SECTION 34 11 00
RAIL REPLACEMENT PROJECT

Part 1 – GENERAL

1.01 SUMMARY

A. The Detroit People Mover (DPM) System serves the Greater Detroit Downtown business area providing convenient service to attractions including Detroit Opera House, Joe Louis Arena, Cobo Hall Convention Center, the Renaissance Center and Greek Town, along with various hotels and restaurants. The system is an aerial structure loop, 2.88 miles long, as shown in Appendix 34 11 00 A and B - Site Plan Drawings Z631-TW-3 and Z631-TW-6 respectively carrying a single mainline track. The aerial structure height varies and is approximately 35 to 45 feet above street level. The aerial structure carries numerous components, both part of and ancillary to the track, such as the running rails and fasteners for the track; the Linear Induction Motor (LIM) Reaction Rail along the centerline of track; two Automatic Train Control (ATC) cables with conduits, two non-metallic wire ways and the wall mounted Traction Power Rail System as shown in Appendix 34 11 00 B – Typical Section Through Guideway Beam.

B. The Work involved is twofold and includes:
    1. The re-alignment and re-construction of the Track as shown in Appendix A.
    2. Re-construction of Special Trackwork Switch components of the No 6 Turnout identified as DPM Turnout No. 1 which is adjacent to the north entry to the DPM Maintenance Center as shown in the Rail Replacement Project Plan set provided in this package.

1.02 RELATED SECTIONS

A. Specifications for construction activities

1. Section 34 11 05 Re-construction of Direct Fixation Track
2. Section 34 11 10 Installation of Rails for Expansion Joints
3. Section 34 11 12 Installation of Existing Rail Anchor Locations
4. Section 34 11 15 Dismantling of Existing Track
5. Section 34 11 20 Refurbishment Existing Direct Fixation Fasteners
6. Section 34 11 25 Thermite Welding of Rail
7. Section 34 11 30 Replacement of Female Anchor Inserts
8. Section 34 11 40 Re-construction of Special Trackwork Switch Components

9. Section 34 11 45 Procurement of Special Trackwork Switch Components
10. Section 34 11 50 115RE TEE Rail

B. Appendices to these construction activity specifications

1. Appendix 34 11 00 A Site Plan DTC-001
2. Appendix 34 11 00 B Typical Section through Guideway
3. Appendix 34 11 00 C Site Plan DWGS Z 631-TW-4 thru Z 631-TW-9
4. Appendix 34 11 05 A Sliding Rail Joint DWGS Z 631-TW-22, Z 631-TW-23 & DTC-015
5. Appendix 34 11 20 A Direct Fixation Fasteners Drawings –Set of 7
6. Appendix 34 11 25 A Calibration Rail
7. Appendix 34 11 25 B Dynamic Test – Loading Arrangement/Moment Diagram
8. Appendix 34 11 25 C Record of Thermite Rail Weld

1.03 REFERENCES - PROCUREMENT DOCUMENTS

A. Specifications for procurement of materials

1. Section 34 11 45 Procurement of Special Trackwork Switch Components
2. Section 34 11 50 115 RE Tee Rail

B. Appendices to these procurement specifications

1. Appendix 34 11 45 A Downtown Detroit Site Plan
2. Appendix 34 11 45 B Typical Section Through Guideway Beam
3. Appendix 34 11 45 C Turnout No 1 (LH) with Movable Point Frog on Existing Fasteners 21114/DPM
4. Appendix 34 11 45 D Machining of Tongue Blades – No. 6 Turnout DWG44543K/DPM
5. Appendix 34 11 45 E Point Machine L710H (Switch Rod Arrangement) DWG82001 01402
6. Appendix 34 11 45 F Point Machine L710H (Switch Rod Detailed Assembly) DWG 82001 01402
7. Appendix 34 11 45 G Movable Point Frog 9º31’38” 115RE Rail DWG 21125/DPM

1.04 SUBMITTALS

A. THIS ARTICLE NOT USED.

1.05 QUALITY ASSURANCES

A. THIS ARTICLE NOT USED.

PART 2- PRODUCTS

2.01 CONTRACTOR FURNISHED MATERIALS

A. Trackwork Contractor to furnish all necessary Materials specified in these Sections and ancillary components to provide an acceptable working track structure.

PART 3- EXECUTION

3.01 WORK BY CONTRACTOR

A. Trackwork Contractor to undertake all necessary Work specified in these Sections to provide an acceptable working track structure.

PART 4- MEASUREMENT AND PAYMENT

4.01 THIS PART NOT USED

END OF SECTION

SECTION 34 11 05
RE-CONSTRUCTION OF DIRECT FIXATION TRACK

Part 1 – GENERAL

1.01 SUMMARY

A. Section includes the requirements to Re-construct Direct Fixation Track by change-out of 115RE rail on the Detroit Transportation Corporation's (DTC) Detroit People Mover (DPM) Elevated Guideway System.

B. The Work Includes requirements for:
   1. Direct fixation track installation on a refurbished Guideway Structure Deck using new and used track materials to the proper tolerances.
   2. Dismantling existing direct fixation track and salvaging components as specified in Section 34 11 15.
   3. Guideway Structure Deck surface preparation for applying tapered shims to establish corrected rail cant slope according to standard practices.
   4. Refurbishing and re-installing the existing direct fixation track fasteners with new components at the corrected top-of-rail elevations with superelevation and proper rail cant slope as specified in Section 34 11 20.
   5. Transporting the pre-curved rail to the Guideway track site.
   6. Rail cutting and Thermite welding of the pre-curved rail sticks to produce continuous welded rail for track installation per Section 34 11 25.
   7. Transition rail head machining, cutting and Thermite welding into track.
   8. Adjusting the center-of-track LIM Reaction Rail cap elevation to suit the new top of rail plane elevations.
   9. Adjusting the parapet wall mounted Power Rail system elevations to suit the new top of rail plane elevations.
   10. Re-establishing the bolted or exothermically welded Grounding Cables located within the track curve area and work zone.
   11. Performing all ancillary work required to complete an acceptable trackway for the operation of the Detroit People Mover vehicles.
   12. Supplying Contractor Furnishing materials.

C. Related Sections
   1. Section 34 11 00 – Rail Replacement Project
   2. Section 34 11 10 – Installation of Rails for Expansion Sliding Rail Joints

3. Section 34 11 12 – Installation at Existing Rail Anchor Locations
4. Section 34 11 15 – Dismantling of Existing Track
5. Section 34 11 20 – Refurbishing Existing Direct Fixation Fasteners
6. Section 34 11 25 – Thermite Welding of Rail

1.02 REFERENCES

A. American Railway Engineering and Maintenance of Way Association (AREMA):
   1. AREMA Manual for Railway Engineering

1.03 SUBMITTALS

A. Submit information requirements:
   1. Work Plan in accordance with Paragraph 3.02A.
   2. Product Data:
      a. Thermite Weld Kit source and Technical Information per Section 34 11 25.
      b. Other Material (tapered shims and epoxy bonding agent) not provided by DTC necessary to provide a complete corrected installation.
      c. New Rail Certified Documentation.
   3. Quality Control Program:
      a. Within 10 Days of Notice to Proceed and prior to commencing of any trackwork activities, submit the Quality Control Program, which shall confirm the quality of all materials and installation of the Work of this Contract.
   4. Qualifications Statements:
      a. Qualifications and experience record of the proposed Trackwork Superintendent and Trackwork Foreman (foreman) per Paragraph 1.05B
      b. Qualifications, testing program, and procedures from the certified independent testing laboratory per Subparagraph 1.05C.3.h

1.04 QUALITY CONTROL PROGRAM

A. Submit a Quality Control Program regulating methods, procedures, and processes to ensure compliance with standards of quality required by the Contract Documents.

B. Within 10 Days after the effective date of the Notice to Proceed, submit for approval of DTC a detailed narrative explaining the Quality Control Program and procedures to be utilized for the Work and a description of the organization to be used on the Contract.
   1. All Work undertaken prior to approval of the Quality Control Program will be at the Contractor's risk.

2. DTC will review the Contractor's methods, procedures, and processes for compliance with the approved program.
   a. Keep all records of the Work performed by the Contractor complete and available to DTC during the performance of the Contract; and to such other agencies and for longer periods as may be specified elsewhere in the Contract.
3. Give DTC sufficient notice when Work in any form is proposed so DTC may witness the procedures while work on this Contract is being performed.

C. Quality Control Program (QCP) Contents and Purpose:
   1. To assure Quality Assurance and Quality Control, prepare and submit to DTC a written Quality Control Program (QCP), which will confirm the quality of all Materials and installation of the Work of this Contract.
   2. The QCP shall define the tests and measurements to be conducted by the Contractor, the instruments and equipment required for the tests and measurements, the frequency of tests, and documentation of the results.
   3. The QCP shall cover all phases of the Work from Material manufacture to trackwork completion , including at least the following specific items:
      a. Material control and batch traceability.
      b. Shipping, handling, and storage controls and measurements.
      c. Equipment maintenance, including calibration measurements, dates and tests.
      d. Surface preparation treatments.
      e. Environmental measurements, such as ambient temperature, rainfall, and similar items.
      f. Provisions addressing test failure and retesting procedures.
      g. Field rail welding and grinding control.
      h. Test Requirements for Thermite Welds per Section 34 11 25:
         1) Select a certified independent testing laboratory to perform required testing, and submit its qualifications, testing program, and procedures to DTC for acceptance prior to using their services on the Project.
         2) Submit certification from the independent testing laboratory that the Materials to be installed in the track have passed the tests specified for them.
            a) Provide certified test reports to DTC indicating the Material is acceptable prior to installation of the Material.
   4. The QCP shall cover restoration of auxiliary systems to their correct relationship to the track.
      a. Method and material to be used to restore the LIM reaction rail to its design relationship to the track running rails.

b. Method and material to be used to restore the wall mounted power rail to its design relationship to the track running rails.

1.05 QUALITY ASSURANCE

A. The responsibility for all quality control for this Contract lies with the Contractor.

B. Trackwork Superintendent and Trackwork Foreman:
   1. Employ a Trackwork Superintendent and Trackwork Foreman (foremen) to be in charge of trackwork operations and supervise the Work.
   2. Qualifications: Employ experienced individuals for these positions who each have a minimum of 5 years of documented leadership experience in direct fixation transit track construction.
   3. Within 10 Days of Notice to Proceed and prior to commencing of any trackwork activities, submit the names, qualifications, and experience record of the proposed Trackwork Superintendent(s) and Trackwork Foreman (foremen) including a list of the Transit Authorities/Administrations employing the candidates and a reference name for each.

C. Notification of testing and unrestricted access:
   1. Give written notice to DTC when tests are to occur, or provide DTC with a current testing schedule.
      a. Provide at least 5 Days advance notice of the availability of an item for inspection.
   2. At any time during the Contract, afford DTC full access without charge to all facilities necessary for examination of the work to satisfy DTC that the Materials, as well as the finished product, comply with the Specifications.
      a. Provide DTC with access to all quality control tests and measurements so that all tests, measurements, and documentation can be witnessed and reviewed.
      b. Regular examination of the product will take place during normal working hours.
   3. Present Material for inspection in a safe area away from excessive noise and manufacturing activities.

1.06 STORAGE, HANDLING AND DELIVERY

A. DTC-furnished Materials will be available at the DPM Maintenance Center yard, to store, load and transport to the Work Site, and use on the Project.

B. Handle Contractor-furnished track items during delivery, storage and installation according to instructions in product manuals or information obtained from the various Suppliers.
   1. Prior to any delivery of these Materials, submit a copy of all written information describing handling and storage of these track Materials to DTC.
   2. Do not perform operations likely to cause scratching, notching, rubbing, scoring, or striking of the rails.

C. Store all Materials and equipment to be used in construction in a manner to protect them from detrimental effects of the elements.
   1. Stack Materials well above ground level and protect them from the elements with plastic sheeting or as appropriate.
   2. Store the trackwork Materials off of the ground on pallets, timber dunnage, platforms, or other approved supports and in a manner that will permit easy access for inspection and identification.

