

## **SPECIAL SPECIFICATION**

**4418**

### **Ballasted Track Rehabilitation**

**1. Description.** This Item shall govern for the rehabilitation of ballasted track on constructed trackbed. Ballasted track rehabilitation includes, but is not limited to, placing ballast; distributing, replacing, and lining ties; installing and field welding running rail; raising and lining track; installing vehicular grade crossings and other incidentals as specified herein. Track on ballasted deck bridges is also included.

**2. Materials.**

**A. Rail.**

Use Type RE 115, 119, or 136 lb. Standard Strength Rail supplied by the Contractor and conforming to the requirements of American Railway Engineering and Maintenance of Way Association (AREMA) Chapter 4 "Rail" for constructing track and replacing rail as necessary in plans. The Contractor will furnish the necessary welding materials, welds, joint bars, anchors, spikes, bolts, nuts, and any other materials necessary for the rail installation. In the event any existing rail should break during tie removal, installation, surfacing, or any other portion of the project; the Engineer will determine whether the rail should be replaced or spliced by installation of joint bars. The Contractor will furnish the necessary joint bars, anchors, spikes, bolts, nuts, securements, welding, and any other materials necessary for the rail installation of the same rail section size as the break.

**B.** Use Type RE 90 lb, 115 lb, or 112 lb Standard Strength Rail conforming to the requirements of AREMA Chapter 4 "Rail" "Class 1" for "compromise" sections to connect 119 or 136# CWR sections with existing 90# jointed rail sections or 70# jointed rail sections. The Contractor will furnish the necessary welding materials, welds, joint bars, anchors, spikes, bolts, nuts, and any other materials necessary for the rail installation.

**C. Switch Points.**

Use Type RE 90, 112, 119, 115, or 136 lb. Standard Strength Rail supplied by the Contractor and conforming to the requirements of American Railway Engineering and Maintenance of Way Association (AREMA) Chapter 4 "Rail" for replacing switch points as necessary in plans. Switch points shall be replaced on both sides where marked on the plans and replaced as a set. The Contractor will furnish transportation of the switch points and the necessary plates, anchors, joint bars, bolts, clips, and other necessary materials of the same rail section size.

#### **D. Turnouts.**

Contractor shall furnish rail, frogs, switch stands, connecting rods, plates, switch ties, cross ties, securements, and all other materials used in construction of turnouts and switch mechanisms in accordance with AREMA Specifications Chapter 4 and construct all turnouts complete as required by plans. Turnouts shall be constructed and placed as shown on the drawings. Contractor shall install all new turnouts complete in place.

#### **E. Track Crossties.**

1. Track crossties shall conform to the current AREMA Specifications, Chapter 30, "Ties". The track crossties shall be new Oak, Douglas Fir, or Mixed Hardwood Wood ties, 7 inches x 9 inches x 8 feet-6 inches minimum AREMA-7 inch Grade.
2. Crossties shall be treated according to the American Wood Preservers Association Standards, based on 50 percent creosote and 50 percent coal tar solution with a minimum preservative retention of 8 pounds per cubic foot of Wood.
3. Crossties shall be seasoned, dimensioned and prebored prior to treatment and treated in accordance with AWPA Standard C6 "Crossties and Switch Ties - Preservative Treatment by Pressure Processes", or ASTM D 1760 "Standard Specification for Pressure Treatment of Timber Products". All ties shall be fitted with anti-splitting devices, regardless of their tendency to split.
4. Ties shall be inspected and certified by an approved commercial testing laboratory stating that the ties to be used meet the specifications in accordance with AWPA Standard M2 "Standard for Inspection of Treated Wood Products". Results of test and inspections shall be furnished to the Engineer.

#### **F. Switch Ties.**

1. Switch ties shall conform to the current AREMA Specifications, Chapter 30, "Timber Switch Ties". The switch ties shall be new Oak, Douglas Fir, or Mixed Hardwood Wood ties, AREMA-7 inch Grade. Switch ties shall be 7 inches x 9 inches x the length required by the plans and necessary for installation at the location indicated by the Engineer.
2. Switch ties shall be treated according to the American Wood Preservers Association Standards, based on 50 percent creosote and 50 percent coal tar solution with a minimum preservative retention of 8 pounds per cubic foot of Wood.
3. Switch ties shall be seasoned, dimensioned and prebored prior to treatment and treated in accordance with AWPA Standard C6 "Crossties and Switch Ties - Preservative Treatment by Pressure Processes", or ASTM D 1760 "Standard Specification for Pressure Treatment of Timber Products". All ties shall be fitted with anti-splitting devices, regardless of their tendency to split.

4. Switch ties shall be inspected and certified by an approved commercial testing laboratory stating that the ties to be used meet the specifications in accordance with AWPAs Standard M2 “Standard for Inspection of Treated Wood Products”. Results of test and inspections shall be furnished to the Engineer.

**G. Tie Plates.**

Hot worked, high carbon, double shoulder, flat bottom tie plates shall be 7.5 in. x 11 in. or the largest size available for the rail size with 1:40 cant and conform to the AREMA specifications, Chapter 5, “Track”, with punched A-8 square spike holes shall be used to replace any broken or missing tie plates.

**H. Track Spikes.**

Supply new high carbon steel track spikes conforming to the requirements of AREMA Chapter 5 “Track”. Deliver track spikes to the Job Site in Engineer approved containers (kegs). Install in accordance with instructions herein and Federal Railroad Administration (FRA) Standards.

**I. Joint Bars, Compromise Joint Bars and Track Bolts.**

Use joint bars, compromise joint bars and track bolts conforming to the requirements of AREMA Chapter 4, Part 2, Section 2.8, “Specifications for Quenched Carbon-Steel Joint Bars, Microalloyed Joint Bars, and Forged Compromise Joint Bars”. Compromise joint bars must be new and of the size, shape, and punch necessary to fit the rail sizes and sections being joined. Only factory designed and produced (forged or cast) compromise joint bars may be used to join rails of different sizes or sections.

**J. Rail Anchors.**

Use Grip type rail anchors conforming to the requirements of AREMA Chapter 5, Section 7 “Rail Anchors”.

