32"	7 9/16"	3 15/32"	8	7°-09'-10"	14'-8"	5'-4 1/2"	9'-3 1/2"	7 9/16"	14 13/32"	35'-6 3/4"	36'-5 1/4"	7'-11 5/8"	8'-0 3/8"
9	16'-6"(28'-4")	1°-48'-32"	72'-3 1/2"	36'-11 1/2"	37'-1 11/16"	615'-1 7/16"	9°-19'-29"	28'-10 1/4"	41'-2 1/2"	53'-6 3/4"	1'-0 11/32"	1'-9 3/8"	2'-9 7/16"	0"	5 15/32"	9	6°-21'-35"	17'-11"	7'-0"	10'-11"	8 13/16"	15 1/32"	40'-1 5/16"	40'-10 31/32"	8'-11 29/32"	9'-0 11/32"
10	16'-6"(29'-6")	1°-48'-32"	78'-9"	42'-3"	42'-4 31/32"	779'-4 11/16"	7°-21'-23"	29'-11 3/4"	43'-5 1/2"	56'-11 1/4"	1'-0 9/32"	1'-9 1/32"	2'-8 13/32"	2'-0 25/32"	6 15/16"	10	5°-43'-29"	17'-11"	7'-0"	10'-11"	7 7/8"	13 19/32"	44'-7 25/32"	45'-4 3/16"	9'-11 11/16"	10'-0 5/16"

NOTES

1. The data shown are computed for turnouts out of straight standard 4'-8 1/2" gage track. If the wheel base of the equipment used requires wider gage for the switch alignment or curvature shown, the lead and alignment of curved closure rail shall be maintained, and inside stock and curved rails shall be moved out the necessary amount. The gage of straight track through switch will then be increased and the straight closure rail shall be bent to true alignment in advance of toe of frog.
2. FROG DESIGNS
   For short spring rail type frogs, the straight closure, and for solid manganese frogs, the straight and curved closures, shall be lengthened to conform.
3. For length of closure rails, see Plan No. 911.
4. For bills of timber for various turnouts and crossovers see Plan No. 912.
5. For permissible speeds see AREMA Chapter 5.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

TURNOUT AND CROSSOVER DATA FOR STRAIGHT SPLIT SWITCHES

PLAN NO. 910–12

Adopted 1934. Converted to CAD 2002. Revised 2012.

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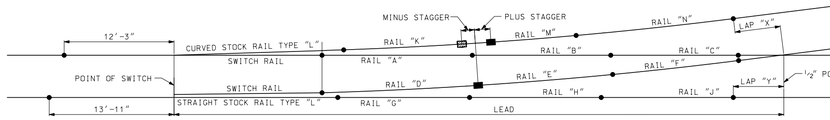


TABLE A

CLOSURE RAILS AND JOINT LOCATION FOR LEFT HAND TURNOUT TYPE "L"

FROG No.	LENGTH OF SWITCH RAIL	TOE LENGTH TO 1/2" POINT	LEAD P.S. TO 1/2" POINT	CLOSURE RAILS - LENGTH IN FEET AND INCHES						TURNOUT RAILS - LENGTH IN FEET AND INCHES						STRAIGHT STOCK RAIL	CURVED STOCK RAIL	PLUS STAGGER	MINUS STAGGER	LAP "X"	LAP "Y"
				STRAIGHT RAILS			CURVED RAILS			STRAIGHT RAILS			CURVED RAILS								
				RAIL "A"	RAIL "B"	RAIL "C"	RAIL "D"	RAIL "E"	RAIL "F"	RAIL "G"	RAIL "H"	RAIL "J"	RAIL "K"	RAIL "M"	RAIL "N"						
5	11'-0"	3'-6 1/2"	42'-6 1/2"	28'-0"	---	---	19'-6"	8'-9 5/8"	---	19'-6"	---	---	15'-0"	---	---	30'-0"	30'-0"	2'-11 3/4"	---	9'-23 5/16"	6'-11 1/2"
6	11'-0"	3'-9"	47'-6"	32'-9"	---	---	19'-6"	13'-5 5/8"	---	19'-6"	---	---	15'-0"	---	---	30'-0"	30'-0"	2'-9 7/8"	---	14'-2 5/16"	11'-11"
7	16'-6"	4'-8 1/2"	62'-1"	27'-0"	13'-10 1/2"	---	25'-0 7/8"	16'-0"	---	27'-0"	---	---	16'-0"	---	---	39'-0"	39'-0"	1'-7 3/4"	---	18'-10 11/16"	10'-0"
8	16'-6"	5'-1"	68'-0"	27'-0"	19'-5"	---	27'-0"	19'-7 1/8"	---	33'-0"	---	---	16'-0"	---	---	39'-0"	39'-0"	---	4 5/16"	24'-10 7/16"	9'-11"
9	16'-6"	6'-4 1/2"	72'-3 1/2"	30'-0"	19'-5"	---	27'-0"	22'-6 7/8"	---	33'-0"	---	---	16'-0"	19'-6"	---	39'-0"	39'-0"	---	4 3/4"	9'-8 1/8"	14'-2 1/2"
10	16'-6"	6'-5"	78'-9"	30'-0"	25'-10"	---	25'-11 5/8"	30'-0"	---	39'-0"	---	---	16'-6"	27'-0"	---	39'-0"	39'-0"	1'-0 7/8"	---	8'-2"	14'-8"
11	22'-0"	7'-0"	91'-10 1/4"	39'-0"	23'-10 1/4"	---	23'-11 5/8"	39'-0"	---	33'-0"	---	---	33'-0"	---	---	60'-0"	60'-0"	2'-0 1/8"	---	10'-9 1/2"	12'-9 1/4"
12	22'-0"	7'-9 1/2"	96'-8"	39'-0"	27'-10 1/2"	---	39'-0"	27'-11 5/8"	---	39'-0"	---	---	16'-6"	19'-6"	---	60'-0"	60'-0"	3'-6 5/16"	---	12'-7 7/16"	11'-7"
14	22'-0"	8'-7 1/2"	107'-0 3/4"	30'-0"	30'-0"	16'-6 3/8"	16'-6 3/8"	27'-0"	33'-0"	19'-6"	30'-0"	---	19'-6"	27'-0"	---	60'-0"	60'-0"	1'-11 1/2"	---	12'-6 11/16"	11'-5 3/4"
15	30'-0"	9'-5"	126'-4 1/2"	33'-0"	33'-0"	20'-11 1/2"	30'-0"	18'-0 7/8"	39'-0"	33'-0"	33'-0"	---	33'-0"	30'-0"	---	60'-0"	60'-0"	2'-11 7/16"	---	15'-4 7/8"	14'-3 1/2"
16	30'-0"	9'-5"	131'-4"	33'-0"	33'-0"	25'-11"	33'-0"	19'-11 5/8"	39'-0"	33'-0"	30'-0"	---	33'-0"	33'-0"	---	60'-0"	60'-0"	---	2'-0 1/16"	17'-4 1/8"	16'-3"
18	30'-0"	11'-0 1/2"	140'-11 1/2"	39'-0"	33'-0"	27'-11"	39'-0"	33'-0"	27'-11 5/8"	39'-0"	39'-0"	---	19'-6"	27'-0"	33'-0"	60'-0"	60'-0"	---	1'-7 3/8"	13'-6"	16'-10 1/2"
20	30'-0"	11'-0 1/2"	151'-11 1/2"	39'-0"	32'-11"	39'-0"	39'-0"	39'-0"	32'-11 5/8"	30'-0"	30'-0"	30'-0"	19'-6"	30'-0"	39'-0"	60'-0"	60'-0"	---	1'-7 3/8"	17'-6 5/16"	15'-10 1/2"

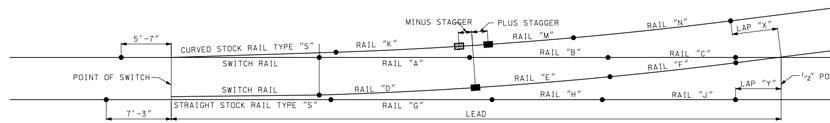


TABLE B

CLOSURE RAILS AND JOINT LOCATION FOR LEFT HAND TURNOUT TYPE "S"

FROG No.	LENGTH OF SWITCH RAIL	TOE LENGTH TO 1/2" POINT	LEAD P.S. TO 1/2" POINT	CLOSURE RAILS - LENGTH IN FEET AND INCHES						TURNOUT RAILS - LENGTH IN FEET AND INCHES						STRAIGHT STOCK RAIL	CURVED STOCK RAIL	PLUS STAGGER	MINUS STAGGER	LAP "X"	LAP "Y"
				STRAIGHT RAILS			CURVED RAILS			STRAIGHT RAILS			CURVED RAILS								
				RAIL "A"	RAIL "B"	RAIL "C"	RAIL "D"	RAIL "E"	RAIL "F"	RAIL "G"	RAIL "H"	RAIL "J"	RAIL "K"	RAIL "M"	RAIL "N"						
5	11'-0"	3'-6 1/2"	42'-6 1/2"	28'-0"	---	---	13'-3 5/8"	15'-0"	---	---	---	---	---	---	---	30'-0"	30'-0"	8 7/16"	---	17'-6 3/16"	19'-9 1/2"
6	11'-0"	3'-9"	47'-6"	32'-9"	---	---	13'-5 5/8"	19'-6"	---	16'-0"	---	---	15'-0"	---	---	30'-0"	30'-0"	5"	---	7'-6 5/16"	8'-9"
7	16'-6"	4'-8 1/2"	62'-1"	27'-0"	13'-10 1/2"	---	16'-0"	25'-0 7/8"	---	19'-6"	---	---	19'-6"	---	---	39'-0"	39'-0"	---	1'-3 1/4"	8'-8 11/16"	10'-10"
8	16'-6"	5'-1"	68'-0"	27'-0"	19'-5"	---	30'-0"	16'-7 1/8"	---	19'-6"	---	---	16'-0"	---	---	39'-0"	39'-0"	3'-4 1/8"	---	18'-2 7/16"	16'-9"
9	16'-6"	6'-4 1/2"	72'-3 1/2"	30'-0"	19'-5"	---	33'-0"	16'-6 7/8"	---	27'-0"	---	---	16'-6"	---	---	39'-0"	39'-0"	9 3/4"	---	22'-0 1/2"	13'-6 1/2"
10	16'-6"	6'-5"	78'-9"	33'-0"	22'-10"	---	30'-0"	25'-11 5/8"	---	33'-0"	---	---	16'-0"	16'-6"	---	39'-0"	39'-0"	3'-2 3/4"	---	12'-6"	14'-0"
11	22'-0"	7'-0"	91'-10 1/4"	23'-10 1/4"	39'-0"	---	29'-11 5/8"	33'-0"	---	27'-0"	---	---	27'-0"	---	---	60'-0"	60'-0"	2'-8 1/2"	---	10'-1 1/2"	12'-1 1/4"
12	22'-0"	7'-9 1/2"	96'-8"	39'-0"	27'-10 1/2"	---	30'-0"	19'-6"	17'-5 5/8"	30'-0"	---	---	30'-0"	---	---	60'-0"	60'-0"	2'-7 7/8"	---	11'-11 7/16"	13'-11"
14	22'-0"	8'-7 1/2"	107'-0 3/4"	30'-0"	30'-0"	16'-5 1/4"	30'-0"	27'-0"	27'-0"	39'-0"	---	---	19'-6"	19'-6"	---	60'-0"	60'-0"	2'-11 7/16"	---	13'-4 13/16"	15'-3 3/4"
15	30'-0"	9'-5"	126'-4 1/2"	33'-0"	33'-0"	18'-0 3/8"	30'-0"	30'-0"	30'-0"	33'-0"	27'-0"	---	33'-0"	19'-6"	---	60'-0"	60'-0"	7 7/16"	---	19'-2 5/8"	16'-7 1/2"
16	30'-0"	9'-5"	131'-4"	33'-0"	33'-0"	25'-11"	39'-0"	19'-11 5/8"	33'-0"	33'-0"	27'-0"	---	33'-0"	39'-0"	---	60'-0"	60'-0"	2'-1"	---	21'-2 1/4"	18'-7"
18	30'-0"	11'-0 1/2"	140'-11 1/2"	39'-0"	33'-0"	27'-11"	33'-0"	39'-0"	27'-11 5/8"	33'-0"	39'-0"	---	16'-6"	33'-0"	19'-6"	60'-0"	60'-0"	2'-0 13/16"	---	17'-4"	16'-8 1/2"
20	30'-0"	11'-0 1/2"	151'-11 1/2"	39'-0"	39'-0"	32'-11"	39'-0"	39'-0"	32'-11 5/8"	30'-0"	30'-0"	19'-6"	16'-6"	28'-0"	39'-0"	60'-0"	60'-0"	2'-0 5/8"	---	13'-10 5/16"	19'-8 1/2"

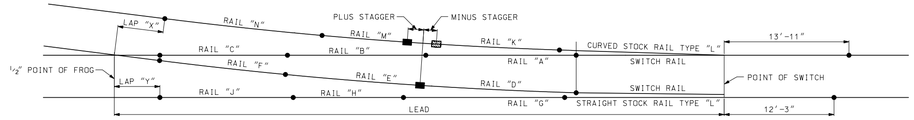


TABLE C

CLOSURE RAILS AND JOINT LOCATION FOR RIGHT HAND TURNOUT TYPE "L"

FROG No.	LENGTH OF SWITCH RAIL	TOE LENGTH TO 1/2" POINT	LEAD P.S. TO 1/2" POINT	CLOSURE RAILS - LENGTH IN FEET AND INCHES						TURNOUT RAILS - LENGTH IN FEET AND INCHES						STRAIGHT STOCK RAIL	CURVED STOCK RAIL	PLUS STAGGER	MINUS STAGGER	LAP "X"	LAP "Y"
				STRAIGHT RAILS			CURVED RAILS			STRAIGHT RAILS			CURVED RAILS								
				RAIL "A"	RAIL "B"	RAIL "C"	RAIL "D"	RAIL "E"	RAIL "F"	RAIL "G"	RAIL "H"	RAIL "J"	RAIL "K"	RAIL "M"	RAIL "N"						
5	11'-0"	3'-6 1/2"	42'-6 1/2"	28'-0"	---	---	19'-6"	8'-9 5/8"	---	15'-0"	---	---	15'-0"	---	---	30'-0"	30'-0"	2'-11 3/4"	---	10'-10 3/16"	9'-9 1/2"
6	11'-0"	3'-9"	47'-6"	32'-9"	---	---	19'-6"	13'-5 5/8"	---	19'-6"	---	---	15'-0"	---	---	30'-0"	30'-0"	1'-1 7/8"	---	15'-10 7/8"	10'-3"
7	16'-6"	4'-8 1/2"	62'-1"	27'-0"	13'-10 1/2"	---	27'-0"	14'-0 7/8"	---	27'-0"	---	---	16'-0"	---	---	39'-0"	39'-0"	---	1'-11 1/8"	20'-6 11/16"	8'-4"
8	16'-6"	5'-1"	68'-0"	33'-0"	16'-5"	---	27'-0"	19'-7 1/8"	---	30'-0"	---	---	19'-6"	---	---	39'-0"	39'-0"	1'-5 13/16"	---	23'-0 7/8"	11'-3"
9	16'-6"	6'-4 1/2"	72'-3 1/2"	27'-0"	19'-5"	---	27'-0"	22'-6 7/8"	---	33'-0"	---	---	16'-0"	19'-6"	---	39'-0"	39'-0"	---	2'-0 3/4"	11'-4 1/8"	12'-6 1/2"
10	16'-6"	6'-5"	78'-9"	33'-0"	22'-10"	---	25'-11 5/8"	30'-0"	---	39'-0"	---	---	16'-0"	27'-0"	---	39'-0"	39'-0"	---	1'-1 1/8"	10'-4"	13'-0"
11	22'-0"	7'-0"	91'-10 1/4"	39'-0"	23'-10 1/4"	---	39'-0"	23'-11 5/8"	---	33'-0"	---	---	16'-6"	19'-6"	---	60'-0"	60'-0"	1'-10 11/16"	---	9'-5 1/2"	11'-1 1/4"
12	22'-0"	7'-9 1/2"	96'-8"	39'-0"	27'-10 1/2"	---	39'-0"	27'-11 5/8"	---	33'-0"	---	---	16'-6"	19'-6"	---	60'-0"	60'-0"	1'-10 5/16"	---	14'-3 7/16"	15'-1"
14	22'-0"	8'-7 1/2"	107'-0 3/4"	30'-0"	30'-0"	16'-5 1/4"	30'-0"	27'-0"	27'-0"	39'-0"	---	---	27'-0"	19'-6"	---	60'-0"	60'-0"	1'-9 11/16"	---	14'-2 13/16"	20'-3 3/4"
15	30'-0"	9'-5"	126'-4 1/2"	33'-0"	33'-0"	20'-11 1/2"	30'-0"	14'-11 1/2"	33'-0"	33'-0"	30'-0"	---	33'-0"	30'-0"	---	60'-0"	60'-0"	2'-9"	---	21'-6 5/8"	15'-7 1/2"
16	30'-0"	9'-5"	131'-4"	33'-0"	33'-0"	25'-11"	33'-0"	19'-11 5/8"	39'-0"	33'-0"	30'-0"	---	33'-0"	33'-0"	---	60'-0"	60'-0"	---	3'-8 1/16"	19'-0 1/4"	17'-7"
18	30'-0"	11'-0 1/2"	140'-11 1/2"	39'-0"	33'-0"	27'-11"	39'-0"	33'-0"	27'-11 5/8"	39'-0"	39'-0"	---	19'-6"	27'-0"	33'-0"	60'-0"	60'-0"	---	3'-3 7/16"	15'-2"	15'-2 1/2"
20	30'-0"	11'-0 1/2"	151'-11 1/2"	39'-0"	39'-0"	32'-11"	39'-0"	39'-0"	32'-11 5/8"	30'-0"	30'-0"	30'-0"	19'-6"	30'-0"	39'-0"	60'-0"	60'-0"	---	3'-3 5/8"	19'-2 5/16"	14'-2 1/2"

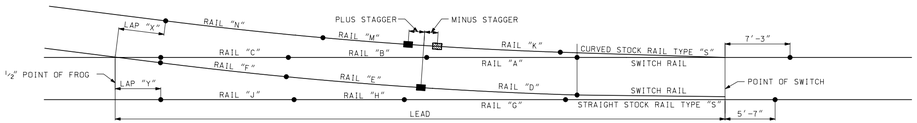


TABLE D

CLOSURE RAILS AND JOINT LOCATION FOR RIGHT HAND TURNOUT TYPE "S"

FROG No.	LENGTH OF SWITCH RAIL	TOE LENGTH TO 1/2" POINT	LEAD P.S. TO 1/2" POINT	CLOSURE RAILS - LENGTH IN FEET AND INCHES						TURNOUT RAILS - LENGTH IN FEET AND INCHES						STRAIGHT STOCK RAIL	CURVED STOCK RAIL	PLUS STAGGER	MINUS STAGGER	LAP "X"	LAP "Y"
				STRAIGHT RAILS			CURVED RAILS			STRAIGHT RAILS			CURVED RAILS								
				RAIL "A"	RAIL "B"	RAIL "C"	RAIL "D"	RAIL "E"	RAIL "F"	RAIL "G"	RAIL "H"	RAIL "J"	RAIL "K"	RAIL "M"	RAIL "N"						
5	11'-0"	3'-6 1/2"	42'-6 1/2"	28'-0"	---	---	13'-3 5/8"	15'-0"	---	---	---	---	---	---	---	30'-0"	30'-0"	---	11 5/16"	19'-2 5/16"	18'-11 1/2"
6	11'-0"	3'-9"	47'-6"	32'-9"	---	---	13'-5 5/8"	19'-6"	---	16'-0"	---	---	16'-0"	---	---	30'-0"	30'-0"	---	1'-3"	8'-2 9/16"	7'-1"
7	16'-6"	4'-8 1/2"	62'-1"	27'-0"	13'-10 1/2"	---	18'-0 7/8"	23'-0"	---	19'-6"	---	---	19'-6"	---	---	39'-0"	39'-0"	---	2'-5 3/8"	10'-4 11/16"	9'-2"
8	16'-6"	5'-1"	68'-0"	27'-0"	19'-5"	---	30'-0"	16'-7 1/8"	---	19'-6"	---	---	16'-0"	---	---	39'-0"	39'-0"	1'-8 1/4"	---	19'-10 7/16"	15'-1"
9	16'-6"	6'-4 1/2"	72'-3 1/2"	30'-0"	19'-5"	---	30'-0"	19'-6 7/8"	---	27'-0"	---	---	16'-0"	---	---	39'-0"	39'-0"	1'-7 1/2"	---	24'-2 1/2"	11'-10 1/2"
10	16'-6"	6'-5"	78'-9"	33'-0"	22'-10"	---	30'-0"	25'-11 5/8"	---	33'-0"	---	---	16'-0"	19'-6"	---	39'-0"	39'-0"	1'-6 3/4"	---	11'-2"	12'-4"
11	22'-0"	7'-0"	91'-10 1/4"	23'-10 1/4"	39'-0"	---	29'-11 5/8"	33'-0"	---	27'-0"	---	---	27'-0"	---	---	60'-0"	60'-0"	1'-0 1/2"	---	11'-9 1/2"	10'-5 1/4"
12	22'-0"	7'-9 1/2"	96'-8"	39'-0"	27'-10 1/2"	---	29'-11 5/8"	39'-0"	---	30'-0"	---	---	33'-0"	---	---	60'-0"	60'-0"	3'-0 1/4"	---	10'-7 7/16"	12'-3"
14	22'-0"	8'-7 1/2"	107'-0 3/4"	30'-0"	30'-0"	16'-5 1/4"	30'-0"	27'-0"	27'-0"	39'-0"	---	---	19'-6"	19'-6"	---	60'-0"	60'-0"	1'11 1/16"	---	15'-0 13/16"	13'-7 3/4"
15	30'-0"	9'-5"	126'-4 1/2"	33'-0"	33'-0"	14'-11 1/2"	39'-0"	18'-0 3/4"	30'-0"	30'-0"	27'-0"	---	33'-0"	27'-0"	---	60'-0"	60'-0"	---	1'-0 9/16"	17'-4 5/8"	14'-11 1/2"
16	30'-0"	9'-5"	131'-4"	33'-0"	33'-0"	25'-11"	39'-0"	19'-11 5/8"	33'-0"	30'-0"	30'-0"	---	19'-6"	39'-0"	---	60'-0"	60'-0"	3'-5"	---	19'-10 1/4"	16'-11"
18	30'-0"	11'-0 1/2"	140'-11 1/2"	39'-0"	33'-0"	27'-11"	33'-0"	39'-0"	27'-11 5/8"	33'-0"	39'-0"	---	19'-6"	33'-0"	19'-6"	60'-0"	60'-0"	3'-4 7/16"	---	16'-0"	14'-6 1/2"
20	30'-0"	11'-0 1/2"	151'-11 1/2"	39'-0"	39'-0"	32'-11"	39'-0"	39'-0"	32'-11 5/8"	30'-0"	30'-0"	19'-6"	19'-6"	27'-0"	39'-0"	60'-0"	60'-0"	3'-4 5/8"	---	13'-6 5/16"	18'-0 1/2"

NOTES:

1. Type "L" turnouts are for general use, except for No.5 and 6 turnouts.
2. Alternate Type "S" turnouts are for use with No.5 and 6 turnouts, and where limited space requires location of joints ahead of switch nearer to switch point.
3. Insulated joints shown thus ——▬—— on plans are located to conform to AREMA C. and S. Manual of Recommended Practice, Part 2.1.20a. b. and c. and if other rail lengths are used, the stagger of the joint must not exceed 4'-6".
4. Rail lengths provide for 3/8" end posts at insulated joints.
5. For additional turnout data see Plan Basic No.910.
6. For bills of timber for various turnouts see Plan Basic No.912.