D. Transport any Materials remaining upon completion of the trackwork to DTC's South Material Storage Yard.

PART 2 – PRODUCTS

2.01 DTC-FURNISHED MATERIALS

A. Certain new Materials will be furnished by DTC to the Contractor for installation under this Contract
   1. If the quantities of DTC furnished Materials prove to be insufficient to complete the Work additional materials will be provided so long as the insufficiency is not due to Contractor error or neglect.
   2. If more Material than the quantity furnished by DTC is required due to Contractor error or neglect, the Contractor shall provide the necessary Materials to complete the Work.

B. 115 RE rail, provided by DTC for four purposes:
   1. For fabrication into continuous welded rail, the rails not requiring precurving
   2. For fabrication into continuous welded rail, the rails requiring precurving
   3. For formation into transition rails
   4. Forming part of the fabrication on special trackwork

C. Components to be used in refurbishment of direct fixation fasteners, as described in Section 34 11 20, Refurbishment of Existing Direct Fixation Fasteners.

D. High Density Polyethylene Superelevation Shims of the following thicknesses:
   1. 1/16 inch – RED
   2. .3/32 inch – BLUE
   3. 1/8 inch – GREEN
   4. .1/4 inch – BLACK

2.02 CONTRACTOR-FURNISHED MATERIALS

A. Furnish all Materials, except for DTC furnished Materials listed in Paragraph 2.01A, and furnish all equipment required to complete the direct fixation trackwork in an acceptable manner, including but not limited to, the following:
   1. Grinders and grinding wheels for structure deck surface grinding (if required).
   2. Thermite welding Materials (kits) for fabrication of continuous welded rail (CWR) with DTC supplied 115RE rail sticks.
   3. Exothermic weld Materials (kits) for connecting Grounding Cables.
   4. Tapered stainless steel rail cant corrective shims.
   5. Epoxy Bonding Agent for adhering tapered shims in position to the concrete structure deck surface.
   6. Submit appropriate Product Data and Shop Drawings for the Materials provided as part of the Work of this Section that do not have requirements for such submittals under other Sections.

2.03 EQUIPMENT

A. Use construction equipment and tools for track construction that conform to AREMA Manual for Railway Engineering, or approved equal.
   1. Use construction equipment suitable for operation on the DPM System and Guideway Structure.
   2. Provide construction equipment for operation on the Guideway Structure that is good repair and with all safety and protective appliances in place and functioning.
   3. Provide on-track equipment conforming to AREMA Manual for Railway Engineering, Volume 3, Chapter 27 Maintenance of Way Work Equipment, Part 2 Roadway machines, except all equipment shall fit within the allowed maximum dimensions and weight limits of the DPM system.

4. Provide tools used in track construction conforming to AREMA Manual for Railway Engineering Volume 1, Chapter 5 Track, Part 6 Specifications and Plans for Track Tools, or as approved by DTC.
5. Do not use on-track construction equipment that exceeds the structure design loads of the track.
6. All equipment used to construct track shall be leak proof.
7. Calibrate all tools as appropriate for use.

B. Use on-track equipment with a clearance envelope that conforms to DTC's clearance requirements for the Guideway System.
   1. Information concerning the Guideway System characteristics will be provided by DTC upon request by the Contractor.
   2. Verify that proposed equipment meets these requirements.

C. Rail Thermometers:
   1. Use reliable AREMA standard rail thermometers as specifies in the AREMA Manual for Railway Engineering Volume 1, Chapter 5 Track, Part 6 Specifications and Plans for Track Tools.
   2. Deliver two rail thermometers to DTC prior to laying any rail.
      a. The two rail thermometers shall be approved by DTC, and they shall be identical to those used by the Contractor.

2.04 SOURCE QUALITY CONTROL

A. Arrange with DTC for permission to inspect DTC furnished Materials at DTC's DPM Maintenance Center as a prelude to Contractor acceptance of the Material.
   1. Identify in writing with pictures any defects or shortages in DTC furnished Materials.
   2. After receiving and acceptance of DTC furnished Materials, the Contractor bears full responsibility for the Materials accepted.

B. Make arrangements to have DTC inspect all Contractors' furnished Materials at the Contractor's construction holding or storage site.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Have the track superintendent or foreman in charge of the re-construction of track thoroughly inspect the track site with surveyed fastener markings in place on the Guideway Deck to comprehend the structure work to be undertaken for eventual

placement of new CWR to the current track alignment and new profile grade line for direct fixation trackwork.

B. Note and take pictures of conditions and any and all defects towards the re-construction of track and report same to DTC prior to commencing trackwork.

3.02 PREPARATION

A. Work Plan: Prior to beginning the Work specified in this or any other Sections, submit a detailed Work Plan describing the dismantling, sorting, stock piling, transporting of rail, welding of rail and re-construction procedures required for the Work, including but not limited to the following:
   1. Details for inspecting structure deck, loading, transporting and unloading, and distributing rail sticks for preparation of CWR by track curve construction schedule.
   2. Details for dismantling the existing direct fixation track as specified in Section 34 11 15 Dismantling of Existing Track.
   3. Details for structure deck surface tapered shimming and details for direct fixation fastener shimming.
   4. Details for direct fixation fastener refurbishment as specified in Section 34 11 20 Refurbishment Existing Direct Fixation Fasteners.
   5. Specific preparation and installation procedures for undertaking Thermite welding as specified in Section 34 11 25 Thermite Welding of Rail.
   6. Include details and components pertaining to the methods, templates, fixtures, of transporting equipment required for this Work.
   7. Placing of continuous welded rail (CWR) in-track.
   8. Details for laying and fastening CWR, including proposed methods and equipment, and a detailed procedure for achieving uniform longitudinal rail stress at the zero stress temperature as specified in Article 3.03, below.

3.03 TRACK CONSTRUCTION

A. Provide track construction conforming to the standards and specifications for track construction in the AREMA Manual for Railway Engineering except as modified herein.

B. Cutting of Rail:
   1. Do not make holes in the rail or cuts in the rail except where shown on the Drawings and as specified herein.
   2. Cut rails square and clean by using saws or abrasive cutting discs only.
   3. Remove burrs and excess metal on the rail ends after cutting by grinding.

4. If cutting to fit is required when butting CWR to existing rail and the option of cutting away existing standard carbon or new high strength CWR exists, cut the standard carbon rail.

C. Avoid damaging structure deck, structure deck physical survey markers and ancillary Guideway components such as Linear Introduction Motor (LIM) Reaction Rail mounted at the centerline of track, ATC Cables mounted adjacent to the LIM Reaction Rail, Traction Power Rails mounted on the parapet walls, Grounding Cables and the Cable Troughs mounted on the deck adjacent to the parapet walls.
   1. Repair all Contractor damages to existing facilities.
   2. Undertake repairs to existing facilities according to DTC standards.
   3. Undertake structure deck surface tapered shimming according to DTC standards.
   4. Undertake direct fixation fastener shimming according to DTC standards.
   5. Undertake direct fixation fastener refurbishment as specified in Section 34 11 20 Refurbishment Existing Direct Fixation Fasteners.
   6. Undertake the CWR welding of rail sticks by the Thermite welding process as specified in Section 34 11 25 Thermite Welding of Rail.

D. Prior to placing on-track equipment on the newly laid rail, secure the rail in a manner that prevents damage to the structure and trackwork Material.
   1. Move on-track equipment over partially secured track in a manner that prevents damage to the structure and trackwork Material.
      a. Construct track to conform to the track alignment, profile, and geometry as specified herein, and as indicated in the Drawings by placing and anchoring the fasteners (fixed position by embedded inserts) to final vertical profile grade line.
      b. Clean the structure deck by power washing to remove all laitance and debris from the deck surface which will be in contact with the fasteners or shims prior to placing shims or fasteners.
   2. Horizontal Alignment: Mathematical alignment data for the track to be re-constructed will be provided.
      a. Engineering Track Stationing is used to reference all geometric control points.
      b. Track Stationing increases in a counterclockwise direction on the loop track.
      c. For tangent track the horizontal alignment is based on the centerline of track equidistant between the gauge sides of the running rails.
      d. For curved track the horizontal alignment is based on the centerline of track with the inside rail located 2 feet 4-1/4 inch radially from the centerline of track measured at the gauge line of the rails.

e. The inside rail is used to establish both horizontal and vertical alignment of the track, the outside rail and amount of superelevation will be measured from the fixed inside rail.

3. Vertical Alignment (Profile): Mathematical alignment data for the track to be re-constructed will be provided and will be verified by the survey team – Advanced Geomatics.
   a. On vertical tangent track the profile grade line (PGL) at the centerline of track refers to the top of rail (T/R) in its final position.
   b. On horizontal track curves the required profile grade line is at the top of the low rail or inner rail in its final position.
4. Track Gauge: Provide constant 4 foot 8-1/2 inch track gauge throughout the alignment.
5. Rail Cant (Inclination): The track consists of both rails inclined to a rail cant at 1:40 towards the center of the track.
   a. Proper rail cant shall be established on the high outside rail by shimming the surface structure deck where marked on the deck surface.
6. Superelevation:
   a. Locate and establish the inner rail at the required profile grade line indicated on the Drawings.
   b. Obtain superelevation by rotating the top of the rail plane about the top of the low rail head.
   c. Attain superelevation uniformly over the length of the spiral.
   d. Provide an intermediate vertical rail curve in the outside (high) rail at the intersection points of the superelevated profile alignment to ease the vertical profile grade line.
   e. Provide zero superelevation at the beginning of intermediate vertical curve at the tangent-to-spiral point and increase the superelevation uniformly through the length of the spiral to the full superelevation and intermediate vertical curve at the spiral to central curve, or spiral to spiral point if there is a zero length central curve.
   f. The same shall be applied at the run-out of superelevation at the exit end of the track curve.
   g. Pre-curved rail will be paint marked on the top of rail with theoretical tangent-to-spiral; spiral-to-curve, curve-to-spiral; spiral-to-spiral and spiral-to-tangent point for track curve orientation.

E. Continuous Welded Rail (CWR): Handle CWR in a proper manner, do not drag or slide rail along Guideway surface or on direct fixation fasteners; do not strike or bump the rail; use rollers for moving the rail to reduce damage to the fasteners and rail.

F. Rail Temperature and Gap: The rail replacement will be controlled by the length of rail removed for re-construction. At the removal of rail at the track curve the removal rail temperature (Fahrenheit Degrees) shall be recorded.
   1. Rail shall be permanently fastened and welded in place only when the replacement rail is within plus or minus 10 degrees F of the recorded removal temperature.
   2. Determine the actual rail temperatures using thermometers as specified in Article 2.03C of this Section.
   3. Measure temperatures by placing two thermometers on the shaded side of the rail base next to the web and leave them in place until no change in the readings are detected, but not less than 10 minutes.
   4. Take the average of the two thermometer readings to establish the temperature.
   5. Record:
      a. Mark the side of the adjacent or controlling Sliding Rail Expansion Joint rail affected by removal and replacement of the curved rail to confirm no substantial movement when work is undertaken.
      b. Length of rail removed measured along the curved rail head.
      c. Temperature of rail when removed.
      d. Length of replacement CWR considering weld gaps for final welds.
      e. Temperature of replacement rail at time of last tie in weld.
      f. Confirm Sliding Rail Expansion Joint rail has not moved prior to welding CWR string in track.
      g. Reposition rail in Sliding Rail Expansion Joint if movement is detected prior to undertaking final cut and weld when rail is at similar temperature and measured to proper length.

G. Fastening the Low Rail: Place the CWR on the secured low rail fasteners seats in accordance with approved Work Plan.
   1. Clamp and fasten the CWR to the fasteners only when the rail is within 10 degrees Fahrenheit of the removed rail temperature.
   2. Secure the low rail in final horizontal alignment position using the fastener adjustable rail base clips.

H. Closure Weld: Undertake the final welding of the low rail CWR string into track by the Thermite welding process as specified in Section 34 11 25 Thermite Welding once the replacement rail position and temperature is confirmed.