**K. Derails.**

Supply left hand or right hand hinge derails as necessary of the appropriate size for the particular rail installation location shown in the plans.

**L. Guard rails.**

Install guard rails of the appropriate size for the particular rail installation location as shown on the plans.

**M. Subballast.**

Subballast shall consist of a foundation coarse for a typical highway-railroad grade crossing roadbed and shall be composed of uncrushed or crushed aggregates of either caliche, argillaceous limestone, conglomerate, gravel, crushed slag or other granular materials as approved by the Engineer. Aggregate retained on a No. 10 sieve must consist of hard, durable particles or fragments of stone, gravel, sand or slag. Materials that break up when alternately frozen and thawed or wetted and dried are not permitted.

Aggregate must not have a percentage of wear of more than 50 percent, by the Los Angeles abrasion test. A higher or lower percentage of wear may be specified by the Engineer, depending on the material available.

Unless otherwise indicated on the plans, provide subballast consisting of gradations as set forth in Table 1.

**Table 1**

Sieve Size	Subballast Gradations					
	2"	1"	3/4"	No. 10	No. 40	No. 200
% Passing (optimum)	100	95	67	38	21	7
% Passing (permissible.)	100	90-100	50-84	26-50	12-30	0-10

**N. Ballast.**

1. Supply crushed stone ballast that is hard, dense, of angular particle structure providing sharp corners and cubical fragments, free of deleterious materials. Provide ballast material that has a high resistance to temperature changes, chemical attack, high electrical resistance, low absorption properties and free of cementing characteristics. Submit Certificates of Compliance for all ballast materials furnished under this contract for review and approval by the Engineer prior to transporting ballast to the Job Site.

**2. Ballast Classifications.**

Ballast shall be main line quality, AREMA Standard 4A Gradation. A variety of materials may be processed into the railroad ballast. The following general classifications and the accompanying definitions list the most common materials. Detailed examination of the individual materials will be made to determine the specific mineralogical composition. No crushed gravel is allowed.

- a. **Granite.** Granite is a plutonic rock having an even texture and consisting primarily of feldspar and quartz.
- b. **Trap Rock.** Trap rock is any dark-colored, fine-grained non-granitic hypabyssal or extrusive rock.
- c. **Quartzite.** Quartzite is a granoblastic, metamorphic rock consisting mainly of quartz and formed by recrystallization or sandstone or chert by either regional or thermal metamorphism. Quartzite may also be very hard but unmetamorphosed sandstone consisting chiefly of quartz grains with secondary silica that the rock breaks across or through the grains rather than around them.
- d. **Carbonate Rocks.** Carbonate rocks are sedimentary rocks consisting primarily of carbonate materials such as limestone and dolomite.
- e. **Slags.** Slags are materials formed during the metal-making process by fusion fluxstones, coke and other metallic particles.

### 3. Property Requirements.

#### a. Physical Analysis.

- (1) **Method of Sampling.** Secure field samples in accordance with ASTM D-75. Reduce test samples from field samples in accordance with ASTM C 702.
- (2) **Sieve Analysis.** Perform sieve analysis in accordance with ASTM C 136. All sieve analyses require wet sieving.
- (3) **Material Finer than No. 200 Sieve.** Test material finer than a No. 200 Sieve in accordance with ASTM C 117.
- (4) **Bulk Specific Gravity and Absorption.** Determine bulk specific gravity and percentage of absorption in accordance with ASTM C 127. Specific gravity shall conform to AREMA standards at 2.4 minimum.
- (5) **Percentage of Clay Lumps and Friable Particles.** Determine percentage of clay lumps and friable particles in accordance with ASTM C 142.
- (6) **Resistance to Degradation.** Determine the resistance to degradation in accordance with ASTM C 131 or C 535 as follows: test materials having gradations containing particles retained on the 1" sieve by ASTM C 535, test materials having gradations of 100 percent passing the 1" sieve by ASTM C 131.
- (7) **Sodium Sulfate Soundness.** Sodium sulfate soundness tests shall be made in accordance with ASTM C 88.
- (8) **Unit Weight.** The weight per cubic foot shall be determined in accordance with ASTM C 29.
- (9) **Percentage of Flat and/or Elongated Particles.** Percent of flat and/or elongated particles shall be determined in accordance with U.S. Army Corps of Engineers Test CRD-C-119.
- (10) **Plasticity Index.** The plastic limit, liquid limit and plasticity index shall be determined in accordance with ASTM D 423 and D 424. Each sample shall be tested in two ways; one test shall test the fines generated by the Los Angeles Machine, and the other test shall test the fines contained in the total sample. The portions of these samples generated by the Los Angeles Machine, and passing the #40 sieve shall be non-plastic (NP). The portion of the total sample passing the #40 sieve shall have a liquid limit of not more than 25, and plasticity index of not more than 6.

#### b. Chemical Analysis.

- (1) No specific chemical analysis is considered essential for the evaluation of granite, trap rocks, or quartzite type materials, provided the materials are defined by applicable method.

For carbonate materials, dolomitic limestone is defined as having a magnesium carbonate content of 28 to 36 percent. Those carbonate materials indicating magnesium carbonate values above 36 percent shall be defined dolomite. Carbonate material indicating magnesium carbonate values below 28 percent shall be defined as limestone. Chemical analysis will be used in selecting or evaluating plant sites. Magnesium carbonate content of carbonate materials shall be tested and defined in accordance with ASTM C 25.

- (2) The blending, stockpiling and other production handling operations shall be managed by the producer to minimize segregation of the finished product. Stockpiling operations shall minimize, as practical, breakage or excessive fall in stockpiling operations and movement of wheeled or tracked machines over stockpile material shall be limited. Processed ballast shall be washed and/or rescreened as necessary to remove fine particle contamination as defined by the specification.
- (3) The manufacturer shall ensure the fitness of the cars for loading of prepared materials, arranging to clean cars of deleterious materials, plug leaks, close doors, and other like operations as necessary.
- (4) TxDOT or its representative reserve the right to visit the producers facility during usual business hours unscheduled for the following purpose of examining the production facility and methods.
- (5) Prior to installation, the supplier should provide the Engineer with certified results of ballast quality and gradation as conducted by a testing laboratory acceptable to the Engineer. The supplier shall receive approval from the Engineer for the testing laboratory prior to performing tests.