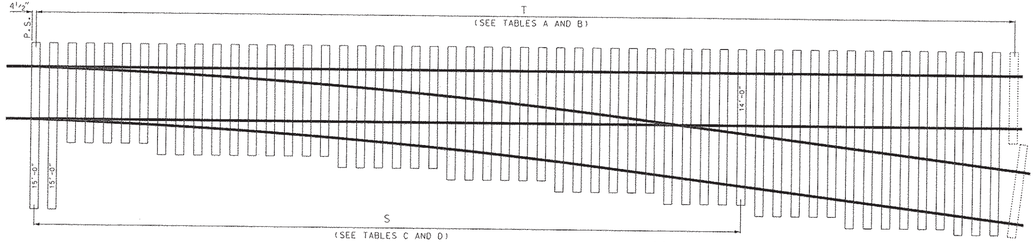
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

LOCATION OF JOINTS FOR TURNOUTS WITH STRAIGHT SPLIT SWITCHES

PLAN NO. 911-02

Adopted March 1934. Supersedes in part Plans No.901 to 908 Incl. Revised March 1941. Converted to C.A.D. October 2002.

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DRAWN No.8
(CURVED SWITCH POINTS)

TABLE A — BILL OF SWITCH TIES FOR TURNOUTS WITH STRAIGHT SWITCHES

FROG No.	LENGTH OF SWITCH RAIL	TOE LENGTH TO ½" POINT	LEAD P.S. TO ½" POINT	LENGTHS AND QUANTITIES OF TIES 9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"	16'-0"	17'-0"	QTY OF TIES	BOARD MEASURE	TRACK LENGTHS OF CROSS TIES REPLACED T
7	16'-6"	5'-4"	62'-1"	7	13	6	5	3	4	6	6	2	52	3329	88'-0"
8	16'-6"	5'-4½"	68'-0"	7	13	6	6	4	5	7	6	3	57	3701	97'-8"
9	16'-6"	7'-0"	72'-3½"	7	13	7	7	6	5	8	6	4	63	4127	105'-8"
10	16'-6"	7'-0"	78'-9"	7	15	8	7	6	6	7	8	4	68	4452	115'-11"

TABLE B — BILL OF SWITCH TIES FOR TURNOUTS WITH CURVED SWITCHES

FROG No.	LENGTH OF SWITCH RAIL	TOE LENGTH TO ½" POINT	LEAD P.S. TO ½" POINT	LENGTHS AND QUANTITIES OF TIES 9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"	16'-0"	17'-0"	QTY OF TIES	BOARD MEASURE	TRACK LENGTHS OF CROSS TIES REPLACED T
6	13'-0"	5'-4½"	49'-9"	5	8	5	5	4	3	5	5	2	42	2746	71'-11"
7	13'-0"	5'-4"	54'-8½"	5	10	6	5	4	4	6	6	2	48	3145	80'-7"
8	13'-0"	5'-4½"	58'-11⅞"	5	10	6	6	6	5	5	6	3	52	3429	88'-7"
9	19'-6"	7'-0"	74'-1¼"	9	13	8	6	6	5	8	6	4	65	4216	107'-6"
10	19'-6"	7'-0"	78'-11"	9	13	9	7	6	6	7	8	4	69	4499	116'-1"
11	19'-6"	8'-7½"	83'-6"	9	14	9	8	7	6	8	8	4	73	4762	124'-1"
12	19'-6"	8'-7½"	87'-3½"	9	14	9	9	8	7	9	9	4	78	5140	131'-11"
14	26'-0"	10'-3"	108'-7½"	12	19	13	9	9	8	11	11	5	97	6321	160'-9"
15	26'-0"	10'-3"	113'-5"	12	19	13	11	9	9	11	12	6	102	6694	169'-4"
16	26'-0"	11'-10½"	118'-5"	12	21	14	11	9	11	10	12	6	106	6867	178'-1"
20	39'-0"	15'-1½"	156'-0½"	20	27	15	14	13	11	15	14	7	138	8863	230'-8"
24	39'-0"	16'-9"	177'-3"	34	21	15	12	16	15	17	14	14	158	9666	264'-0"

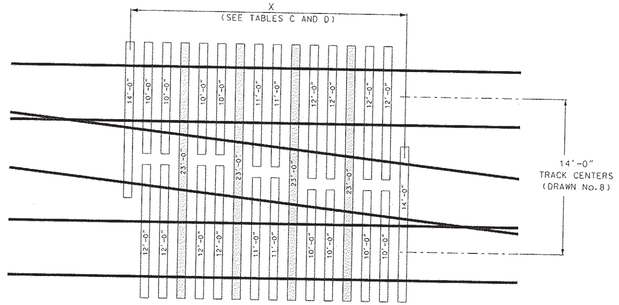


TABLE C — BILL OF SWITCH TIES FOR CROSSOVERS WITH STRAIGHT SWITCHES

FROG No.	LENGTH OF SWITCH RAIL	TOE LENGTH TO ½" POINT	LEAD P.S. TO ½" POINT	LENGTHS AND QUANTITIES OF TIES (INCLUDES THE TOTAL NUMBER OF SWITCH TIES FROM POINT OF SWITCH TO POINT OF SWITCH) 9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	23'-0"	QTY OF TIES	BOARD MEASURE	TRACK LENGTH (PARALLEL TRACKS) OF CROSS TIES REPLACED = S + X S	X
7	16'-6"	5'-4"	62'-1"	14	30	20	14	6	16	5	105	6337	64'-1"	24'-3"
8	16'-6"	5'-4½"	68'-0"	14	34	14	20	8	10	4	104	6279	72'-10¾"	25'-0½"
9	16'-6"	7'-0"	72'-3½"	14	32	22	20	12	10	5	115	7030	78'-3½"	27'-4⅞"
10	16'-6"	7'-0"	78'-9"	14	38	24	22	12	22	5	137	8468	85'-5"	30'-6¹³⁄₁₆"

TABLE D — BILL OF SWITCH TIES FOR CROSSOVERS WITH CURVED SWITCHES

FROG No.	LENGTH OF SWITCH RAIL	TOE LENGTH TO ½" POINT	LEAD P.S. TO ½" POINT	LENGTHS AND QUANTITIES OF TIES (INCLUDES THE TOTAL NUMBER OF SWITCH TIES FROM POINT OF SWITCH TO POINT OF SWITCH) 9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	23'-0"	QTY OF TIES	BOARD MEASURE	TRACK LENGTH (PARALLEL TRACKS) OF CROSS TIES REPLACED = S + X S	X
6	13'-0"	5'-4½"	49'-9"	10	22	14	16	8	6	3	79	4793	62'-7"	21'-3"
7	13'-0"	5'-4"	54'-8½"	10	24	20	14	8	16	5	97	6095	57'-8½"	24'-3"
8	13'-0"	5'-4½"	58'-11"	10	28	14	20	12	10	4	98	6048	63'-10½"	25'-0½"
9	19'-6"	7'-0"	74'-1¼"	18	32	24	18	12	10	5	119	7208	80'-1"	27'-4⅞"
10	19'-6"	7'-0"	78'-11"	18	34	26	22	12	22	5	139	8563	85'-7"	30'-6¹³⁄₁₆"
11	19'-6"	8'-7½"	83'-6"	18	38	24	26	14	12	8	140	8820	89'-11½"	35'-7½"
12	19'-6"	8'-7½"	87'-3½"	18	36	28	26	16	22	8	154	9671	95'-6"	36'-5½"
14	26'-0"	10'-3"	108'-7½"	24	50	34	30	18	26	8	190	11718	118'-4½"	42'-9"
15	26'-0"	10'-3"	113'-5"	24	50	38	34	18	18	10	192	11855	125'-7"	47'-11¹¹⁄₁₆"
16	26'-0"	11'-10½"	118'-5"	24	54	41	37	18	22	8	204	12479	133'-8"	40'-11¼"
20	39'-0"	15'-1½"	156'-0½"	40	74	42	48	26	22	14	266	14690	165'-5¹¹⁄₁₆"	66'-3⅞"
24	39'-0"	16'-9"	177'-3"	78	54	54	36	32	40	11	305	15419	200'-7³⁄₄"	60'-4¹³⁄₁₆"

NOTES

1. Data - For tabulation of general turnout and crossover data for straight switches, see Plan No. 910.
2. Data - For tabulation of general turnout and crossover data for curved switches, see Plan No. 920.
3. Lengths of switch ties in tables are based on 9'-0" cross ties.
4. Board measure given in tables is based on switch ties 7" x 9".
5. Data in tables are based on locating ties under switches and frogs as indicated on AREMA Trackwork Plans of these units and on spacing of other ties approximately 20" center to center.
6. Lengths shown for crossovers in Tables "C" and "D" are based on 14'-0" track centers and should be modified to suit for other track centers.

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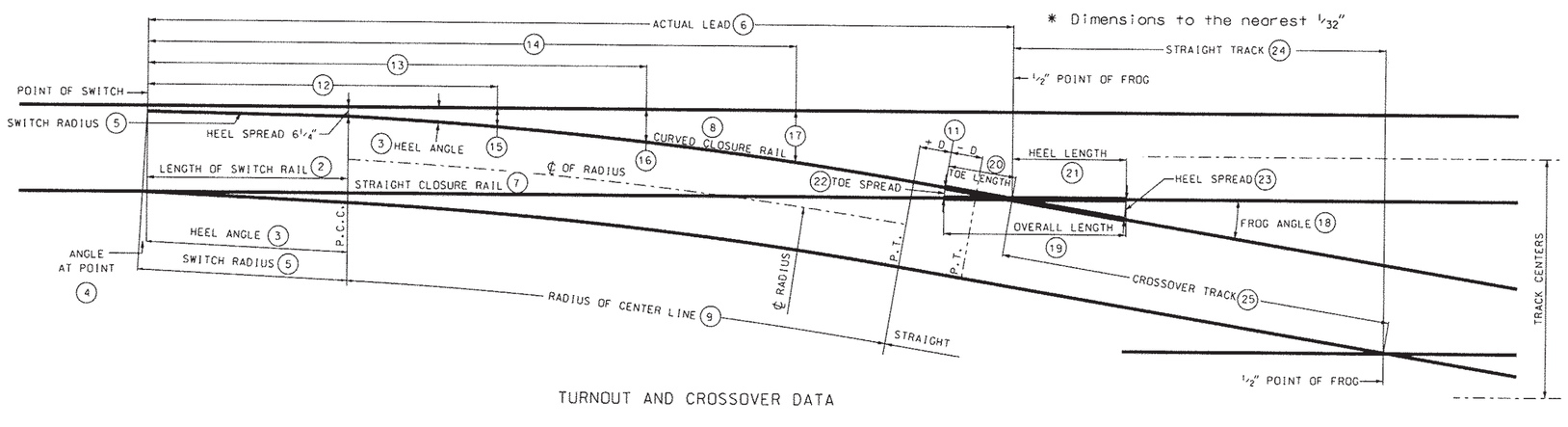
BILLS OF SWITCH TIES
FOR TURNOUTS
AND
CROSSOVERS

PLAN NO. 912-12

Adopted 1952. Revised March 1958. Converted to C.A.D. October 2002.

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	PROPERTIES OF CURVED SWITCHES					CLOSURE DISTANCE		LEAD CURVE			GAGE LINE OFFSETS						PROPERTIES OF FROGS							DATA FOR CROSSOVER			
																								14'-0" TRACK CENTERS		FOR CHANGE OF 1'-0" IN TRACK CENTERS	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(1)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)		
FROG No.	LENGTH OF SWITCH RAIL	HEEL ANGLE	POINT DETAIL No.5100		ACTUAL LEAD	STRAIGHT CLOSURE RAIL	CURVED CLOSURE RAIL *	RADIUS OF CENTER LINE	DEGREE OF CURVE	DISTANCE D ●							FROG No.	FROG ANGLE	OVERALL LENGTH	TOE LENGTH	HEEL LENGTH	TOE SPREAD ●	HEEL SPREAD ●	STRAIGHT TRACK ●	CROSSOVER TRACK ●	STRAIGHT TRACK ●	CROSSOVER TRACK ●
			POINT 0" THK ANGLE AT PT.	SWITCH RADIUS																							
	FT. IN.	DEG. MIN. SEC	DEG. MIN. SEC.	FEET	FT. IN.	FT. IN.	FT. IN.	FEET	DEG. MIN. SEC.	INCHES	FT. IN.	FT. IN.	FT. IN.	INCHES	INCHES	FT. IN.		DEG. MIN. SEC	FT. IN.	FT. IN.	FT. IN.	INCHES	INCHES	FT. IN.	FT. IN.	FT. IN.	FT. IN.
6	13'-0"	2°-54'-00"	1°-41'-31"	616.55	49'-9"	31'-3 1/2"	31'-6 13/16"	283.88	20°-17'-20"	- 17 9/16"	21'-3"	29'-6"	37'-9"	12 23/32"	22 1/32"	2'-10 9/32"	6	9°-31'-38"	13'-0 1/2"	5'-4 1/2"	7'-8"	10 1/4"	15 27/32"	26'-5"	27'-7"	5'-11 1/2"	6'-0 1/2"
7	13'-0"	2°-54'-00"	1°-41'-31"	616.55	54'-8 1/2"	36'-4 1/2"	36'-7 3/8"	409.77	14°-01'-02"	- 15 5/8"	22'-0"	31'-0"	40'-0"	12 29/32"	21 15/16"	2'-9 3/8"	7	8°-10'-16"	13'-0"	5'-4"	7'-8"	8 5/8"	13 5/8"	31'-0"	32'-0"	6'-11 9/16"	7'-0 7/16"
8	13'-0"	2°-54'-00"	1°-41'-31"	616.55	58'-11 1/8"	40'-6 5/8"	40'-9 5/16"	550.75	10°-25'-03"	- 4 19/32"	23'-3"	33'-6"	43'-9"	13 5/8"	23 5/16"	2'-11 9/32"	8	7°-09'-10"	14'-8"	5'-4 1/2"	9'-3 1/2"	7 9/16"	14 13/32"	35'-6 3/4"	36'-5 1/4"	7'-11 5/8"	8'-0 3/8"
9	19'-6"(30'-10 1/2")	1°-59'-15"	1°-04'-24"	1222.17	74'-1 1/4"	36'-2 3/4"	36'-4 31/32"	632.15	9°-04'-23"	- 7 1/2"	31'-6"	43'-6"	55'-6"	12 5/8"	21 23/32"	2'-9 5/16"	9	6°-21'-35"	17'-11"	7'-0"	10'-11"	8 13/16"	15 1/32"	40'-1 5/16"	40'-10 11/16"	8'-11 23/32"	9'-0 11/32"
10	19'-6"(31'-3 1/2")	1°-59'-15"	1°-04'-24"	1222.17	78'-11"	40'-7 1/2"	40'-9 17/32"	806.09	7°-06'-45"	- 12 1/16"	32'-9"	46'-0"	59'-3"	13 1/16"	22 1/2"	2'-10 19/32"	10	5°-43'-29"	17'-11"	7'-0"	10'-11"	7 7/8"	13 19/32"	44'-7 13/16"	45'-4 3/16"	9'-11 11/16"	10'-0 5/16"
11	19'-6"(31'-7 1/2")	1°-59'-15"	1°-04'-24"	1222.17	83'-6"	43'-3"	43'-4 23/32"	1009.34	5°-40'-44"	- 15 5/8"	33'-9"	48'-0"	62'-3"	13 13/32"	22 15/16"	2'-10 15/16"	11	5°-12'-18"	21'-2"	8'-7 1/2"	12'-6 1/2"	8 7/8"	14 3/32"	49'-2 9/32"	49'-9 27/32"	10'-11 23/32"	11'-0 9/32"
12	19'-6"(31'-11")	1°-59'-15"	1°-04'-24"	1222.17	87'-3 1/2"	46'-9"	46'-10 3/4"	1205.02	4°-45'-22"	+ 7 5/8"	34'-6"	49'-6"	64'-6"	13 5/8"	23 3/32"	2'-11 3/32"	12	4°-46'-19"	22'-10"	8'-7 1/2"	14'-2 1/2"	8 1/8"	14 23/32"	53'-8 17/32"	54'-3 1/2"	11'-11 3/4"	12'-0 1/4"
14	26'-0"(37'-5 1/2")	1°-27'-00"	0°-50'-44"	2464.55	108'-7 1/2"	60'-11"	61'-0 15/32"	1576.40	3°-38'-10"	- 3 7/32"	44'-6"	63'-0"	81'-6"	13 3/16"	22 23/32"	2'-10 27/32"	14	4°-05'-27"	26'-0 1/2"	10'-3"	15'-9 1/2"	8 3/32"	14 1/32"	62'-9"	63'-3"	13'-11 25/32"	14'-0 7/32"
15	26'-0"(37'-7 1/2")	1°-27'-00"	0°-50'-44"	2464.55	113'-5"	65'-6 1/2"	65'-7 7/8"	1872.90	3°-03'-34"	- 3 1/32"	45'-6"	65'-0"	84'-6"	13 13/32"	23 1/32"	2'-11"	15	3°-49'-06"	27'-8"	10'-3"	17'-5"	7 11/16"	14 7/16"	67'-3 1/4"	67'-8 3/4"	14'-11 13/16"	15'-0 3/16"
16	26'-0"(37'-10")	1°-27'-00"	0°-50'-44"	2464.55	118'-5"	68'-8 1/2"	68'-9 25/32"	2240.84	2°-33'-26"	- 32 3/4"	46'-9"	67'-6"	88'-3"	13 23/32"	23 15/32"	2'-11 17/32"	16	3°-34'-47"	29'-3 1/2"	11'-10 1/2"	17'-5"	8 13/32"	13 9/16"	71'-9 1/2""	72'-2 21/32"	15'-11 13/16"	16'-0 3/16"
20	39'-0"(57'-5 1/2")	1°-04'-30"	0°-27'-19"	3605.70	156'-0 1/2"	83'-5 1/2"	83'-6 1/2"	3329.91	1°-43'-15"	- 24 5/8"	65'-6"	92'-0"	118'-6"	13 15/32"	23 1/4"	2'-11 17/32"	20	2°-51'-51"	37'-5"	15'-1 1/2"	22'-3 1/2"	8 9/16"	13 7/8"	89'-10"	90'-2 5/32"	19'-11 27/32"	20'-0 5/32"
24	39'-0"(57'-7 1/2")	0°-59'-02"	0°-32'-46"	5105.62	177'-3"	102'-10 1/2"	102'-11 11/16"	5103.26	1°-07'-22"	- 41 3/4"	64'-8 1/2"	90'-5"	116'-1 1/2"	17 15/16"	26 23/32"	3'-1 3/32"	24	2°-23'-13"	43'-11"	16'-9"	27'-2"	7 7/8"	14 1/16"	107'-10 5/16"	108'-1 13/16"	23'-11 7/8"	24'-0 1/8"



TURNOUT AND CROSSOVER DATA

NOTES

1. The data shown are computed for turnouts out of straight standard 4'-8 1/2" gage track. If the wheel base of the equipment used requires wider gage for the switch alinement or curvatures shown, the lead and the alinement of curved closure rail shall be maintained, and inside stock and curved rails shall be moved out the necessary amount. The gage of straight track through switch will then be increased and the straight closure rail shall be bent to true alinement in advance of toe of frog.
2. FROG DESIGNS
   For short spring rail type frogs, the straight closure, and for solid manganese frogs, the straight and curved closures, shall be lengthened to conform.
3. For length of closure rails, see Plan No. 921.
4. For bills of timber for various turnouts and crossovers see Plan No.912.
5. For permissible speeds see AREMA Manual Chapter 5.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

TURNOUT AND CROSSOVER DATA FOR CURVED SPLIT SWITCHES

PLAN NO. 920-12

Adopted 1941. Converted to CAD 2002. Revised 2012

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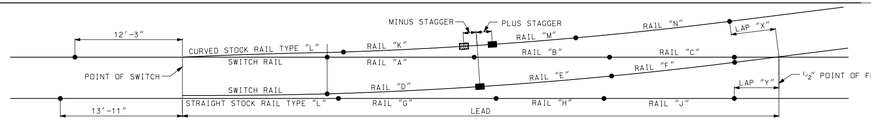


TABLE A

CLOSURE RAILS AND JOINT LOCATION FOR LEFT HAND TURNOUT TYPE "L"

FROG No.	LENGTH OF SWITCH RAIL	TOE LENGTH TO ½" POINT	LEAD P.S. TO ½" POINT	CLOSURE RAILS - LENGTH IN FEET AND INCHES						TURNOUT RAILS - LENGTH IN FEET AND INCHES								STRAIGHT STOCK RAIL	CURVED STOCK RAIL	PLUS STAGGER	MINUS STAGGER	LAP "X"	LAP "Y"
				STRAIGHT RAILS			CURVED RAILS			STRAIGHT RAILS				CURVED RAILS									
				RAIL "A"	RAIL "B"	RAIL "C"	RAIL "D"	RAIL "E"	RAIL "F"	RAIL "G"	RAIL "H"	RAIL "J"	RAIL "K"	RAIL "M"	RAIL "N"								
5	13'-0"	3'-6½"	44'-6½"	28'-0"	---	---	16'-0"	12'-3½"	---	---	---	---	---	---	---	39'-0"	39'-0"	---	0'-7⅝"	17'-1⅜"	19'-5½"
6	13'-0"	3'-9"	49'-9"	33'-0"	---	---	16'-6"	16'-8⅞"	---	---	---	---	---	---	---	39'-0"	39'-0"	---	2'-2⅞"	22'-5½"	24'-8"
7	13'-0"	4'-8½"	54'-8½"	37'-0"	---	---	16'-6"	20'-8½"	---	---	---	---	---	---	---	39'-0"	39'-0"	---	2'-3⅞"	27'-6"	29'-7½"
8	13'-0"	5'-1"	58'-11½"	25'-0"	15'-10⅛"	---	24'-0"	17'-0¼"	---	19'-6"	---	---	13'-0"	---	---	39'-0"	39'-0"	3'-2⅜"	---	18'-9⅛"	14'-4¼"
9	13'-6"	6'-4½"	74'-1¼"	30'-0"	18'-2⅜"	---	25'-0"	23'-4⅝"	---	22'-9¼"	---	---	14'-0"	22'-9¼"	---	39'-0"	39'-0"	3'-11"	---	26'-3⅛"	19'-7"
10	13'-6"	6'-5"	78'-11"	33'-0"	20'-0"	---	23'-1⅝"	30'-0"	---	33'-0"	---	---	19'-6"	19'-6"	---	39'-0"	39'-0"	3'-11"	---	12'-9⅞"	20'-10"
11	13'-6"	7'-0"	83'-6"	39'-0"	18'-0"	---	21'-1½"	36'-0"	---	39'-0"	---	---	17'-10½"	21'-0"	---	39'-0"	39'-0"	4'-3¼"	---	17'-6¾"	19'-5"
12	13'-6"	7'-9½"	87'-3½"	30'-0"	30'-0"	---	21'-1⅜"	39'-0"	---	39'-0"	---	---	17'-10⅝"	30'-0"	---	39'-0"	39'-0"	4'-3¼"	---	12'-4½"	23'-2½"
14	26'-0"	8'-7½"	108'-7½"	39'-0"	30'-0"	---	39'-0"	35'-1⅛"	---	39'-0"	---	---	19'-6"	30'-0"	---	60'-0"	60'-0"	2'-5¾"	---	11'-1⅞"	23'-6½"
15	26'-0"	9'-5"	113'-5"	39'-0"	39'-0"	---	39'-0"	19'-6"	19'-7"	39'-0"	---	---	19'-6"	33'-0"	---	60'-0"	60'-0"	2'-5¾"	---	12'-11½"	28'-4"
16	26'-0"	9'-5"	118'-5"	33'-0"	30'-0"	20'-0"	39'-0"	25'-0"	19'-0⅞"	39'-0"	19'-0"	---	19'-11⅛"	39'-0"	---	60'-0"	60'-0"	2'-10½"	---	11'-6¼"	14'-4"
18	39'-0"	11'-0½"	147'-0½"	39'-0"	39'-0"	19'-0"	39'-0"	39'-0"	19'-0⅞"	39'-0"	39'-0"	---	28'-0"	27'-0"	28'-0"	60'-0"	60'-0"	---	2'-1⅛"	16'-1⅛"	22'-11½"
20	39'-0"	11'-0½"	156'-0½"	39'-0"	39'-0"	28'-0"	39'-0"	39'-0"	28'-0⅝"	39'-0"	28'-0"	28'-0"	28'-0"	27'-0"	39'-0"	60'-0"	60'-0"	---	2'-1½"	14'-1¼"	14'-11½"