I. Establishing Superelevation: Using the low rail as a vertical template, establish the corresponding superelevation at the high outside rail using a Geismar track gauge.
   1. Apply the proper amount of fastener base shims to set the designed superelevation
   2. Secure the fasteners to the deck structure.
   3. Place the CWR on the secured high rail fastener seats in accordance with approved Work Plan.
   4. Clamp and fasten the CWR to the fasteners only when the rail is within 10 degrees Fahrenheit of the removed rail temperature.
   5. Secure the high rail in final horizontal alignment position using the fastener adjustable rail base clips.

J. Closure Weld: Undertake the final welding of the high rail CWR string into track by the Thermite welding process as specified in Section 34 11 25 Thermite Welding once the replacement rail position and temperature is confirmed.

3.04 TRACK CONSTRUCTION TOLERANCES – NOTE [I]

A. Comply with the Track Construction Tolerances for Direct Fixation Track as specified below:
   1. Track Gauge – plus or minus 1/8 inch.
   2. Cross Level – plus or minus 1/8 inch, the thinnest shim to be provided is 1/16 inch thick to be used for establishing tangent track Cross level elevations and Superelevation elevations in track curves.
   3. Horizontal Alignment – plus or minus 3/16 inches – Notes [II] [III] and [IV].
   4. Vertical Alignment – plus or minus 1/8 inch, the thinnest shim provided is 1/16 inch thick to be used for establishing tangent track Cross level elevations and Superelevation elevations in track curves – Notes [II] [III] and [V].

NOTES FOR TOLERANCES:

[I] In order to verify that constructed track is within these tolerances, an “As Built” survey, conducted by an authorized survey team (Advanced Geomatics), is required. See Article 3.08 – Final Track Inspection of this section.

[II] Deviation is the allowable construction discrepancy between the theoretical designed alignment and the actual constructed track position.

[III] Rate of change variations in track gauge, horizontal alignment, vertical alignment, cross level and track surface is limited to 1/8 inch per 15 feet of track.

[IV] Deviation (horizontal) in Station Platform Areas is plus 0 toward the platform, 1/8 inch away from the platform.

[V] Deviation (vertical) in Station Platform Areas is plus 1/8, minus 1/8 inch to be within conformity with the latest American Disability Act requirements.

3.05 LINEAR INDUCTION MOTOR (LIM) REACTION RAIL ADJUSTMENT

A. The LIM Reaction Rail position shall be adjusted to reposition the Reaction Rail to its proper horizontal and vertical relationship with the rails replaced and repositioned as part of this Contract.
   1. Raise or lower the Reaction Rail assembly by deck bolt adjustment using DTC's standard go/no-go gauge.
   2. This work will be considered incidental to the overall Work and will not be measured.

B. As Optional work at the direction of DTC, adjust the LIM Reaction Rail vertical adjustment to reposition the Reaction Rail to the proper height with existing rail outside of the re-construction of direct fixation track Work area.
   1. Raise or lower the Reaction Rail assembly by deck bolt adjustment according to the Drawings and using DTC's standard go/no-go gage.
   2. This work will be performed at the direction of DTC and may be performed outside of the 15-day system shutdown period, as agreed between DTC and the Contractor.
   3. This work will be measured and paid on a LIM Rail per-linear-foot basis as "Bid Item Number 12 – Option A" on Bid Form B, and is not included in the Total Bid Price on Bid Form B.

3.06 D C POWER RAIL ADJUSTMENT

A. Following completion of final adjustments in the position of the running rails, the power rail shall be adjusted to restore the correct relationship between the D C Power Rail and the track running rails.
   1. Reposition the wall mounted bracket assembly with the bracket adjustment slots using DTC's standard go/no-go gauge.

3.07 RUNNING RAIL GROUNDING STRAPS

A. All existing grounding rail straps shall be reconnected to the new rail.
   1. Re-attach seven bolted Grounding Straps by drilling the new rail or exothermically welded Grounding Straps to the new rail.

3.08 FINAL TRACK INSPECTION

A. In order to determine the acceptability of all finished track, immediately after completion of track installation perform an "As Built" track survey and inspection measuring all the parameters specified with the Specification with sufficient accuracy to establish that the track and related adjacent components (LIM Reaction Rail and Power Rails) have been reconstructed within the tolerances specified.
   1. The "As Built" survey of all components shall be undertaken to verify that reconstructed track is within these tolerances.
   2. The "As Built" survey shall be undertaken by the pre-selected authorized survey team – Advanced Geomatics Professional Surveyors.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Re-construction of Direct Fixation Track will be measured by the track foot of direct fixation installed, "as built" surveyed, and accepted unless otherwise indicated on the Plans, in the Specifications, or in the Bid Form.
   1. The Work of Re-construction of Direct fixation Track on an existing Guideway deck requires dismantling existing track; possible grinding of structure deck slab; shimming of structure deck slab; refurbishing direct fixation fasteners and shimming of rail, this support Work will be considered incidental to the overall Work and will not be measured.

B. The Work also includes re-installing bolted or Exothermic Welded Rail Grounding Straps.

4.02 PAYMENT

A. Direct Fixation Track on existing Guideway measured as specified in Article 4.01, will be paid for at the Contract unit price for "Re-construction of Direct Fixation Track on Existing Guideway" unless otherwise indicated on the Drawings, in the Specifications, or in the Bid Form.

B. Rail Grounding Straps on existing Guideway measured as specified in Article 4.01, will be paid for at the Contract unit price for "Rail Grounding Straps on Existing Guideway" (Bolted or Exothermic Weld) unless otherwise indicated on the Drawings, in the Specifications, or in the Bid Form.

C. The Contract price for each item will be payment in full for furnishing all labor, Materials, tools, equipment and incidentals, and doing all Work necessary to complete the Work specified.

D. Pay items specified under this Section and incorporated into the Bid Items for this Contract are listed below:

PAY ITEM	DESCRIPTION	PAY UNIT
34 11 05-01	Re-construction Direct Fixation Track	Track Foot
34 11 05-02	Rail Grounding Straps on Existing Guideway (Bolted or Exothermic Weld)	Each

END OF SECTION

SECTION 34 11 10
INSTALLATION OF RAILS FOR EXPANSION JOINTS

Part 1 – GENERAL

1.01 SUMMARY

A. The completed rail expansion joint shall be fabricated and installed so that the completed wheel running surface will to the greatest extent practical provide an unchanged wheel contact area throughout the length of the joint.

B. Related Sections:
   1. Section 34 11 05 – Re-construction of Direct Fixation Track
   2. Section 34 11 15 – Track Profile Grade Line Installation by Shimming
   3. Section 34 11 25 – Thermite (Field) Welding
   4. Section 34 11 50 – 115RE Tee Rail

1.02 REFERENCES

A. American Railway Engineering & Maintenance of Way Association (AREMA)
   1. Manual for Railway Engineering
      a. Chapter 4 Rail
   2. Portfolio of Trackwork Plans
      a. Plan No. 221, Details for Switch Points

B. American Standards & Tests of Materials ASTM
   1. ASTM A588 Standard Specification for Carbon Structural Steel
   2. Fasteners:
      a. Bolts: ASTM F3125
      b. Nuts: ASTM A563
      c. Washers: ASTM A436

1.03 SUBMITTALS

A. Submit the Quality Control Program described below.

B. Submit source of materials in advance of placing orders for those materials.

C. Submit types of equipment to be used on the structure, including weights and dimensions with sufficient information to determine compliance with the weight and dimensional constraints of the DTM system.

1.04 QUALITY CONTROL

A. The Quality Control Program shall describe regulating methods, procedures, and processes to ensure compliance with standards of quality required by the Contract Documents for Approval in compliance with Section 34 11 05 – Re-construction of Direct Fixation Track.
    1. All Work undertaken prior to approval of the Quality Control Program will be at the Contractor's risk.
    2. DTC will review the Contractor's methods, procedures, and processes for compliance with the approved program.
        a. Keep records of the Work performed complete and available to DTC during the performance of the Contract; and to such other agencies and for longer periods as may be specified elsewhere in the Contract.
    3. Give DTC sufficient notice when Work in any form is proposed so DTC may witness the procedures while work is being performed.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Components to be fabricated of rails shall be of 115RE as specified in the AREMA Manual Chapter 4 and Specification Section 34 11 50.

B. Steel components not otherwise specified on the plans shall be ASTM Grade A588 steel.

C. Fasteners
    1. Bolts shall be ASTM F3125 Grade A490 Type 3
    2. Nuts shall be ASTM A563 Grade DH3
    3. Washers shall be ASTM F436 Type 3 circular washers

PART 3 – EXECUTION

3.01 GENERAL

A. Protect from damage the existing Guideway Structure, the track and components ancillary to the track. These ancillary components consist of the Linear Induction Motor (LIM) Reaction Rail along the centerline of track; two Automatic Train Control (ATC) cables

with conduits, two non-metallic wire ways and the wall mounted Traction Power Rail System and communications and power cabling.

B. Grind or shim the deck as necessary to ensure that the top of rail through the installed rail expansion joint will be at the design top of rail through that portion of the alignment.

C. The installed rail expansion joint shall have a cant (inclination) toward the centerline of track of 1 in 40. Grind the deck or place shims as needed to provide this cant.

D. Should any of the anchor inserts in the deck be unusable, the location of the rail expansion joint and all supports be offset 12 inches and a full set of new inserts be installed. The direction of offset will be determined by DTC.

E. Clear and clean the work area for the Work of preparing the Structure Deck for re-installation of direct fixation fasteners and elevation shims.

3.02 DOUBLE POINT FIXED RAIL FABRICATION

A. The shape of the point shall be as shown on AREMA Portfolio Plan 221, Detail 5100, except as follows:
   1. The field side reinforcing bar shall be ½ inch thick as shown in Detail 5100, but the gauge side reinforcing bar shall be1 ¼ inches thick.
   2. There shall be no point rise.
   3. Base of rail shall be flat as shown on the drawing.

B. A single radius curve shall be machined in the sliding rail side to match the radius of the sliding rail.

3.03 SLIDING RAIL FABRICATION

A. Each sliding rail length shall be not less than 13’-0” long to provide sufficient length for installation of thermite welds in installation.

B. Ends of sliding rails shall not be drilled for joint bars

C. The undercut of the head shall be as shown on AREMA Portfolio Plan 221, Detail 5100.

D. For purpose of flexibility, the base shall not be as shown on AREMA Portfolio Plan 221, Detail 5100, but shall be cut vertically on both sides as shown on the plans.

E. The sliding rail shall be precurved to a radius of 150 feet, with the point of tangency located 15 inches beyond the designed end of the fixed rail.

F. The head of the sliding rail shall be milled to form a straight extension of the running rails off each end of the expansion joint. The depth of the milling shall be ¼ inch below the plane of the top of the rails.

G. All mill marking on the field side of the rail web shall be ground smooth with the web surface.

H. All rust, scale, and irregularities on the field side of the rail web, the underside of the head and the top of the base shall be removed and the surface smoothed.

3.04 OTHER COMPONENTS

A. Steel plate and shapes shall be A588 unless stated otherwise on the plans.

B. ¼ inch diameter grease fitting holes shall be drilled for and fitted with a SAE H-100 1/4"-28 SAE Straight Taper Thread Grease Fitting

3.05 INSTALLATION PROCEDURES

A. The installation procedure described herein does not relieve the contractor of his responsibility to achieve the specified quality of the final installation.

B. Expansion joint location shall be the same as that of the joint being replaced unless the existing anchor inserts in the deck cannot be reused. In that case the offset position shall be shifted, the amount and distance shall be as directed by DTC.

C. Should the amount of head wear require it, the adjacent rails shall be cut back beyond the location described below by the length of a transition rail as described in section 34 11 45 and such a transition rail shall be installed.

D. Installation process guidance:
   1. The relative positions of sliding rails and fixed rail shall be positioned as shown on the drawings and the fabrication clamped so as to prevent relative movement of the components during the installation process.
   2. The existing joint shall be removed and the deck and fastener seat locations cleaned.

