Special Specification 4145
Ballasted Track Construction and Rehabilitation

1. DESCRIPTION

Furnish the construction of railroad track and the rehabilitation of existing track in accordance with this specification, project plans, and the American Railway Engineering and Maintenance of Way Association's (AREMA) "Manual for Railway Engineering." Track construction includes, but is not limited to, placing ballast, distributing and lining ties, installing and field welding running rail, installing jointed rail, installing turnouts and switches, rehabilitating existing ties and rail, raising and lining track, installing vehicular grade crossings and other incidentals as specified. Track on ballasted and open deck bridges is also included.

2. MATERIALS

2.1. General

2.1.1. Use new material conforming to this specification unless otherwise designated in the plans or as approved by the Engineer. New material must be free from defects, rust, or damage and conform to the requirements of AREMA standards unless otherwise shown on the plans, these specifications, or as required by the Engineer. Provide new material in an unblemished condition, free from defects, rust, or damage.

2.1.2. Where second hand material is permitted by the plans or approved by the Engineer, the second hand material must be in good condition and conform to AREMA Standards unless otherwise shown on the plans or approved by the Engineer. Second hand material must be straight and true, in good condition, and free from excess rust, pits, or wear. Test second hand rail for head wear, corrosion, base wear, sweeps, kinks, cracking, delamination, or any other defect including internal metal defects. Ensure the material meets the appropriate specifications indicated below.

2.2. Rail

2.2.1. Use Type RE 115, 119, 132, or 136 lb. Standard Strength Rail supplied by the Contractor and conforming to the requirements of AREMA Chapter 4 "Rail" for constructing track and replacing rail unless otherwise required as shown on the plans. Rail on curves greater than 1° 30' must be head hardened rail. For jointed rail or field-welded rail, furnish rail as show on the plans or in lengths of 39 ft. with 11% shorts varying by 1 ft. increments from 38 ft. down to 25 ft. in length, if lengths are not otherwise specified.

2.2.2. The Contractor will furnish the necessary joint bars, anchors, spikes, bolts, nuts, securements, welding, 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 welding or the 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.

2.2.3. Submit to the Engineer five (5) copies of a layout showing the proposed rail types, continuous welded rail (CWR) lengths, and field welds for approval before track construction. Designate on the track layouts the size of transition rail, compromise rail, and compromise joints as shown on the plans or as necessary at locations where the proposed rail joins with existing rail. Field verify the sizes of required transition rail, compromise rail, and compromise joints then submit a detailed list of the sizes and locations to the Engineer before to beginning track construction.

2.2.4. Furnish reports of the chemical and mechanical test results to the Engineer. For continuously welded rail (CWR), provide continuous shop welded rail when specified by the plans and transport it, excluding rail for industry leads, in 80 ft., 400 ft., or longer than 400 ft. sections to the project site unless shorter sections are required due to curve length, or fit between switches. Meet the requirements of AREMA Manual, Chapter 4, "Specifications for Fabrication of Continuous Welded Rail" (electric flash butt welds) for shop welding. Joints must be field welded using the Thermite welding process between the sections.

2.3. Compromise Rail and Transition Rail.

2.3.1. Use Type RE 90, 112, 115, or 119 lb. Standard Strength Rail conforming to the requirements of AREMA Chapter 4 "Rail" "Class 1" unless otherwise required as shown on the plans for "compromise" or "transition" sections to connect replacement rail sections with existing rail sections of dissimilar size.

2.4. Switch Points.

2.4.1. Use Type RE 90, 112, 119, 115, or 136 lb. Standard Strength Rail conforming to the requirements of AREMA Chapter 4 "Rail" and matching the existing rail type unless otherwise required or as shown on the plans for installing or replacing switch points. Switch points must be replaced on both sides as shown 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.

2.5. Turnouts.

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

2.6. Track Crossties.

2.6.1. Track crossties must conform to the current AREMA Specifications, Chapter 30, "Ties." The track crossties must be new Oak, Douglas Fir, or Mixed Hardwood Wood ties, 7 in. x 9 in. x 8 ft. 6 in. minimum AREMA-7 inch Grade or as shown on the plans.

2.6.2. Bridge crossties must conform to the current AREMA Specifications, Chapter 30, "Ties." The bridge crossties must be new Oak, Douglas Fir, or Mixed Hardwood Wood ties, 7 in. x 9 in. x 9 ft. minimum AREMA-7 inch Grade or as shown on the plans.

2.6.3. Ties under grade crossing panels must be of new Oak, Douglas Fir, or Mixed Hardwood ties, 7 in. x 9 in. x 10 ft. minimum AREMA-7 inch Grade.

2.6.4. Crossties must be treated according to the American Wood Preservers Association Standards, based on 50% creosote and 50% coal tar solution with a minimum preservative retention of 8 pcf of Wood. Treatment must conform to AREMA Manual Chapter 3, Parts 6, 7, 8, and 9 for applicable timber species. Treat field cuts or drilled holes with a compatible preservative before installing, spiking, or bolting. No boultonizing of ties will be permitted.

2.6.5. Crossties must be seasoned, dimensioned and prebored before 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 must be fitted with anti-splitting devices, regardless of their tendency to split.

2.6.6. Ties must 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 must be furnished to the Engineer. Ties may be rejected for excessive checking, warp, twist, or other defects as determined by the Engineer.

2.7. Switch Ties.

2.7.1. Switch ties must conform to the current AREMA Specifications, Chapter 30, “Timber Switch Ties.” The track crossties must be new Oak, Douglas Fir, or Mixed Hardwood Wood ties, AREMA-7 inch Grade. Switch ties must be 7 in. x 9 in. x the length shown on the plans and necessary for installation at the location indicated by the Engineer.