**Table 2**  
**Ballast Gradations**

Square Opening	2-1/2"	2"	1-1/2"	1"	3/4"
% Passing (optimum)	100	95	60	10	0
% Passing (permissible.)	100	90-100	60-90	10 - 35	0 - 10

**O. Yard Track Ballast.**

Supply crushed stone ballast for use on yard tracks, AREMA Standard 5 Gradation to provide improved walkways and safety conditions along yard tracks.

**3. Equipment.**

All on-track equipment used in connection with the project shall comply with Federal Railroad Administration regulations contained in 49 CFR 214 Subpart D, Roadway Maintenance Machine Safety.

#### 4. Construction or Work Methods.

##### A. General Requirements.

1. Before starting work, the Contractor shall fully inform the Engineer of the construction methods he proposes to use, the adequacy of which shall be subject to the approval of the Engineer.
2. Concurrence on the part of the Engineer of any proposed construction methods or approval of equipment does not relieve the Contractor of the responsibility for the safety or correctness of the methods, the adequacy of his equipment or from carrying out the work in full accordance with the contract.
3. The following codes, regulations, reference standards, and specifications apply to work included in this section:
  - a. AREMA, Manual for Railway Engineering, Chapter 1 “Roadway and Ballast”, Chapter 4 “Rail” and Chapter 5 “Track”.
  - b. American Welding Society (AWS): D1.1
  - c. Applicable referenced ASTM Specifications
  - d. Track Safety Standards of the Federal Railroad Administration (FRA).
  - e. Standard drawings provided by the Engineer.
4. Any Items not covered specifically herein shall be in accordance with AREMA Standards and recommended practices subject to the approval of the Engineer. Construction must adhere to all TxDOT Standard Plans, Project Plans, and FRA requirements. Subballast construction methods must conform to TxDOT Standard Specification Item 247.
5. The following review/approval milestones will be monitored during the project:
  - a. **Grading.** Reviewed and approved prior to placement of subballast.
  - b. **Ballasted Trackwork.** Reviewed, approved and coordinate the track construction to assure compliance with TxDOT requirements.
  - c. **Welding.** All welds, including compromise welds shall conform to the requirements of AREMA Chapter 4 “Rail”, Part 2.3 “Specification for the Quality Assurance of Electric-Flash Butt Welding of Rail” and/or Part 2.5 “Specification for the Quality Assurance of Thermite Welding of Rail.”
6. All workers employed in the project or supervising the project shall have been certified according to Federal Railroad Administration regulations contained in 49 CFR 214, Subpart C, Roadway Worker Protection.

7. When the Contractor desires to occupy any space above the top of rail within the horizontal distance of 12 ft. either side of the centerline of any track, measured at right angles to the track centerline, it will be necessary that he obtain authority from the Railroad with at least 24 hr. advance notice. The authority will be requested and granted according to the Railroad operating rules, and the Contractor will fully comply with all instructions issued by the Railroad in regards to occupancy of the track. If, in the judgment of the Railroad, flagmen are required, they will be furnished at the Railroad's expense.
8. The Contractor shall require his employees, agents, or subcontractors to comply with any and all instructions or warnings of the Railroad's flagmen as to clearance for the passage of trains.
9. All scaffolding, materials, and equipment used in the Contractor's operations shall, at all times, be maintained at a clearance from the tracks as approved by the Engineer, except when working within the limits of authority granted to occupy the tracks.
10. TxDOT's acceptance of trackage and its appurtenances which have been built shall be based on the Engineer's written statement that construction and construction materials have met TxDOT standards.
11. Unless otherwise specified by the plans or directed by the Engineer, all removed materials shall become the property of the Contractor. All removed materials and debris must be removed from the railroad right of way and TxDOT property, and disposed of in a manner approved by the Engineer.
12. The Replacement of railroad ties, ballast distribution, surfacing work, and associated mechanical operations will be performed using standard on-track equipment. All work must be performed using on-track equipment except in designated materials storage area and mobilization areas where SW3P plans are in effect.
13. Off-track mobile equipment may only operate in designated materials storage areas or mobilization areas where SW3P plans are in effect.

**B. Trackwork.**

1. All ties shall be spaced uniformly at 19.5 inches center-to-center of ties (24 crossties per 39 feet of rail), and laid with heart side down, except when ties are not true.
2. Ties shall be placed and maintained square to the line of rail on straight track and radially on curves. The right-hand end of ties (direction determined by facing away from initial point of the line) shall be lined parallel with the rail.
3. Tie hooks, tongs or tie crane shall be used in handling ties, to avoid damage to the ties. New treated ties must not be adzed without authority from the Engineer.

If adzing is authorized, an approved preservative shall be applied to the adzed surface.