3. The adjacent existing rails shall be cut back beyond the joint bars not less than 20 inches, the precise distance determined to provide for the location of the thermite weld used to attach the expansion joint to the existing rail.
4. The replacement expansion joint shall be placed and fully bolted into position.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The measurement of Installation of Rail Expansion Joints will be per each complete and in place.

B. The measurement of Transition Rails, if required will be per each complete and in place. These rails may or may not be required. For purposes of costing the project, it will be assumed that there will be 2 per rail expansion joint.

4.02 PAYMENT

A. Payment for Installation of Rail Expansion Joints will be per each complete and in place.

B. Payment for Transition Rails, if required will be per each complete and in place. The quantity of these items is indeterminate at this time. The quantity may vary between zero up to 2 per rail expansion joint. For pricing purposes the quantity will be assumed to be 2 per rail expansion joint.

END OF SECTION

SECTION 34 11 12
INSTALLATION AT EXISTING RAIL ANCHOR LOCATIONS

Part 1 – GENERAL

1.01 SUMMARY

A. This specification describes the reinstallation of the existing rail anchor on new rail. It also describes for the case where the existing rail anchor is unusable in part or in total, fabrication and installation of a new rail anchor on new rail at the location of the existing rail anchor.

B. Related Sections:
   1. Section 34 11 05 – Re-construction of Direct Fixation Track
   2. Section 34 11 15 – Track Profile Grade Line Installation by Shimming
   3. Section 34 11 50 – 115RE Tee Rail

1.02 REFERENCES

A. American Railway Engineering & Maintenance of Way Association (AREMA)
   1. Portfolio of Trackwork Plans
      a. Plan No. 221, Details for Switch Points

B. American Standards & Tests of Materials ASTM
   1. ASTM A588 Standard Specification for Carbon Structural Steel
   2. Fasteners:
      a. Bolts: ASTM F3125
      b. Nuts: ASTM A563
      c. Washers: ASTM A436

1.03 SUBMITTALS

A. Submit the Quality Control Program described below.

B. Submit source of materials in advance of placing orders for those materials.

C. Submit types of equipment to be used on the structure, including weights and dimensions with sufficient information to determine compliance with the weight and dimensional constraints of the DTM system.

1.04 QUALITY CONTROL

A. The Quality Control Program shall describe regulating methods, procedures, and processes to ensure compliance with standards of quality required by the Contract Documents for Approval in compliance with Section 34 11 05 – Re-construction of Direct Fixation Track.
    1. All Work undertaken prior to approval of the Quality Control Program will be at the Contractor's risk.
    2. DTC will review the Contractor's methods, procedures, and processes for compliance with the approved program.
        a. Keep records of the Work performed complete and available to DTC during the performance of the Contract; and to such other agencies and for longer periods as may be specified elsewhere in the Contract.
    3. Give DTC sufficient notice when Work in any form is proposed so DTC may witness the procedures while work is being performed.

PART 2 – PRODUCTS

2.01 MATERIALS

A. D-bars to be placed in the rail web shall be shaped in the rail contact area like the switch point reinforcing bars shown on AREMA Portfolio Plan No. 221, Detail 5100

B. Steel components not otherwise specified on the plans shall be ASTM Grade A588 steel.

C. Fasteners
    1. Bolts shall be ASTM F3125 Grade A490 Type 3
    2. Nuts shall be ASTM A563 Grade DH3
    3. Washers shall be ASTM F436 Type 3 circular washers
    4. Double coil spring washers shall meet the material requirements of ASTM F436 Type 3

PART 3 – EXECUTION

3.01 GENERAL

A. Protect from damage the existing Guideway Structure, the track and components ancillary to the track. These ancillary components consist of the Linear Induction Motor (LIM) Reaction Rail along the centerline of track; two Automatic Train Control (ATC) cables with conduits, two non-metallic wire ways and the wall mounted Traction Power Rail System and communications and power cabling.

B. Location of the replacement rail anchor shall be the same as that of the rail anchor being replaced unless the existing anchor inserts in the deck cannot be reused.

C. Grind or shim the deck as necessary to ensure that the top of rail through the installed rail anchor will be at the design top of rail through that portion of the alignment.

D. Rail shall have a cant (inclination) toward the centerline of track of 1 in 40 through the rail anchor. Grind the deck or place shims as needed to provide this cant.

E. Deck insert for bolts holding the rail anchor: Should any of the inserts be unusable, the location of the rail anchor and all supports be offset 24 inches and a full set of new inserts be installed. The direction of offset will be determined by DTC.

F. Clear and clean the work area for the Work of preparing the Structure Deck for re-installation of the rail anchor and elevation shims.

3.02 RAIL TREATMENT

A. Holes in rail shall not be pre-drilled.

B. Within the length of rail that will be within the anchor length and to a distance each side of not less than 12 inches:
   1. All mill marking on the rail web shall be ground smooth with the web surface.
   2. All rust, scale, and irregularities on the rail web, the underside of the head and the top of the base shall be removed and the surface smoothed

C. Position of holes in rail web shall be marked and drilling of these holes shall be performed after the rail is in its final position within the rail anchor.

3.03 INSTALLATION PROCEDURE

A. The installation procedure described herein does not relieve the contractor of his responsibility to achieve the specified quality of the final installation
.

B. This procedure guide line applies to both the case where existing anchor materials are being reused, or where new anchor material are being installed
.

C. In the case of anchor materials being reused, this reuse may not extend to the shims placed between D bar and angle, as the lateral position of the rail may differ from that of the rail being removed. In such case new shims shall be used to the extent necessary to meet the correct lateral position of the rail.

D. Installation process guidance:
   1. Ensure that the rail is in the correct final position both laterally and vertically.
   2. Place the angles and fully bolt them to the deck.
   3. Position D bars and shims, tightly filling the space between angle and rail web.
   4. If holes in D bars do not align vertically with the holes in the angle, adjust vertical position of angles as needed to attain that vertical alignment.
   5. Mark positions on web of rail to determine position of holes in rail web.
   6. Disassemble, marking pieces as needed to ensure that they will be placed correctly upon reassembly.
   7. Drill holes in rail web and deburr
   8. Reassemble, beginning with attachment of D bars, shims and angles to rail.
   9. Clean up.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The measurement of Installation of Rail Anchors will be per each complete and in place.

4.02 PAYMENT

A. Payment for Installation of Rail Anchors will be per each complete and in place.

END OF SECTION

SECTION 34 11 15
DISMANTLING OF EXISTING TRACK

Part 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. The Dismantling of existing Direct Fixation Track on The Detroit People Mover (DPM) System.
   2. Providing the equipment and materials for unfastening direct fixation rail clips; removal of the rail for salvage, un-anchoring fasteners and removal of the direct fixation fasteners with components and associated leveling shims for possible re-use.
   3. Removal and disposal of the existing Delrin Clips from the rail clips.
   4. Removal and disposal of the fastener rail base slide shims.
   5. Removal and disposal of the fastener clip bolts/nuts/washers, anchor bolts and spring washers.
   6. Disposal of the un-re-useable fastener leveling shims.

B. Related Sections:
   1. Section 34 11 00 – Rail Replacement Project
   2. Section 34 11 05 – Re-construction of Direct Fixation Track
   3. Section 34 11 20 – Refurbishment Existing Direct Fixation Fasteners

1.02 REFERENCES

A. THIS ARTICLE NOT USED

1.03 SUBMITTALS

A. Submit the following in Certified Documentation for rail and component removal and disposition for approval in compliance with Section 34 11 05 – Re-construction of Direct Fixation Track and as specified below:

B. A description of how the Dismantling Work will be undertaken.
   1. Outline the methods for the rail cutting, extent of rail cutting and removal of rail from the elevated structure.

C. A description of the equipment to be used in the Dismantling Work and the purpose and process of use of each piece of equipment.

D. Processes and methods to be used to protect from damage the existing Guideway Structure and auxiliary system components presently in place, including but not limited to DPM center-of-track located LIM rail and Automatic Train Control antenna assemblies, power rail system and all communications and power cabling.

E. A description of the methods and procedures to be used when occupying Detroit City streets for all removal to ensure compliance with the City's Standard Regulations.

1.04 QUALITY CONTROL

A. Submit a Quality Control Program regulating methods, procedures, and processes to ensure compliance with standards of quality required by the Contract Documents for Approval in compliance with Section 34 11 05 – Re-construction of Direct Fixation Track.
   1. All Work undertaken prior to approval of the Quality Control Program will be at the Contractor's risk.
   2. DTC will review the Contractor's methods, procedures, and processes for compliance with the approved program.
      a. Keep all records of the Work performed by the Contractor complete and available to DTC during the performance of the Contract; and to such other agencies and for longer periods as may be specified elsewhere in the Contract.
   3. Give DTC sufficient notice when Work in any form is proposed so DTC may witness the procedures while work on this Contract is being performed.

PART 2 – PRODUCTS

2.01 GENERAL

A. Bolt release or penetrating oil, WD-40 or equal. Purpose: Ease of disassembly of fastener rail clips, anchor bolts and bolted Ground Cable to rail-web connections.

PART 3 – EXECUTION

3.01 GENERAL

A. Survey the track structure to establish the limits of track tangent and curved rail for removal.

B. Apply penetrating release solution (WD-40 or other) to the four fastener bolts for ease in dismantling.

C. Dismantle the bolt and nuts holding rail clips to release the rail hold-down clips.

D. Chisel off the welded Grounding Cable Exothermic Welds from the rail web and dismantle bolted Grounding Cables.

E. Cut the rail in suitable lengths for lifting and removal from the Guideway Structure.

F. Dismantle the fastener anchor bolts to release the fastener from deck surface.

G. Collect and dispose of the existing used fastener Delrin clips and polyethylene rail base slide pads.

H. Collect and dispose of the rail clip bolts.

I. Collect and dispose of the rail anchor bolts.

J. Collect and stock pile (adjacent to the removed location) the existing fastener deck shims for re-use.

K. Clear and clean the work area for the Work of preparing the Structure Deck for re-installation of direct fixation track with new pre-curve rail.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The Work in this Section will be considered as incidental to the overall Work of rail replacement and will not be Measured.

4.02 PAYMENT

A. The Work in this Section will be considered as incidental to the overall Work of rail replacement and will not be included in Payment.

END OF SECTION

SECTION 34 11 20
REFURBISHMENT EXISTING DIRECT FIXATION FASTENERS

Part 1 – GENERAL

1.01 SUMMARY

A. Section includes:
   1. Refurbishment of existing Direct Fixation Fasteners for reuse in the track of The Detroit People Mover (DPM) System.
   2. Providing the equipment to undertake refurbishment of these fasteners.
   3. Checking the fastener condition in the serrated and bolting area to determine whether or not the fastener is of a sound condition for re-installation.

B. Related Sections:
   1. Section 34 11 05 – Re-construction of Direct Fixation Track
   2. Section 34 11 15 – Dismantling of Aerial Direct Fixation Track

1.02 REFERENCES

A. THIS ARTICLE NOT USED.

1.03 SUBMITTALS

A. Submit in Certified Documentation the fastener refurbishment procedures to be undertaken for evaluation of the fastener condition. In these procedures shall be described:
   1. Procedures to be used to determine whether or not the fastener can be refurbished so that its reuse will result in construction of track that will be in compliance with for the requirements of Section 34 11 05 – Re-construction of Direct Fixation Track.
   2. A detailed description of how the fastener serrated area continued functionality is to be determined and if it is, how it is to be treated.
   3. A detailed description of how the bolt slot continued functionality is to be determined and if it is, how it is to be treated.

B. Submit a Quality Control Program

C. Submit a Fastener Condition Report for each fastener containing the information required in 3.01C. The report shall be submitted within 48 hours of the inspection of the fastener.