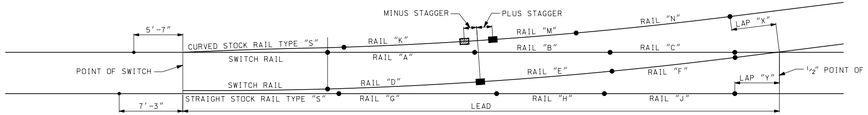


TABLE B

CLOSURE RAILS AND JOINT LOCATION FOR LEFT HAND TURNOUT TYPE "S"

FROG No.	LENGTH OF SWITCH RAIL	TOE LENGTH TO ½" POINT	LEAD P.S. TO ½" POINT	CLOSURE RAILS - LENGTH IN FEET AND INCHES						TURNOUT RAILS - LENGTH IN FEET AND INCHES								STRAIGHT STOCK RAIL	CURVED STOCK RAIL	PLUS STAGGER	MINUS STAGGER	LAP "X"	LAP "Y"
				STRAIGHT RAILS			CURVED RAILS			STRAIGHT RAILS				CURVED RAILS									
				RAIL "A"	RAIL "B"	RAIL "C"	RAIL "D"	RAIL "E"	RAIL "F"	RAIL "G"	RAIL "H"	RAIL "J"	RAIL "K"	RAIL "M"	RAIL "N"								
5	13'-0"	3'-6½"	44'-6½"	28'-0"	---	---	17'-0"	11'-3½"	---	---	---	---	---	---	---	39'-0"	39'-0"	4'-0⅞"	---	10'-5¾"	12'-9½"
6	13'-0"	3'-9"	49'-9"	33'-0"	---	---	16'-8⅞"	16'-6"	---	---	---	---	---	---	---	39'-0"	39'-0"	4'-2¼"	---	15'-9½"	18'-0"
7	13'-0"	4'-8½"	54'-8½"	37'-0"	---	---	16'-6"	20'-8½"	---	---	---	---	---	---	---	39'-0"	39'-0"	4'-4¼"	---	20'-1⅛"	22'-11½"
8	13'-0"	5'-1"	58'-11½"	25'-0"	15'-10⅛"	---	17'-0¼"	24'-0"	---	18'-0"	---	---	15'-0"	---	---	39'-0"	39'-0"	3'-9⅜"	---	10'-1⅛"	9'-2⅛"
9	13'-6"	6'-4½"	74'-1¼"	30'-0"	18'-2⅜"	---	25'-0"	23'-4⅝"	---	22'-9¼"	---	---	14'-0"	---	---	39'-0"	39'-0"	3'-10⅝"	---	26'-3⅛"	19'-7"
10	13'-6"	6'-5"	78'-11"	33'-0"	20'-0"	---	30'-0"	23'-1⅝"	---	33'-0"	---	---	19'-6"	15'-10⅜"	---	39'-0"	39'-0"	3'-9¼"	---	9'-2⅛"	21'-2"
11	13'-6"	7'-0"	83'-6"	39'-0"	18'-0"	---	27'-1½"	30'-0"	---	39'-0"	---	---	16'-6"	21'-0"	---	39'-0"	39'-0"	3'-7"	---	12'-3¼"	12'-9"
12	13'-6"	7'-9½"	87'-3½"	30'-0"	30'-0"	---	27'-1⅜"	33'-0"	---	39'-0"	---	---	16'-0"	25'-0"	---	39'-0"	39'-0"	3'-6⅞"	---	12'-1⅛"	16'-6½"
14	26'-0"	8'-7½"	108'-7½"	39'-0"	35'-0"	---	30'-0"	25'-0"	19'-1⅛"	39'-0"	---	---	---	39'-0"	---	60'-0"	60'-0"	---	1'-4⅝"	14'-11⅝"	16'-10½"
15	26'-0"	9'-5"	113'-5"	39'-0"	39'-0"	---	30'-0"	25'-0"	23'-1"	39'-0"	---	---	---	39'-0"	---	60'-0"	60'-0"	---	1'-4⅞"	19'-9¼"	21'-8"
16	26'-0"	9'-5"	118'-5"	33'-0"	30'-0"	20'-0"	30'-0"	30'-0"	23'-0⅞"	39'-0"	---	---	---	39'-0"	---	60'-0"	60'-0"	---	1'-4⅞"	24'-9⅜"	26'-8"
18	39'-0"	11'-0½"	147'-0½"	39'-0"	39'-0"	19'-0"	39'-0"	39'-0"	19'-0⅞"	39'-0"	39'-0"	---	27'-0"	39'-0"	---	60'-0"	60'-0"	3'-6⅞"	---	26'-5⅛"	16'-3½"
20	39'-0"	11'-0½"	156'-0½"	39'-0"	39'-0"	28'-0"	39'-0"	39'-0"	28'-0⅝"	39'-0"	30'-0"	30'-0"	19'-6"	27'-0"	28'-0"	60'-0"	60'-0"	3'-6⅞"	---	18'-5¼"	23'-9½"

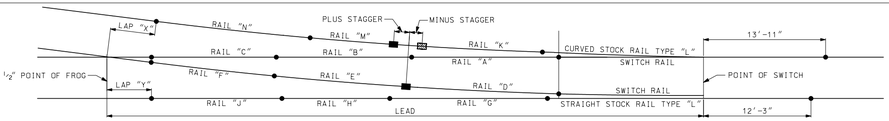


TABLE C

CLOSURE RAILS AND JOINT LOCATION FOR RIGHT HAND TURNOUT TYPE "L"

FROG No.	LENGTH OF SWITCH RAIL	TOE LENGTH TO ½" POINT	LEAD P.S. TO ½" POINT	CLOSURE RAILS - LENGTH IN FEET AND INCHES						TURNOUT RAILS - LENGTH IN FEET AND INCHES								STRAIGHT STOCK RAIL	CURVED STOCK RAIL	PLUS STAGGER	MINUS STAGGER	LAP "X"	LAP "Y"
				STRAIGHT RAILS			CURVED RAILS			STRAIGHT RAILS				CURVED RAILS									
				RAIL "A"	RAIL "B"	RAIL "C"	RAIL "D"	RAIL "E"	RAIL "F"	RAIL "G"	RAIL "H"	RAIL "J"	RAIL "K"	RAIL "M"	RAIL "N"								
5	13'-0"	3'-6½"	44'-6½"	28'-0"	---	---	16'-0"	12'-3½"	---	---	---	---	---	---	---	39'-0"	39'-0"	---	3'-3⅜"	18'-9⅜"	17'-9½"
6	13'-0"	3'-9"	49'-9"	33'-0"	---	---	16'-6"	16'-8⅞"	---	---	---	---	---	---	---	39'-0"	39'-0"	---	3'-10⅞"	24'-1½"	23'-0"
7	13'-0"	4'-8½"	54'-8½"	37'-0"	---	---	16'-6"	20'-8½"	---	---	---	---	---	---	---	39'-0"	39'-0"	---	3'-11⅞"	29'-2"	27'-11½"
8	13'-0"	5'-1"	58'-11½"	25'-0"	15'-10⅛"	---	24'-0"	17'-0¼"	---	19'-6"	---	---	13'-0"	---	---	39'-0"	39'-0"	1'-6⅜"	---	20'-5⅛"	12'-8⅛"
9	13'-6"	6'-4½"	74'-1¼"	30'-0"	18'-2⅜"	---	25'-0"	23'-4⅝"	---	22'-9¼"	---	---	14'-0"	---	---	39'-0"	39'-0"	2'-3"	---	14'-5⅞"	19'-2"
10	13'-6"	6'-5"	78'-11"	33'-0"	20'-0"	---	23'-1⅝"	30'-0"	---	33'-0"	---	---	19'-6"	19'-6"	---	39'-0"	39'-0"	2'-7¼"	---	13'-0⅝"	20'-0"
11	13'-6"	7'-0"	83'-6"	39'-0"	18'-0"	---	21'-1½"	36'-0"	---	39'-0"	---	---	17'-10½"	21'-0"	---	39'-0"	39'-0"	2'-7¼"	---	19'-2⅝"	17'-9"
12	13'-6"	7'-9½"	87'-3½"	30'-0"	30'-0"	---	21'-1⅜"	39'-0"	---	39'-0"	---	---	17'-10⅝"	30'-0"	---	39'-0"	39'-0"	2'-7¼"	---	14'-0½"	21'-6½"
14	26'-0"	8'-7½"	108'-7½"	39'-0"	35'-0"	---	39'-0"	35'-1⅛"	---	39'-0"	---	---	19'-6"	30'-0"	---	60'-0"	60'-0"	0'-9¾"	---	12'-9⅝"	21'-10½"
15	26'-0"	9'-5"	113'-5"	39'-0"	39'-0"	---	39'-0"	19'-6"	19'-7"	39'-0"	---	---	19'-6"	33'-0"	---	60'-0"	60'-0"	0'-9¾"	---	14'-1¼"	26'-1⅜"
16	26'-0"	9'-5"	118'-5"	33'-0"	30'-0"	20'-0"	39'-0"	25'-0"	19'-0⅞"	39'-0"	19'-0"	---	19'-11⅛"	39'-0"	---	60'-0"	60'-0"	1'-2½"	---	13'-2¼"	12'-8"
18	39'-0"	11'-0½"	147'-0½"	39'-0"	39'-0"	19'-0"	39'-0"	39'-0"	19'-0⅞"	39'-0"	39'-0"	---	28'-0"	27'-0"	28'-0"	60'-0"	60'-0"	---	3'-9⅛"	17'-9⅛"	21'-3½"
20	39'-0"	11'-0½"	156'-0½"	39'-0"	39'-0"	28'-0"	39'-0"	39'-0"	28'-0⅝"	39'-0"	28'-0"	28'-0"	28'-0"	27'-0"	39'-0"	60'-0"	60'-0"	---	3'-9¼"	15'-9¼"	13'-3½"

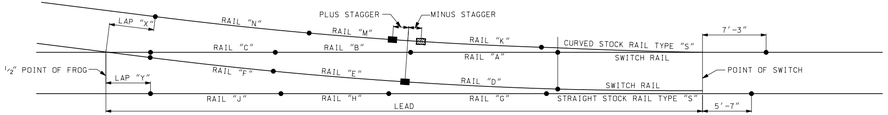


TABLE D

CLOSURE RAILS AND JOINT LOCATION FOR RIGHT HAND TURNOUT TYPE "S"

FROG No.	LENGTH OF SWITCH RAIL	TOE LENGTH TO ½" POINT	LEAD P.S. TO ½" POINT	CLOSURE RAILS - LENGTH IN FEET AND INCHES						TURNOUT RAILS - LENGTH IN FEET AND INCHES								STRAIGHT STOCK RAIL	CURVED STOCK RAIL	PLUS STAGGER	MINUS STAGGER	LAP "X"	LAP "Y"
				STRAIGHT RAILS			CURVED RAILS			STRAIGHT RAILS				CURVED RAILS									
				RAIL "A"	RAIL "B"	RAIL "C"	RAIL "D"	RAIL "E"	RAIL "F"	RAIL "G"	RAIL "H"	RAIL "J"	RAIL "K"	RAIL "M"	RAIL "N"								
5	13'-0"	3'-6½"	44'-6½"	28'-0"	---	---	17'-0"	11'-3½"	---	---	---	---	---	---	---	39'-0"	39'-0"	2'-4⅞"	---	12'-1⅜"	11'-1½"
6	13'-0"	3'-9"	49'-9"	33'-0"	---	---	16'-8⅞"	16'-6"	---	---	---	---	---	---	---	39'-0"	39'-0"	2'-6¼"	---	17'-5½"	16'-4"
7	13'-0"	4'-8½"	54'-8½"	37'-0"	---	---	16'-6"	20'-8½"	---	---	---	---	---	---	---	39'-0"	39'-0"	2'-8⅝"	---	22'-0"	21'-3½"
8	13'-0"	5'-1"	58'-11½"	25'-0"	15'-10⅛"	---	17'-0¼"	24'-0"	---	18'-0"	---	---	15'-0"	18'-0"	---	39'-0"	39'-0"	2'-1⅝"	---	8'-9¼"	10'-6⅞"
9	13'-6"	6'-4½"	74'-1¼"	30'-0"	18'-2⅜"	---	25'-0"	23'-4⅝"	---	22'-9¼"	---	---	14'-0"	---	---	39'-0"	39'-0"	1'-7¼"	---	21'-11⅜"	17'-11"
10	13'-6"	6'-5"	78'-11"	33'-0"	20'-0"	---	30'-0"	23'-1⅝"	---	33'-0"	---	---	19'-6"	15'-10⅜"	---	39'-0"	39'-0"	2'-1⅛"	---	11'-5½"	12'-6"
11	13'-6"	7'-0"	83'-6"	39'-0"	18'-0"	---	27'-1½"	30'-0"	---	39'-0"	---	---	16'-6"	21'-0"	---	39'-0"	39'-0"	1'-1"	---	13'-11½"	11'-1"
12	13'-6"	7'-9½"	87'-3½"	30'-0"	30'-0"	---	27'-1⅜"	33'-0"	---	39'-0"	---	---	16'-0"	25'-0"	---	39'-0"	39'-0"	1'-10⅞"	---	13'-9⅛"	14'-10½"
14	26'-0"	8'-7½"	108'-7½"	39'-0"	35'-0"	---	30'-0"	25'-0"	19'-1⅛"	39'-0"	---	---	---	39'-0"	---	60'-0"	60'-0"	---	3'-0⅝"	16'-7⅝"	15'-2½"
15	26'-0"	9'-5"	113'-5"	39'-0"	39'-0"	---	30'-0"	25'-0"	23'-1"	39'-0"	---	---	---	39'-0"	---	60'-0"	60'-0"	---	3'-0¾"	21'-5½"	20'-0"
16	26'-0"	9'-5"	118'-5"	33'-0"	30'-0"	20'-0"	30'-0"	30'-0"	23'-0⅞"	39'-0"	---	---	---	39'-0"	---	60'-0"	60'-0"	---	3'-0⅞"	26'-5⅜"	25'-0"
18	39'-0"	11'-0½"	147'-0½"	39'-0"	39'-0"	19'-0"	39'-0"	39'-0"	19'-0⅞"	39'-0"	39'-0"	---	27'-0"	39'-0"	---	60'-0"	60'-0"	1'-10⅞"	---	28'-11⅜"	14'-7½"
20	39'-0"	11'-0½"	156'-0½"	39'-0"	39'-0"	28'-0"	39'-0"	39'-0"	28'-0⅝"	39'-0"	39'-0"	28'-0"	30'-0"	30'-0"	19'-6"	28'-0"	27'-0"	28'-0"	60'-0"	20'-11½"	22'-11½"

NOTES:

1. Type "L" turnouts are for general use.
2. Alternate Type "S" turnouts are for use where limited space requires location of joints ahead of switch nearer to switch point.
3. Insulated joints shown thus ——■—— on plans are located to conform to AREMA C. and S. Manual of Recommended Practice, Part 2.1.20a. b. and c. and if other rail lengths are used, the stagger of the joint must not exceed 4'-6".
4. Rail lengths provide for ⅜" end posts at insulated joints.
5. For additional turnout data see Plan Basic No.920.
6. For bills of timber for various turnouts see Plan Basic No.912.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

LOCATION OF JOINTS FOR TURNOUTS WITH CURVED SPLIT SWITCHES

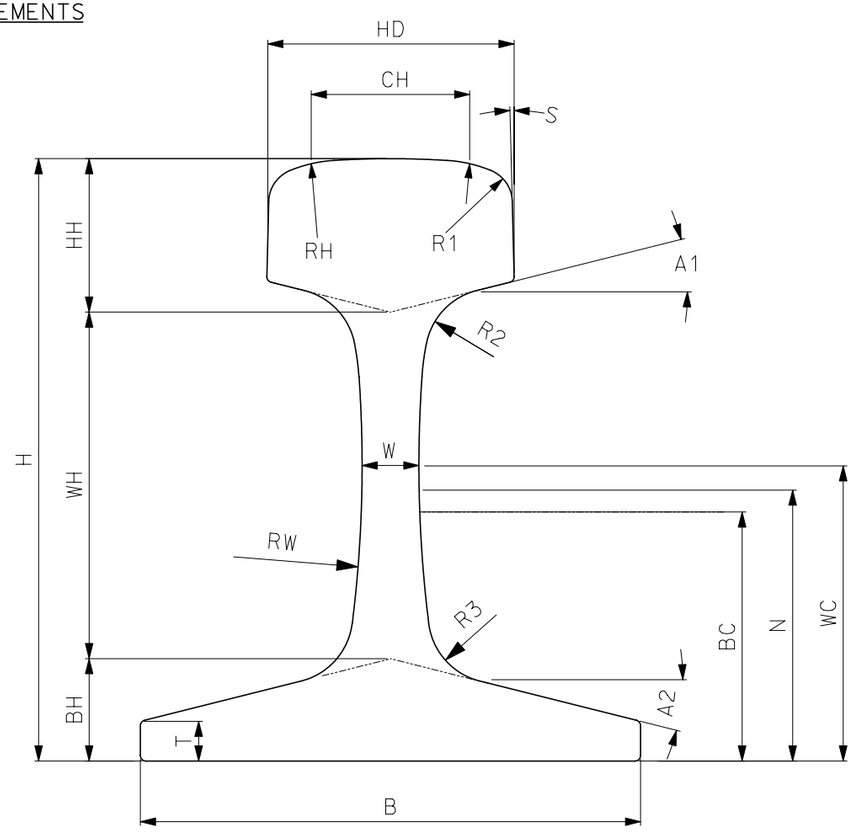
PLAN NO. 921-02

Adopted March 1941. Revised March 1952. Converted to C.A.D. November 2002.

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KEY TO RAIL SECTION MEASUREMENTS

A1 – BOTTOM HEAD ANGLE
A2 – BASE ANGLE
B – BASE WIDTH
BC – BOLT CENTER LINE
BH – BASE HEIGHT
CH – HEAD RADIUS WIDTH
H – RAIL HEIGHT
HD – HEAD WIDTH
HH – HEAD HEIGHT
N – NEUTRAL AXIS
RH – HEAD RADIUS
RW – WEB RADIUS
R1 – GAGE CORNER RADIUS
R2 – TOP FILLET RADIUS
R3 – BOTTOM FILLET RADIUS
S – HEAD SIDE SLOPE*
T – BASE EDGE THICKNESS
W – WEB THICKNESS
WC – WEB CENTER LINE
WH – WEB HEIGHT



KEY FOR REFERENCES:

A – AREMA PLAN 1001-03
B – AREMA PLAN 1004-03
C – RAILS AND FASTENINGS 1916, LACKAWANNA STEEL CO.
D – HANDBOOK OF RAILROAD TRACK STANDARDS (ARMY)
E – 1948 RAILWAY ENGINEERING & MAINTENANCE CYCLOPEDIA
F – D.WEMMER – SANTINA & THOMPSON
G – AREMA VOLUME 1
H – TABLE FROM DU-WEL STEEL
I – RAILS AND ACCESSORIES – THE PA.STL. CO., MD STL. CO.
J – RAILS 1914 CARNEGIE STEEL COMPANY
K – CORRESPONDENCE FROM BETHLEHEM STEEL CORP.
L – 1955 RAILWAY ENGINEERING & MAINTENANCE CYCLOPEDIA
N – RAILWAY TRACK AND TRACK WORK, E.E. RUSSEL TRATMAN, 1897 AND 1909 EDITIONS
O – ILLINOIS POCKET COMPANION, ILLINOIS STEEL, 1934
P – CORRESPONDENCE, FROM ART WORTH, CANADIAN NATIONAL RAILWAY
Q – SYDNEY STEEL CORP.

* ON HEAD FREE SECTIONS, THE BOTTOM OF THE HEAD IS NARROWER THAN THE TOP, THUS THE SIDE SLOPE IN THE OPPOSITE DIRECTION FROM STANDARD SECTIONS.

Note: RE refers to AREMA and its predecessor AREA.

AMERICAN RAILWAY ENGINEERING
AND MAINTENANCE OF WAY ASSOCIATION

RAIL SECTIONS – IN USE SINCE ABOUT 1900
LIGHT DENSITY AND SHORT LINE RAILWAY

Information 1952, Revised 1996 . Converted to C.A.D. February 2003.