4. Tie plates must set squarely on the tie and shall be of the dimensions to fit the base of rail used. All track shall be fully tie plated and spiked in accordance with proper criteria. Tie plates shall be centered and have full bearing on ties. Rail shall be properly seated in the tie plates and not riding on the shoulder of the tie plate. Tie plates and rail shall be cleaned before being laid. Tie plates must be placed with slope of plate towards center of track.
5. All rail shall be gauged when laid. The standard gauge is 4 feet 8-1/2 inches between points 5/8 inch below the top of rail on the two inside edges of the rail. All gauges used by the Contractor will be checked by the Engineer. If found to be more than 1/16 inch in variance from the master gauge, those gauges shall immediately be removed from the job.
6. Track bolts, with nuts, which have wrench turn fittings, shall be used where required. Spring washers shall be the correct size to fit the bolt. All bolts will be tightened with an approved bolt machine or torque wrench to a torque of 650 foot-pounds. Bolting shall be started with the center bolts working toward the ends and all nuts shall be turned up tight with bolt heads staggered inside and outside of the rail alternately.
7. All track spikes are to be the proper size. Care shall be taken to make sure that the base of rail is not riding on the shoulder of the tie plate when spikes are driven. Spikes shall be started, driven vertically, and square when driven into the spike holes of the tie plate. Crooked or bent spikes shall be removed and replaced. Straightening with maul of spikes started crooked will not be permitted. When spikes are pulled, the hole shall be plugged with a standard treated tie plug. In driving the spikes, the last few blows of the hammers shall be such that the spike head will not be bent or broken, and the hammer shall not be permitted to strike directly upon the rail.
8. All rail shall be spiked to ties with not less than four spikes per tie, one spike in contact with gauge side and one in contact with field side of each rail. Spikes shall be staggered so that the outside spikes shall be on the same side of the tie and the inside spikes on the opposite side. Ties shall be spiked through the tie plates with two rail holding spikes in each tie plate on tangent track; the rail gauge side and rail field side spikes in each tie plate being driven diagonally across from each other.
9. Rail shall not be struck with maul or heavy tool when spiking, gauging or lining.
10. Immediately after completion of track surfacing, spikes shall be settled in place with the underside of the head of the spike contacting the top of base of rail with a minimum of pressure.
11. Tie plugs, where required, shall fill holes from which spikes are drawn. The plugs shall conform to the current AREMA Specifications for Tie Plugs, and are to be treated with a Creosote oil solution.

- 12.** Grip type rail anchors shall be applied by an approved rail anchor applicator machine and in the approved manner for the particular type of anchor furnished and as directed by the Engineer. Rail anchors shall be installed on every other tie after the ballast operation and the track is raised, lined and ties re-spaced. On ballast deck bridges and within 100 feet of a ballast deck bridge, all ties shall be fully box-anchored. Under no circumstances shall rail anchors be installed on ties under or immediately adjacent to rail joints, nor shall anchors be installed on one side of the tie under one rail and on the opposite side of the tie under the other rail.
- 13.** Care shall be taken to avoid overdriving or damaging anchors. Anchors shall not be driven along the rail. Sufficient rail anchors shall be applied and maintained to effectively control longitudinal rail movement. Anchors shall be installed on the same side(s) of the tie on both rails. Anchors must not be applied to one rail only, but must be applied to both rails in a uniform pattern. For continuously welded rail (CWR), anchors must not be applied on the opposite rail directly across from the joints or straps.
- 14.** Track shall be box anchored every other tie except within any turnout, curves greater than or equal to three (3) degrees, within 100 feet of any bridge or on any bridge where track shall be fully box anchored on every tie. Box anchoring is defined as installing opposing anchors to bear against each side of the tie on each rail for a total of four anchors per cross tie.
- 15.** When laying rail in tangent track, the right-hand rail (direction determined by facing away from initial point of line), shall be laid first and lined to the staked track alignment. After each right-hand rail is lined and spiked, the left-hand rail shall be laid to accurate gauge and spiked to gauge every third tie with gauge spikes fully driven (except through joint areas) before the track gauges are removed. The left hand rail shall be laid into the track, and rail joint bolts installed (if used) before spiking to gauge, and before gauge spikes are driven. The left-hand rail shall be held in place snugly against the track gauges with lining bars.
- 16.** When laying up to existing track tie-in locations, a combination of rails less than standard length may be used to avoid cutting, if practicable. Rail saws shall be used when necessary to cut rail. The use of a torch or track chisel will not be permitted. All necessary new bolt holes shall be marked, using an approved rail drilling template and the drilling operation shall be carefully performed. Both cutting and drilling shall utilize proper lubrication. Cut rails shall be drilled and fully bolted. There shall be no extra holes in the rail. The burred edges on bolt holes drilled in the field shall be carefully removed by grinding. When necessary to cut secondhand rail, the cut end shall be beveled. When necessary to cut new standard carbon rail, the cut end shall be end hardened and beveled in accordance with Railroad Specifications.
- 17.** When working with rail deliveries, the Contractor shall unload the materials as directed by the Engineer. The Contractor shall provide for the handling and laying of rail in such a manner as to avoid damage to the roadbed, sub-ballast and rail. Care must be taken to avoid twisting or damaging the rail sections.

In areas where new construction is adjacent to existing track, care must be taken to prevent damage to existing track from equipment operation and construction activities.

18. The Contractor shall provide such equipment, tools and materials as necessary and in common practice for welded rail track construction. It may be necessary for the Contractor to move the welded rail strings to the exact location of installation. The Contractor shall furnish such additional equipment and supplies as may be required to handle and place the CWR strings and the cost thereof included in the unit price for track construction.
19. When unloading CWR, joint straps shall be removed, rail ends by-passed when necessary and wooden blocks or shims shall be placed between rail ends to accommodate thermal expansion of rail. CWR must not be unloaded where it would obstruct a grade crossing and must either be cut or buried through it.
20. The desired laying temperature of the rail shall be determined by the Engineer. The Contractor shall record the temperature of each rail laid. Rail temperature measurements shall be taken on the base of rail on the side away from the sun.
21. When it is not possible to lay rail at the desired laying temperature, the Contractor shall make the necessary adjustment at a later date. The exact procedure used to adjust the rail temperature must be approved by the Engineer.
22. The Contractor should apply all rail anchors immediately behind the laying of rail. Ballast must be unloaded and all cribs filled as soon as rail anchors have been applied. The track should be surfaced and tamped as soon as possible after the laying of the rail.

### **C. Rail Joints.**

1. Rail not in CWR locations shall be staggered according to the direction of the Engineer, except when balancing the joints for switch leads, road crossings, bridge ends and signal circuits, as well as in secondary tracks where use of prefabricated track panels is authorized. To reduce the resonant reaction, rail joints shall be staggered at 12 feet from the nearest joint on the opposite rail. To avoid unnecessary rail cutting in providing staggered joints, a two-foot tolerance will be permitted in either direction. When laying rail, joints must not be located in road crossings, bridge decks, or on ends of bridges.
2. At the time rail is being laid, joint bars shall be applied, placing one bolt at each end of rail in the joint bar. Before the bolts are tightened, and after the track has been surfaced and lined, the joint bars shall be removed and the joint bars as well as the rail ends within the limits of the joint bar area shall be thoroughly cleaned with a wire brush to remove all rust, dirt and mill scale. The contact surface of the joint bars shall then be lubricated using a liberal amount of lubricant as approved by the Engineer. After application of lubricant, the joint bars are to be reapplied; taking care to see that no dirt, gravel or other foreign material is permitted to get into the lubricated area.