2.7.2. Switch ties must be treated according to the American Wood Preservers Association Standards, based on 50% creosote and 50% coal tar solution with a minimum preservative retention of 8 pcf of Wood. No boultonizing of switch ties will be permitted.

2.7.3. Switch ties must be seasoned, dimensioned and prebored before 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 must be fitted with anti-splitting devices, regardless of their tendency to split.

2.7.4. Switch ties must 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 must be furnished to the Engineer.

2.8. Tie Plates.

2.8.1. Hot worked, high carbon, double shoulder, flat bottom tie plates must conform to the AREMA specifications, Chapter 5, “Track,” with punched A-8 square spike holes. Where necessary on curves, use 16 in. tie plates in accordance with AREMA specifications, Chapter 5, “Track.”

2.9. Track Spikes and Coach Screws.

2.9.1. Supply new high carbon steel track spikes and coach screws 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 sections 4.2.7. through 4.2.14 of this Special Specification, and Federal Railroad Administration (FRA) Standards.

2.10. Joint Bars and Track Bolts.

2.10.1. Use joint bars, track bolts, nuts, and washers 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 or transition rails must be used in lieu of compromise joint bars when joining rails of different sizes and/or sections as specified in section 4.4 of this specification.

2.11. Rail Anchors.

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

2.12. Derails.

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

2.13. Guard rails.

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

2.14. Subballast.

2.14.1. Subballast must consist of a foundation coarse for a typical railroad roadbed and must 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%, by the Los Angeles abrasion test. A higher or lower percentage of wear may be specified by the Engineer, depending on the material available. Submit Certificates of Compliance for all ballast materials furnished under this contract for review and approval by the Engineer before transporting ballast to the Job Site.

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

Table1
Subballast Gradations

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

2.15. Ballast.

2.15.1. 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 before transporting ballast to the Job Site.

2.15.2. Ballast Classifications. Ballast must 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.

2.15.2.1. Granite.

Granite is a plutonic rock having an even texture and consisting primarily of feldspar and quartz.

2.15.2.2. Trap Rock.

Trap rock is any dark-colored, fine-grained non-granitic hypabyssal or extrusive rock.

2.15.2.3. Quartzite.

Quartzite is a granoblastic, metamorphic rock consisting mainly of quartz and formed by recrystallization of 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.

2.15.2.4. Carbonate Rocks.

Carbonate rocks are sedimentary rocks consisting primarily of carbonite materials such as limestone and dolomite.

2.15.2.5. Slags.

Slags are materials formed during the metal-making process by fusion fluxstones, coke and other metallic particles.

2.15.3. Property Requirements.

2.15.3.1. Physical Analysis.

2.15.3.1.1. Method of Sampling. Secure field samples in accordance with ASTM D-75. Reduce test samples from field samples in accordance with ASTM C 702.

2.15.3.1.2. Sieve Analysis. Perform sieve analysis in accordance with ASTM C 136. All sieve analyses require wet sieving.

2.15.3.1.3. Material Finer than No. 200 Sieve. Test material finer than a No. 200 Sieve in accordance with ASTM C 117.

2.15.3.1.4. Bulk Specific Gravity and Absorption. Determine bulk specific gravity and percentage of absorption in accordance with ASTM C 127. Specific gravity must conform to AREMA standards at 2.6 minimum.

2.15.3.1.5. Percentage of Clay Lumps and Friable Particles. Determine percentage of clay lumps and friable particles in accordance with ASTM C 142.535 as follows: test materials having gradations containing particles retained on the 1 in. sieve by ASTM C 535, test materials having gradations of 100% passing the 1 in. sieve by ASTM C 131.

2.15.3.1.6. Sodium Sulfate Soundness. Sodium sulfate soundness tests must be made in accordance with ASTM C 88.

2.15.3.1.7. Unit Weight. The weight per cubic foot must be determined in accordance with ASTM C 29.

2.15.3.1.8. Percentage of Flat and/or Elongated Particles. Percent of flat and/or elongated particles must be determined in accordance with U.S. Army Corps of Engineers Test CRD-C-119.

2.15.3.1.9. Plasticity Index. The plastic limit, liquid limit and plasticity index must be determined in accordance with ASTM D 423 and D 424. Each sample must be tested in two ways; one test must test the fines generated by the Los Angeles Machine, and the other test must test the fines contained in the total sample. The portions of these samples generated by the Los Angeles Machine, and passing the #40 sieve must be non-plastic (NP). The portion of the total sample passing the #40 sieve must have a liquid limit of not more than 25, and plasticity index of not more than 6.

2.15.3.2. Chemical Analysis.

2.15.3.2.1. 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%. Those carbonate materials indicating magnesium carbonate values above 36% must be defined dolomite. Carbonate material indicating magnesium carbonate values below 28% must be defined as limestone. Chemical analysis will be used in selecting or evaluating plant sites. Magnesium carbonate content of carbonate materials must be tested and defined in accordance with ASTM C 25.

2.15.3.2.2. The blending, stockpiling and other production handling operations must be managed by the producer to minimize segregation of the finished product. Stockpiling operations must minimize, as practical, breakage or excessive fall in stockpiling operations and movement of wheeled or tracked machines over stockpile material must be limited. Processed ballast must be washed and/or rescreened as necessary to remove fine particle contamination as defined by the specification.

2.15.3.2.3. The manufacturer must 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.

2.15.3.2.4. TxDOT or its representative reserve the right to visit the producer's facility during usual business hours unscheduled for the following purpose of examining the production facility and methods.