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TABLE OF RAIL SECTIONS - (DIMENSIONS IN INCHES)

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
WT./ YD. LB.	TYPE	MANUFACTURER AND SECTION NUMBER															RAIL HEIGHT	BASE WIDTH	HEAD WIDTH	WEB THICKNESS	HEAD HEIGHT	WEB HEIGHT	BASE HEIGHT	BASE EDGE THICKNESS	HEAD RADIUS	WEB RADIUS	GAGE CORNER RADIUS	TOP FILLET RADIUS	BOTTOM FILLET RADIUS	HEAD SIDE SLOPE	HEAD BOTTOM ANGLE	BASE ANGLE	HEAD RADIUS WIDTH	WEB CENTER LINE	NEUTRAL AXIS DISTANCE	BOLT CENTER LINE	REFERENCE
		U.S. STEEL	BETHELEM	ILLINOIS	OLD ILLINOIS	CARNEGIE	TENNESSE TC & I	LACKAWANNA	MIDVALE	COLORADO CF & I	INLAND	CAMBRIA	MARYL. PENN.	DOMINION	ALGOMA	SYDNEY	H	B	HD	W	HH	WH	BH	T	RH	RW	R1	R2	R3	S	A1	A2	CH	WC	N	BC	
8	ARA-B			841		841	841			81							1 9/16	1 9/16	23/32	5/32	7/16	13/16	5/16		8	12				VERT	13°	13°		23/32	0.70		H.O
	ASCE			840	801	840	840										1 9/16	1 9/16	13/16	5/32	15/32	13/16	9/32		12	12	5/32	3/16	3/16	VERT	13°	13°		11/16	0.75	11/16	D.H.J.O
10	ASCE			1040		1040	1040										1 3/4	1 3/4	15/16	3/16	33/64	15/16	19/64		12	12	5/32	3/16	3/16	VERT	13°	13°		49/64	0.87	49/64	H.J.L.O
	MISC.									101							1 9/16	1 11/16	29/32	9/32	7/16	13/16	5/16							VERT	13°	13°		23/32			H
	ARA-B			1230		1230	1230			122							2 3/64	1 3/4	59/64	3/16	9/16	1 3/32	25/64		12					4°	13°	13°		STR.	0.91		H.O
12	ASCE		12-AS	1240	1201	1240	1240	120	580								2	2	1	3/16	9/16	1 3/32	11/32		12	12	5/32	3/16	3/16	VERT	13°	13°		57/64	0.96	57/64	D.H.J.O
	PA STL. CO.- MD STL. CO.												66				2	2	1 1/16	3/16	19/32	1 5/64	21/64	3/32	4 1/2	4 1/2	3/16	5/32	5/32	5°	13°	13°		55/64		55/64	I
14	ARA-B			1430		1430	1430			143							2 3/64	1 21/32	1 1/64	9/32	9/16	1 3/32	25/64							4°	13°	13°		STR.	0.92		H.L.O
	ASCE			1440													2 1/16	2 1/16	1 1/16	1/4	5/8	1 3/32	11/32		12	12	5/32	3/16	3/16	VERT	13°	13°		57/64	1.02	57/64	J.O
16	ARA-B			1630		1630	1630			162							2 7/16	2	1 7/64	7/32	4/64	1 23/64	7/16							4°	13°	13°		STR.	1.13		H.O
	ASCE		16-AS	1640	1601	1640	1640	160	579								2 3/8	2 3/8	1 11/64	7/32	4/64	1 23/64	3/8		12	12	3/16	3/16	3/16	VERT	13°	13°		1 7/128	1.15	1 7/128	D.H.J.O
	PA STL. CO.- MD STL. CO.												48				2 11/32	2 11/32	1 7/32	7/32	45/64	1 9/32	23/64		4	4 1/2	3/16	5/32	5/32	5°	12°	12°		1		1	I
18	ARA-B			1830		1830	1830			182							2 7/16	2 5/64	1 3/16	19/64	4/64	1 23/64	7/16							4°	13°	13°		STR.	1.14		H.O
	ARA-B			2030		2030	2030			203							2 43/64	2 1/4	1 17/64	1/4	23/32	1 15/32	3/64							4°	13°	13°		STR.	1.25		H.O
20	ASCE		20-AS	2040	2001	2040	2040	200	578								2 5/8	2 5/8	1 11/32	1/4	23/32	1 15/32	7/16		12	12	1/4	3/16	3/16	VERT	13°	13°		1 1/64	1.27	1 1/64	D.H.J.O
	PA STL. CO.- MD STL. CO.												47				2 1/2	2 1/2	1 7/16	1/4	25/32	1 5/16	13/32	3/32	4 1/2	4 1/2	7/32	3/16	3/16	5°	12°	12°		1 1/32		1 1/32	I
	ARA-B			2530		2530	2530			252							2 13/16	2 1/2	1 29/64	9/32	28/32	1 31/64	35/64		12	12	1/4	1/4	1/4	4°	13°	13°		1 37/128	1.30		H.O
25	ASCE		25-AS	2540	2502	2540	2540	250	577				264				2 3/4	2 3/4	1 1/2	19/64	25/32	1 31/64	31/64		12	12	1/4	1/4	1/4	VERT	13°	13°		1 29/128	1.33	1 29/128	D.H.I.J.O
	PA STL. CO.- MD STL. CO.												45				2 3/4	2 21/32	1 9/16	19/64	29/32	1 13/32	7/16	7/64	7	7	7/32	7/32	7/32	5°	12°	12°		1 9/64		1 9/64	I.
	ARA-B			3030		3030	3030			303							3 11/64	2 3/4	1 19/32	5/16	7/8	1 23/32	37/64		12	12	5/16	1/4	1/4	4°	13°	13°		1 7/16	1.50		H.O
30	ASCE												269				3	3	1 5/8	21/64	55/64	1 39/64	17/32		12	12	1/4	1/4	1/4	VERT	13°	13°		1 43/128			I
	ASCE		30-AS	3040	3002	3040	3040	300	576	301							3 1/8	3 1/8	1 11/16	21/64	7/8	1 23/32	17/32		12	12	5/16	1/4	1/4	VERT	13°	13°		1 25/64	1.52	1 25/64	D.H.J.O
	PA STL. CO.- MD STL. CO.												44				3	3 5/16	1 45/64	11/32	15/16	1 9/16	1/2	1/8	7 1/2	9	1/4	1/4	1/4	5°	12°	12°		1 9/32		1 9/32	I
	ARA-B			3530		3530	3530			352							3 23/64	3	1 23/32	11/32	6/64	1 25/32	5/8		12	12	5/16	1/4	1/4	4°	13°	13°		1 33/64	1.58		H.O
35	ASCE												265				3 1/4	3 1/4	1 3/4	23/64	15/16	1 17/64	37/64		12	12	5/16	1/4	1/4	VERT	13°	13°				1 57/128	I
	ASCE		35-AS	3540	3502	3540	3540	350	575	351							3 5/16	3 5/16	1 3/4	23/64	6/64	1 25/32	37/64		12	12	5/16	1/4	1/4	VERT	13°	13°		1 15/32	1.60	1 15/32	D.H.J.O
	PA STL. CO.- MD STL. CO.												43				3 1/16	3 3/8	1 7/8	3/8	1	1 35/64	33/64	1/8	7 1/2	10	5/16	5/16	5/16	5°	12°	12°		1 9/32		1 9/32	I
	ARA-B			4030		4030	4030			403							3 33/64	3 3/16	1 53/64	3/8	1 1/64	1 55/64	43/64		12	12	5/16	1/4	1/4	4°	13°	13°		1 77/128	1.67		H.O
40	ASCE		40-AS	4040	4004	4040	4040	400	545	401			138				3 1/2	3 1/2	1 7/8	25/64	1 1/64	1 55/64	5/8		12	12	5/16	1/4	1/4	VERT	13°	13°		1 77/128	1.68	1 77/128	D.H.I.J.O
	PA STL. CO.- MD STL. CO.												32				3 1/2	3 1/2	1 29/32	25/64	1 1/8	1 55/64	33/64	5/32	5 1/2	11	9/32	5/16	5/16	6°	10°	10°		1 7/16		1 7/16	I
	ARA-B			4530		4530	4530			452							3 47/64	3 3/8	1 63/64	13/32	1 1/16	1 31/32	45/64		12	12	5/16	1/4	1/4	4°	13°	13°		1 11/16	1.75		H.O
45	ASCE		45-AS	4540	4504	4540	4540	450	549	451			266				3 11/16	3 11/16	2	27/64	1 1/16	1 31/32	21/32		12	12	5/16	1/4	1/4	VERT	13°	13°		1 41/64	1.78	1 41/64	D.H.I.J.O
	PA STL. CO.- MD STL. CO.												36				3 5/8	3 5/8	1 15/16	13/32	1 9/32	1 51/64	35/64	5/32	4 1/2	9	11/32	1/4	5/16	5°	11°	10°		1 15/32		1 15/32	I

Information 1952. Revised 1996 . Converted to C.A.D. February 2003.

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TABLE OF RAIL SECTIONS – (DIMENSIONS IN INCHES)

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
WT./ YD. LB.	TYPE	MANUFACTURER AND SECTION NUMBER															RAIL HEIGHT	BASE WIDTH	HEAD WIDTH	WEB THICKNESS	HEAD HEIGHT	WEB HEIGHT	BASE HEIGHT	BASE EDGE THICKNESS	HEAD RADIUS	WEB RADIUS	GAGE CORNER RADIUS	TOP FILLET RADIUS	BOTTOM FILLET RADIUS	HEAD SIDE SLOPE	HEAD BOTTOM ANGLE	BASE ANGLE	HEAD RADIUS WIDTH	WEB CENTER LINE	NEUTRAL AXIS DISTANCE	BOLT CENTER LINE	REFERENCE
		U.S. STEEL	BETHELEM	ILLINOIS	OLD ILLINOIS	CARNEGIE	TENNESSE TC & I	LACKAWANNA	MIDVALE	COLORADO CF & I	INLAND	CAMBRIA	MARYL. PENN.	DOMINION	ALGOMA	SYDNEY	H	B	HD	W	HH	WH	BH	T	RH	RW	R1	R2	R3	S	A1	A2	CH	WC	N	BC	
48	ARA-B			4830		4830	4830			484							3 47/64	3 29/64	2 1/16	31/64	1 1/16	1 31/32	45/64		12	12	5/16	1/4	1/4	4°	13°	13°		1 11/16			H,O
	ASCE			4840	4803	4840	4840			482							3 11/16	3 49/64	2 5/64	1/2	1 1/16	1 31/32	21/32							VERT.	13°	13°		1 41/64		1 41/64	D,H
	M.S.CO.		48-BS														4 1/4	4	1 29/32	3/8	1 1/8	2 29/64	43/64							VERT.	13°	13°		1 115/128			H
	PA STL. CO.– MD STL. CO.												88				4	4	1 29/32	3/8	1 3/8	2	5/8	1/8	10	15	1/4	1/4	1/4	VERT.	13°	13°		1 5/8		1 5/8	I
50	ASCE		50-AS	5040	5005	5040	5040	500	542	500			129				3 7/8	3 7/8	2 1/8	7/16	1 1/8	2 1/16	1 1/16		12	12	5/16	1/4	1/4	VERT	13°	13°		1 23/32	1.88	1 23/32	D,I,J
	PA STL. CO.– MD STL. CO.												22				4	4	2 3/32	13/32	1 3/8	1 63/64	41/64	1/8	10	8	7/16	1/4	1/4	5°	13°	13°		1 5/8		1 5/8	I
52	RIO GRANDE SO.									521							4	4	2 1/8	25/64	1 23/64	2	41/64							VERT.	13°	13°		1 41/64		1 41/64	D,H
55	ASCE		55-AS	5540	5501	5540	5540	550	537				130				4 1/16	4 1/16	2 1/4	15/32	1 1/64	2 1/64	23/32		12	12	5/16	1/4	1/4	VERT.	13°	13°		1 103/128	1.97	1 103/128	D,H,I,J
56	ASCE		56-AS	5640		5640	5640										4 1/16	4 11/128	2 35/128	63/128	1 91/512	2 41/256	371/512							VERT.	13°	13°		1 103/128			H
	MISC.			5651		5651	5651										4 1/4	3 31/32	2 7/32	13/32	1 7/16	2 1/8	11/16							1/10 TO 1	14°	12°50′		1 3/4		1 13/16	D,H
	MISC.			5633	5616	5633	5633										4 1/4	4 1/8	2 1/4	3/8	1 21/64	2 1/8	45/64	1/8	10	8	7/16	1/4	1/4	5°	13°	13°		1 49/64		1 49/64	D,H,J
	MISC.									562							4 1/4	4 1/8	2 1/4	53/128	1 7/32	2 17/64	49/64							VERT.	13°	13°		1 115/128		1 115/128	D,H
	MISC.								511								4	3 53/64	2 19/64	29/64	1 51/128	2 59/64	87/128							1/32 TO 5/8	12°	12°				1 41/64	D
	MISC.			5607		5607	5607										4	3 27/32	2 5/16	15/32	1 13/32	1 29/32	11/16							1/32 TO 5/8	12°	12°		1 41/64			H
	PA STL. CO.– MD STL. CO.												51				4 1/4	4 1/32	2 9/32	27/64	1 27/64	2 1/8	45/64	1/8	10	12	7/16	5/16	5/16	6°	13°	13°		1 49/64		1 49/64	I
	C.B. & Q.			5608													4 1/16	4 1/16	2 7/32	15/32	1 13/64	2 1/8	47/64		12	11	1/4	3/8	3/8	VERT.	13°	13°					N
58	PA STL. CO.– MD STL. CO.												7				4 1/4	4 1/4	2 3/16	13/32	1 27/64	2 1/8	45/64	1/8	14	10	1/8	1/4	1/4	3°	13°	13°		1 49/64		1 49/64	I
	PA STL. CO.– MD STL. CO.												63				4	4	2 11/32	1/2	1 15/32	1 27/32	11/16	1/4	11	11	7/16	1/4	1/4	3°	15°	12°		1 39/64		1 39/64	I
60	ARA-A	6020		6020		60RA	602					568			121		4 1/2	4	2 1/4	15/32	1 15/64	2 29/64	13/16		14	14	3/8	3/8	3/8	1/16 TO 1	1 TO 4	1 TO 4		2 17/64	2.13	2 5/128	D,E,F,J,O
	ARA-B	6030		6030		60RB	6030					571					4 3/16	3 11/16	2 1/8	31/64	1 1/4	2 1/16	7/8		12	12	3/8	5/16	5/16	3°	13°	13°		1 29/32	1.95	1 29/32	D,E,F,H,J
	ASCE	6040	60-AS	6008	6015	60a	600	600	533	603		533	244	6001	105		4 1/4	4 1/4	2 3/8	31/64	1 7/32	2 17/64	49/64		12	12	5/16	1/4	1/4	VERT.	13°	13°		1 115/128	2.05	1 115/128	D,E,F,I,J
	ASCE			6007		60K-R						527					4 1/4	4 1/4	VARI																		F
	ASCE			6013		60M-O		600X				509					VARI	4 1/4																			F
	ASCE			6012									71	6002	129																					F
	ASCE					60P						514																									F
	ASCE	6087					6087			4840							4 5/8	4 1/2	2 1/2																		F
	MISC.	6033		6017		60N	6033		503			503					4 1/4	4 13/16	2 21/64	29/64	1 55/128	2 7/64	91/128	1/8	10	8	7/16	1/4	1/4	5°	13°	13°		1 49/64		1 49/64	D,F,H,J
	MISC.	6051		6051	6001	6051	6051										4 1/4	4 1/16	2 5/16	1/2	1 1/16	2 1/8	11/16							1/10 TO 1	14°	12°50′		1 3/4		1 3/4	A,D,H
	PA STL. CO.– MD STL. CO.												6				4 1/4	4 1/4	2 3/8	1/2	1 27/64	2 1/8	45/64		10		7/16	1/4	1/4		13°	13°		1 49/64		1 49/64	I
	QUEBEC CENTRAL																4 3/8	4 3/8	2 1/4	1/2	1 1/4	2 5/16	13/16		12	12	1/4	1/4	1/4	VERT.	13°	13°					N
65	ASCE	6540	65-AS	6540	6507	6540	6540	650	534	653			236				4 7/16	4 7/16	2 13/32	1/2	1 9/32	2 3/8	23/32		12	12	5/16	1/4	1/4	VERT.	13°	13°		1 31/32	2.14	1 31/32	A,D,E,I,J
	CANADIAN PACIFIC		654	6508		6508	6508	654									4 31/64	4 3/8	2 1/4	15/32	1 9/32	2 11/32	55/64							1/32 TO 3/4	1 TO 4	1 TO 4		2 1/32		2 1/32	D,H
	MISC.				6501												4 3/8	4 7/16	2 3/8	29/64	1 1/2	2 5/32	23/32							1/16 TO 3/4	14°30′	12°30′				1 51/64	D

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TABLE OF RAIL SECTIONS – (DIMENSIONS IN INCHES)