3. Rail expansion shims must be used to establish the proper opening between rails. Expansion shims must not be used at the ends of strings when laying CWR.
4. Bond wires that are broken or damaged during rail replacement, tie replacement, surfacing, or other contractor operations will be replaced by the contractor.
5. At joints, the opening between rail ends must be as shown in the following table:

For 39 ft Rail:

Rail Temperature	Opening
Below 25° F	½"
51° F to 75° F	1/8"
Above 75° F	1/8" every other joint

For 78 ft Rail:

Rail Temperature	Opening
Below 25° F	½"
25° F to 50° F	3/8"
51° F to 75° F	1/4"
75° F to 100° F	1/8"
Above 100° F	1/8" every other joint

6. Rail thermometers of the approved type must be used to determine the rail temperature.
7. The application of lubricants and general maintenance of rail joints in jointed-rail territory are necessary to ensure that the rail is working properly to accommodate rail expansion and contraction resulting from temperature variations, and prevent the occurrence of track buckles or sun kinks and pull-aparts. Joint bars and rail ends must be cleaned and lubricated with an approved joint lubricant when installing joint bars.
8. When laying new or second hand jointed rail, or constructing new track using jointed rail, the contact surface of the rail ends and joint bars shall be lubricated using a liberal amount of approved lubricant.
9. To maintain free rail movement in existing joint rail territory, joint area must be thoroughly lubricated along all marring surfaces and into the interior of the bars, using a Hudson sprayer or equivalent.

Frozen joint conditions shall be corrected by loosening the bolts and breaking the bars free from the rail to permit proper oiling and ensure free rail movement within the joint.

10. Where joint bars are required, the joint bars must be installed with the full number of bolts and the nuts tightened to the proper tension. Joint bars shall be either 4-hole, 24 in. or 6-hole, 36 in. joint bars fully bolted with lock washers; elliptically punched for oval necked bolts. Bolts shall be inserted into the joint bars from alternating sides of the rail, seated in the elliptical bolt holes, so that bolt heads are located next to the nut of the bolt in the adjoining bolt hole. Rail joints shall be applied so that bars are not cocked between base and head of rail. Bars are to be properly seated in rail.
11. Where the running surface of rails at joints are mismatched by more than one eighth (1/8) inch, the Contractor shall build up, grind and profile the rail according to the Engineer's instructions. A rail of more section shall not be ground down to match the lesser, but the lesser built up.

#### **D. Compromise Joints.**

1. At permanent connections of different rail sections, compromise joints or compromise welds shall be used, and where practicable they shall not be located in crossings, main track curves, on open deck bridges, or in turnouts.
2. Compromise Joints are required at all locations between the ends of rail of different weights or cross section. The Contractor shall install all compromise joints as directed by the Engineer. Installation of compromise joints shall be considered incidental to track laying and no separate payment made therefore. Compromise joints shall not be placed within the limits of turnouts.

#### **E. Joint Bars.**

1. Joint bars that are removed shall be reapplied to the rail, unless broken. Joint bars shall be either 4-hole, 24 in. or 6-hole, 36 in. joint bars fully bolted with lock washers; elliptically punched for oval necked bolts. Bolts shall be inserted into the joint bars from alternating sides of the rail, seated in the elliptical bolt holes, so that bolt heads are located next to the nut of the bolt in the adjoining bolt hole. Rail joints shall be applied so that bars are not cocked between base and head of rail. Bars are to be properly seated in rail. All cracked or broken joint bars shall be replaced and held for the Engineer's inspection.
2. The application of lubricants and general maintenance of rail joints in jointed-rail territory are necessary to ensure that the rail is working properly to accommodate rail expansion and contraction resulting from temperature variations, and prevent the occurrence of track buckles or sun kinks and pull-aparts. Joint bars and rail ends must be cleaned and lubricated with an approved joint lubricant when installing joint bars. Joints must be installed with the full number of bolts and the nuts tightened to the proper tension.

3. When laying new or second hand jointed rail, or constructing new track using jointed rail, the contact surface of the rail ends and joint bars shall be lubricated using a liberal amount of approved lubricant.
4. To maintain free rail movement in existing joint rail territory, joint area must be thoroughly lubricated along all marring surfaces and into the interior of the bars, using a Hudson sprayer or equivalent. Frozen joint conditions shall be corrected by loosening the bolts and breaking the bars free from the rail to permit proper oiling and ensure free rail movement within the joint.

**F. Ballasting and Surfacing.**

1. Furnishing, delivery and unloading of ballast to project site is the Contractor's responsibility. Care must be taken to insure that track and walkways are safe for movement.
2. Haul and place ballast material in such a way that damage to adjacent areas is avoided.
3. Ballast shall be uniformly distributed and the track raised, lined, surfaced, and tamped, with the finished surface of the ballast dressed in accordance with the approved drawings or the Engineer's instructions.
4. The track shall be laid and connected before ballast is spread and raised. It will not be permissible to operate over long stretches of track before it has been raised and surfaced unless approved by the Engineer. Immediately prior to unloading ballast for the final raise, the track shall be lined as close as practical to the stakes and all ties straightened and re-spaced as necessary. Ballast shall then be spread evenly and leveled to the required section, taking care to assure that subgrade material is not intermixed with the ballast.
5. Ballast shall be spread and the track raised in a series of lifts to the approved elevation. No single lift shall be higher than 4 inches. In raising track, if jacks or mechanical tampers are used they shall be so regulated as to avoid the binding or straining of joints. Sufficient sets of track jacks, if used, shall be simultaneously used and properly spaced to avoid sharp breaks or bends in the rail when the track is raised. Both rails shall be raised simultaneously and to proper cross level by utilizing standard track level boards with each set of track raising jacks (minimum three insertions).
6. Tamping is to be done by machines approved by the Engineer, in a manner that will produce uniform compaction. Tamping must not disturb subgrade/subballast. Thorough tamping under the rail set is required, and joint ties shall be tamped especially firm.
7. Tamping will not be permitted at the middle of a tie. Both ends of a tie shall be tamped simultaneously and tamping inside and outside the rail shall be done at the same time.