2.15.3.2.5. The supplier must receive approval from the Engineer for the testing laboratory before performing tests. Before installation, the supplier should provide the Engineer with certified results of ballast quality and gradation (refer to Table 2 for acceptable percentages) as conducted by a testing laboratory acceptable to the Engineer.

Table 2
Ballast Gradations

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

2.16. Vehicular Grade Crossing Materials.

2.16.1. Supply vehicular grade crossing materials as required by the Plans, Special Specifications, or as directed. Materials must meet the requirements stated in Plans, TxDOT Standard Specifications, and this Special Specification.

2.16.2. Vehicular grade crossings must be constructed as required by the Plans and Special Specifications or as directed.

2.16.3. Vehicular grade crossings intersecting publicly owned or maintained roadways must be of either wood panel or concrete panel construction.

3. EQUIPMENT

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

4. CONSTRUCTION

4.1. General Requirements.

4.1.1. Before starting work, the Contractor must fully inform the Engineer of the construction methods he proposes to use, the adequacy of which are subject to the approval of the Engineer.

4.1.2. 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.

4.1.3. The following codes, regulations, reference standards, and specifications apply to work included in this section:

- AREMA, Manual for Railway Engineering, Chapter 1 "Roadway and Ballast," Chapter 4 "Rail" and Chapter 5 "Track"
- American Welding Society (AWS): D1.1

- Applicable referenced ASTM Specifications
- Track Safety Standards of the Federal Railroad Administration (FRA).
- Standard drawings provided by the Engineer

Any Items not covered specifically must be in accordance with AREMA Standards and recommended practices subject to the approval of the Engineer. Construction must adhere to all TxDOT Standard Specifications, Project Plans, and FRA requirements. Subballast construction methods must conform to Item 247, “Flexible Base.”

4.1.4. All workers employed in the project or supervising the project must have been certified according to Federal Railroad Administration (FRA) regulations contained in 49 CFR 213, “Track Safety Standards”; 49 CFR 214, “Railroad Workplace Safety”; 49 CFR 217, “Railroad Operating Rules”; 49 CFR 218, “Railroad Operating Practices”; 49 CFR 237, “Bridge Safety Standards”: and all other FRA regulations, rules, and orders as applicable. All workers employed in the project must comply with the workplace safety requirements of the operating railroad which may be subject to change. Changes to the operating railroad's safety requirements may impact training requirements and construction activities, and may result in extra costs for the contractor. All training requirements are subsidiary to the work and will not be reimbursed or considered for payment.

4.1.5. When the Contractor desires to occupy any space above the top of rail within the horizontal distance of 10 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.

4.1.6. The Contractor must 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.

4.1.7. All scaffolding, materials, and equipment used in the Contractor’s operations must, 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.

4.1.8. TxDOT’s acceptance of trackage and its appurtenances which have been built must be based on the Engineer’s written statement that construction and construction materials have met TxDOT standards.

4.1.9. Unless otherwise shown on the plans or directed by the Engineer, all removed materials will 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.

4.1.10. Milestones - The following milestones will be reviewed and approved during the project:

4.1.10.1. Grading - Review and approve before placement of subballast.

4.1.10.2. Ballasted Trackwork - Review, approve, and coordinate the track construction to assure compliance with TxDOT requirements.

4.1.10.3. Vehicular Grade Crossing - Review, approve, and coordinate the vehicular crossing to assure compliance with TxDOT requirements.

4.1.10.4. Welding - All welds, including compromise and transition welds must 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.” Welds must be tested in accordance with AREMA standards and all test results provided to the Engineer.

4.2. Trackwork.

4.2.1. 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 whenever possible.

4.2.2. Designated materials storage areas and mobilization areas must have SW3P plans implemented as shown on the plans before off-track equipment operates in those areas.

4.2.3. Ties must be placed as shown on the plans or as directed. Defective ties must be replaced as shown on the plans or as marked by the Engineer or his designee. The ties must be designated before the commencement of work. The Contractor will remove designated ties and replace them with new ties, laid with the heartwood face down.

4.2.4. Ties must be placed on 19.5 in. centers in main tracks and laid with the heart wood side down. Individually replaced ties must be centered in the gap and not skewed. All ties must be laid at right angles to the rail with the ends lined uniformly.

4.2.5. Ties must 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) must be lined parallel with the rail.

4.2.6. Tie hooks, tongs or tie crane must 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 must be applied to the adzed surface.

4.2.7. Tie plates must set squarely on the tie and must be of the dimensions to fit the base of rail used. All tracks must be fully tie plated and spiked in accordance with proper criteria. Tie plates must be centered and have full bearing on ties. Rail must be properly seated in the tie plates and not riding on the shoulder of the tie plate. Tie plates and rail must be cleaned before being laid. Tie plates must be placed with slope of plate towards center of track.

4.2.8. Tie plates that are removed from marked ties must be reapplied to the replacement tie, unless broken or replaced due to an increase in rail size. All broken tie plates will be replaced and held for the Engineer’s inspection.

4.2.9. All rail must be gauged when laid and when replacement ties are spiked. The standard gauge is 4 ft. 8-1/2 in. between points 5/8 in. 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 in. in variance from the master gauge, those gauges must immediately be removed from the job.

4.2.10. Track bolts, with nuts, which have wrench turn fittings, must be used where required. Spring washers must 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 ft.-lbs. Bolting must be started with the center bolts working toward the ends and all nuts must be turned up tight with bolt heads staggered inside and outside of the rail alternately.