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
WT./ YD. LB.	TYPE	MANUFACTURER AND SECTION NUMBER															RAIL HEIGHT	BASE WIDTH	HEAD WIDTH	WEB THICKNESS	HEAD HEIGHT	WEB HEIGHT	BASE HEIGHT	BASE EDGE THICKNESS	HEAD RADIUS	WEB RADIUS	GAGE CORNER RADIUS	TOP FILLET RADIUS	BOTTOM FILLET RADIUS	HEAD SIDE SLOPE	HEAD BOTTOM ANGLE	BASE ANGLE	HEAD RADIUS WIDTH	WEB CENTER LINE	NEUTRAL AXIS DISTANCE	BOLT CENTER LINE	REFERENCE
		U.S. STEEL	BETHELEM	ILLINOIS	OLD ILLINOIS	CARNEGIE	TENNESSEE TC & I	LACKAWANNA	MIDVALE	COLORADO CF & I	INLAND	CAMBRIA	MARYL. PENN.	DOMINION	ALGOMA	SYDNEY	H	B	HD	W	HH	WH	BH	T	RH	RW	R1	R2	R3	S	A1	A2	CH	WC	N	BC	
65	MISC.				6504												$4^{1}/_{2}$	$4^{1}/_{2}$	$2^{7}/_{16}$	$^{1}/_{2}$	$1^{31}/_{64}$	$2^{19}/_{64}$	$^{23}/_{32}$							4°	13°	13°				$1^{7}/_{8}$	D
66	MISC.																$4^{13}/_{32}$	$4^{7}/_{16}$	$2^{13}/_{32}$	$^{15}/_{32}$	$1^{17}/_{32}$	$2^{1}/_{8}$	$^{3}/_{4}$							CURV. $4^{1}/_{2}$°R	13°	13°		$1^{13}/_{16}$			H
	NORTHERN PACIFIC			6602		6602	6602		547				145				$4^{17}/_{32}$	$4^{1}/_{2}$	$2^{5}/_{16}$	$^{17}/_{32}$	$1^{27}/_{64}$	$2^{1}/_{32}$	$^{49}/_{64}$		12	12	$^{1}/_{4}$	$^{1}/_{4}$	$^{1}/_{4}$	VERT.	13°	13°		$1^{15}/_{16}$		$1^{15}/_{16}$	D,H,I
67	MISC.	6733		6704		6704	6704		515								$4^{1}/_{2}$	$4^{1}/_{2}$	$2^{13}/_{32}$	$^{1}/_{2}$	$1^{5}/_{8}$	$2^{1}/_{8}$	$^{3}/_{4}$	$^{1}/_{8}$	10	8	$^{7}/_{16}$	$^{1}/_{4}$	$^{1}/_{4}$	$^{1}/_{16}$ To $^{3}/_{4}$	13°	13°		$1^{13}/_{16}$		$1^{13}/_{16}$	A,D,J
	PA STL. CO.– MD STL. CO.												2				$4^{1}/_{2}$	$4^{1}/_{2}$	$2^{3}/_{8}$	$^{1}/_{2}$	$1^{21}/_{32}$	$2^{7}/_{64}$	$^{47}/_{64}$	$^{1}/_{8}$	11	11	$^{11}/_{32}$	$^{1}/_{4}$	$^{1}/_{4}$	5°	14°	13°		$1^{25}/_{32}$		$1^{25}/_{32}$	I
67.5	RUSSIAN								587								$5^{3}/_{64}$	$4^{21}/_{64}$	$2^{23}/_{64}$	$^{15}/_{32}$	$1^{23}/_{64}$	$2^{11}/_{16}$	$^{29}/_{32}$							VERT.	1 To 3	1 To 3				$2^{1}/_{4}$	D
68	MISC.																$4^{3}/_{8}$	$4^{1}/_{2}$	$2^{1}/_{2}$	$^{1}/_{2}$	$1^{15}/_{32}$	$2^{1}/_{8}$	$^{25}/_{32}$							$^{1}/_{16}$ To $^{11}/_{16}$	13°	13°		$1^{27}/_{32}$			H
	PA STL. CO.– MD STL. CO.												62				$4^{1}/_{2}$	$4^{1}/_{2}$	$2^{15}/_{32}$	$^{1}/_{2}$	$1^{35}/_{64}$	$2^{3}/_{16}$	$^{49}/_{64}$	$^{3}/_{32}$	12	8	$^{1}/_{2}$	$^{1}/_{4}$	$^{1}/_{4}$	6°	13°	13°		$1^{55}/_{64}$		$1^{55}/_{64}$	I
70	ARA–A			7020		7020	7020	7031									$4^{3}/_{4}$	$4^{1}/_{4}$	$2^{3}/_{8}$	$^{1}/_{2}$	$1^{11}/_{32}$	$2^{1}/_{2}$	$^{29}/_{32}$		14	14	$^{3}/_{8}$	$^{3}/_{8}$	$^{3}/_{8}$	$^{1}/_{16}$ To 1	1 To 4	1 To 4		$2^{13}/_{32}$	2.20	$2^{5}/_{32}$	C,E,J
	ARA–B		174	7030		7030	7030	7032									$4^{35}/_{64}$	$4^{3}/_{64}$	$2^{3}/_{8}$	$^{33}/_{64}$	$1^{23}/_{64}$	$2^{17}/_{64}$	$^{59}/_{64}$		12	12	$^{3}/_{8}$	$^{5}/_{16}$	$^{5}/_{16}$	3°	13°	13°		$2^{7}/_{128}$	2.16	$2^{7}/_{128}$	C,D,E,J
	ASCE	7040	70–AS	7040	7010	7040	7040	700	532	701			237				$4^{5}/_{8}$	$4^{5}/_{8}$	$2^{7}/_{16}$	$^{33}/_{64}$	$1^{11}/_{32}$	$2^{15}/_{32}$	$^{13}/_{16}$		12	12	$^{5}/_{16}$	$^{1}/_{4}$	$^{1}/_{4}$	VERT.	13°	13°		$2^{3}/_{64}$	2.22	$2^{3}/_{64}$	A,C,D,E,I,J
	BANGOR & AROOSTOOK		70–BA					703					97				$4^{3}/_{4}$	$4^{3}/_{4}$	$2^{7}/_{16}$	$^{1}/_{2}$	$1^{13}/_{32}$	$2^{19}/_{32}$	$^{3}/_{4}$	$^{1}/_{8}$	12	12	$^{1}/_{4}$	$^{1}/_{4}$	$^{1}/_{4}$	VERT.	12°	12°		$2^{3}/_{64}$		$2^{3}/_{64}$	D,H,I
	CHICAGO & ALTON				7002												$4^{3}/_{8}$	4	$2^{35}/_{96}$	$^{35}/_{64}$	$1^{17}/_{24}$	$1^{11}/_{12}$	$^{3}/_{4}$							$^{1}/_{24}$ To $^{5}/_{16}$	12°	12°				$1^{17}/_{24}$	D
	PENNSYLVANIA			7033	7005	7033	7033		504				57				$4^{1}/_{2}$	$4^{1}/_{2}$	$2^{7}/_{16}$	$^{1}/_{2}$	$1^{19}/_{32}$	$2^{1}/_{8}$	$^{25}/_{32}$	$^{9}/_{64}$	10	8	$^{7}/_{16}$	$^{1}/_{4}$	$^{1}/_{4}$	4°	13°	13°		$1^{27}/_{32}$		$1^{27}/_{32}$	D,E,H,I
72	CAN.PAC. (SANDBERG)																$4^{15}/_{16}$	$4^{1}/_{2}$	$2^{1}/_{4}$	$^{1}/_{2}$	$1^{5}/_{8}$	$2^{25}/_{64}$	$^{59}/_{64}$		6	VERT.	$^{1}/_{2}$	$^{3}/_{8}$	$^{3}/_{8}$	VERT.	15°	15°				$2^{15}/_{128}$	N
	CHI. & NOR. WESTERN	7250	72–NP	7250	7201	7250	7250		581								$4^{3}/_{4}$	$4^{3}/_{4}$	$2^{3}/_{8}$	$^{9}/_{16}$	$1^{13}/_{32}$	$2^{1}/_{2}$	$^{27}/_{32}$							VERT.	14°	14°		$2^{3}/_{32}$		$2^{3}/_{32}$	A,D,E
	SPOKANE INT'L. RY							722									$4^{45}/_{64}$	$4^{5}/_{8}$	$2^{7}/_{16}$	$^{33}/_{64}$	$1^{27}/_{64}$	$2^{15}/_{32}$	$^{13}/_{16}$		12	12	$^{5}/_{16}$	$^{1}/_{4}$	$^{1}/_{4}$	VERT.	13°	13°		$2^{3}/_{64}$	2.25	$2^{3}/_{64}$	C
74	PA STL. CO.– MD STL. CO.												146				$4^{11}/_{16}$	$4^{3}/_{4}$	$2^{7}/_{16}$	$^{9}/_{16}$	$1^{3}/_{4}$	$2^{3}/_{16}$	$^{3}/_{4}$		15	15	$^{3}/_{8}$	$^{5}/_{16}$	$^{5}/_{16}$		17°	13°		$1^{7}/_{8}$		$1^{7}/_{8}$	I
75	ASCE	7540	75–AS	7540	7506	7540	7540	750	529	753			214				$4^{13}/_{16}$	$4^{13}/_{16}$	$2^{15}/_{32}$	$^{17}/_{32}$	$1^{27}/_{64}$	$2^{35}/_{64}$	$^{27}/_{32}$		12	12	$^{5}/_{16}$	$^{1}/_{4}$	$^{1}/_{4}$	VERT.	13°	13°		$2^{15}/_{128}$	2.30	$2^{15}/_{128}$	A,C,D,E,I,J
	BOSTON AND MAINE		92					752					92				5	5	$2^{1}/_{2}$	$^{9}/_{16}$	$1^{7}/_{16}$	$2^{47}/_{64}$	$^{53}/_{64}$		12	STR.	$^{1}/_{4}$	$^{1}/_{4}$	$^{1}/_{4}$	VERT.	13°	13°		STR.	2.37	$2^{1}/_{8}$	C,I
	LACKAWANNA		75–C					753									$4^{11}/_{16}$	5	$2^{1}/_{2}$	$^{1}/_{2}$	$1^{43}/_{64}$	$2^{13}/_{64}$	$^{13}/_{16}$		$10^{1}/_{2}$	10	$^{7}/_{16}$	$^{5}/_{16}$	$^{5}/_{16}$	$^{1}/_{16}$ To 1	18°	12°45′		$1^{117}/_{128}$	2.24	$1^{117}/_{128}$	C,D
	INT. & GRT. NOR			7551		7551	7551										$4^{3}/_{4}$	5	$2^{1}/_{2}$	$^{9}/_{16}$	$1^{7}/_{16}$	$2^{15}/_{32}$	$^{27}/_{32}$							VERT.	13°	13°		$2^{5}/_{64}$			E,H
	MISC.																$4^{3}/_{4}$	$4^{1}/_{2}$	$2^{1}/_{2}$	$^{1}/_{2}$	$1^{27}/_{32}$	$2^{1}/_{8}$	$^{29}/_{32}$							6°	13°	13°		$1^{27}/_{32}$			H
	MISSOURI PACIFIC	7550	75–MP	7550	7512	7550	7550	754	528								$4^{3}/_{4}$	$4^{3}/_{4}$	$2^{9}/_{16}$	$^{9}/_{16}$	$1^{7}/_{16}$	$2^{15}/_{32}$	$^{27}/_{32}$		12	30	$^{3}/_{8}$	$^{1}/_{4}$	$^{1}/_{4}$	VERT.	13°	13°		$2^{5}/_{64}$	2.29	$2^{5}/_{64}$	A,C,D
	NAT.RY.MEX.		128														5	5	$2^{3}/_{4}$	$^{1}/_{2}$	$1^{3}/_{8}$	$2^{7}/_{8}$	$^{3}/_{4}$							VERT.	12°	12°				$2^{3}/_{16}$	D
	N.Y.C.(DUDLEY)																5	$4^{3}/_{4}$	$2^{5}/_{8}$	$^{17}/_{32}$	$1^{3}/_{8}$	$2^{3}/_{4}$	$^{7}/_{8}$	$^{9}/_{32}$	14	14	$^{1}/_{4}$	$^{1}/_{2}$	$^{5}/_{16}$	4°	14°	14°				$2^{1}/_{8}$	N
	PA STL. CO.– MD STL. CO.												87				$4^{3}/_{4}$	$4^{3}/_{4}$	$2^{1}/_{2}$	$^{9}/_{16}$	$1^{1}/_{2}$	$2^{7}/_{16}$	$^{13}/_{16}$		12	VERT.	$^{1}/_{4}$	$^{1}/_{4}$	$^{1}/_{4}$	VERT.	13°	13°		STR.		$2^{1}/_{32}$	I
	SEABOARD (DUDLEY)		75–DY	7522		7522	7522						221				5	5	$2^{9}/_{16}$	$^{1}/_{2}$	$1^{3}/_{8}$	$2^{3}/_{4}$	$^{7}/_{8}$		14	14	$^{5}/_{16}$	$^{1}/_{2}$	$^{5}/_{16}$	3°	14°	14°		$2^{5}/_{8}$		$2^{1}/_{4}$	D,H,I,J
	UNION PACIFIC		75–B	7523	7513	7523	7523			754			249				5	5	$2^{9}/_{16}$	$^{33}/_{64}$	$1^{3}/_{8}$	$2^{13}/_{16}$	$^{13}/_{16}$		12	12	$^{5}/_{16}$	$^{1}/_{4}$	$^{1}/_{4}$	VERT.	13°	13°		$2^{5}/_{8}$		$2^{1}/_{4}$	D,H,I,J
	UNION PACIFIC	7524	75–SP	7524		7524	7524			757							$4^{15}/_{16}$	$4^{7}/_{16}$	$2^{7}/_{16}$	$^{33}/_{64}$	$1^{3}/_{8}$	$2^{5}/_{8}$	$^{15}/_{16}$		14	14	$^{3}/_{8}$	$^{3}/_{8}$	$^{3}/_{8}$	$^{1}/_{16}$ To 1	1 To 4	1 To 4		$2^{1}/_{2}$		$2^{1}/_{4}$	A,D,J
76	PA STL. CO.– MD STL. CO.												216				$4^{3}/_{4}$	5	$2^{1}/_{2}$	$^{1}/_{2}$	$1^{11}/_{16}$	$2^{1}/_{4}$	$^{13}/_{16}$	$^{5}/_{32}$	20	VERT.	$^{3}/_{8}$	$^{5}/_{16}$	$^{5}/_{16}$		14°30′	12°		STR.		$1^{15}/_{16}$	I
77.5	GREAT NORTHERN				77501			775									5	5	$2^{3}/_{8}$	$^{5}/_{8}$	$1^{11}/_{16}$	$2^{1}/_{2}$	$^{13}/_{16}$							5°	14°	14°				$2^{1}/_{16}$	D
78	OLD COLONY		78–OC										98				$4^{3}/_{4}$	5	$2^{1}/_{2}$	$^{17}/_{32}$	$1^{3}/_{4}$	$2^{7}/_{32}$	$^{25}/_{32}$		12	12	$^{3}/_{8}$	$^{7}/_{16}$	$^{7}/_{16}$	5°	14°	12°15′		$1^{57}/_{64}$			H,I

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TABLE OF RAIL SECTIONS – (DIMENSIONS IN INCHES)

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
WT./ YD. LB.	TYPE	MANUFACTURER AND SECTION NUMBER															RAIL HEIGHT	BASE WIDTH	HEAD WIDTH	WEB THICKNESS	HEAD HEIGHT	WEB HEIGHT	BASE HEIGHT	BASE EDGE THICKNESS	HEAD RADIUS	WEB RADIUS	GAGE CORNER RADIUS	TOP FILLET RADIUS	BOTTOM FILLET RADIUS	HEAD SIDE SLOPE	HEAD BOTTOM ANGLE	BASE ANGLE	HEAD RADIUS WIDTH	WEB CENTER LINE	NEUTRAL AXIS DISTANCE	BOLT CENTER LINE	
		U.S. STEEL	BETHELEM	ILLINOIS	OLD ILLINOIS	CARNEGIE	TENNESSE TC & I	LACKAWANNA	MIDVALE	COLORADO CF & I	INLAND	CAMBRIA	MARYL. PENN.	DOMINION	ALGOMA	SYDNEY	H	B	HD	W	HH	WH	BH	T	RH	RW	R1	R2	R3	S	A1	A2	CH	WC	N	BC	REFERENCE
79	PA STL. CO.– MD STL. CO.												76				$4\frac{3}{4}$	$4\frac{3}{4}$	$2\frac{5}{8}$	$\frac{5}{8}$	$1\frac{5}{8}$	$2\frac{11}{32}$	$\frac{25}{32}$	$\frac{1}{8}$	12	9	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{4}$	6°	13°	13°				$1\frac{15}{16}$	I
79.5	FRICTIONLESS		79.5-C														$5\frac{3}{16}$	$5\frac{3}{16}$	$1\frac{15}{16}$	$\frac{9}{16}$	$2\frac{1}{32}$	$2\frac{9}{32}$	$\frac{7}{8}$							4°	13°	13°		$2\frac{1}{64}$		$2\frac{1}{64}$	D,H
	ARA–A	8020	80–RA	8020		8020	8020	8031		801							$5\frac{1}{8}$	$4\frac{5}{8}$	$2\frac{1}{2}$	$\frac{33}{64}$	$1\frac{7}{16}$	$2\frac{23}{32}$	$\frac{31}{32}$		14	14	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{9}{16}$	2.31	$2\frac{21}{64}$	C,E,H,J
	ARA–B	8030	80–RB	8030		8030	8030	8032	569	802							$4\frac{15}{16}$	$4\frac{7}{16}$	$2\frac{7}{16}$	$\frac{35}{64}$	$1\frac{15}{32}$	$2\frac{15}{32}$	1		12	12	$\frac{3}{8}$	$\frac{5}{16}$	$\frac{5}{16}$	3°	13°	13°		$2\frac{15}{64}$	2.27	$2\frac{15}{64}$	C,D,E,H,J
	ASCE	8040	80–AS	8040		8040	8040	800	530	800	8040		251				5	5	$2\frac{1}{2}$	$\frac{35}{64}$	$1\frac{1}{2}$	$2\frac{5}{8}$	$\frac{7}{8}$		12	12	$\frac{5}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	VERT.	13°	13°		$2\frac{3}{16}$	2.38	$2\frac{3}{16}$	A,C,D,E,I,J
	CAN.NOR.		804	8010		8010	8010	804									5	5	$2\frac{9}{16}$	$\frac{35}{64}$	$1\frac{13}{32}$	$2\frac{11}{16}$	$\frac{29}{32}$							$\frac{1}{16}$ To 1	13°	13°		$2\frac{1}{4}$		$2\frac{1}{4}$	D,H,L
80	DUDLEY	8022	80–DY	8022		8022	8022						220				$5\frac{1}{8}$	5	$2\frac{21}{32}$	$\frac{17}{32}$	$1\frac{1}{2}$	$2\frac{3}{4}$	$\frac{7}{8}$		14	14	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{5}{16}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{5}{8}$		$2\frac{1}{4}$	A,I,J
	FRICTIONLESS		80–MC–F														$5\frac{3}{16}$	$5\frac{3}{16}$	$1\frac{15}{16}$	$\frac{9}{16}$	$2\frac{1}{32}$	$2\frac{9}{32}$	$\frac{7}{8}$							4°	13°	13°		$2\frac{1}{64}$			H
	GREAT NORTHERN				8009			802									5	5	$2\frac{13}{32}$	$\frac{5}{8}$	$1\frac{5}{8}$	$2\frac{1}{2}$	$\frac{7}{8}$							5°	14°	14°				$2\frac{1}{8}$	D
	HOCKING VALLEY								540								5	$4\frac{59}{64}$	$2\frac{31}{64}$	$\frac{29}{64}$	$1\frac{95}{128}$	$2\frac{25}{64}$	$\frac{111}{128}$							4°	13°	13°				$2\frac{1}{16}$	D
	NEW YORK CENTRAL		220	8022	8008	8022	8022	801	543								$5\frac{1}{8}$	5	$2\frac{21}{32}$	$\frac{17}{32}$	$1\frac{1}{2}$	$2\frac{3}{4}$	$\frac{7}{8}$		14	14	$\frac{5}{16}$	$\frac{1}{2}$	$\frac{5}{16}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{5}{8}$	2.43	$2\frac{1}{4}$	C,D
	ASCE	8540	85–AS	8540	8504	8540	8540	850	531	851	8540		235				$5\frac{3}{16}$	$5\frac{3}{16}$	$2\frac{9}{16}$	$\frac{9}{16}$	$1\frac{35}{64}$	$2\frac{3}{4}$	$\frac{57}{64}$		12	12	$\frac{5}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	VERT.	13°	13°		$2\frac{17}{64}$	2.47	$2\frac{17}{64}$	A,C,D,E,I,J
	C.B. & Q.	8543	85–CB	8543	8506	8543	8543	855		852							$5\frac{3}{16}$	$5\frac{3}{16}$	$2\frac{21}{32}$	$\frac{9}{16}$	$1\frac{35}{64}$	$2\frac{3}{4}$	$\frac{57}{64}$							5°	13°	13°		$2\frac{17}{64}$		$2\frac{17}{64}$	A,D,E
	CANADIAN PACIFIC	8524	85–CP	8524		8524	8524	856			8524			8501	113		$5\frac{1}{8}$	5	$2\frac{1}{2}$	$\frac{9}{16}$	$1\frac{7}{16}$	$2\frac{11}{16}$	1	$\frac{3}{8}$	8	8	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{32}$ To 1	1 To 4	1 To 4		$2\frac{11}{32}$	$2\frac{19}{64}$	$2\frac{11}{32}$	A,D,J,P
	HEAD FREE – CAN.PAC													8504	137		$5\frac{1}{4}$	5	$2\frac{23}{64}$	$\frac{9}{16}$	$1\frac{9}{16}$	$2\frac{11}{16}$	1	$\frac{3}{8}$	8	8	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{25}$ To 1	1 To 4	1 To 4		$2\frac{11}{32}$	2.35	$2\frac{11}{32}$	P
	DENVER & RIO GRANDE									850							$5\frac{1}{4}$	$5\frac{1}{4}$	$2\frac{1}{2}$	$\frac{9}{16}$	$1\frac{3}{4}$	$2\frac{5}{8}$	$\frac{7}{8}$							4°	13°	13°		STR.		$2\frac{3}{16}$	A,D
	D. & R.G. / C & S									853							$5\frac{3}{8}$	$4\frac{7}{8}$	$2\frac{1}{2}$	$\frac{9}{16}$	$1\frac{15}{32}$	$2\frac{23}{32}$	1							$\frac{1}{16}$ To 1	1 To 4	1 To 4				$2\frac{29}{64}$	D
85	GREAT NORTHERN		854	8553	8509	8553	8553	854									5	5	$2\frac{21}{32}$	$\frac{21}{32}$	$1\frac{13}{32}$	$2\frac{1}{2}$	$\frac{29}{32}$							5°	14°	14°		$2\frac{5}{32}$		$2\frac{5}{32}$	D,E
	MISSOURI PACIFIC	8550	853	8550	8507	8550	8550										$5\frac{7}{32}$	$5\frac{1}{4}$	$2\frac{15}{32}$	$\frac{75}{128}$	$1\frac{3}{4}$	$2\frac{33}{64}$	$\frac{55}{64}$							2°30′	13°	13°		STR.		$2\frac{21}{128}$	A,D,E,H
	N.Y.C. & STL./ KCS		85–NK	8521		8521	8521	8531			8521						$5\frac{3}{8}$	$4\frac{7}{8}$	$2\frac{17}{32}$	$\frac{17}{32}$	$1\frac{29}{64}$	$2\frac{15}{16}$	$\frac{63}{64}$		14	14	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{23}{32}$	2.43	$2\frac{29}{64}$	C,E,J,L
	PENNSYLVANIA	8531	85–PS	8531	8530	8531	8531	8530	559		8531						$5\frac{1}{8}$	$4\frac{5}{8}$	$2\frac{1}{2}$	$\frac{17}{32}$	$1\frac{21}{32}$	$2\frac{15}{32}$	1		10	10	$\frac{7}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	VERT.	15°	13°		$2\frac{15}{64}$	2.38	$2\frac{15}{64}$	A,C,D,E
	PENNSYLVANIA		85–PR	8533	8503	8533	8533	852	500				67				5	5	$2\frac{9}{16}$	$\frac{17}{32}$	$1\frac{3}{4}$	$2\frac{3}{8}$	$\frac{7}{8}$	$\frac{5}{32}$	10	8	$\frac{7}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	4°	13°	13°		$2\frac{1}{16}$		$2\frac{1}{16}$	D,E,I
	SEABOARD (DUDLEY)		85–DY	8522		8522	8522	851					261				$5\frac{1}{4}$	5	$2\frac{11}{16}$	$\frac{17}{32}$	$1\frac{5}{8}$	$2\frac{3}{4}$	$\frac{7}{8}$		14	14	$\frac{5}{16}$	$\frac{1}{2}$	$\frac{5}{16}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{5}{8}$	2.57	$2\frac{1}{4}$	C,D,I
	SOO LINE	8520		8520		8520	8520										$5\frac{3}{8}$	$4\frac{7}{8}$	$2\frac{1}{2}$	$\frac{9}{16}$	$1\frac{15}{32}$	$2\frac{23}{32}$	1							3°34′35″	14°2′11″	14°2′11″		$2\frac{23}{32}$		$2\frac{23}{64}$	A,D,E,L,M
	WESTERN PACIFIC																$5\frac{1}{4}$	$5\frac{1}{4}$	$2\frac{1}{2}$	$\frac{9}{16}$	$1\frac{3}{4}$	$2\frac{5}{8}$	$\frac{7}{8}$		10	VERT.	$\frac{7}{16}$	$\frac{5}{16}$	$\frac{5}{16}$	4°	13°	13°				$2\frac{3}{16}$	N
	ARA–A	9020	90–RA	9020		9020	9020	9031	563	902	9020						$5\frac{5}{8}$	$5\frac{1}{8}$	$2\frac{9}{16}$	$\frac{9}{16}$	$1\frac{15}{32}$	$3\frac{5}{32}$	1		14	14	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{29}{32}$	2.54	$2\frac{37}{64}$	A,C,D,E,J
	ARA–B	9030	90–RB	9030		9030	9030	9032	561	905	9030						$5\frac{17}{64}$	$4\frac{49}{64}$	$2\frac{9}{16}$	$\frac{9}{16}$	$1\frac{33}{64}$	$2\frac{5}{8}$	$1\frac{1}{32}$		12	12	$\frac{3}{8}$	$\frac{5}{16}$	$\frac{5}{16}$	3°	13°	13°		$2\frac{11}{32}$	2.45	$2\frac{11}{32}$	A,C,D,E,J
	ASCE	9040	90–AS	9040	9002	9040	9040	900	535		9040		245				$5\frac{3}{8}$	$5\frac{3}{8}$	$2\frac{5}{8}$	$\frac{9}{16}$	$1\frac{19}{32}$	$2\frac{55}{64}$	$\frac{59}{64}$		12	12	$\frac{5}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	VERT.	13°	13°		$2\frac{45}{128}$	2.55	$2\frac{45}{128}$	A,C,D,E,I,J
90	AT & SF	9021	90–SF	9021		9021	9021	9033		903	9021						$5\frac{5}{8}$	$5\frac{3}{16}$	$2\frac{9}{16}$	$\frac{9}{16}$	$1\frac{15}{32}$	$3\frac{5}{32}$	1							$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{29}{32}$		$2\frac{37}{64}$	A,C,D,E
	CHI. & NOR. WESTERN	9035	90–OM	9035		9035	9035	904									$5\frac{15}{32}$	$5\frac{3}{32}$	$2\frac{1}{2}$	$\frac{1}{2}$	$1\frac{17}{32}$	$2\frac{31}{32}$	$1\frac{1}{32}$		12	12	$\frac{3}{8}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{3}{64}$ To $\frac{3}{4}$	13°	13°		$2\frac{33}{64}$	2.47	$2\frac{23}{64}$	A,D,E,O
	DENVER & RIO GRANDE									906							$5\frac{1}{2}$	$5\frac{1}{8}$	$2\frac{9}{16}$	$\frac{9}{16}$	$1\frac{5}{8}$	$2\frac{7}{8}$	1							4°	14°	14°		$2\frac{5}{8}$		$2\frac{7}{16}$	A,D
	FRICTIONLESS			9039		9039	9039										$5\frac{5}{8}$	$5\frac{1}{8}$	$2\frac{1}{4}$	$\frac{9}{16}$	2	$2\frac{5}{8}$	1							$\frac{1}{4}$ To $1\frac{3}{8}$	13°	13°		$2\frac{5}{16}$		$2\frac{5}{16}$	D,H
	FRICTIONLESS			9029		9029	9029										$6\frac{3}{32}$	$5\frac{1}{8}$	$1\frac{59}{64}$	$\frac{9}{16}$	$1\frac{15}{16}$	$3\frac{5}{32}$	1							$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{37}{64}$		$2\frac{37}{64}$	D,H

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TABLE OF RAIL SECTIONS – (DIMENSIONS IN INCHES)