All ties that are pulled loose in the track raising operation shall be placed in their proper position and properly tie-plated and fully spiked before tamping. The track shall be true to line and grade as staked with tangent track level transversely.

8. During each track raise, the track is to be tamped in such a manner that it will be uniform. During the raising and tamping operations, sufficient spot boards, track level boards or other approved surfacing devices shall be constantly used to insure the correct surface and cross level in the track after tamping work is completed.
9. After ballasting is completed and the track is in correct gauge, surfaced and lined according to the stakes, the ballast shall be trimmed neatly to the section shown on the drawings, and any surplus material shall be spread evenly along the slopes of the ballast section. Dressing of the ballast by placing earth higher than the ballast toe and thus preventing proper drainage will not be permitted.
10. Bring the initial layer of compacted ballast to an elevation that will establish the track surface no higher than 2 inches below final base of rail grade. Refer to plans and cross sections for ballast depth and base of rail grades.
11. Ballast shall be inserted under ties in minimum 2-1/2 inch, maximum 4 inch lifts. Cribs shall be filled with ballast to the top of tie.
12. Do not perform track surfacing unless the cribs are filled with ballast.
13. Special care must be taken when surfacing during hot weather in order to avoid track buckles.
14. Perform track surfacing by an approved method which prevents undue bending of the rail or straining of the joints.
15. Both rails shall be raised at one time and as uniformly as possible.
16. Ties that have been pulled loose shall be replaced to proper position and shall be fully tamped to proper elevation.
17. Ballast shall be kept clean and free of segregation during handling and placing operations.
18. Ballast to be thoroughly tamped from each tie end to 15 inches outside and inside of rail. Centers are to be filled but not tamped.
19. Tamping tools shall be inserted simultaneously on opposite sides of the same tie to prevent the tie from cocking, to insure that the ballast under the tie is completely compacted and that the rail is firmly seated on the tie plate.
20. When using power tampers in tandem, the machines should be of the same type and have identical tamping heads to produce uniform compaction.
21. Track shall be constructed to the alignment and grade prescribed by the plans. Deviation from established gauge and cross level shall not exceed 1/4 inch; deviation from profile grade and horizontal alignment shall not exceed 1/4 inch in 50 feet. All work shall be acceptable to the Engineer.

22. Tangent track shall be cross level.
23. No humps or sags will be accepted nor will irregularities in alignment, either on tangent or curved track, that exceed previously defined deviations.
24. Maximum allowable adjustment in line after final resurfacing is 2 inches.
25. Top of track ballast shall be dressed parallel with top of ties, extending a minimum 9 inches beyond the end of tie, then on three to one slope to subballast. Not less than three insertions of tamping tools shall be made.
26. Before final acceptance, all track shall be surfaced and accurately lined to remove all irregularities of cross level, surface or line caused by settlement or compaction of ballast following traffic loading. Any ties not giving full support to rails shall be retamped. Bolts shall be retightened, if necessary, to bring to full tension and spikes set down to full rail contact.
27. TxDOT's acceptance of trackage and its appurtenances which have been built shall be based on the Engineer's written statement that construction and construction materials have met TxDOT standards, Special Specifications, and Plans.

#### **G. Field Rail Welding.**

1. Clean the rails to be free of grease, oil, dirt, loose scale, and moisture to a minimum of six inches back from the rail ends, including the rail end surfaces, by use of a wire brush. Align the faces of the rail ends. Rail ends to show no steel defects, dents, or porosity before welding.
2. If rail must be cut to length for any reason, cut it square and clean by means of rail saws or abrasive cutting wheels in accordance with AREMA, "Specifications for Steel Rails."
3. Straighten rail not meeting the requirements of AREMA, "Specifications For Fabrication of Continuous Welded Rail", to be within the specified tolerance. If any rail cannot be straightened, cut it back a sufficient distance to achieve the required alignment. Perform all straightening or cutting prior to welding.
4. Align and properly gap the ends of the rails to be welded to produce a weld which conforms to the alignment tolerances specified. Hold the rail gap and alignment during field welding without change during the complete welding cycle. Align rail on the head of the rail. Vertical alignment shall provide for a flat running surface. Horizontal alignment shall be in such a manner that any difference in the width of heads of rails occurs on the field side. Horizontal offsets shall not exceed 0.040 inch in the head and 0.125 inch in the base.
5. Surface misalignment tolerance shall conform to the following:
  - a. Combined Vertical Offset and Crown Camber. Not to exceed 0.080 inch per foot at 600 degrees Fahrenheit or less. No dip camber shall be allowed.