4.2.11. Securement of ties to open deck bridge structures must be in accordance with the plans or as directed.

4.2.12. All track spikes are to be the proper size. Care must 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 must be started, driven vertically, and square when driven into the spike holes of the tie plate. Crooked or bent spikes must be removed and replaced. Straightening with maul of spikes started crooked will not be permitted. When spikes are pulled, the hole must be plugged with a standard treated tie plug. In driving the spikes, the last few blows of the hammers must be such that the spike head will not be bent or broken, and the hammer must not be permitted to strike directly upon the rail.

4.2.13. Ties must be spiked through the tie plates with three rail-holding spikes in each tie plate on curved track. The rail gauge side of the tie plate must be spiked through the tie plates with two rail-holding spikes on curved track. The rail field side of the tie plate must be spiked through the tie plates with one rail-holding spike on curved track.

4.2.14. All rail must 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 must be staggered so that the outside spikes must be on the same side of the tie and the inside spikes on the opposite side. Ties must 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.

4.2.15. Rail must not be struck with maul or heavy tool when spiking, gauging or lining.

4.2.16. Immediately after completion of track surfacing, spikes must 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.

4.2.17. Tie plugs, where required, must completely fill holes from which spikes are drawn. The plugs must conform to the current AREMA Specifications, Chapter 30, Part 3.1.5, “Specifications for Tie Plugs and Synthetic Tie Plugging Materials”. Tie Plugs must be made of either wood or synthetic materials. Wood plugs must be treated with Creosote or a similar preservative. Synthetic plug materials, including epoxies, must conform to the recommended manufacturer’s specifications for application, use, and disposal.

4.2.18. Grip type rail anchors must be applied in the approved manner for the particular type of anchor furnished and as directed. Rail anchors must be installed on every other tie, or as shown on the plans, after the ballast operation and the track is raised, lined and ties re-spaced or as directed. All ties must be fully box-anchored in the following areas:

- Entire length of ballast deck bridges
- Entire length of open deck bridges
- Within 200 ft. of a ballast or open deck bridge
- Entire length of roadway crossings
- Within 200 ft. of a roadway crossing
- Entire length of turnouts

4.2.19. Track must be box anchored as shown on the plans and as required. 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.

4.2.20. Under no circumstances must rail anchors be installed on ties under or immediately adjacent to rail joints, nor must anchors be installed on one side of the tie under one rail and on the opposite side of the tie under the other rail.

4.2.21. Care must be taken to avoid overdriving or damaging anchors. Anchors must not be driven along the rail. Sufficient rail anchors must be applied and maintained to effectively control longitudinal rail movement. Anchors must 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 CWR, anchors must not be applied on the opposite rail directly across from the joints or straps.

4.2.22. Rail anchors which are dislodged or removed during work, including surfacing, are to be replaced in box pattern. To avoid tie skewing, the anchors must be applied against the same tie on opposite rails. Rail anchors when applied must have full bearing against a sound tie.

4.2.23. Rail saws must be used when necessary to cut rail. The use of a torch or track chisel will not be permitted.

4.2.24. All necessary new bolt holes must be marked, using an approved rail drilling template and the drilling operation must be carefully performed. Both cutting and drilling must use proper lubrication. Cut rails must be drilled and fully bolted. There must be no extra holes in the rail. The burred edges on bolt holes drilled in the field must be carefully removed by grinding. When necessary to cut secondhand rail, the cut end must be beveled. When necessary to cut new standard carbon rail, the cut end must be end hardened and beveled in accordance with Railroad Specifications.

4.2.25. The Contractor must record the number of crossties replaced between each whole-number milepost and provide a report of that information to the Engineer or his designee daily. When crossties are replaced between multiple mileposts the Contractor must record the number of crossties replaced between each individual whole-number milepost and provide a report of that information to the Engineer or his designee daily.

4.2.26. The Contractor must record the number of crossties replaced on each bridge approach and each bridge and provide a report of that information to the Engineer or his designee daily. When crossties are replaced on multiple bridges and bridge approaches, the Contractor must record the number of crossties replaced on each bridge and bridge approach and provide a report of that information to the Engineer or his designee daily.

4.2.27. When laying rail in tangent track the right-hand rail (direction determined by facing away from initial point of line), must be laid first and lined to the staked track alignment. After each right-hand rail is lined and spiked, the left-hand rail must 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 must 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 must be held in place snugly against the track gauges with lining bars.

4.2.28. 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 must be used when necessary to cut rail. The use of a torch or track chisel will not be permitted. All necessary new bolt holes must be marked, using an approved rail drilling

template and the drilling operation must be carefully performed. Both cutting and drilling must utilize proper lubrication.

4.2.29. When working with rail deliveries, the Contractor must unload the materials as directed. The Contractor must 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.

4.2.30. The Contractor must 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. When unloading CWR, joint straps must be removed, rail ends by-passed when necessary and wooden blocks or shims must 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.

4.2.31. 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.

4.3. Rail Joints.

4.3.1. All rail joints must be welded unless shown otherwise on the plans or as directed. Rail not in CWR locations must be staggered according to the direction of the Engineer, except when balancing the joints for switch leads, grade 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 must be staggered at 12 ft. from the nearest joint on the opposite rail. To avoid unnecessary rail cutting in providing staggered joints, a 2 ft. tolerance will be permitted in either direction. When laying rail, joints must not be located in grade crossings, bridge decks, or on ends of bridges.

4.3.2. At the time rail is being laid, joint bars must be applied as shown on the plans, 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 must be removed and the joint bars as well as the rail ends within the limits of the joint bar area must be thoroughly cleaned with a wire brush to remove all rust, dirt and mill scale. The contact surface of the joint bars must 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.

4.3.3. 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.

4.3.4. The desired laying temperature of the rail is determined by the Engineer. The Contractor must record the temperature of each rail laid. Rail temperature measurements must be taken on the base of rail on the side away from the sun.