1.04 QUALITY CONTROL

A. The Quality Control Program shall describe the methods, procedures, and processes to be used to ensure compliance with standards of quality required by the Contract Documents to enable that the use of these refurbished fasteners in track will result in a track that will comply with the requirements of Section 34 11 05 – Re-construction of Direct Fixation Track and as specified below:
   1. All work undertaken prior to approval of the Quality Control Program will be at the Contractor's risk.
   2. DTC will review the Contractor's methods, procedures, and processes for compliance with the approved program.
      a. Keep all records of the Work performed by the Contractor complete and available to DTC during the performance of the Contract; and to such other agencies and for longer periods as may be specified elsewhere in the Contract.
   3. Give DTC sufficient notice when Work in any form is proposed so DTC may witness the procedures while work on this contract is being performed.

PART 2 – PRODUCTS

2.01 GENERAL

A. DTC will furnish the following new Materials for all fasteners to be refurbished:
   1. New "DELRIN" molded clamp pads
   2. New Round Head Square Neck Bolts
   3. New Self-Locking Nuts
   4. New Helical Spring Lock Washers
   5. New Rail Seat Base Extruded Channel

PART 3 – EXECUTION

3.01 GENERAL

A. Protect from damage the existing Guideway Structure, the tracks and components ancillary to the track. These ancillary components consist of the Linear Induction Motor (LIM) Reaction Rail along the centerline of track; two Automatic Train Control (ATC) cables with conduits, two non-metallic wire ways and the wall mounted Traction Power Rail System and communications and power cabling.

B. Replacement Elastomeric Rail Fasteners of the design shown on J-16281-63 and J-16281-64 are not readily available. Protect the condition of the existing fasteners when working with and around the existing in-place direct fixation fasteners.

C. If a fastener is determined by DTC to not be reusable, a replacement will be provided by DTC. Cost of the replacement fastener will be assigned as follows:
   1. If due to the negligence of the contractor, at the expense of the Contractor
   2. If due to the condition of the fastener, at the expense of DTC.

D. Inspect each and every direct fixation fastener body shown in DWG J 16281-64 for suitability for re-use.
   1. Inspect in-depth for rust deterioration and breakage
   2. Immediately inform DTC of deficient quality fasteners.
   3. A decision will be made by DTC as to whether or not the extent of the detrimental condition permits reuse.

E. Power wire brush each and every direct fixation fastener's serrated tooth areas to remove of pitted rust and residue to reestablish the remaining serrated tooth portions to allow for interface with the matching serrated rail clips on re-assembly.

F. Power wire brush each and every direct fixation fastener's rail seat area to remove pitted rust and residue to reestablish a clean rail seat area to allow for the seating of the new fastener rail base slide pad shown in Drawing Y-30061-1-E on re-assembly.

G. Power wire brush each and every direct fixation fastener's bolting areas to remove pitted rust and residue to reestablish a clean bolt, nut or washer seat area to allow for proper seating of the new bolts, nuts, and spring washers on re-assembly.

H. Power wire brush each and every direct fixation fastener clip Drawing Y-29099-2-F in the serrated clip area to remove pitted rust and residue to reestablish the remaining serrated tooth portions to allow for interface with the matching serrated direct fixation fastener on re-assembly.

I. Power wire brush each and every direct fixation fastener clip in the clip bolting area to remove pitted rust and residue to reestablish a clean bolt, nut or washer area to allow for proper seating of new bolts (Drawing Y-32075-7), nuts (Drawing Y-29096-1), and spring washers (Drawing Y-31758-1) respectively on re-assembly.

J. Power wire brush each and every direct fixation fastener clip in the Delrin clip area to remove pitted rust and residue to reestablish the Delrin clip contact area portion to allow for application of new Delrin clips as shown in Drawing Y-30062-1 for interface with the rail base and direct fixation fastener on re-assembly.

K. Checking the two fastener clip bolt slots to determine whether they can adequately engage and retain the new square neck bolts (Drawing Y-32075) that secure the assembled fastener clip or clamp shown in Drawing Y-30063-1.

L. Salvage the flat plate Washer (Drawing Y-31117-1) and Spacer (Drawing Y-32865-1) respectively and power wire brush to remove pitted rust and residue to establish a satisfactory condition for re-assembly.

M. Salvage the flat metal fastener leveling shims and power wire brush to remove pitted rust and residue to establish a satisfactory condition for re-assembly.

N. Clear and clean the Work area for the work of preparing the Structure Deck for re-installation of direct fixation track with new rail.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The Work in this Section will be considered as incidental to the overall Work of Re-construction of Direct Fixation Track and will not be measured.

4.02 PAYMENT

A. The Work in this Section will be considered as incidental to the overall Work of Re-construction of Direct Fixation track and will not be included in Payment.

END OF SECTION

SECTION 34 11 25
THERMITE WELDING OF RAIL

PART 1 – GENERAL

1.01 DESCRIPTION

A. Description: This Section includes furnishing, installing, and testing exothermic thermite rail welds to connect rail sticks and special trackwork rails as specified herein and in accordance with the requirements of AREMA, Chapter 4, Section 3.13, Specifications for Quality Assurance of Thermite Welding of Rail.

B. Work described in this section includes but is not limited to:
1. Site Verification of Conditions
2. Preparation
3. Thermite welding Procedures
4. Weld Numbering
5. Finishing Welds
6. Repair
7. Quality Control
8. Cleanup

C. Related Sections:
1. Section 34 11 05 – Re-construction of Direct Fixation Track
2. Section 34 11 40 – Re-construction of Special Trackwork Switch Components
3. Section 34 11 50 – 115RE Tee Rail (Reference Procurement of Rail)

1.02 REFERENCES

A. American Railway Engineering and Maintenance-of-Way Association (AREMA):
1. Manual for Railway Engineering, Chapter 4, Part 3, Section 3.13

B. ASTM International (ASTM):
1. ASTM E10 Standard Test Method for Brinell Hardness of Metallic Materials
2. ASTM E164 Standard Practice for Contact Ultrasonic Testing of Weldments

C. American Society for Non-Destructive Testing (ASNT):
   1. ASNT Central Certification Program (ACCP)
   2. ANSI/ASNT CP-189 Standard for Qualification and Certification of Nondestructive Testing Personnel
   3. Recommended Practice No. SNT-TC-1A

1.03 SUBMITTALS

A. Submittal information requirements:
   1. Quality Program in accordance with Section 34 11 05 – Re-construction of Direct Fixation Track.
   2. Quality Control Program in accordance with Article 1.04a.1 herein.
   3. Results of all tests required in Article 1.04, including the welds and rail pieces tested where required.
   4. Welding foreman's qualifications, certifications, and experience record in accordance with Article 1.04B herein.
   5. Relevant to the Testing Agency:
      a. Copy of the testing agency agreement in accordance with Article 1.04C.1.c herein
      b. Testing agency qualifications, personnel, and certification of testing program and procedures in accordance with Article 1.04C.2.b herein
      c. Testing agency inspection program in accordance with Article 1.04C.3.a herein
   6. Certified qualification test results for the thermite welding procedures in accordance with 1.04D.1.e herein.
   7. Welding crew qualification documentation in accordance with Article 1.04D.1 herein.
   8. Certification from the material manufacturer that the powder portions of the thermite welding kit comply with the referenced requirements, including hardness requirements of AREMA high strength rail.
   9. The manufacturer's instructions or procedures for the thermite welding process prior to performing the thermite welding to qualify the thermite welding procedure, welding foreman, and welding crews.
   10. The manufacturer's recommendations concerning handling, storage, and shelf life of thermite rail welding products.
   11. Certified test results documenting the outcome of the testing of the test welds om accordance with Article 1.04D.1 herein.
   12. Production rail welding test reports in accordance with Article 3.07B.1 herein.

13. Thermite welding records every two days in accordance with Article 3.07F.1 herein.
14. The paint marker to be used to mark the welds for identification.

1.04 QUALITY ASSURANCE / QUALITY CONTROL

A. Quality Control Program:

1. Develop and maintain a Quality Control Program for handling, storing, and installing thermite welds to regulate methods, procedures, and processes.
   a. Thermite Welding Procedure:
      1) Prepare a detailed thermite welding procedures for DTC review and approval covering step-by-step directions for making thermite welds in the rail.
         a) If the manufacturer's recommended procedures for welding high-strength rail differ from those for welding standard rail, state the specific differences and procedures for each.
      2) Include a complete description of each of the following items and other essential information in each thermite welding procedure:
         a) Manufacturer's trade name for the welding process
         b) Method used for cutting rail and cleaning rail ends
         c) Rail end spacing, tolerance, and procedure for setting the rail gap
         d) Methods and equipment to be used to maintain the rail gap and alignment during welding
         e) Methods for placing and luting prepared molds
         f) Method used for preheating rail ends, including duration in time and temperature range
         g) Procedure for igniting and flashing prior to drop into mold, including minimum duration in time (in seconds) required before drop
         h) Procedure for tapping the mold, including minimum duration in time required to cool the weld under the mold insulation
         i) Methods used for removing gates and risers, and for finishing the weld to make it suitable for ultrasonic inspection, including a description of special tools and equipment required
         j) Method for producing the hardness specified in Article 3.07E.2 herein
         k) Quality Control procedures

l) Environmental and safety methods for controlling smoke and fumes when thermite welding in tunnels and other enclosed areas.

b. Submit the Quality Control Program to DTC for acceptance.

B. Welding Foreman:

1. Employ a welding foreman who has a minimum of 5 years' experience supervising thermite welding to directly supervise all thermite welding.
2. Submit the welding foreman's qualifications, certifications, and experience record for approval.

C. Testing Agency:

1. Employ a reputable, certified, and independent testing agency(s) experienced in performing all of the tests required by this Section to perform all weld qualification testing and production weld testing and to certify whether or not each weld meets the quality criteria. The testing agency shall not be changed during the duration of the Contract.
   a. The following shall be in the Contractor's agreement with the testing agency:
      1) The testing agency is responsible to DTC, not the Contractor.
         a) DTC, at its discretion, may observe all inspection and testing.
      2) All communication between the testing agency and the Contractor shall be copied to DTC.
   b. At least 30 days before welding testing operations are initiated, submit a copy of the agreement with the testing agency for approval.
2. The independent testing agency testing program, personnel, and procedures shall be certified.
3. Submit the testing agency, its personnel, and certification of their testing program and procedures to DTC.
4. Test technicians performing non-destructive examination of rail welds shall hold an ASNT Level II or Level III certification in accordance with Recommended Practice No. SNT-TC-1A, the ACCP, and ANSI/ASNT CP-189; and shall have at least 1 year of experience testing for defects in rail.
5. Inspection Procedures:
   a. The independent testing agency shall prepare an inspection program and submit it to DTC for approval.

b. The program shall include a description of proposed procedures, equipment, and reports.

D. Qualifying the Thermite Welding Procedure:

1. Prior to beginning production thermite welding, qualify the welding crew and thermite welding procedure described in Article 1.04A herein, by preparing and testing four qualification weld samples as follows:
   a. Prepare and test qualification weld samples joining:
      1) High strength rail to high strength rail (2 required – Labeled 1A & 1B)
      2) High strength rail to standard rail (2 required – Labeled 2A & 2B)
   b. The qualification weld samples shall be prepared by the welding crew in the presence of DTC personnel.
   c. To prepare each qualification weld sample, join two pieces of rail, each a minimum of 30 inches in length.
   d. The testing agency shall test each of the four qualification weld samples to qualify the welding crew and the welding procedure by using the following specified test procedures:
      1) Visual and dimensional inspection testing as specified in Article 1.04E herein
      2) Ultrasonic testing specified in Article 1.04F herein
      3) Brinell Hardness testing specified in Article 1.04G herein
      4) Dynamic testing specified in Article 1.04H herein
      5) Slow bend testing specified in Article 1.04I herein
   e. The thermite welding procedure will be considered qualified if all tests and inspections, and the weld kit, meet or exceed the acceptance requirements specified.
   f. If tests or inspections fail, re-submit a revised thermite welding procedure to qualify the revised procedure in accordance with the requirements herein.
2. Do not begin production thermite welding until a thermite welding procedure is qualified and accepted by DTC in accordance with the requirements herein.
3. DTC has, at its sole discretion, the authority to waive either in whole or in part the requirements for qualification weld testing provided that the Contractor presents information that documents that the welding processes, including Article 1.04D.1.f herein, and crews proposed for the Work have passed similar testing within a 12-month period immediately preceding the commencement of rail welding operations.