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
WT./ YD. LB.	TYPE	MANUFACTURER AND SECTION NUMBER															RAIL HEIGHT	BASE WIDTH	HEAD WIDTH	WEB THICKNESS	HEAD HEIGHT	WEB HEIGHT	BASE HEIGHT	BASE EDGE THICKNESS	HEAD RADIUS	WEB RADIUS	GAGE CORNER RADIUS	TOP FILLET RADIUS	BOTTOM FILLET RADIUS	HEAD SIDE SLOPE	HEAD BOTTOM ANGLE	BASE ANGLE	HEAD RADIUS WIDTH	WEB CENTER LINE	NEUTRAL AXIS DISTANCE	BOLT CENTER LINE	REFERENCE
		U.S. STEEL	BETHELEM	ILLINOIS	OLD ILLINOIS	CARNEGIE	TENNESSE TC & I	LACKAWANNA	MIDVALE	COLORADO CF & I	INLAND	CAMBRIA	MARYL. PENN.	DOMINION	ALGOMA	SYDNEY	H	B	HD	W	HH	WH	BH	T	RH	RW	R1	R2	R3	S	A1	A2	CH	WC	N	BC	
	GREAT NORTHERN	9024	90-GH	9024		9024	9024			908	9024						$5\frac{3}{8}$	5	$2\frac{5}{8}$	$\frac{9}{16}$	$1\frac{15}{32}$	$2\frac{7}{8}$	$1\frac{1}{32}$		12	14	$\frac{7}{16}$	$\frac{7}{16}$	$\frac{5}{8}$	$\frac{1}{16}$ To 1	13°	13°		$2\frac{53}{64}$	2.41		A.E.H.O
	GREAT NORTHERN			9036		9036											$5\frac{3}{8}$	5	$2\frac{5}{8}$	$\frac{19}{32}$	$1\frac{15}{32}$	$2\frac{7}{8}$	$1\frac{1}{32}$							5°	13°	13°				$2\frac{7}{16}$	D
	GREAT NORTHERN		90-GN	9034	9010	9034	9034	9030	560	904							$5\frac{3}{8}$	5	$2\frac{5}{8}$	$\frac{5}{8}$	$1\frac{1}{2}$	$2\frac{7}{8}$	1		14	14	$\frac{5}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	5°	13°	13°		$2\frac{5}{8}$	2.37	$2\frac{7}{16}$	C.D.E.J
90	HEAD FREE – R.A.	9027	90-RA-T	9027		9027	9027			TC1013							$5\frac{25}{32}$	$5\frac{1}{8}$	$2\frac{31}{64}$	$\frac{9}{16}$	$1\frac{5}{8}$	$3\frac{5}{32}$	1		14	14	$\frac{3}{8}$	$\frac{3}{8}$		$\frac{1}{16}$ To 1	1 To 4:U=54°	1 To 4		$2\frac{29}{32}$			A.B.E.K
	INTERBOROUGH R.T.	9050	90-RT	9050		9050	9050	902					77				5	5	$2\frac{7}{8}$	$\frac{11}{16}$	$1\frac{25}{32}$	$2\frac{11}{32}$	$\frac{7}{8}$	$\frac{5}{32}$	12	9	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{4}$	8°	13°	13°		$2\frac{1}{32}$		$2\frac{1}{16}$	A.D.E.I
	LEHIGH VALLEY																5	5	$2\frac{3}{4}$	$\frac{5}{8}$	$1\frac{53}{64}$	$2\frac{15}{64}$	$\frac{15}{16}$	$\frac{1}{3}$	12	9	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{4}$	5°	14°	14°				$2\frac{1}{16}$	N
	N.Y.C.(DUDLEY)		90-DY					901									$5\frac{1}{2}$	5	$2\frac{29}{32}$	$\frac{9}{16}$	$1\frac{1}{2}$	$3\frac{1}{32}$	$\frac{31}{32}$		14	14	$\frac{5}{16}$	$\frac{1}{2}$	1	$\frac{1}{16}$ To 1	1 To 4	1 To 4		3	2.52	$2\frac{3}{8}$	A.C.D
	UNION PACIFIC	9023		9023	9003	9023	9023			901							$5\frac{3}{4}$	$5\frac{3}{8}$	$2\frac{3}{4}$	$\frac{17}{32}$	$1\frac{1}{2}$	$3\frac{3}{8}$	$\frac{7}{8}$							VERT.	13°	13°		3		$2\frac{9}{16}$	A.D.E
91	LACKAWANNA		91-DL	9133		9133	9133	911									$5\frac{1}{4}$	$5\frac{3}{8}$	$2\frac{5}{8}$	$\frac{5}{8}$	$1\frac{41}{64}$	$2\frac{11}{16}$	$\frac{59}{64}$		10	8	$\frac{7}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	4°	13°	13°		$2\frac{17}{64}$	2.43	$2\frac{17}{64}$	C.D.J
92	FRICTIONLESS		304														$5\frac{7}{16}$	$5\frac{3}{8}$	$1\frac{15}{16}$	$\frac{5}{8}$	$2\frac{3}{32}$	$2\frac{5}{16}$	$1\frac{1}{32}$							4°	13°	13°				$2\frac{3}{16}$	D
93	FRICTIONLESS		93-NH-F					932									$6\frac{1}{8}$	$5\frac{1}{2}$	$2\frac{1}{8}$	$\frac{19}{32}$	$1\frac{13}{16}$	$3\frac{3}{8}$	$\frac{15}{16}$							$\frac{3}{16}$ To $1\frac{1}{4}$	13°	13°		$2\frac{5}{8}$		$2\frac{5}{8}$	D.H
	ASCE							950					267				$5\frac{9}{16}$	$5\frac{9}{16}$	$2\frac{11}{16}$	$\frac{9}{16}$	$1\frac{41}{64}$	$2\frac{63}{64}$	$\frac{15}{16}$		12	12	$\frac{5}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	VERT.	13°	13°		$2\frac{55}{128}$	2.65	$2\frac{55}{128}$	C.I
95	BOSTON & ALBANY																$5\frac{1}{32}$	$5\frac{1}{2}$	3	$\frac{5}{8}$	$1\frac{9}{16}$	$2\frac{15}{32}$	1	$\frac{5}{16}$	14	14	$\frac{5}{16}$	$\frac{1}{2}$	$\frac{5}{16}$	4°	14°	14°		$2\frac{9}{32}$			N
	W & H RY. (DUDLEY)		95-DY					951									$5\frac{1}{32}$	$5\frac{1}{2}$	3	$\frac{5}{8}$	$1\frac{9}{16}$	$2\frac{15}{32}$	1		14	14	$\frac{5}{16}$	$\frac{1}{2}$	$\frac{5}{16}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{13}{32}$	2.36	$2\frac{9}{32}$	C.H.I
97	FRICTIONLESS		97-CO-F														$5\frac{7}{8}$	$5\frac{9}{64}$	$2\frac{1}{4}$	$\frac{9}{16}$	$1\frac{15}{16}$	$2\frac{55}{64}$	$1\frac{5}{64}$							$\frac{1}{4}$ To $1\frac{1}{4}$	13°	13°		$2\frac{65}{128}$		$2\frac{65}{128}$	D.H
98	FRICTIONLESS		98-PS-F														$5\frac{27}{32}$	5	$2\frac{1}{2}$	$\frac{9}{16}$	$1\frac{31}{32}$	$2\frac{25}{32}$	$1\frac{3}{32}$							15°30′	15°	13°		$2\frac{31}{64}$		$2\frac{31}{64}$	D.H
	ARA-A	10020	100-RA	10020		10020	10020	10031	565	1003	10020						6	$5\frac{1}{2}$	$2\frac{3}{4}$	$\frac{9}{16}$	$1\frac{9}{16}$	$3\frac{3}{8}$	$1\frac{1}{16}$		14	14	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{3}{4}$	2.75	$2\frac{3}{4}$"	A.C.D.E.J
	ARA-B	10030	100-RB	10030		10030	10030	10032	564	1002	10030						$5\frac{41}{64}$	$5\frac{9}{64}$	$2\frac{21}{32}$	$\frac{9}{16}$	$1\frac{45}{64}$	$2\frac{55}{64}$	$1\frac{5}{64}$		12	12	$\frac{3}{8}$	$\frac{5}{16}$	$\frac{5}{16}$	3°	13°	13°		$2\frac{65}{128}$	2.63	$2\frac{65}{128}$	A.C.D.E.J
	AREMA	10025	100-RE	10025		10025	10025			10025	10025						6	$5\frac{3}{8}$	$2\frac{11}{16}$	$\frac{9}{16}$	$1\frac{21}{32}$	$3\frac{9}{32}$	$1\frac{1}{16}$		14	14	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{5}{8}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{31}{32}$	2.75	$2\frac{45}{64}$	A.D.E.O
	ASCE	10040	100-AS	10040	10001	10040	10040	1000	536				247				$5\frac{3}{4}$	$5\frac{3}{4}$	$2\frac{3}{4}$	$\frac{9}{16}$	$1\frac{45}{64}$	$3\frac{5}{64}$	$\frac{31}{32}$		12	12	$\frac{5}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	VERT.	13°	13°		$2\frac{65}{128}$	2.73	$2\frac{65}{128}$	A.C.D.E.I.J
	CANADIAN PACIFIC															100-CP-RE	$6\frac{1}{16}$	$5\frac{3}{8}$	$2\frac{11}{16}$	$\frac{9}{16}$	$1\frac{23}{32}$	$3\frac{9}{32}$	$1\frac{1}{16}$	$\frac{3}{8}$	14	14	$\frac{9}{16}$	$\frac{3}{8}$	$\frac{5}{8}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{31}{32}$	2.773	$2\frac{45}{64}$	Q
	CHI. & NOR. WESTERN	10035	100-OM	10035		10035	10035	1006			10035						$5\frac{45}{64}$	$5\frac{3}{64}$	$2\frac{3}{16}$	$\frac{9}{16}$	$1\frac{39}{64}$	$2\frac{61}{64}$	$1\frac{3}{64}$		12	12	$\frac{3}{8}$	$\frac{5}{16}$	$\frac{5}{16}$	3°	13°	13°		$2\frac{79}{128}$	2.53	$2\frac{79}{128}$	A.D.E.O
	ELGIN JOLIET & EAST			10050		10050	10050										$5\frac{9}{16}$	5	$2\frac{21}{32}$	$\frac{9}{16}$	$1\frac{37}{64}$	$2\frac{51}{64}$	$1\frac{3}{16}$							$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{75}{128}$		$2\frac{75}{128}$	D.H
	GREAT NORTHERN	10036	100-GN	10036		10036	10036	1008									$5\frac{3}{4}$	5	$2\frac{3}{4}$	$\frac{9}{16}$	$1\frac{5}{8}$	3	$1\frac{1}{8}$							$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{13}{16}$		$2\frac{5}{8}$	A.D.E
100	HEAD FREE – R.A.		100-RA-T											10004	136		$6\frac{5}{32}$	$5\frac{1}{2}$	$2\frac{11}{16}$	$\frac{9}{16}$	$1\frac{23}{32}$	$3\frac{3}{8}$	$1\frac{1}{16}$		14	14	$\frac{3}{8}$	$\frac{3}{8}$		$\frac{1}{16}$ To 1	1 To 4:U=49°	1 To 4		$2\frac{15}{16}$			A.B
	HEAD FREE – R.E.		100-RE-T														$6\frac{1}{16}$	$5\frac{3}{8}$	$2\frac{39}{64}$	$\frac{9}{16}$	$1\frac{23}{32}$	$3\frac{9}{32}$	$1\frac{1}{16}$							$\frac{1}{16}$ To 1	1 To 4:U=57°	1 To 4		$2\frac{31}{32}$			A.B.E.K
	INTERBOROUGH R.T.	10005	100-RT	10005		10005	10005	1005									$5\frac{3}{4}$	$5\frac{3}{4}$	$2\frac{7}{8}$	$\frac{9}{16}$	$1\frac{45}{64}$	$3\frac{5}{64}$	$\frac{31}{32}$		12	12	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{4}$	8°	13°	13°		$2\frac{1}{2}$	2.65	$2\frac{1}{2}$	A.C.E.J.K
	N.Y., N.H. & H.	10034	100-NH	10034	10004	10034	10034	1002					100				6	$5\frac{1}{2}$	$2\frac{3}{4}$	$\frac{19}{32}$	$1\frac{23}{32}$	$3\frac{11}{32}$	$\frac{15}{16}$		12	12	$\frac{7}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	4°	13°	13°		$2\frac{39}{64}$	2.89	$2\frac{5}{8}$	A.C.D.E.I.J
	NEW YORK CENTRAL		100-DY	10022	10003	10022	10022	1001									6	$5\frac{1}{2}$	3	$\frac{19}{32}$	$1\frac{5}{8}$	$3\frac{13}{32}$	$\frac{31}{32}$		14	14	$\frac{5}{16}$	$\frac{1}{2}$	$\frac{5}{16}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{43}{64}$	2.89	$2\frac{5}{8}$	C.D
	PENNSYLVANIA	10031	100-PS	10031		10031	10031	10030	558		10031						$5\frac{11}{16}$	5	$2\frac{43}{64}$	$\frac{9}{16}$	$1\frac{13}{16}$	$2\frac{25}{32}$	$1\frac{3}{32}$		10	10	$\frac{7}{16}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{3}{32}$ To 1	15°	13°		$2\frac{31}{64}$	2.63	$2\frac{31}{64}$	A.C.D.E.J.O
	PENNSYLVANIA	10033	100-PR	10033	10002	10033	10033	1003	520				96				$5\frac{1}{2}$	$5\frac{1}{2}$	$2\frac{13}{16}$	$\frac{5}{8}$	$1\frac{7}{8}$	$2\frac{11}{16}$	$\frac{15}{16}$	$\frac{11}{64}$	10	8	$\frac{7}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	4°	13°	13°		$2\frac{9}{32}$		$2\frac{9}{32}$	A.D.E.I
	READING	10032	100-RG	10032		10032	10032	1007									$5\frac{5}{8}$	$5\frac{3}{8}$	$2\frac{21}{32}$	$\frac{9}{16}$	$1\frac{45}{64}$	$2\frac{55}{64}$	$1\frac{1}{16}$		12	12	$\frac{7}{16}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{3}{64}$ To 1	13°	13°		$2\frac{63}{128}$	2.55	$2\frac{63}{128}$	A.D.O
	R.W. HUNT																6	$5\frac{1}{2}$	$2\frac{9}{16}$	$\frac{9}{16}$	$1\frac{19}{32}$	$3\frac{21}{64}$	$1\frac{5}{64}$		12	12	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	VERT.	14°	14°				$2\frac{95}{128}$	N

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TABLE OF RAIL SECTIONS – (DIMENSIONS IN INCHES)

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
WT./ YD. LB.	TYPE	MANUFACTURER AND SECTION NUMBER															RAIL HEIGHT	BASE WIDTH	HEAD WIDTH	WEB THICKNESS	HEAD HEIGHT	WEB HEIGHT	BASE HEIGHT	BASE EDGE THICKNESS	HEAD RADIUS	WEB RADIUS	GAGE CORNER RADIUS	TOP FILLET RADIUS	BOTTOM FILLET RADIUS	HEAD SIDE SLOPE	HEAD BOTTOM ANGLE	BASE ANGLE	HEAD RADIUS WIDTH	WEB CENTER LINE	NEUTRAL AXIS DISTANCE	BOLT CENTER LINE	REFERENCE
		U.S. STEEL	BETHELEM	ILLINOIS	OLD ILLINOIS	CARNEGIE	TENNESSE TC & I	LACKAWANNA	MIDVALE	COLORADO CF & I	INLAND	CAMBRIA	MARYL. PENN.	DOMINION	ALGOMA	SYDNEY	H	B	HD	W	HH	WH	BH	T	RH	RW	R1	R2	R3	S	A1	A2	CH	WC	N	BC	
100	SANDBERG																$5\frac{3}{4}$	$6\frac{1}{4}$	3	$17/32$	$1\frac{7}{8}$			$\frac{3}{8}$	$5\frac{3}{4}$	VERT.	$\frac{1}{2}$			VERT	20°	20°					N
101	LACKAWANNA	10133	101–DL	10133		10133	10133	10130									$5\frac{7}{16}$	$5\frac{3}{8}$	$2\frac{3}{4}$	$\frac{5}{8}$	$1\frac{23}{32}$	$2\frac{11}{16}$	$1\frac{1}{32}$		10	8	$\frac{7}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	4°	13°	13°		$2\frac{3}{8}$	2.46	$2\frac{3}{8}$	A,C,E
105	LACKAWANNA	10533	105–DL	10533		10533	10533	1052									6	$5\frac{3}{8}$	$2\frac{3}{4}$	$\frac{5}{8}$	$1\frac{23}{32}$	$3\frac{1}{4}$	$1\frac{1}{32}$		10	8	$\frac{7}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	4°	13°	13°		$2\frac{21}{32}$	2.79	$2\frac{21}{32}$	A,C,E
	DUDLEY	10524	105–DY	10524		10524	10524				10524						6	$5\frac{1}{2}$	3	$\frac{5}{8}$	$1\frac{5}{8}$	$3\frac{13}{32}$	$\frac{31}{32}$		14	14	$\frac{5}{16}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$3\frac{1}{8}$	2.88		A,E,O
	NEW YORK CENTRAL		105–B	10522		10522	10522	1051									6	$5\frac{1}{2}$	3	$\frac{5}{8}$	$1\frac{5}{8}$	$3\frac{13}{32}$	$\frac{31}{32}$		14	14	$\frac{5}{16}$	$\frac{1}{2}$	1	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$3\frac{1}{8}$	2.88	$2\frac{5}{8}$	C,D
106	MISC.									1060							$6\frac{3}{16}$	$5\frac{1}{2}$	$2\frac{29}{32}$	$\frac{19}{32}$	$1\frac{3}{4}$	$3\frac{3}{8}$	$1\frac{1}{16}$							1 To 40	1 To 4	1 To 4		$2\frac{15}{16}$			H
107	N.Y.,N.H. & H.	10734	107–NH	10734		10734	10734	1072									$6\frac{1}{8}$	$5\frac{1}{2}$	$2\frac{3}{4}$	$\frac{19}{32}$	$1\frac{23}{32}$	$3\frac{1}{32}$	$1\frac{1}{16}$		12	12	$\frac{7}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	4°	13°	13°		$2\frac{47}{64}$	2.78	$2\frac{47}{64}$	A,C,E
110	AREMA	11025	110–RE	11025		11025	11025			1100	11025						$6\frac{1}{4}$	$5\frac{1}{2}$	$2\frac{25}{32}$	$\frac{19}{32}$	$1\frac{23}{32}$	$3\frac{13}{32}$	$1\frac{1}{8}$		14	14	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{5}{8}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$3\frac{1}{8}$	2.83		A,E,O
	ASCE												268				$6\frac{1}{8}$	$6\frac{1}{8}$	$2\frac{7}{8}$	$37/64$	$1\frac{25}{32}$	$3\frac{11}{32}$	1		12	12	$\frac{5}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	VERT.	13°	13°		$2\frac{43}{64}$			I
	C.T.A.	11050															7	6	$2\frac{3}{4}$	$\frac{9}{16}$	$1\frac{7}{8}$	$4\frac{5}{16}$	$1\frac{3}{16}$							3°34′30″	14°	9°					A
	GREAT NORTHERN	11036	110–GN	11036		11036	11036				11036						$6\frac{1}{2}$	$5\frac{1}{2}$	$2\frac{3}{4}$	$\frac{19}{32}$	$1\frac{5}{8}$	$3\frac{3}{4}$	$1\frac{1}{8}$		14	14	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$3\frac{1}{4}$	2.90		A,E,O
	HEAD FREE – AREMA	11027	110–RE–T	11027		11027	11027				11027						$6\frac{7}{16}$	$5\frac{1}{2}$	$2\frac{11}{16}$	$\frac{19}{32}$	$1\frac{29}{32}$	$3\frac{13}{32}$	$1\frac{1}{8}$		14	14	$\frac{3}{8}$	$\frac{3}{8}$		$\frac{1}{16}$ To 1	1 To 4:U=55°30′	1 To 4		$3\frac{1}{8}$			A,B,E,K
	LEHIGH VALLEY	11033	110–LV	11033		11033	11033										6	$5\frac{1}{2}$	$2\frac{7}{8}$	$\frac{19}{32}$	$1\frac{7}{8}$	$3\frac{1}{16}$	$1\frac{1}{16}$							4°	1 To 4	1 To 4		$2\frac{15}{16}$		$2\frac{3}{4}$	A,D,E
112	AREMA	11228	112–RE	11228		11228	11228			1121	11228						$6\frac{5}{8}$	$5\frac{1}{2}$	$2\frac{23}{32}$	$\frac{19}{32}$	$1\frac{11}{16}$	$3\frac{13}{16}$	$1\frac{1}{8}$		24	10 & 23	1 & $1\frac{1}{4}$	$\frac{3}{8}$	$\frac{5}{8}$	1 To 40	1 To 4	1 To 4		$3\frac{3}{4}$			A,E,K
	HEAD FREE – R.E.	11227	112–RE–T	11227		11227	11227				11227–HF						$6\frac{3}{4}$	$5\frac{1}{2}$	$2\frac{11}{16}$	$\frac{19}{32}$	$1\frac{13}{16}$	$3\frac{13}{16}$	$1\frac{1}{8}$		14	10 & 23	$\frac{3}{8}$	$\frac{3}{8}$		1 To 40	1 To 4:U=58°	1 To 4		$3\frac{3}{4}$			A,B,E
	CB & Q – TR	11229		11229		11229	11229			1122							$6\frac{3}{4}$	$5\frac{1}{2}$	$2\frac{1}{2}$	$\frac{5}{8}$	$1\frac{3}{4}$	$3\frac{7}{8}$	$1\frac{1}{8}$							1 To 40	1 To 4:U=77°45′	1 To 4		$3\frac{1}{8}$			A,E,K
113	HEAD FREE – SO.PAC	11327	113–RE–T	11327		11327	11327			1130							$6\frac{13}{16}$	$5\frac{1}{2}$	$2\frac{11}{16}$	$\frac{19}{32}$	$1\frac{7}{8}$	$3\frac{13}{16}$	$1\frac{1}{8}$		14	10 & 23	1 & $\frac{3}{8}$	$\frac{3}{8}$		1 To 40	1 To 4:U=58°	1 To 4	$1\frac{19}{32}$	$3\frac{3}{4}$			A,B,E
115	AREMA	11525	115–RE	11525		11525	11525			1150	11525						$6\frac{5}{8}$	$5\frac{1}{2}$	$2\frac{23}{32}$	$\frac{5}{8}$	$1\frac{11}{16}$	$3\frac{13}{16}$	$1\frac{1}{8}$		10	3 & 14	$1\frac{1}{2}$ & $\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{4}$	1 To 40	1 To 4	1 To 4	$1\frac{1}{4}$	$3\frac{1}{4}$	2.98		A,E,G
	D.R.G.W.									1155							$6\frac{5}{8}$	$5\frac{1}{2}$	$2\frac{23}{32}$	$\frac{3}{4}$	$1\frac{11}{16}$	$3\frac{13}{16}$	$1\frac{1}{8}$							4°	13°	13°		$3\frac{1}{32}$			E
	DUDLEY	11522/11523	115–DY	11523		11523	11523										$6\frac{1}{2}$	$5\frac{1}{2}$	3	$\frac{5}{8}$	$1\frac{11}{16}$	$3\frac{3}{4}$	$1\frac{1}{16}$		14	14	$\frac{5}{16}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$3\frac{3}{8}$	3.03		A,E,O
	MISC.																6	$5\frac{9}{16}$	$2\frac{15}{16}$	$\frac{21}{32}$	$1\frac{7}{8}$	$3\frac{1}{16}$	$1\frac{1}{16}$							$\frac{1}{16}$ To 1	1 To 4	1 To 4		$2\frac{15}{16}$			H
118	LACKAWANNA		118–DL–M														$6\frac{1}{2}$	$5\frac{3}{8}$	$2\frac{7}{8}$	$\frac{5}{8}$	$1\frac{29}{32}$	$3\frac{1}{2}$	$1\frac{3}{32}$							3.25°	13°	13°		$3\frac{13}{32}$			E
119	AREMA	11937								1190	11937						$6\frac{13}{16}$	$5\frac{1}{2}$	$2\frac{29}{32}$	$\frac{5}{8}$	$1\frac{7}{8}$	$3\frac{13}{16}$	$1\frac{1}{8}$		14	3 & 14	$1\frac{1}{2}$ & $\frac{9}{16}$	$\frac{3}{4}$	$\frac{3}{4}$	1 To 40	1 To 4	1 To 4	$1\frac{1}{4}$	$3\frac{1}{4}$	3.12		G
120	AREMA			12025		12025	12025										$6\frac{1}{2}$	$5\frac{3}{4}$	$2\frac{7}{8}$	$\frac{5}{8}$	$1\frac{29}{32}$	$3\frac{17}{32}$	$1\frac{3}{16}$							$\frac{1}{16}$ To 1	1 To 4	1 To 4		$3\frac{1}{4}$			H
	MFG.STD.		120–MS														$6\frac{1}{4}$	$5\frac{3}{4}$	$2\frac{7}{8}$	$\frac{5}{8}$	$1\frac{29}{32}$	$3\frac{5}{32}$	$1\frac{3}{16}$	$\frac{1}{8}$	12	12	$\frac{7}{16}$	$\frac{3}{8}$	$\frac{3}{8}$	4°	14°	14°		$2\frac{49}{64}$		$2\frac{49}{64}$	H,J
	NEW YORK CENTRAL		120–DY					1201									7	6	3	$\frac{21}{32}$	$1\frac{5}{8}$	$4\frac{5}{16}$	$1\frac{1}{16}$		14	20	$\frac{5}{16}$	$\frac{1}{2}$	1	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$3\frac{7}{8}$	3.12	3	C,D,E
122	CB (B&O)		122–CB														$6\frac{25}{32}$	6	$2\frac{15}{16}$	$\frac{21}{32}$	$1\frac{15}{16}$	$3\frac{39}{64}$	$1\frac{15}{64}$	$\frac{1}{8}$	10	3 & 14	$1\frac{1}{4}$ & $\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{4}$	1 To 20	1 To $2\frac{3}{4}$	1 To $2\frac{3}{4}$,1 To 13.7	$1\frac{15}{64}$	$3\frac{21}{64}$	3.18		K
125	PENNSYLVANIA		308	12531		12531	12531	12530	584								$6\frac{1}{2}$	$5\frac{1}{2}$	3	$\frac{21}{32}$	$1\frac{7}{8}$	$3\frac{13}{32}$	$1\frac{7}{32}$		12	16	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{3}{4}$	VERT.	18°	14°		$3\frac{1}{4}$	3.00	$2\frac{59}{64}$	C,D,E
125.5	FRICTIONLESS		125.5–PS–F														7	$5\frac{1}{2}$	$1\frac{13}{16}$	$11/16$	$2\frac{3}{8}$	$3\frac{13}{32}$	$1\frac{7}{32}$							VERT.	18°	14°		$3\frac{1}{4}$		$2\frac{3}{4}$	D,H
127	DUDLEY	12723	127–DYM								12723						7	$6\frac{1}{4}$	3	$\frac{21}{32}$	$1\frac{11}{16}$	$4\frac{5}{32}$	$1\frac{5}{32}$							$\frac{1}{16}$ To 1	1 To 4	1 To 4		$3\frac{7}{8}$			A,H
	NEW YORK CENTRAL		127–DY	12722		12722	12722				12722						7	$6\frac{1}{4}$	3	$\frac{21}{32}$	$1\frac{11}{16}$	$4\frac{5}{32}$	$1\frac{5}{32}$		14	18	$\frac{5}{16}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{16}$ To 1	1 To 4	1 To 4		$3\frac{7}{8}$	3.10		E,O
129	CB & Q – TR	12929		12929		12929	12929				12929						$7\frac{5}{16}$	6	$2\frac{5}{8}$	$\frac{21}{32}$	$1\frac{27}{32}$	$4\frac{9}{32}$	$1\frac{3}{16}$							1 To 40	1 To 4	1 To 4		$3\frac{1}{2}$			A,E