4.3.5. When it is not possible to lay rail at the desired laying temperature, the Contractor must make the necessary adjustment at a later date. The exact procedure used to adjust the rail temperature must be approved by the Engineer.

4.3.6. Bond wires that are broken or damaged during rail replacement, tie replacement, surfacing, or other contractor operations will be replaced by the Contractor. Replacement will be subsidiary to the other track work and no separate payment will be made.

4.3.7. At joints, the opening between rail ends must be in accordance with Table 3:

Table 3
Joint Openings

Rail Temperature	Opening for 39 ft Rail	Opening for 78 ft Rail
Below 25°F	1/2”	1/2"
25°F to 50°F	3/8”	3/8”
51°F to 75°F	1/8”	1/4"
76°F to 100°F	1/8” every other joint	1/8”
Above 100°F	1/8” every other joint	1/8” every other joint

4.3.8. Rail thermometers of the approved type must be used to determine the rail temperature.

4.3.9. 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 must be lubricated using a liberal amount of approved lubricant.

4.3.10. 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 must 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.

4.3.11. 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 must 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 must 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 must be applied so that bars are not cocked between base and head of rail. Bars are to be properly seated in rail.

4.3.12. In the event any existing joint bars should crack or break during tie replacements, ballasting, surfacing, or any other portion of the project; the Contractor will replace the defective joint bars with bars of the same size. Replacement of such broken or cracked bars will be subsidiary to the other trackwork and no separate payment will be made.

4.3.13. Where the running surface of rails at joints is mismatched by more than 1/8 in., the Contractor must build up, grind and profile the rail according to the Engineer’s instructions. A rail of more section must not be ground down to match the lesser, but the lesser built up.

4.3.14. 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.

4.3.15. 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 must be lubricated using a liberal amount of approved lubricant.

4.3.16. 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 must 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.

4.4. Compromise Rails and Transition Rails.

At permanent connections of different rail sections, compromise rails or transition rails must be placed in lieu of compromise joints or compromise welds, and where practicable they must not be located in grade crossings, main track curves, on open deck bridges, or in turnouts.

Compromise rails or transition rails are required at all locations between the ends of rail of different weights or cross section. The Contractor must install all compromise rails and transition rails as directed. Compromise rails and transition rails must not be placed within the limits of turnouts.

4.5. Field Rail Welding.

Clean the rails to be free of grease, oil, dirt, loose scale, and moisture to a minimum of 6 in. 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.

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."

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 before welding.

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 must provide for a flat running surface. Horizontal alignment must be in such a manner that any difference in the width of heads of rails occurs on the field side. Horizontal offsets must not exceed 0.040 in. in the head and 0.125 in. in the base.

4.5.1. Surface misalignment tolerance must conform to the following:

4.5.1.1. Combined Vertical Offset and Crown Camber. Not to exceed 0.080 in. per foot at 600°F or less. No dip camber will be allowed.

4.5.1.2. Gauge Misalignment Tolerance. Combined horizontal offset and horizontal kink camber not to exceed 0.080 in. per foot at 600°F or less.

4.5.2. All rails for electric-flash butt welds must have the scale removed down to the bright metal in the end zones on the top and bottom of the rails where the welding current-carrying electrodes contact on head and base of rail.

All electric-flash butt welds must be forged to point of refusal to further plastic deformation and have a minimum upset of 1/2 in., with 5/8 in. as standard. If flashing on electric-flash butt welds is interrupted because of malfunction or external reason, with less than 1/2 in. of flashing distance remaining before upsetting, rails must be reclamped in the machine and flashing initiated again.

4.5.3. Rails for preheated rail welds must be cleaned 2 in. on each side of the weld, to remove scale and rust using a power actuated grinder, with abrasive wheel. Rail ends must be preheated before 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.

4.5.4. Inspect each weld using a 3 ft. straightedge along the centerline of the rail and 0.625 in. 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.

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 in.

4.5.5. Finish the completed weld by grinding to conform to the following requirements:

- Rail head surface and sides must be finished ground to a smooth and uniform surface.
- The web zone (underside of head, web, top of base, both fillets each side) must be finished to not greater than 1/8 in. of parent contour or closer, but must not be deeper than parent section. Finishing must eliminate all cracks.
- All notches created by offset conditions or twisted rails must be eliminated by grinding to blend the variations.
- All fins on the weld due to shearing drag must be removed before final inspection.
- All heavy grinding must be performed on the hot metal, immediately following welding, by an approved rail grinder, to prevent metallurgical damage. Finish grinding must 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 hand 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°F.
- Jagged, notched or badly mismatched end faces must 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.

4.5.6. 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 and rail in accordance with ASTM E164 and the AWS D1.1. Use ultrasonic test equipment capable of detecting a 3/64 in. discontinuity, 6-1/2 in. below the top of rail. Test results must be supplied to the Engineer for review and approval before the rail installation or replacement is accepted.

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 11W calibration block, also made of rail steel.

4.5.7. The Contractor's rail distressing procedure must be presented to the Engineer for approval before welding can commence.

4.5.8. 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.

4.6. Ballasting and Surfacing.

4.6.1. Ballast

4.6.1.1. 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.

4.6.1.2. Haul and place ballast material in such a way that damage to adjacent areas is avoided.

4.6.1.3. Ballast must 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.

4.6.1.4. The track must 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 before unloading ballast for the final raise, the track must be lined as close as practical to the stakes and all ties straightened and re-spaced as necessary. Ballast must then be spread evenly and leveled to the required section, taking care to assure that subgrade material is not intermixed with the ballast.