- b.** Gauge Misalignment Tolerance. Combined horizontal offset and horizontal kink camber not to exceed 0.080 inch per foot at 600 degrees Fahrenheit or less.
- 6.** All rails for electric-flash butt welds shall have the scale removed down to the bright metal in those end zones, top and bottom of the rails where the welding current-carrying electrodes contact on head and base of rail.
- 7.** All electric-flash butt welds shall be forged to point of refusal to further plastic deformation and have a minimum upset of 1/2 inch, with 5/8 inch as standard. If flashing on electric-flash butt welds is interrupted because of malfunction or external reason, with less than 1/2 inch of flashing distance remaining before upsetting, rails shall be reclamped in the machine and flashing initiated again.
- 8.** Rails for preheated rail welds shall be cleaned 2 inches on each side of the weld, to remove scale and rust using a power actuated grinder, with abrasive wheel. Rail ends shall be preheated prior to welding to at least the temperature designed by the welding manufacturer and for a sufficient time to ensure full fusion of the weld metal to the rail ends without cracking of the rail or weld.
- 9.** Inspect each weld using a 3 foot straightedge along the centerline of the rail and 0.625 inch below top of rail on the gauge side of the rail head. Center the straightedge over the weld. The gap between the straightedge and the rail to comply with the requirements of AREMA, Chapter 4 Governing the Inspection, Grinding and Heat Treating of Track Components.
- 10.** Bring rails and joints in the finished track to a true surface and alignment by means of an approved grinding machine. If end bolt hole is drilled in the rail to be welded, the minimum allowable distance from end of rail to edge of end bolt hole is 6”.
- 11.** Finish the completed weld by grinding to conform with the following requirements:
  - a.** Rail head surface and sides shall be finished ground to a smooth and uniform surface.
  - b.** The web zone (underside of head, web, top of base, both fillets each side) shall be finished to not greater than 1/8 inch of parent contour or closer, but shall not be deeper than parent section. Finishing shall eliminate all cracks.
  - c.** All notches created by offset conditions or twisted rails shall be eliminated by grinding to blend the variations.
  - d.** All fins on the weld due to shearing drag shall be removed prior to final inspection.
  - e.** All heavy grinding shall be performed on the hot metal, immediately following welding, by an approved rail grinder, to prevent metallurgical damage. Finish grinding shall be carried out in a cooled down condition. Use a straightedge frequently while grinding to make sure that a good straight surface is produced.

If a hard grinder must be used, extra care must be taken to insure a smooth running surface without low spots. Any grinding of the web and base of the weld should be done while the web is at least 450 degrees Fahrenheit.

- f. Jagged, notched or badly mismatched end faces shall be preflashed to an even or mated condition before setting up rails for preheating and final flashing to assure that the entire surfaces of the rail ends are uniformly flashing immediately preceding upsetting.
12. Test all welds at the time of welding and ultrasonically test both the welds and the rail once the rails have been laid in final position. Ultrasonically inspect welds in accordance with ASTM E164 and the AWS D1.1. Use ultrasonic test equipment capable of detecting a 3/64 inch discontinuity, 6-1/2 inches below the top of rail.
13. At a minimum, scan the weld from the top and both sides of the rail head and the base. Scan the weld from both sides on the face for longitudinal and transverse discontinuities using the applicable scanning pattern or patterns. Use equipment which has a distance amplitude correction feature. Calibrate the equipment daily using an 11 W calibration block, also made of rail steel.
14. Inspection Personnel: Qualify all inspection personnel in accordance with AWS D1.1. Cut out and re-weld all welds giving fault indication in ultrasonic inspection.

#### **H. Turnouts.**

1. Turnouts shall be constructed in strict conformity with the shop drawings, plans, and the Engineer's instructions.
2. The switch stands shall be fastened securely to head blocks and shall be square with the track. The targets shall be lined parallel with the rails of the major track when the switch is lined for the major track. All switch ties shall be fully tie plated.
3. Stock rails for turnouts shall be bent accurately and shall not be sprung into place. All frogs, with the exception of self-guarded frogs, shall be protected by guardrails installed in accordance with the standard plans before any train is allowed to pass over them.
4. Turnouts shall also include switchman walkways.
5. Turnouts shall have all special switch plates, frog and guard rail plates fully spiked. Spiking standards shall be per the approved shop drawings, plans, Special Specification, and the Engineer's instructions.
6. Panel turnouts shall be constructed in conformity with the approved shop drawings, plans, the Engineer's instructions, and these specifications. Care shall be taken in unloading or moving the panel sections so as not to skew or bend the sections or cause damage to the prepared subgrade. The Contractor shall adjust anchors, ties, spikes, switch plates, braces, etc., as necessary to conform to the standard plan.

7. Where required, derails shall be installed in conformity with the plans, specifications, and/or instructions, and shall be inspected and approved by the Engineer before final acceptance and operation over the track.

**I. Removing Ballasted Track and Turnouts.**

1. After designated sections of ballasted track and turnouts are no longer needed to carry traffic they shall be disconnected from the rail line and all salvageable materials shall be removed.
2. Fill in ditches, except as needed for drainage and scarify abandoned trackbed and/or plow so as to mix it with soil to the satisfaction of the Engineer. The entire area of the removed ballasted track and turnouts shall be smoothed by blading or other methods.

**J. Salvaging.** Unless otherwise specified, all removed materials shall become the property of the contractor.

**K. Vehicular Grade Crossing.**

1. When preparing to work in vehicular grade crossings, the contractor shall notify the owner of a private crossing of the work to be done at least twenty-four (24) hours in advance of the proposed work. The contractor shall notify the city, county, or state road authority of crossing work to be done on publicly owned roads at least twenty-four (24) hours in advance of the proposed work. The contractor shall coordinate with the private crossing owner or the road authority regarding the type of work to be performed and the time the crossing will be blocked or closed. Private crossings shall only be closed for one day. Public crossings may be closed for more than one day if appropriate detours are arranged with the responsible road authority.
2. When crossties are replaced within vehicular grade crossings, finished crossings shall be constructed to the lines and grades indicated on the plans or as directed by the Engineer. Grade crossing surfaces shall be replaced as shown in the plans or as directed by the Engineer.
3. Verify that the track has been installed in accordance with the specifications and approved for alignment and profile by the Engineer.
4. Temporary crossing surfaces shall be constructed where necessary as directed by the Engineer.
5. Verify that cross-ties are of correct length, position and spacing. Correct any deficiencies before proceeding with grade crossing installation.
6. Each cross-tie in vehicular grade crossings shall be plated and double-spiked with 4 rail holding spikes per tie plate.
7. Each cross-tie in vehicular grade crossings shall be fully box-anchored.

8. Install filter fabric and perforated pipe extending to the indicated limits shown in accordance with the manufacturer's instructions when required by the state or local road authority or when directed by the Engineer. Filter fabric shall meet the requirements of Departmental Material Specification DMS-6200 "Filter Fabric".
9. Protect filter fabrics from puncture throughout construction.
10. Rail shall be replaced within all vehicular grade crossings included in the project as shown in the plans. Joints in replacement rail within the crossing shall be welded and joints in rail at crossing approaches shall be welded within 15 feet of the crossing.
11. All welds within the crossing surface shall be ground flush on all sides of the rail except on the bottom of the base.
12. Fouled ballast materials shall be removed for a minimum distance of 20 feet from the ends of the crossing. The crossing and approaches shall be raised within specifications to allow drainage away from the crossing.
13. The track must be properly lined, tamped, compacted, spiked, broomed and anchored before any crossing material is installed.