E. Visual and Dimensional Inspection: Subsequent to finishing the weld, visually and dimensionally inspect each weld to determine conformance with the alignment and finishing tolerances in AREMA Manual for Railway Engineering, Volume 1, Chapter 4 Rail, Section 3.11, Specifications for Fabrication of Continuous Welded Rail, except as modified by this Section.

1. Inspect each of the four welds 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 railhead.
2. Center the straightedge over the weld; the gap between the end of the straightedge and the railhead shall not exceed AREMA Chapter 4 criteria.
3. Cut out and re-weld out-of-tolerance welds in accordance with these Specifications.

F. Ultrasonic Testing:

1. Test Procedure:
   a. Scan each of the four rails in a zigzag pattern to scan the full rail weld at a scanning level of plus 20 dB minimum, twisting the probe on one side of the weld only, and at a rate not exceeding 6 inches per second.
   b. Scan longitudinally to the rail and overlap each pass a minimum of 10 percent.
   c. When a reflection of greater amplitude than the acceptance criteria listed in Article 1.04F.2 herein is found, scan the full perimeter of the weld from both sides to ensure full weld coverage and determination of the discontinuity size, type, and location.
2. Acceptance Criteria: All welds shall be free from defects or flaws giving a reflected display of greater than 20 percent of the distance-amplitude correction curve at the calibration level, and that are free from defects or flaws of equal or greater amplitude than shown in Table 34 11 25-1.

Table 34 11 25-1
Minimum Acceptance Levels (Decibels) Weld Thickness (inches)
and Transducer Angle

Reflector	5/16" to 3/4"	3/4" to 1-1/2"	1-1/2" to 2-1/2"		2-1/2" to 4"		4" to 6"	
Severity	70°	70°	70°	45°	70°	45°	70°	45°
Large Reflectors	+8	+3	+1	+4	-4	+1	-7	-2
Small Reflectors	+9	+4	+1	+6	-2	+3	-5	0
Minor Reflectors	+10	+5	+3	+8	0	+5	-3	+2

G. Brinell Hardness Test for Testing Qualification Welds:

1. Test Procedure:
   a. Preparation:
      1) Longitudinally section sample 2A of the high strength to standard rails along the centerline of the rail for a distance of 6 inches on each side of the weld and test for Brinell Hardness.
      2) Microetch and photograph the section to show fusion lines and heat-affected zones.
      3) Establish a grid pattern commencing 1/4 inch below top of rail in 1/2-inch increment rows for 3 inches below the top of rail extending on the same grid pattern for 3-1/2 inches on each side of the centerline of the weld and on a grid pattern of 1-inch increments beyond the heat-affected zone until the hardness is that of the original parent metal
   b. Test the longitudinal sectioned face for hardness at points on the grid pattern in accordance with ASTM E10 with a 10 mm ball and an applied load of 3,000 kg.
2. Acceptance Criteria: The BHN in the weld area and adjacent heat affected zones shall be as follows:
   a. For high-strength Rail: 310 minimum and 400 maximum.
   b. The heat affected zone shall be 1-1/4 inch maximum width 1/4 inch below the top of rail head.
3. Submit the tested rail section to DTC along with the test report.

H. Rolling Load Test for Dynamic Testing of Qualification Welds:
1. Test Procedure:
a. From the high strength to high strength qualification weld sample 1A, after it has passed the visual and ultrasonic testing and subject it to the dynamic rolling load test.
b. Place the test sample on supports separated by 36 inches on center with the weld located between the supports as shown in Figure 34 11 25 - 1.
c. To simulate a rolling load, use two hydraulic rams to repeatedly apply loads to the rail alternately at Points A and B as shown in Figure 34 11 25 - 1.
1) Vary each load approximately sinusoidaly from 0 to 44,400 pounds.
a) Monitor the loads with load cells placed between each ram and the rail head.
b) Calibrate the load cells prior to commencement of the test program.
2) Apply loading for 2 million load cycles.
a) One application of the load at Point A followed by one application of the load at Point B constitutes one load cycle.
d. Measure permanent rail deflection at Point A every 500,000 load cycles, and record the measurement to the nearest 0.001 inch.
2. Acceptance Criteria:
a. Following the full 2 million load cycle test, the weld shall have withstood the full number of cycles with no visual cracks and the permanent deflection is less than or equal to 0.094 inch.

I. Slow Bend Test for Dynamic Testing of Qualification Thermite Welds:
1. Test Procedure: After samples 1B and 2B have passed the visual and ultrasonic testing, subject both weld sample types to the slow bend test described in the AREMA Manual for Railway Engineering Volume 1, Chapter 4 Rail, Part 3, Section 3.10, subsection 3.10.3.6 Slow Bend Tests for Electric Flash Butt Welding.
2. Acceptance Criteria:
a. Minimum deflection: 0.60 inch before visible failure for 115RE rail.
b. Modulus of rupture: 120,000 pounds per square inch, minimum for 115RE rail.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Storage of Thermite Welding Materials:
   1. Handle and store welding products in accordance with the manufacturer's recommendations.
   2. Store crucibles, molds, and thermite mix portions in a dry location in order to prevent moisture contamination.
   3. Do not use thermite mix portions stored beyond their stated shelf life.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Thermite Welding Kits: Select and furnish a welding kit that conforms to the requirements of AREMA Manual for Railway Engineering, Vol. I, Chapter 4 Rail, Section 3.13, Specification for the Quality Assurance of Thermite Welding of Rail, except as modified herein.
   1. All materials used on any given thermite weld shall be the products of a single manufacturer or recommended by the manufacturer for use with their welding process and that have passed the manufacturer's quality programs.

B. Provide all other materials required to perform the Work specified herein.

2.02 EQUIPMENT

A. Furnish all testing equipment required to perform weld quality and qualification testing as specified herein as part of the testing agency service.
   1. Visual and Dimensional Testing Measuring Tools:
      a. Taper Gauge:
         1) Manufacturer: L.S. Starrett Company Catalog Number 270, or accepted tool of the same standard of quality.
      b. Straightedge:
         1) Material: Stainless Steel.
         2) Length: 3 feet.
         3) Manufacturer: L.S. Starrett Company Catalog Number 380-36, or accepted tool of the same standard of quality.

2. Ultrasonic Testing Equipment:
    a. Furnish an ultrasonic, pulsed echo instrument capable of inspecting rail welds and detecting a 3/64-inch discontinuity 6-1/2 inches below the top of rail, and having the following features:
        1) A calibrated decibel gain control with 2-dB, minimum, increments.
        2) Operation in the 1 to 5 MHz range.
        3) A graduated CRT screen.
        4) Calibrated paper tape recording attachments to record accurately the CRT screen indications when a non-complying weld is located.
        5) 2.25 MHz angle beam transducers, 1/2 inch by 1 inch at 70 degrees and 45 degrees.
        6) Suitable high-viscosity couplings with good wetting characteristics.
    b. Furnish standard IIW calibration blocks of rail steel for primary reference response and to construct the distance-amplitude correction curve.
    c. Furnish DSC blocks of rail steel for calibration checks.
    d. Furnish an 18-inch long calibration tee rail having hole patterns as shown in Figure 34 11 25 - 2.
3. Brinell Hardness Testing Equipment: Furnish equipment capable of performing Brinell Hardness testing in accordance with ASTM E10 with a 10-mm ball and an applied load of 3,000 kg.
4. Dynamic testing equipment as required by the Testing service to conduct testing indicated in this Section.
5. Provide all other equipment required to perform the Work specified herein.

B. Tools used shall meet the minimum requirements of the manufacturer of the rail welding kit and DTC.

PART 3 – EXECUTION

3.01 SITE VERIFICATION OF CONDITIONS

A. Do not perform thermite welding during periods of precipitation, when winds exceed 25 mph or in the presence of atmospheric electrical activity.

B. During the setup and performance of thermite welding, prohibit other work that would move or vibrate the rails, or otherwise interfere with properly performing the thermite welding and obtaining satisfactory welding results from occurring.

3.02 PREPARATION

A. Thermite Weld Locations:
   1. Stagger the locations of thermite welds in rails on opposite sides of the track a minimum of 20 inches at all locations.
   2. Do not position welds either on or within 6 inches of the edge of a direct fixation rail fastener or turnout support plate.

B. Rail End Preparation:
   1. Cut the rail ends by using a power saw, or abrasive rail cutting machine, after arranging and aligning the saw at right angles to the alignment of the rail. Torch cutting of rail ends is prohibited.
   2. Bolt Holes: The end 12 inches of the rail shall be free of holes and attachments of bond wires.
   3. Clean all rail surfaces of the rails to be welded to a minimum of 6 inches back from the rail ends.
      a. First, use a wire brush to completely remove all dirt and loose scale.
      b. Complete the cleaning using an oxy-acetylene torch at a minimum temperature of 250 degrees Fahrenheit to remove grease, oil, and moisture.
   4. Remove all scale and rust a minimum of 2 inches back from the ends using a power-actuated grinder with an abrasive wheel.
   5. Remove all burrs and lipped metal that would interfere with the fit of the thermite weld mold.
   6. Examine the rail ends for signs of internal defects. If the rail end has not been freshly cut, grind the end to bright metal prior to the examination.

3.03 THERMITE WELDING PROCEDURES

A. Welding procedures and methods:
   1. Do not weld rail ends that show steel defects, dents, or porosity.
   2. Properly gap, camber, and align the ends of the rails to be welded to produce a weld in conformance with the specified tolerances.

B. Weld Gap:
   1. The minimum and maximum gap shall be in accord with the instructions of the manufacturer of the weld kit.
   2. Make the minimum measurement with a go or no-go gauge of the specified dimensions for the thermite process used.

3. Adjust the gap if it is under the minimum or more than 1/8 inch over the specified gap.
4. Wide Gap Thermite Welds:
    a. Wide gap thermite welds are not allowed, except as herein specified.
    b. At the discretion of DTC and only at special trackwork weld locations, wide-gap welds may be permitted to salvage a special trackwork component.
        1) Obtain prior written approval before procuring the wide weld kits.
        2) Wide weld kits, methods, and a qualification test sample shall be qualified in accordance with the thermite weld qualification procedure specified in Article 1.04D herein.

C. Rail Alignment:
1. Measure the rail alignment on the head of the rail.
2. When the weld is completed, the vertical alignment shall provide a level running surface.
    a. Absorb differences of height of the rails at the base.
3. Horizontally align the rail so that differences in the width of the heads of the rails occur on the field side.

D. Gap and align the ends of the rails to be welded to produce a weld that conforms to the following alignment tolerances:
1. Horizontal offsets shall not exceed 0.040 inch in the head and 0.125 inch in the base.
2. Surface Misalignment Tolerance:
    a. Combined vertical offset and crown camber shall not exceed 0.040 inch per foot at 60 degrees Fahrenheit.
    b. Combined vertical offset and dip camber shall not exceed 0.010 inch per foot at 60 degrees Fahrenheit.
3. Gauge Misalignment Tolerance: Combined horizontal offset and horizontal kink shall not exceed 0.040 inch per foot at 60 degrees Fahrenheit.

E. Hold the rail gap and alignment without change during the complete thermite welding cycle by using a hydraulic rail puller/expander and alignment jig.

F. Sealing the Molds: Seal the molds, but do not introduce mold sealant or luting material into the weld chamber.

G. Preheating:
   1. Prior to welding, preheat the rail ends to a temperature and for time sufficient, as indicated in the approved thermite welding procedure, to ensure full fusion of the weld metal to the rail ends without cracking of the rail or weld.
   2. Check the quality of the gas used for preheating to ensure even temperatures are maintained during preheating.
   3. Check the rail temperature by using tempilstick, or as directed by the DTC.