4.6.1.5. Ballast must be spread and the track raised in a series of lifts to the approved elevation. No single lift will be higher than 4 in. In raising track, if jacks or mechanical tampers are used they must be so regulated as to avoid the binding or straining of joints. Sufficient sets of track jacks, if used, must be simultaneously used and properly spaced to avoid sharp breaks or bends in the rail when the track is raised. Both rails must be raised simultaneously and to proper cross level by utilizing standard track level boards with each set of track raising jacks (minimum three insertions).

4.6.1.6. Ballast must be kept clean and free of segregation during handling and placing operations.

4.6.1.7. Ballast must be thoroughly regulated and level for the full length of each tie, end to end, and for the full length and width of the ballast section or bridge unless otherwise directed by the engineer. Centers are to be filled and regulated.

4.6.1.8. Ballast must be thoroughly tamped from each tie end to 15 in. outside and inside of the rail.

4.6.2. Tamping

4.6.2.1. 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 must be tamped especially firm.

4.6.2.2. Tamping will not be permitted at the middle of a tie. Both ends of a tie must be tamped simultaneously and tamping inside and outside the rail must be done at the same time. All ties that are pulled loose in the track raising operation must be placed in their proper position and properly tie-plated and fully spiked before tamping. The track must be true to line and grade as staked with tangent track level transversely.

4.6.2.3. 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 must be constantly used to insure the correct surface and cross level in the track after tamping work is completed.

4.6.2.4. Tamping tools must 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.

4.6.2.5. When using power tampers in tandem, the machines should be of the same type and have identical tamping heads to produce uniform compaction.

4.6.3. Finishing and Surfacing

4.6.3.1. After ballasting is completed and the track is in correct gauge, surfaced and lined according to the stakes, the ballast must be trimmed neatly to the section shown on the drawings, and any surplus material must 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.

4.6.3.2. Bring the initial layer of compacted ballast to an elevation that will establish the track surface no higher than 2 in. below final base of rail grade. Refer to plans and cross sections for ballast depth and base of rail grades.

4.6.3.3. Ballast must be inserted under ties in minimum 2-1/2 in., maximum 4 in. lifts. Cribs must be filled with ballast to the top of tie.

4.6.3.4. Do not perform track surfacing unless the cribs are filled with ballast.

4.6.3.5. Special care must be taken when surfacing during hot weather in order to avoid track buckles.

4.6.3.6. Perform track surfacing by an approved method which prevents undue bending of the rail or straining of the joints.

4.6.3.7. Both rails must be raised at one time and as uniformly as possible.

4.6.3.8. Ties that have been pulled loose must be replaced to proper position and must be fully tamped to proper elevation.

4.6.3.9. Track must be constructed to the alignment and grade prescribed by the approved plans or drawings.

4.6.3.10. Deviation from established gauge and cross level must not exceed 3/4 in. per 62 ft. cord; deviation from profile grade and horizontal alignment must not exceed 3/4 in. All work must be acceptable to the TXPF.

4.6.3.11. Tangent track must be cross level.

4.6.3.12. No humps or sags will be accepted nor will irregularities in alignment, either on tangent or curved track that exceed previously defined deviations. Top of track ballast must be dressed parallel with top of ties for the full length of each tie, end to end and for the full length and width of the ballast section or bridge.

4.6.3.13. Maximum allowable adjustment in line after final resurfacing is 2 in.

4.6.3.14. Top of track ballast must be dressed parallel with top of ties, extending a minimum 9 in. beyond the end of tie, then on three to one slope to subballast. Not less than three insertions of tamping tools must be made.

4.6.4. Acceptance

4.6.4.1. Before final acceptance, all track must 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 must be retamped. Bolts must be retightened, if necessary, to bring to full tension and spikes set down to full rail contact.

4.6.4.2. TxDOT's acceptance of trackage and its appurtenances which have been built must be based on the Engineer's written statement that construction and construction materials have met TxDOT standards, Special Specifications, and Plans.

4.7. Vehicular Grade Crossing.

4.7.1. Preparation

4.7.1.1. When preparing to work in vehicular grade crossings, the Contractor must notify the owner of a private crossing of the work to be done at least 24 hr. in advance of the proposed work. The Contractor must notify the city, county, or state road authority of crossing work to be done on publicly owned roads at least 24 hr. in advance of the proposed work. The Contractor must 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 must 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. Barricades, signs, and traffic handling for closures and detours must be placed in accordance with TxDOT Standard Specification Item 502, "Barricades, Signs, and Traffic Handling".

4.7.2. Approach subgrades and ditches must be re-profiled as required by the plans or as directed.

4.7.3. Temporary crossing surfaces must be constructed where necessary as required by the plans or as directed.

4.7.4. The track must be properly lined, tamped, compacted, spiked, broomed and anchored before any crossing materials are installed.

4.7.5. Ballast, Subballast, and Subgrade

4.7.5.1. Existing ballast and subballast must be excavated to the hard pan below the grade crossing and to a minimum of 12" below the bottom of the crossties. If full surface hard pan is not present or if the subgrade is not fully consolidated, install fully compacted granular fill as base material before placement of subballast, ballast, or crossing materials.

4.7.5.2. 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 must meet the requirements of DMS-6200 “Filter Fabric.” Protect filter fabrics from puncture throughout construction.

4.7.5.3. Fouled ballast materials must be removed for a minimum distance of 20 ft. from the ends of the crossing. The crossing and approaches must be raised within specifications to allow drainage away from the crossing.

4.7.6. Cross-ties

4.7.6.1. Verify that cross-ties are of correct length, position and spacing. Correct any track deficiencies before starting the installation of the vehicular grade crossing.