## **5. Measurement.**

- A. Rail installed will be measured by the linear foot for removal and installation as one unit, including necessary welding materials, welds, weld tests, joint bars, compromise bars, anchors, spikes, bolts, nuts, and any other materials necessary for the rail installation complete in place.
- B. Switch Point Replaced will be measured by each switch point set removed and replaced as one unit, including necessary welding materials, welds, weld tests, joint bars, compromise bars, anchors, spikes, bolts, nuts, blocks, securements, and any other materials necessary for the rail installation complete in place.
- C. Ballasted Track Turnout removal and installation will be measured by each turnout removed and replaced as one unit, including rail, frogs, guard rails, switch stands, connecting rods, plates, switch ties, cross ties, securements, and all other materials used in construction of turnouts and switch mechanisms, complete in place.
- D. Tie Removal and Replacement will be measured jointly by each individual tie removed and replaced as one unit.
- E. Switch Tie Removal and Replacement will be measured jointly by each individual switch tie removed and replaced (not included in a turnout replacement) as one unit and specified by length.
- F. Ballast Delivery and Regulating will be measured by the ton, complete in place.
- G. Yard Track Ballast Delivery and Regulating will be measured by the ton, complete in place.
- H. Ballasted Track Surfacing and Alignment will be measured jointly by the mile.

- I. Timber Vehicular Grade Crossing will be measured by the linear foot for installation and removal, including all ties, rail, ballast, sub-ballast, spikes, joints, bolts, securement, filter fabrics, drains, temporary crossing materials, etc., complete in place.
- J. Concrete Vehicular Grade Crossing will be measured by the linear foot for installation and removal, including all ties, rail, spikes, joints, bolts, securement, filter fabrics, drains, etc., complete in place.

**6. Payment.**

The work performed and material furnished by this Item and measured as provided under "Measurement" will be paid for as follows:

- A. Payment for "Rail Replacement" will be made at the unit price bid for "Rail Replacement. This price shall be full compensation for transportation; storage; all fasteners, plates, spikes, joints, bolts, welds; and for all other materials, tools equipment, labor and incidentals necessary to complete the work.
- B. Payment for "Switch Point Replacement" will be made at the unit price bid for "Switch Point Replacement". This price shall be full compensation for transportation; storage; all fasteners, plates, spikes, joints, bolts, welds; and for all other materials, tools equipment, labor and incidentals necessary to complete the work.
- C. Payment for turnouts will be at the unit price bid for "Ballasted Track Turnout Removal and Replacement". This price shall be full compensation for all furnishing, transportation, installing and removing of all rail, switch points, connecting rods, plates, bolts, securements, switch mechanisms, signs, heel blocks, crossties, switch ties, head block ties, bolts, washers, nuts, and any and all other materials, tools, equipment, labor, and incidentals necessary to complete the work and construction and removal of the turnouts.
- D. Payment for tie replacement will be made at the unit price bid for "Tie Removal and Replacement". This price shall be full compensation for transportation; storage; removal of defective ties, installation of all track work materials including replacement ties, securement, anchors, joint bars, all track work on bridges, track work at vehicular grade crossings; and for the removal of all materials used in Ballasted Track Construction and for all other materials, tools, equipment and incidentals necessary to complete the work.
- E. Payment for switch tie replacement will be made at the unit price bid for "Switch Tie Removal and Replacement" by specified length. This price shall be full compensation for transportation; storage; removal of defective switch ties, installation of all track work materials including replacement ties, securement, anchors, joint bars, all track work on bridges, track work at vehicular grade crossings; and for the removal of all materials used in Ballasted Track Rehabilitation and for all other materials, tools, equipment and incidentals necessary to complete the work.
- F. Payment for Ballast Delivery and Regulating will be made at the unit price bid for "Ballast Delivery and Regulating". This price shall be full compensation for transportation; storage; installation of materials including placing ballast; for regulating ballast to final grade and cross section; for the removal of all materials used in Ballast

Delivery and for all other materials, tools, equipment and incidentals necessary to complete the work.

- G.** Payment for Yard Track Ballast Delivery and Regulating will be made at the unit price bid for "Yard Track Ballast Delivery and Regulating". This price shall be full compensation for transportation; storage; installation of materials including placing ballast; for regulating ballast to final grade and cross section; for the removal of all materials used in Yard Track Ballast Delivery and for all other materials, tools, equipment and incidentals necessary to complete the work.
- H.** Payment for "Ballasted Track Surfacing and Alignment" will be made at the unit price bid for "Ballasted Track Surfacing and Alignment". This price shall be full compensation for transportation; storage; tamping and raising track to final grade and alignment, and for the removal of all materials used in Ballasted Track Surfacing and Alignment and for all other materials, tools, equipment and incidentals necessary to complete the work.
- I.** Payment for Timber Vehicular Grade Crossing will be made at the unit price bid for "Timber Vehicular Grade Crossing". This price shall be full compensation for all temporary crossing materials, crossing materials, filter fabric, underdrains, fasteners; for the removal of the existing crossing materials, filter fabric, underdrains, fasteners; for all ties, rail, ballast, sub-ballast, plates, spikes, joints, bolts, welding; and for all other materials, tools, equipment, labor and incidentals necessary to complete the work.
- J.** Payment for Concrete Vehicular Grade Crossing will be made at the unit price bid for "Concrete Vehicular Grade Crossing". This price shall be full compensation for all crossing materials, filter fabric, underdrains, fasteners; for the removal of the existing crossing materials, filter fabric, underdrains, fasteners; for all ties, rail, ballast, sub-ballast, plates, spikes, joints, bolts, welding; and for all other materials, tools, equipment, labor and incidentals necessary to complete the work.