H. Tapping:
   1. Follow the thermite welding kit manufacturer's instructions and state the minimum timing in seconds to melt the weld metal in the crucible and tap it into the mold.
   2. After the metal has cooled sufficiently to begin solidifying, shear the upset weld metal that overflowed into the mold pans to form the basic rail cross-sectional shape.

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

3.04 WELD NUMBERING

A. Mark a sequential thermite weld number on the rail immediately adjacent to the weld using a paint marker at the time the weld is made.
   1. Paint the number beginning not less than 2 inches and not more than 3 inches from the finished weld on the gauge side web of the rail.
   2. The numbers shall not be less than 2 ½ inches high.

B. Number welds sequentially in the order in which they are made.

C. When defective welds are replaced, assign a new sequential number to the new weld by adding a letter to the defective weld number; for instance, defective weld 7 would be replaced by weld 7A.

D. The weld number and letter if applicable shall correspond with the number recorded in the welding records.

3.05 FINISHING WELDS

A. Finish the weld with a rail-mounted railhead grinder specifically designed for the Work.
   1. Blend all grinding to the parent rail section.
   2. Do not overheat the steel.
   3. Complete heavy grinding while the steel is still hot from welding process.

B. Finish the rail weld in the rail head to match the contour of the head to the following tolerances:
   1. Top of railhead: Plus 0.010 inch to minus 0 inch of the parent rail section.
   2. Sides of railhead: Plus 0.020 or minus 0 inch of parent rail section.

C. Finish the balance of the rail section with a hand-held grinder as follows:
   1. The base riser break off area shall be ground flush with the weld collar. Other than the smoothing of the base riser break off area, the as cast geometry of the thermite weld shall be left intact.

3.06 REPAIR

A. Cut out and reweld welds rejected during inspection and/or testing, or replace them with at least a 13-foot rail welded in its place in accordance with these Specifications.
   1. Cut out and reweld rejected welds in accordance with these Specifications.

3.07 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: A representative from the thermite weld kit manufacturer who is experienced with the thermite welding method being used shall be on site and witness the making of at least the first four acceptable qualification welds.

B. The testing agency specified in Article 1.04C herein, shall perform all inspection and testing of the sample test and production rail welding specified in this Article, prepare test reports for all tests performed, and do the following:
   1. Unless otherwise allowed by DTC, thermite welds shall be tested within 2 days of completion of the weld.
   2. Test reports shall be submitted to the Contractor and DTC within 2 days of testing the weld.

3. Certify whether or not each weld meets the quality criteria specified.
4. Indicate acceptance or rejection of each tested weld by marking the weld.

C. Visual and Dimensional Inspection: Subsequent to finishing the weld, visually inspect each weld to check for surface defects and to determine conformance with the alignment and finishing tolerances herein and in AREMA Manual for Railway Engineering, Volume 1, Chapter 4 Rail, Part 2 Specifications, Section 3.11 Specifications for Fabrication of Continuous Welded Rail.
   a. Each completed weld shall have full penetration and complete fusion and be free of cracks.
   b. Inspect the alignment of 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 railhead.
      1) Center the straightedge over the weld.
      2) The gap between the end of the straightedge and the railhead shall not exceed0.060 inches maximum, or 0.040 inches per foot..
      3) Verify that the tolerances specified in Article 3.03D herein, have been met.
   c. Verify that the finish is within the tolerances specified in Article 3.05B herein.
   d. Cut out and reweld out-of-tolerance welds in accordance with these Specifications.

D. Ultrasonic Testing:
   1. Calibrate the ultrasonic testing equipment at the start and end of each day's work, and at least every 4 hours during periods it is used for examining welds.
      a. Check the calibration with DSC blocks.
      b. If points on the distance-amplitude curve have been changed by more than 20 percent, void all results since the last calibration check and re-examine all welds made since that check.
      c. If the curve has moved on the sweep line by more than 5 percent, void all results since the last calibration check and re-examine all welds since that check.
   2. Have each production weld ultrasonically tested in accordance with Article 1.04F herein.
      a. Test the weld after the rail's position in track is in compliance with the requirements specified in Section 34 11 05 – Re-construction of Direct

Fixation Track, Section 34 11 40 – Re-construction of Special Trackwork Switch Components. Testing shall be conducted only after the rail will not be further handled after testing is complete.

3. The ultrasonic test results submittal form shall identify the weld by the thermite weld identification number and shall include the following information:
   a. Location of the weld in the track.
   b. Results of visual inspection.
   c. Ultrasonic test results, including the size of defects found in the head, web, and base of the rail.
   d. Shape, identity, and location of all reflections.
   e. Trace identity.
   f. Name of inspector.
   g. Other information as required including date, weather at the time of the inspection, unusual conditions, and similar information.
4. Where ultrasonic testing indicates a reflection of greater amplitude than the acceptance criteria in Table 34 11 25-1 allows, paint across that weld on both sides of the rail head and web to identify a weld not conforming to the acceptance criteria.
   a. Make and submit a permanent trace recording of discontinuity indications.

E. Brinell Hardness Test for Testing Welds:
1. Test Procedure:
   a. Prior to testing, remove mill scale or surface residue that may affect test results.
   b. Perform Brinell Hardness testing in accordance with ASTM E10, measuring hardness in the weld area and heat affected zones on the head of the rail at ½ inch intervals.
2. Acceptance Criteria: The Brinell Hardness shall be equal to the Brinell Hardness or the parent metal within a tolerance of plus 30 or minus 50 BHN.
3. If the cooling process being used does not result in the required hardness, suspend all welding until the cooling process is perfected.
4. Relief from the hardness requirements will not be considered or granted.

F. Thermite Welding Records:
1. Maintain a complete and current record of all thermite welds and their locations. Submit them to the DTC on a two day basis during the production of

welds. The record shall show all information required in this Section and submitted on forms similar to the exhibit at the end of this Section. The submitted forms shall be the original record and not data that has been transcribed onto clean sheets back in the office. Forms shall be initialed by the welding foreman and, if present at the time of welding, by DTC and other oversight personnel.

2. Figure 34 11 25-3 illustrates a typical welding record, but does not include boxes for all of the information required. Prepare an appropriate form for thermite welding records that shall include the following information:
    a. Date and time welded.
    b. Weld number.
    c. Location by station stating track identity or direction and rail position or position within a particular special trackwork layout.
    d. Rails being joined. Individually identify each rail at the joint by rail section, heat number, rail letter, and metallurgy (i.e. high-strength, standard strength)
    e. Names of Contractor's welding personnel present.
    f. Name of DTC representative present (if any).
    g. Name of manufacturer's representative (if any).
    h. Rail gap (to the nearest 1/16 inch) and method used to maintain gap during welding.
    i. Weather conditions.
    j. Air and rail temperatures.
    k. Weld kit trade name, the identification numbers of individual components and the shelf-life expiration date(s) marked on the packaging.
    l. Track alignment (curve, tangent, gradient, and similar descriptors).
    m. Rail stress situation at time of welding. For final stick closure welds, document the status of anchorage and the method(s) employed to make certain the rail is at the appropriate stress condition at the time of welding.
    n. Inspection date.
    o. Last calibration testing date of ultrasonic equipment.
    p. Printed names signatures (not initials) of key personnel present.
    q. Inspection results.

3.08 CLEANUP

A. Upon completion of each weld, clean the transit system guideway and right-of-way of all welding debris including discarded molds, slag, discarded equipment, and other debris that accumulated during the Work.

B. Restore the job sites to pre-welding conditions to the satisfaction of DTC.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Thermite welds will be measured per each rail section connecting weld performed, tested, and accepted at required locations, unless otherwise indicated on the Plans or in the Specifications.

4.02 PAYMENT

A. Thermite welds will be paid for at the Contractor unit price for "Thermite Welds for 115RE rail", unless otherwise indicated on the Plans, in the Specifications, or in the Bid Form.

B. The Contract price paid will be payment in full for furnishing all labor, Materials, tools, equipment and incidentals, and doing all Work necessary to complete the Work specified.