4.7.6.2. Each cross-tie in vehicular grade crossings must be plated and double-spiked with 4 rail holding spikes per tie plate.

4.7.6.3. Each cross-tie in vehicular grade crossings must be fully box-anchored.

4.7.6.4. Cross-ties must be long enough to fully support the width of the panels in an even and uniform manner.

4.7.7. Rail

4.7.7.1. Rail must be replaced with new, unused rail within all vehicular grade crossings included in the project as shown on the plans.

4.7.7.2. Weld all rail joints within the limits of the crossing. Limits of the crossing include the full length of the crossing and an additional 15 feet on either side of the crossing as measured along the rail from the edge of the crossing panel furthest from the center of the crossing.

4.7.7.3. All welds within the crossing surface must be ground flush on all sides of the rail except on the bottom of the base.

4.7.8. Crossing panels

4.7.8.1. Panels must be constructed of either prestressed concrete or treated wood, as specified by the plans or as directed.

4.7.8.2. Panels will be supported by the ties in an even and uniform manner.

4.7.8.3. Panels must be secured to the ties below the rail to prevent movement, maintain the grade line of the intersecting roadway, and to establish an even and uniform support for the panels.

4.7.8.4. Panels must extend a minimum of 3 feet from the edge of the traveled way, including shoulders, of the intersecting roadway.

4.7.9. Finishing and Alignment

4.7.9.1. Finished crossings must be constructed to the lines and grades as shown on the plans or as directed. Grade crossing surfaces must be placed as shown on the plans or as directed.

4.7.9.2. Flangeways in crossings must be filled. Filter fabric and asphalt must be installed in the flangeways of timber crossings and rubber fillers must be installed in concrete panel crossings.

4.7.9.3. Where asphalt is specified on the plans or specifications, hot mix asphalt will be used.

4.7.9.4. Verify that the track has been installed in accordance with the plans and specifications and approved for alignment and profile by the Engineer.

4.8. Turnouts.

4.8.1. Turnouts must be constructed in strict conformity with the shop drawings, plans, the Engineer's instructions, and AREMA specifications, Chapter 4, Part 4, "Track Construction".

4.8.2. The switch stands must be fastened securely to head blocks and must be square with the track. The targets must be lined parallel with the rails of the major track when the switch is lined for the major track. All switch ties must be fully tie plated.

4.8.3. Stock rails for turnouts must be bent accurately and must not be sprung into place. All frogs, with the exception of self-guarded frogs, must be protected by guardrails installed in accordance with the standard plans before any train is allowed to pass over them.

4.8.4. Turnouts must also include switchman walkways.

4.8.5. Turnouts must have all special switch plates, frog and guard rail plates fully spiked. Spiking standards must be per the approved shop drawings, as shown on the plans, Special Specification, and the Engineer's instructions.

4.8.6. Panel turnouts must be constructed in conformity with the approved shop drawings, plans, the Engineer's instructions, and these specifications. Care must 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 must adjust anchors, ties, spikes, switch plates, braces, etc., as necessary to conform to the standard plan.

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

4.8.8. All rail within the turnout will be head hardened.

4.8.9. Rail bound and solid steel frogs must be made of manganese castings.

4.9. Removing Ballasted Track and Turnouts.

4.9.1. After designated sections of ballasted track and turnouts are no longer needed to carry traffic they must be disconnected from the rail line and all salvageable materials must be removed.

4.9.2. 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 must be smoothed by blading or other methods.

4.10. Salvaging.

4.10.1. Unless otherwise specified, all removed materials will become the property of the Contractor.

4.11. Warranty.

4.11.1. The Contractor will warrant the rehabilitation of track construction and rehabilitation for a period of 12 months. The warranty period begins with the Engineer's acceptance of the work.

4.11.2. Contractor Inspections. Conduct initial and semiannual inspections of the Track Construction and Rehabilitation. Conduct initial inspections within 7 days after work is completed. For Track Construction and Rehabilitation provide a written report of the existing conditions at the time of the inspection to the Department. Document each inspection with digital photography, and provide a copy of the written report and digital photographs to the Department. Provide sketches, written reports and digital photographs within 30 days after the inspection. Conduct warranty inspections according to 4.1., "General Requirements."

4.11.3. Replace or repair work or materials that do not meet contract specifications. Notify the Engineer at least 72 hrs. before beginning any warranty work. If deficiencies are not corrected within 30 days of a semiannual inspection, the warranty period for the entire project will be extended on a daily basis starting on the 31st day until the deficiency is corrected.

4.11.4. A Department representative will be present for all semiannual inspections. Provide written notification to the Engineer no later than 15 days before any semiannual inspection.

4.11.5. Department Inspections. The Contractor will be provided a copy of any inspections. The Contractor will be notified in writing of any needed warranty work between semiannual inspections. Within 30 days of receipt of the written notification, replace or repair work or materials that do not meet the contract specifications. If deficiencies are not corrected within 30 days of receipt of the written notification, the warranty period for the entire project will be extended on a daily basis starting on the 31st day until the deficiency is corrected. If it is found that the requirements are met, provide documentation of the evaluation results to the Engineer for review and his decision per Item 5, "Control of the Work."

4.11.6. The Department will conduct a final warranty inspection before the expiration of 1 yr. of the project completion date. The Contractor will be notified in writing of the final warranty inspection date at least 15 days before the inspection to allow the Contractor to be present. Absence or failure to witness the final inspection will not delay the final inspection. If the final warranty inspection identifies any work or materials that do not meet the contract specifications, replace or repair the work or materials to meet the contract specifications. Failure to repair or replace work or materials that do not meet the contract specifications, will result in the warranty period for the entire project being extended on a daily basis until all work or materials meet performance requirements and have passed an initial inspection.