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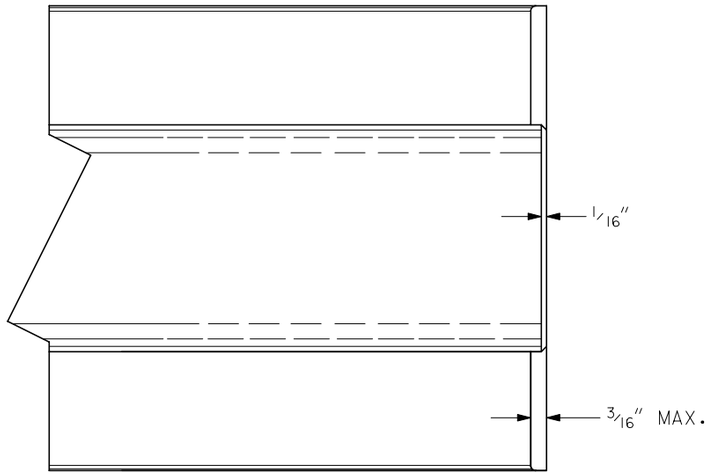
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TABLE OF RAIL SECTIONS – (DIMENSIONS IN INCHES)

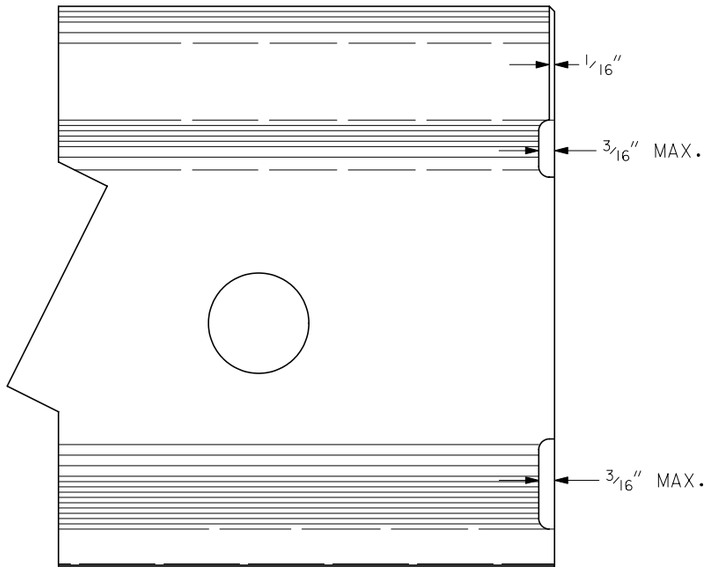
A	B	C	D	E	F	G	H	I	J	K	L	M	N	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
WT./ YD. LB.	TYPE	MANUFACTURER AND SECTION NUMBER																RAIL HEIGHT	BASE WIDTH	HEAD WIDTH	WEB THICKNESS	HEAD HEIGHT	WEB HEIGHT	BASE HEIGHT	BASE EDGE THICKNESS	HEAD RADIUS	WEB RADIUS	GAGE CORNER RADIUS	TOP FILLET RADIUS	BOTTOM FILLET RADIUS	HEAD SIDE SLOPE	HEAD BOTTOM ANGLE	BASE ANGLE	HEAD RADIUS WIDTH	WEB CENTER LINE	NEUTRAL AXIS DISTANCE	BOLT CENTER LINE	
		U.S. STEEL	BETHELEM	ILLINOIS	OLD ILLINOIS	CARNEGIE	TENNESSE TC & I	LACKAWANNA	MIDVALE	COLORADO CF & I	INLAND	CAMBRIA	MARYL. PENN.		DOMINION	ALGOMA	SYDNEY	H	B	HD	W	HH	WH	BH	T	RH	RW	R1	R2	R3	S	A1	A2	CH	WC	N	BC	REFERENCE
	AREMA	13025	130-RE	13025		13025	13025			1300	13025							6 3/4	6	2 15/16	21/32	1 27/32	3 11/16	1 7/32		14	14	3/8	1/2	3/4	1/16 To 1	1 To 4	1 To 4		3 3/8	3.03		A.E.O
	HEAD FREE – P.S.		130-PS-T															6 13/16	5 1/2	3	21/32	2 3/16	3 3/8	1 7/32							STR.	18°: U=58°30′	14°		3 1/4			A
130	HEAD FREE – R.E.	13027	130-RE-T	13027		13027	13027				13027				13001	138		6 13/16	6	2 27/32	21/32	2 1/32	3 11/16	1 7/32		14	14	3/8	1/2		1/16 To 1	1 To 4: U=61°	1 To 4		3 3/8	3.08		A.B.E.O
	PHIL. & READING		130-RG															6 27/32	6	2 15/16	21/32	1 15/16	3 11/16	1 7/32							1/16 To 1	1 To 4	1 To 4		3 3/8			E.K
	PENNSYLVANIA	13031	130-PS	13031		13031	13031	13030	589	1302	13031							6 5/8	5 1/2	3	11/16	2	3 13/32	1 7/32		12	16	7/16	1/2	3/4	VERT.	18°	14°		3 1/4	3.09	2 3/4	A.D.E.O
131	AREMA	13128	131-RE	13128		13128	13128			1311	13128							7 1/8	6	3	21/32	1 3/4	4 3/16	1 3/16		24	10 & 23	1 & 1/4	1/2	3/4	1 To 40	1 To 4	1 To 4		4 1/4			A.E
	HEAD FREE– R.E	13127																7 1/4	6	2 31/32	21/32	1 7/8	4 3/16	1 3/16	1/8	14	10 & 23	3/8	1/2		1 To 40	1 To 4: U=60°30′	1 To 4		4 1/4			A.B.K
132	AREMA	13225	132-RE	13225		13225	13225			1321	13225							7 1/8	6	3	21/32	1 3/4	4 3/16	1 3/16	1/8	10	8 & 16	1 1/4 & 3/8	3/4 & 5/16	7/8	1 To 40	1 To 4	1 To 4	1 1/2	3 7/8	3.20		A.E.G
	HEAD FREE – S.O.PAC	13227	132-RE-T	13227		13227	13227			1320								7 5/16	6	2 31/32	21/32	1 15/16	4 3/16	1 3/16	1/8	14	10 & 23	1 & 3/8	1/2		1 To 40	1 To 4: U=60°30′	1 To 4	1 13/16	4 1/4			A.B.E
133	AREMA	13331	133-RE	13331		13331	13331			1330	13331							7 1/16	6	3	11/16	1 15/16	3 15/16	1 3/16	1/8	10	8 & 16	1 1/4 & 3/8	3/4 & 7/16	3/4	1 To 14.3	1 To 3	1 To 4.011	1.4	3 3/4	3.20		A.E.G
135	CENTRAL OF NJ		135-CR															6 1/2	6	3 9/32	3/4	2	3 9/32	1 7/32							4°	14°	14°		3		2 55/64	D.H
	AREMA	13627	136-RE							1360								7 5/16	6	2 15/16	11/16	1 15/16	4 3/16	1 3/16	1/8	14	8 & 20	1 1/4 & 9/16	3/4 & 5/16	3/4	1 To 40	1 To 4	1 To 4	1.4	3 7/8	3.35		G
	LEHIGH VALLEY	13633	136-LV	13633		13633	13633											7	6 1/2	2 15/16	21/32	1 7/8	3 7/8	1 1/4							4°	1 To 4	1 To 4		3 1/2		3 1/16	A.D.E
136	LEHIGH VALLEY		136-LV															7 3/8	6 1/2	2 15/16	11/16	1 25/32	4 3/8	1 7/32							4°	1 To 4	1 To 4		3 7/8			E
	LEHIGH VALLEY		136-LV-M															7	6 1/2	2 15/16	11/16	1 7/8	3 7/8	1 1/4							4°	1 To 4	1 To 4		3 1/2			E.H
	NEW YORK CENTRAL		136-NYC															7 9/32	6 1/4	2 15/16	11/16	1 7/8	4 5/32															K
140	AREMA / PS	14031	140-RE	14031		14031	14031											7 5/16	6	3	3/4	2 1/16	4 1/16	1 3/16	1/8	10	8 & 27	1 1/4 & 3/8	3/4 & 7/16	3/4	4°	1 To 3	1 To 4	1.4	4	3.37		A.E.G
152	PENNSYLVANIA	15222	152-PS	15224		15224	15224											8	6 3/4	3	11/16	1 27/32	4 7/8	1 9/32		24	6 & 30	1 & 1/4	1/2	3/4	1 To 40	14°	14°	1 13/16	5	3.50		A.E.O
155	PENNSYLVANIA	15531	155-PS	15531		15531	15531											8	6 3/4	3	3/4	2 1/16	4 21/32	1 9/32							4°	18°26′10″	14°		4 11/16			A.E

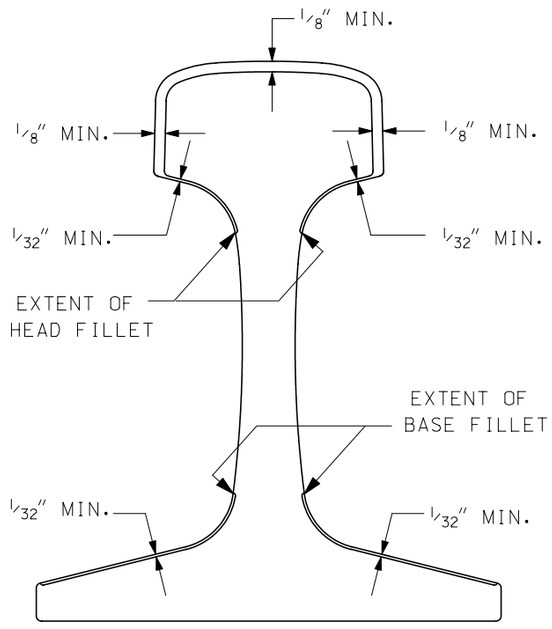
Information 1952. Revised 1996 . Converted to C.A.D. February 2003.

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THE HEEL ENDS OF SWITCH RAILS, THE ENDS OF THE ARMS OF TURNOUT AND CROSSING FROGS, THE ENDS OF CLOSURE RAILS WITHIN CROSSINGS OR OTHER SPECIAL TRACKWORK LAYOUTS, AND THE ANALOGOUS PORTION OF THE ENDS OF SOLID MANGANESE FROGS AND CROSSINGS SHALL BE BEVELED AS SHOWN ON THIS PLAN





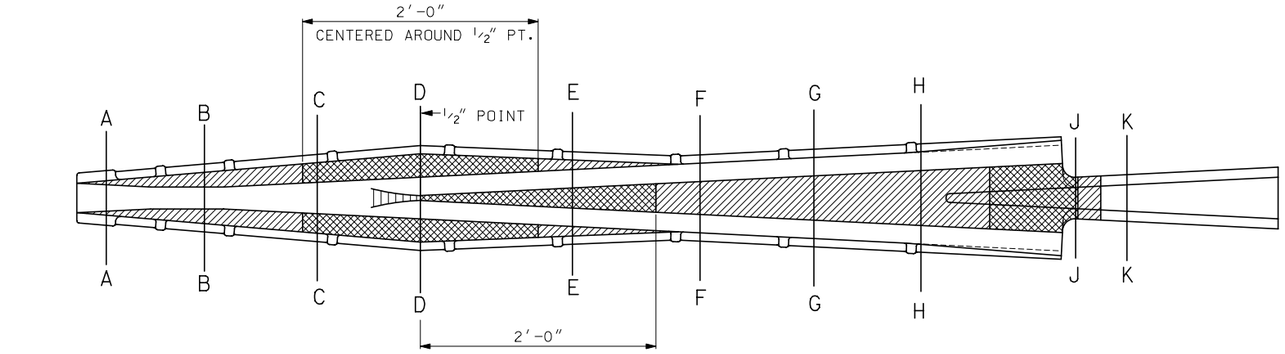
AMERICAN RAILWAY ENGINEERING
AND MAINTENANCE OF WAY ASSOCIATION

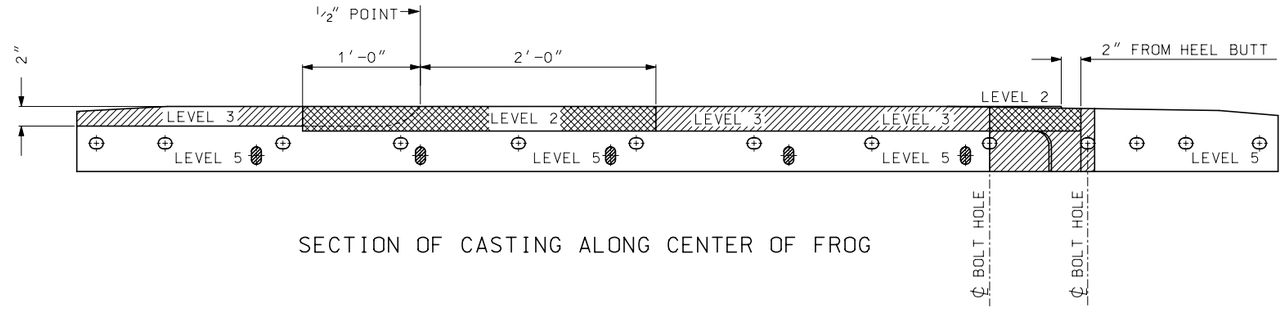
BEVELING OF RAIL ENDS
FOR
SPECIAL TRACKWORK

PLAN NO. 1005–03

Adopted March 1938, Supersedes data in Plan No.100. Converted to C.A.D. March 2003.

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SECTION OF CASTING ALONG CENTER OF FROG

NOTES

WITH REFERENCE TO ASTM E 446,E 186,E 280 AND THE ASTM REFERENCE RADIOGRAPHS, ALL AREMA TYPE MANGANESE FROG CASTINGS MUST MEET THE FOLLOWING CRITERIA:

MUST BE 1, OR 2

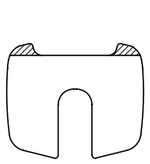
MUST BE 1, 2 OR 3

MUST BE 1, 2,3,4 OR 5

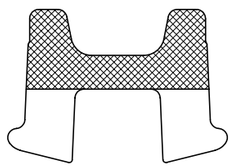
ASTM LEVELS APPLY TO THE FOLLOWING DEFECTS OR DISCONTINUITIES:
-ASTM CATEGORY 'A'- GAS POROSITY
-ASTM CATEGORY 'B'- SAND AND SLAG INCLUSIONS
-ASTM CATEGORY 'C'- SHRINKAGE

THIS SPECIFICATION APPLIES TO ALL RBM FROGS, AREMA PLAN 616, 621 AND ALSO TO AREMA CROSSINGS PLAN 750, 751, 768 AND 769.

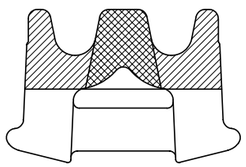
AREMA PLANS 616 AND 621 SHOWN



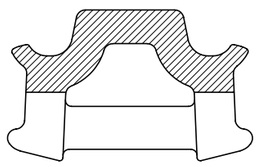
SECTION A–A



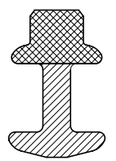
SECTION C–C



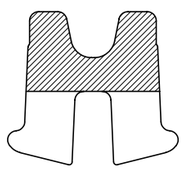
SECTION E–E



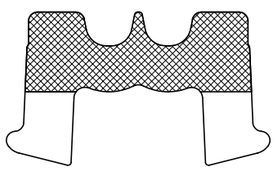
SECTION G–G



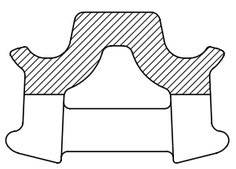
SECTION J–J



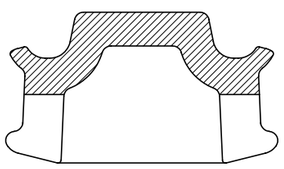
SECTION B–B



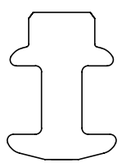
SECTION D–D



SECTION F–F



SECTION H–H



SECTION K–K

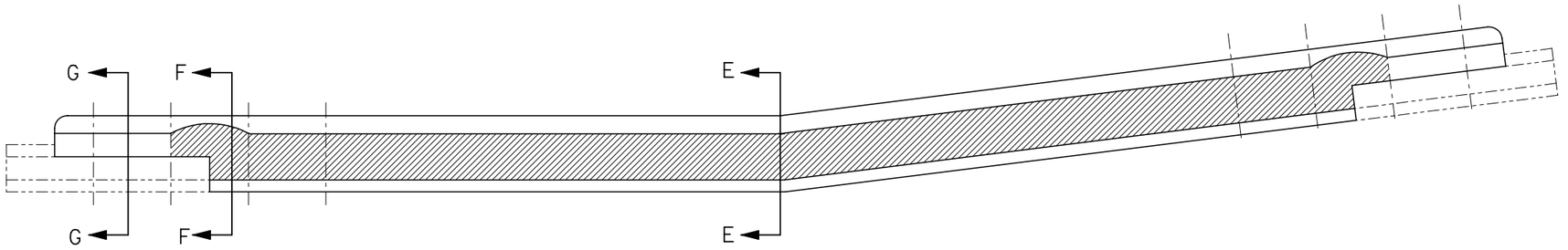
AMERICAN RAILWAY ENGINEERING
AND MAINTENANCE OF WAY ASSOCIATION

RADIOGRAPHIC TESTING OF RAIL BOUND MANGANESE STEEL FROG CASTING, INTERNAL SOUNDNESS SEVERITY LEVELS

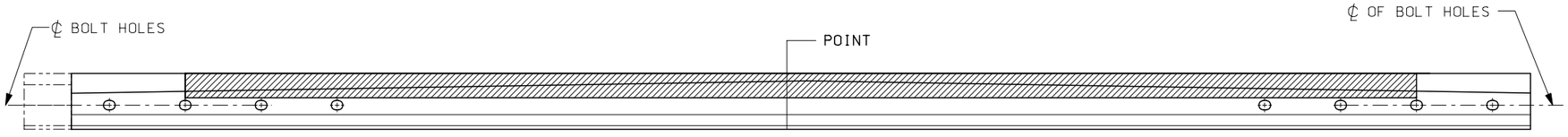
PLAN NO. 1012–03

Adopted March 1992. Converted to C.A.D. April 2003.