4.11.7. The Contractor will be considered in default during the warranty period if:

- any warranty work is not completed within 60 days of an initial, semiannual or final warranty inspection, or receipt of written notice from the Engineer identifying an area of concern;

- any warranty work from the initial inspection is not conducted within 7 days of when the work or materials are installed;
- fails to perform the semiannual inspection or provide the report documenting the inspection; or,
- submits a false or misleading report regarding whether the work or materials meet the performance requirements.

4.11.8. The warranty bond will insure the proper and prompt completion of required warranty work following completion of the project, including payments for all labor performed, equipment and material used in accordance with the specifications.

5. MEASUREMENT

5.1. Tie Removal and Replacement will be measured jointly by each individual tie removed and replaced as one unit.

5.2. Open Deck Bridge Tie Removal and Replacement will be measured jointly by each individual tie removed and replaced as one unit.

5.3. Switch Tie Removal and Replacement will be measured jointly by each individual tie removed and replaced as one unit and specified by length.

5.4. Subballast will be measured by the cubic yard, complete in place.

5.5. Ballast Delivery and Regulating will be measured by the ton, complete in place.

5.6. Ballasted Track Surfacing and Alignment will be measured jointly by the mile.

5.7. Replacement Rail installed will be measured by the linear foot for installation and removal.

5.8. Compromise Rail will be measured by the linear foot for installation and removal.

5.9. Transition Rail will be measured by the linear foot for installation and removal.

5.10. Turnouts will be measured by the each for installation and removal.

5.11. Derails will be measured by the each for installation and removal.

5.12. Guardrails will be measured by the linear foot for installation and removal.

5.13. Welds will be measured by the each connecting two rails together.

5.14. Vehicular Grade Crossing will be measured by the track foot for installation and removal, including all ties, rail, panels, ballast, sub-ballast, spikes, joints, bolts, securement, filter fabrics, drains, temporary crossing materials, etc.

6. PAYMENT

6.1. Payment for tie replacement will be made at the unit price bid for "Tie Removal and Replacement." This price is 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 ballast deck bridges, track work at vehicular grade crossings; and for the removal of all materials used in Track Construction & Rehabilitation and for all other materials, tools, equipment and incidentals necessary to complete the work.

6.2. Payment for open deck bridge tie replacement will be made at the unit price bid for "Open Deck Bridge Tie Removal and Replacement." This price is 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 open deck bridges; and for the removal of all materials used in tie removal and replacement and for all other materials, tools, equipment and incidentals necessary to complete the work.

6.3. Payment for switch tie replacement will be made at the unit price bid for "Switch Tie Removal and Replacement" by specified length. This price is 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 Track Construction & Rehabilitation and for all other materials, tools, equipment and incidentals necessary to complete the work.

6.4. Payment for subballast will be at the unit price bid for “Subballast.” This price is full compensation for furnishing, hauling, placing, sprinkling, rolling the subballast and for all other materials, tools, equipment and incidentals necessary to complete the work.

6.5. Payment for Ballast Delivery and Regulating will be made at the unit price bid for "Ballast Delivery and Regulating.” This price is 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.

6.6. Payment for Ballasted Track Surfacing and Alignment will be made at the unit price bid for "Ballasted Track Surfacing and Alignment." This price is 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.

6.7. Payment for Rail Replacement will be made at the unit price bid for “Rail Replacement.” This price is 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.

6.8. Payment for Compromise Rail will be made at the unit bid price for “Compromise Rail.” This price is full compensation for the removal of existing rails, bolts, nuts, spikes, and all other materials; furnishing, hauling, and installation of materials including compromise rail, welding materials, welds, joint bars, anchors, spikes, bolts, nuts, and all other materials, tools equipment, labor and incidentals necessary to complete the work.

6.9. Payment for Transition Rail will be made at the unit bid price for “Transition Rail.” This price is full compensation for the removal of existing rails, bolts, nuts, spikes, and all other materials; furnishing, hauling, and installation of materials including compromise rail, welding materials, welds, joint bars, anchors, spikes, bolts, nuts, and all other materials, tools equipment, labor and incidentals necessary to complete the work.

6.10. Payment for Turnouts will be made at the unit bid price for “Turnouts.” This price is full compensation for the removal of existing turnouts, rails, bolts, nuts, spikes, and all other materials; furnishing, hauling, and installation of materials including turnout castings (frogs), switch stands, connecting rods, plates, switch ties, cross ties, welding, securements, rail, switch mechanisms, and all other materials, tools equipment, labor and incidentals necessary to complete the work.

6.11. Payments for Derails will be made at the unit bid price for “Derails.” This price is full compensation for furnishing, hauling, and installation of materials including derails, hinges, plates, bolts, securement, signage, marking, locks, and all other materials, tools equipment, labor and incidentals necessary to complete the work.

6.12. Payments for Guardrails will be made at the unit bid price for “Guardrails.” This price is full compensation for furnishing, hauling, and installation of materials including guardrail, plates, spikes, bolts, securement, and all other materials, tools equipment, labor and incidentals necessary to complete the work.

6.13. Payments for Welds will be made at the unit bid price for “Welds.” This price is full compensation for joining two rails by thermite or electric arc induction, and for all materials, tools, equipment, labor and incidentals necessary to complete the work.

6.14. Payment for Vehicular Grade Crossing will be made at the unit price bid for "Vehicular Grade Crossing" by specified type. This price is full compensation for furnishing and installing a vehicular grade crossing; 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, panels, ballast, sub-ballast, plates, spikes, joints, bolts, welding; and for all other materials, tools, equipment, labor and incidentals necessary to complete the work.