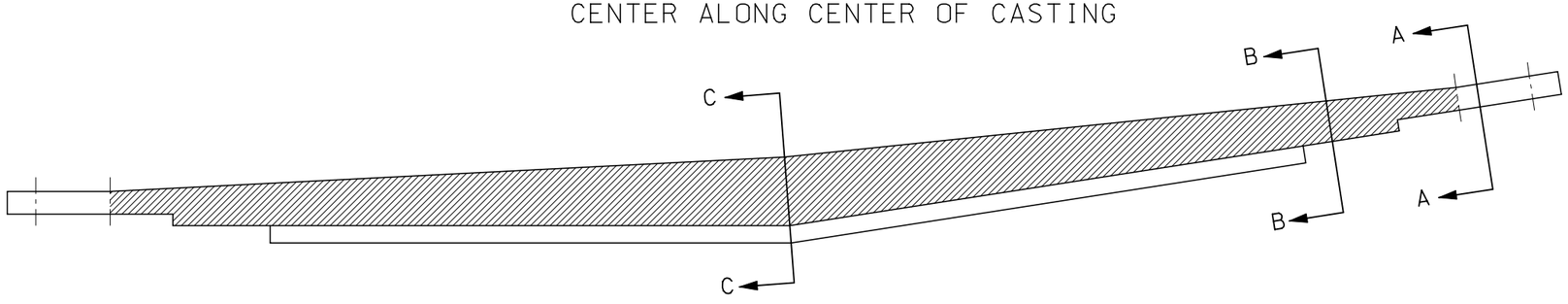
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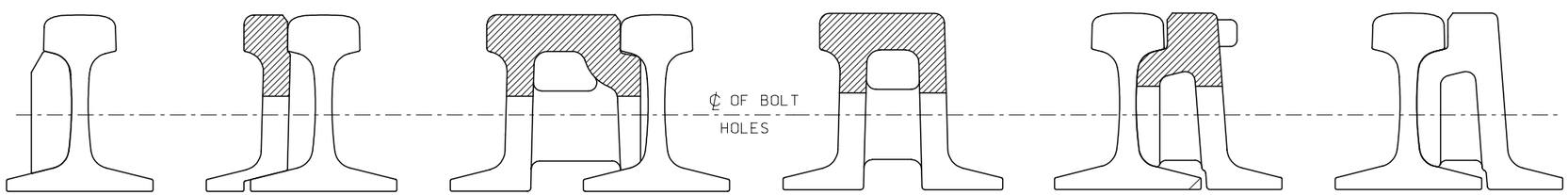
SOLID MANGANESE STEEL KNUCKLE



CENTER ALONG CENTER OF CASTING



RAILBOUND MANGANESE STEEL KNUCKLE



SECTION A–A SECTION B–B SECTION C–C SECTION E–E SECTION F–F SECTION G–G

NOTES:

WITH REFERENCE TO ASTM E 446, E 186, E 280 AND THE ASTM REFERENCE RADIOGRAPHS, ALL AREMA TYPE MANGANESE FROG CASTINGS MUST MEET THE FOLLOWING CRITERIA:

MUST BE 1, OR 2

MUST BE 1, 2 OR 3

MUST BE 1, 2,3,4 OR 5

ASTM LEVELS APPLY TO THE FOLLOWING DEFECTS OR DISCONTINUITIES:

–ASTM CATEGORY 'A'– GAS POROSITY

–ASTM CATEGORY 'B'– SAND AND SLAG INCLUSIONS

–ASTM CATEGORY 'C'– SHRINKAGE

THIS SPECIFICATION APPLIES TO ALL MANGANESE KNUCKLES AREMA PLAN 821.

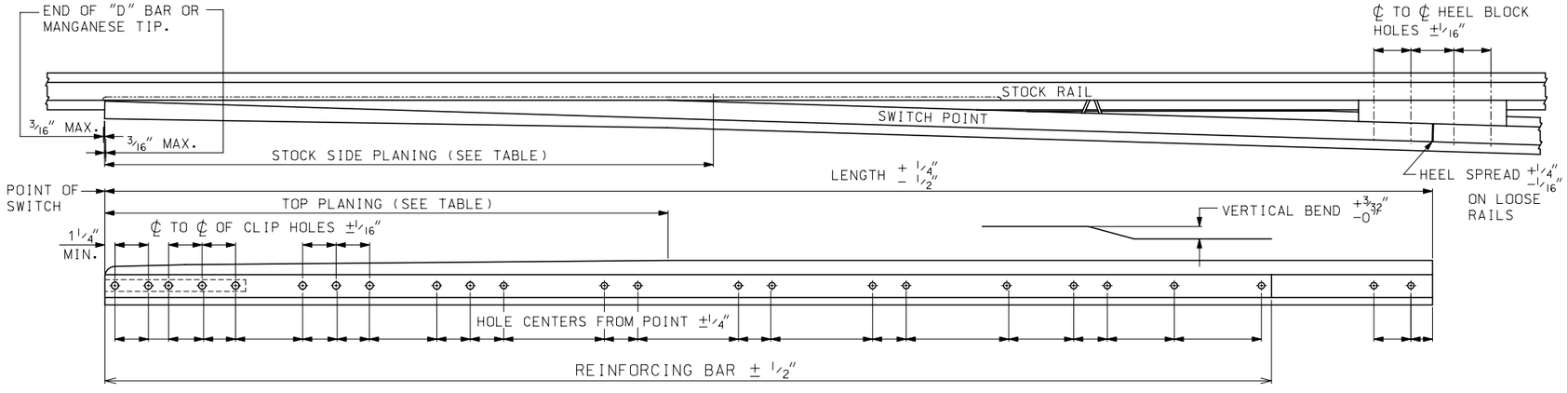
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

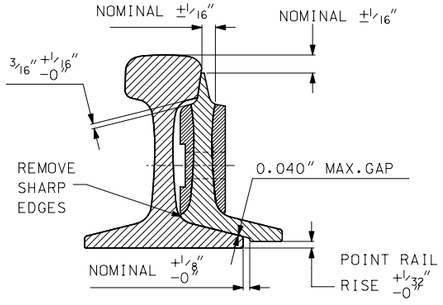
RADIOGRAPHIC TESTING OF RAIL BOUND AND SOLID MANGANESE STEEL KNUCKLES INTERNAL SOUNDNESS SEVERITY LEVELS

PLAN NO. 1017–03

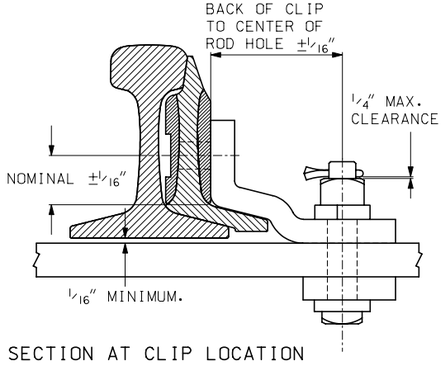
Adopted March 1992. Converted to C.A.D. April 2003.

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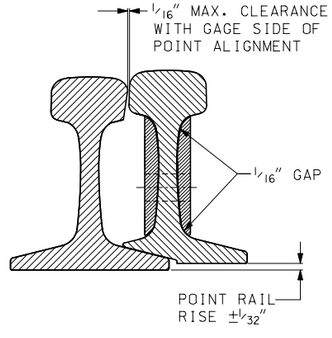




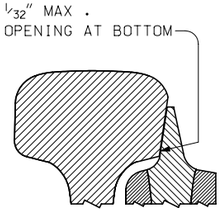
SECTION AT POINT



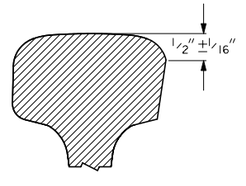
SECTION AT CLIP LOCATION



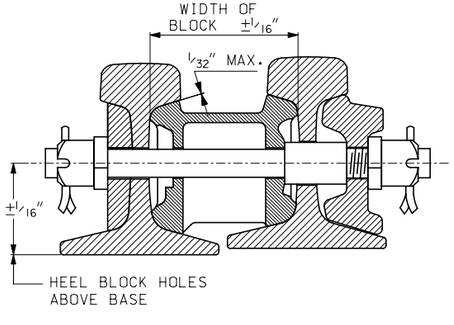
SECTION AT HEAD SEPARATION



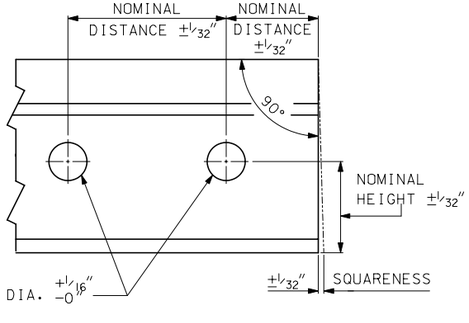
SAMSON FIT



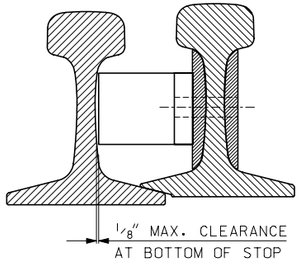
STOCK RAIL UNDERCUT



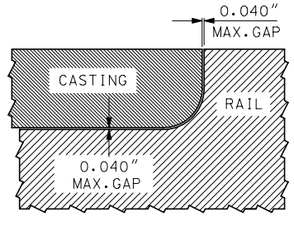
SECTION AT HEEL



JOINT DRILLING



SECTION AT STOP LOCATION



MANGANESE TIP FIT

TOP CUT TOLERANCE BASED ON RAIL HEIGHT TOLERANCE OF +0.040" -0.015"

LENGTH	PLUS	MINUS
5′-0″	3 1/4″	1 1/4″
6′-0″	3 7/8″	1 7/16″
7′-0″	4 1/2″	1 11/16″
9′-0″	5 3/4″	2 1/8″
12′-0″	7 11/16″	2 7/8″
20′-0″	12 13/16″	4 13/16″

STOCK CUT TOLERANCE BASED ON 0.045" VARIANCE

LENGTH	TOLERANCE ±
5′-0″	2 1/4″
6′-0″	3″
7′-0″	3 1/4″
8′-0″	3 1/2″
9′-0″	3 3/4″
10′-0″	4 1/4″
11′-0″	4 3/4″
12′-0″	5 1/4″
13′-0″	5 1/2″
14′-0″	6″
20′-0″	8 1/2″
22′-0″	9 1/2″

NOTES:

1. SPECIFICATIONS – SEE PLAN BASIC No.100.
2. WHEN "D" BARS ARE 28′-0″ LONG OR LONGER, TWO PIECES CAN BE WELDED TOGETHER. WELDED JOINTS MUST BE OFFSET BY A MINIMUM OF 2′-0″.
3. REMOVE STAMPING AND BRANDING WITHIN 1/2" OF JOINT HOLE.
4. PLANED ANGLES ± 1/2°

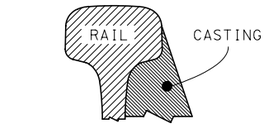
AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

PERMISSIBLE VARIATIONS IN COMPLETED SWITCH POINTS.

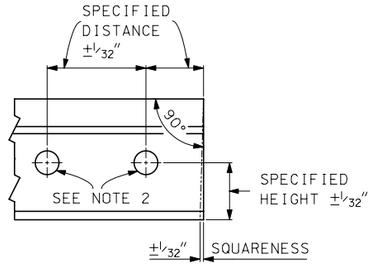
PLAN NO. 1020–03

Adopted 2003

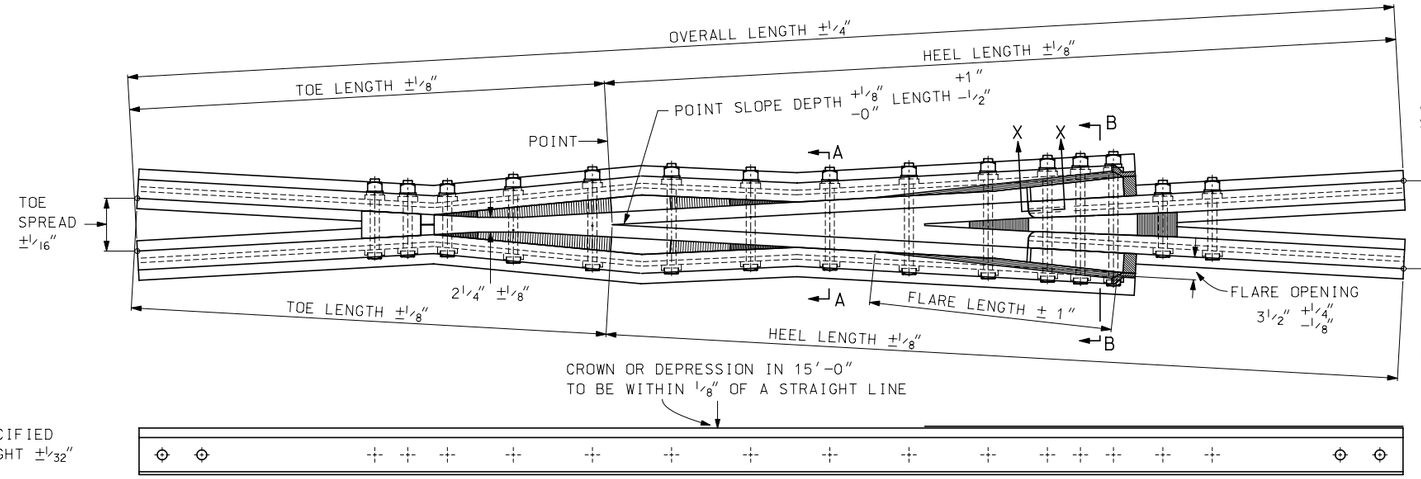
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JOINT MISMATCH CASTING TO BE GROUND TO MATCH RAIL HEAD SLOPE IN 9". 0.040" MISMATCH ALLOWED



RAIL END AND JOINT DRILLING



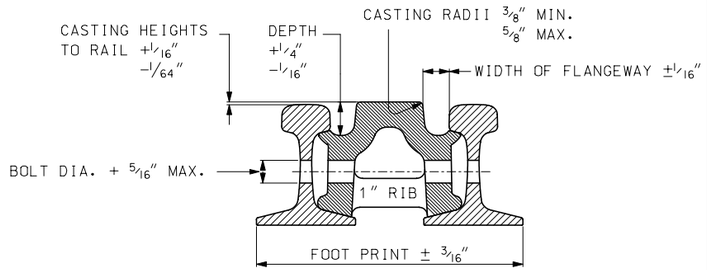
ADJACENT TOE AND HEEL LENGTHS SHALL NOT DIFFER MORE THAN ±1/8"

TOE AND / OR HEEL SPREADS MAY BE ±1/8" TO IMPROVE ALIGNMENT FOR FROG ANGLES GREATER THAN No.6

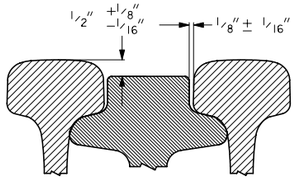
TYPICAL PLAN AND ELEVATION OF A RBM FROG
(DRAWN No.9 FROG)

ALIGNMENT

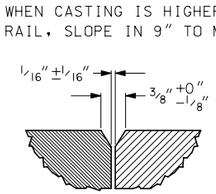
ACTUAL GAUGE LINES OF COMPLETED FROGS SHALL NOT VARY MORE THAN ±1/16" FROM TRUE ALIGNMENT, THE LINE PRODUCED FROM TOE SHALL NOT TOUCH ACTUAL FROG POINT.



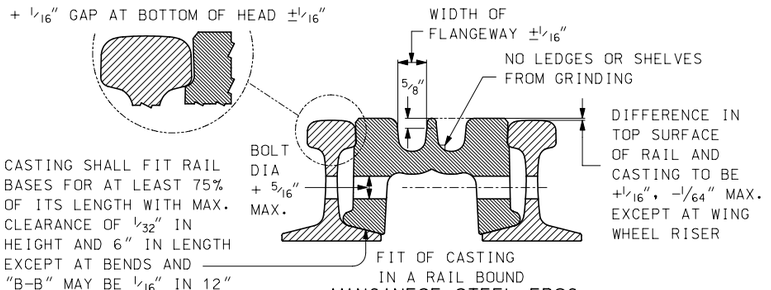
SECTION A–A



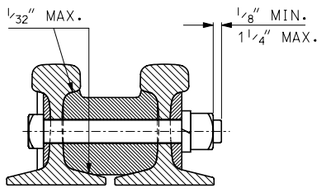
PARTIAL SECTION B–B



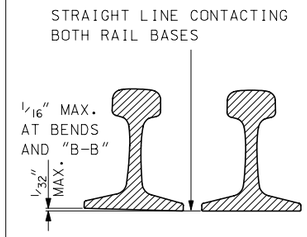
SECTION THROUGH X–X



MANGANESE STEEL FROG
SECTION AT BOLT, NEAR D-D PLAN BASIC No.621



SECTION INDICATING FIT OF CAST TOE AND HEEL FILLER BLOCKS



CROSS LEVEL OF RAIL BASES THROUGH LENGTH OF FROG

NOTES:

1. Specifications – See Plan Basic No.100.
2. JOINT HOLES: A variation of nothing under and 1/16" over in size of bolt holes will be permitted.
3. Depth hardening specification, Brinell hardness number and test locations per Plan Basic 100 and detail part M2 manganese steel castings paragraph M2.7 depth hardening.
4. Remove branding and stamping within 1/2" of bolt hole.
5. Where so specified by the purchaser, the following footprint tolerances shall apply:

   The overall dimension from outer edge to outer edge of frog base shall be the theoretical dimension for that location plus or minus 3/16" these measurements shall be taken at right angles to the centerline of the frog and across the base of the frog at center line of tie locations as specified in the standard drawings. No measurement shall be taken within 6 inches of a bend location.

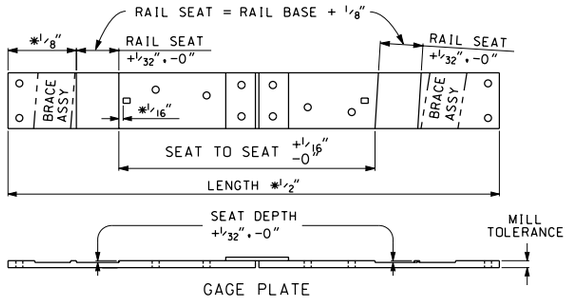
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PERMISSIBLE VARIATIONS IN COMPLETED RBM STEEL FROGS.

PLAN NO. 1021–03

Adopted 2003

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NOTES:
1. ALL HOLES TO BE *1/32" IN SIZE. TOLERANCE APPLIES TO PUNCH ENTRY SIDE.
2. ALL SQUARE HOLES ADJACENT TO RAIL TO BE * 1/32" IN LOCATION UNLESS OTHERWISE NOTED.
3. ALL HOLES NOT ADJACENT TO RAIL TO BE * 1/8" IN LOCATION UNLESS OTHERWISE NOTED.
4. PLATE TO BE FLAT WITHIN * 1/16" FOR EVERY 24" OF LENGTH.
5. PLATE TO BE SQUARE WITHIN * 1/8" IN THE PLATE WIDTH.
6. DIELECTRIC REQUIREMENTS AND ADDITIONAL INSULATION TOLERANCE TO BE PER AREMA SIGNAL MANUAL 8.5.1, 8.5.2 AND 8.5.3

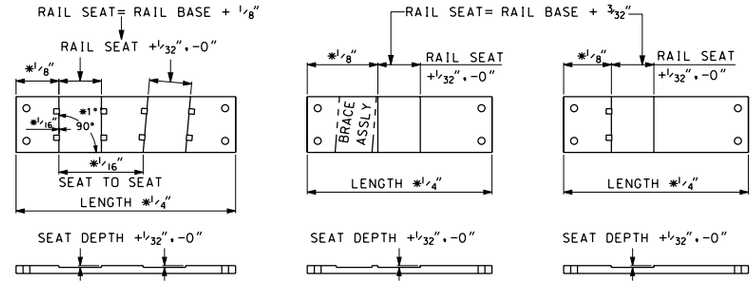
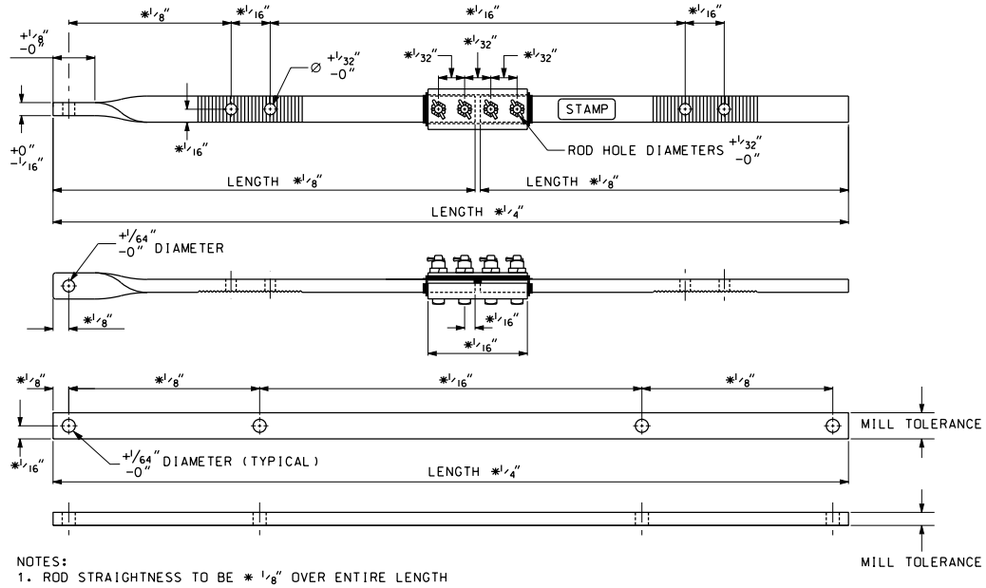
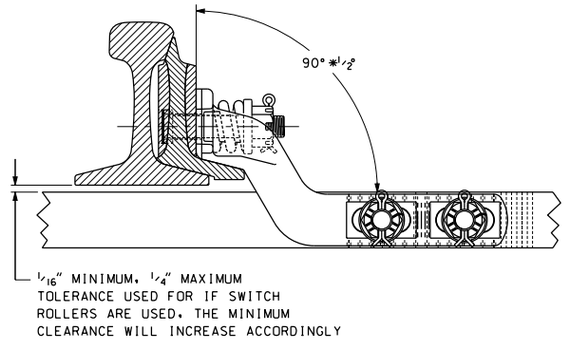


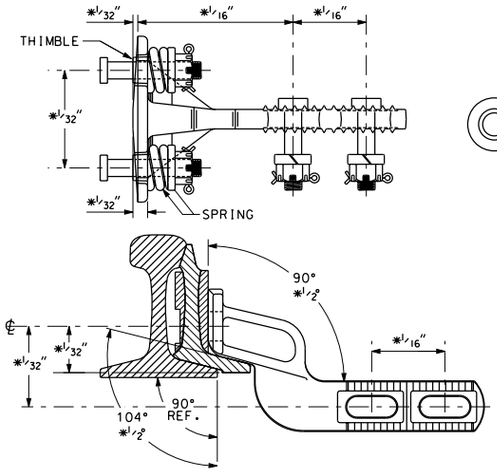
PLATE TOLERANCE



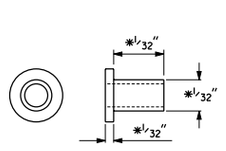
NOTES:
1. ROD STRAIGHTNESS TO BE * 1/8" OVER ENTIRE LENGTH
2. DIELECTRIC REQUIREMENTS AND ADDITIONAL INSULATION TOLERANCE TO BE AS PER AREMA SIGNAL MANUAL 8.5.1, 8.5.2 AND 8.5.3

SWITCH ROD TOLERANCE

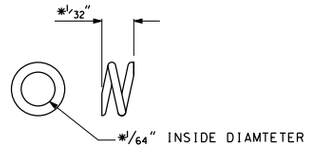




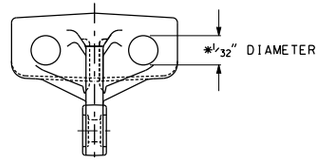
ROCKER CLIP TOLERANCE



THIMBLE



SPRING



AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

PERMISSIBLE VARIATIONS IN COMPLETED SWITCH CLIP, PLATE AND SWITCH ROD

PLAN NO. 1024-08

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