C. Pay item specified under this Section and incorporated into the Bid Items for this Contract are listed below:

Pay Item	Description	Pay Unit
34 11 25-01	Thermite Welds for 115RE rail	Each

Figure 34 11 25-1

CALIBRATION RAIL

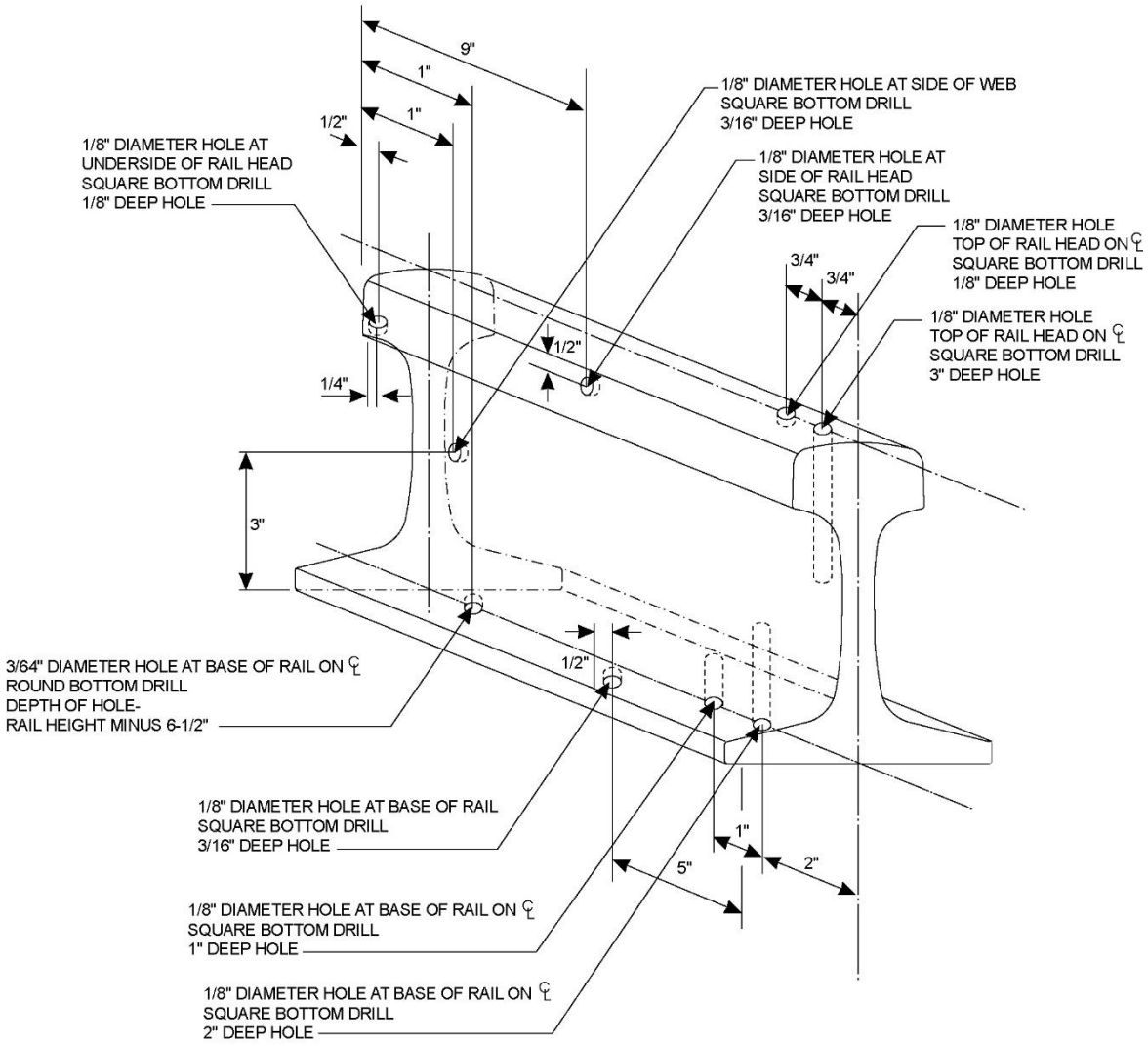


Figure 34 11 38-2

DYNAMIC TEST – LOADING ARRANGEMENT/MOMENT DIAGRAM

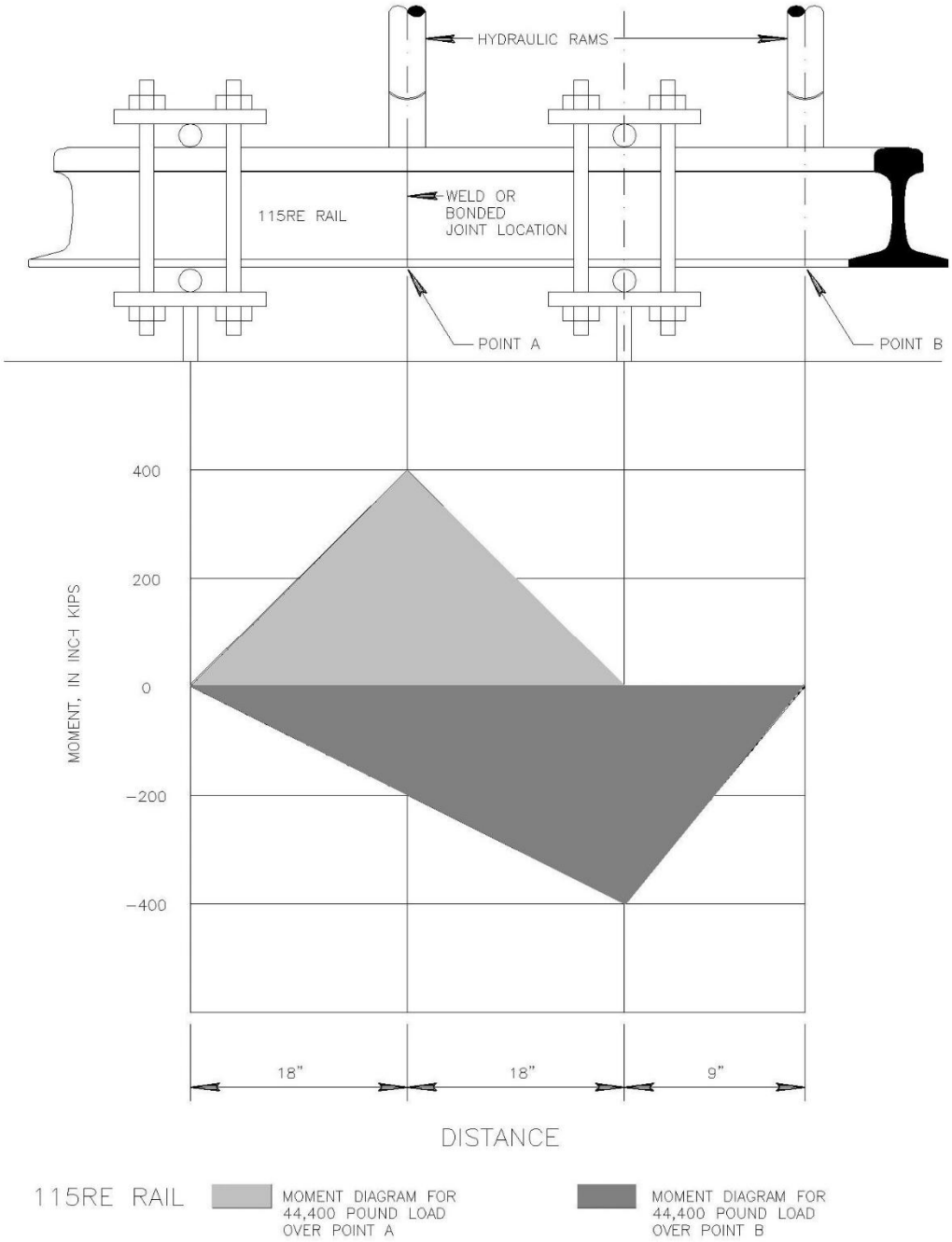


Figure 34 11 25-3

RECORD OF THERMITE RAIL WELD				
Contract Number:				
Weld No.	Date:		Time of weld:	
Track designation or turnout identity:	Engineering station or position within turnout :			
Left or right rail when facing in direction of increasing stationing: ✓One			Left rail	Right rail
Track alignment and construction type (e.g., curve/tangent, % gradient, ballasted, DF) ➔➔				
Back-Station Rail Data:	Rail Section: 115 RE		Mill Brand:	
Year/Month Rolled:	Std. Strength ✓	High-Strength ✓	Heat Number:	
Ahead-Station Rail Data:	Rail Section: 115RE		Mill Brand:	
Year/Month Rolled:	Std. Strength ✓	High-Strength ✓	Heat Number:	
Was a rail cut required? ➔➔	Yes ✓	No ✓	How much?	
Manufacturer, serial number and shelf-life date of weld kit: ➔➔				
Weather:	Air Temperature:		Rail Temperature:	
Rail gap (Nearest 1 mm or 1/16 inch): ➔➔		Rail clamp or stretcher used? ➔	Yes ✓	No ✓
Other notable conditions or circumstances: ➔➔				
Foreman present:	Name:		Signature:	
Const. Mgr. Inspector present:	Name:		Signature:	
Other key person present:	Name:		Signature:	
Other key person present:	Name:		Signature	
			Each person present signs above ↑	
Data recorded by:	Name:		Signature:	

END OF SECTION

SECTION 34 11 30
REPLACEMENT OF FEMALE ANCHOR INSERTS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Section Includes:
   1. The Work described is for the supply of Materials, removal by core drilling and the installation of replacement female anchor inserts embedded in the structure deck for the bolting of direct fixation fastener hold down anchor bolts.
   2. Replacement of the anchor inserts shall be performed should anchor bolt removal be impossible due to bolt breakage within the anchor insert or if the anchor insert is not firmly connected to the deck structure. Bolt breakage may be due to the weathered, aged and rusted conditions of the bolt and the anchor insert and possible deterioration of the initial epoxy grout.

B. Should an anchor bolt be removed without damage to the anchor insert, that Anchor Insert shall not be replaced. See Part 4.

C. Related Sections:
   1. Section 34 11 05 – Re-construction of Direct Fixation Track
   2. Section 34 11 07 – Dismantling of Aerial Direct Fixation Track
   3. Section 34 11 20 – Refurbishment of Existing Direct Fixation Fasteners

1.02 DEFINITIONS

A. Nonshrink Grout: A mortar or grout that does not shrink in the plastic state, nor in the transition from plastic to hardened state, is dimensionally stable in the hardened state, and bonds permanently to a clean steel or coated surface and concrete substrate.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions.

B. Certification: Submit certificates of compliance or laboratory test reports that indicate the following:
   1. Materials used in the grout are free from metallic components and corrosion-producing elements.
   2. Materials used in the grout meet specified shrinkage and compressive strength requirements.

C. Anchor Inserts: Submit Specification Data, Manufacturer's Product Data, and Shop Drawings.

1.04 PROJECT CONDITIONS

A. Handle grout the same as concrete with regard to temperature and curing, and as specified in the Manufacturer's instructions.

PART 2 – PRODUCTS

2.01 MATERIALS

A. In advance of the system shutdown period the Contractor shall procure Anchor Inserts and Cementitious Grout sufficient to replace 10 anchor inserts.

B. Anchor Inserts:
   1. Anchor Inserts shall conform, as a minimum, to ASTM A449 Specifications for Quenched and Tempered Steel Bolts and Studs, SAE Grade 5; and having a Class 2B thread fit.
   2. The insert design shall prevent rotation after cementitious grout has reached its design strength.
   3. Anchor Inserts shall have a minimum length of 4 inches and a maximum length of 5-1/4 inches and an engagement thread length of 2 inches minimum.
   4. Anchor Inserts do not have to be coated.

C. Cementitious Grout:
   1. Nonshrink, nonmetallic, noncorrosive cement-based grout:
   2. ASTM C1107 and CRD-C621.
   3. Manufactured specifically for use in supporting loads in excess of 300 pounds per square foot concentrated load or 100 pounds per square foot uniform load.
   4. ASTM C1107, Grade A, B, or C, as appropriate for the condition or circumstance.

5. Shrinkage at 28 days: None (0.00 shrinkage when tested in accordance with ASTM C827).
6. Compressive Strength, Minimum:
   a. At 1 Day: 1000 pounds per square inch (psi)
   b. At 3 Days: 2500 psi
   c. At 7 Days: 3500 psi
   d. At 28 Days: 5000 psi
7. Initial Setting Time, After Addition of Water: approximately 1 hour at 70 degrees Fahrenheit (F).
8. Provide nonsag trowelability or flowability as necessary for the particular application.

D. Water: Clean and potable, free of impurities detrimental to grout.

2.02 SOURCE QUALITY CONTROL

A. Inspections and Tests: Perform visual inspections, and shrinkage tests using an approved independent test laboratory, and strength tests as necessary to verify performance requirements of grout. Sample and test grout in conformance with applicable ASTM or CRD requirements.

B. Shrinkage Tests:
   1. Cementitious Tests:
      a. Expansion: 0.4 percent maximum at 3, 14, and 28 Days
      b. No displacement when tested in accordance with ASTM C157.
      c. Shrinkage:
         1) None (0.0 percent shrinkage at 28 Days when tested in accordance with ASTM C827 and ASTM C1090).
         2) No vertical volume shrinkage of grout in the plastic or hardened stage at any time.

C. Strength Tests:
   1. Cementitious Grout compressive strength: 5,000 psi minimum at 28 Days when tested in accordance with ASTM C109.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Accurately mark the position of the anchor insert to be cored drilled out by cross hairs considering the required fastener mounting position relative to the other insert.

B. Carefully remove the defective anchor insert by core drilling in a manner that will prevent spalling of the surrounding structure deck concrete. Use a core drill approximately ½ inch larger than the insert diameter and ¼ inch deeper than insert length. With an abrasive disk or drill bit score and roughen the concrete surface in the cored out hole to retain or secure Anchor Insert embedded in Cementitious Grout at pullout test.

C. Prepare concrete surfaces to receive grout by chipping, sandblasting, water blasting, or other accepted methods to remove defective concrete, laitance, dirt, oil, grease, and other foreign matter to achieve sound, clean, and roughened concrete surfaces.

D. Re-position the new anchor insert using the cross hairs and confirming position to other insert. The insert shall be 90 degrees to the concrete deck surface, existing deck if no deck surface grinding is required, or after grinding if deck surface grinding is required. Top of insert shall be level with top of concrete surface plus 0 inch, minus 1/8 inch below maximum.

E. Mix grout ingredients in accordance with the respective manufacturer's instructions and recommendations. Mix grout materials in proper mechanical mixers. Mix grout as close to work area as possible.

F. Fill the perimeter cored hole opening, not disturbing the insert position, with prepared Cementitious Grout in accordance with the manufacturer's instructions.

G. All replacement inserts shall be subjected to the following tests conducted during the construction period.

3.02 UNRESTRAINED PULLOUT TEST

A. Install an anchor bolt in the insert and apply an upward vertical load of 10,000 pounds to the bolt in such a manner that no vertical load is applied to the deck concrete within a six inch radius from the center of the insert. Release the load after two minutes. There shall be no evidence of bolt slippage, concrete cracking or failure of bond between insert, grout and surrounding concrete.

3.03 TORSION TEST

A. Each insert shall be subjected to 600 foot pounds of torque. There shall be no evidence of failure of the bond between the insert, grout and surrounding concrete.

3.04 ACCEPTANCE CRITERIA

A. Once concrete has reached the 7 day compressive strength undertake the above tests within two days. Failure of the above test(s) requires replacement of the failed anchor insert. If failures are persistent do not proceed with insert installation work until cause of failure has been determined and a modified procedure ensuring satisfactory installation is established.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Replacement of female anchor inserts will be measured per each female anchor insert procured and replacement performed, tested, and accepted at required locations.

B. The contractor shall include an allowance in their bid (labor and material) for procurement and replacement of up to ten (10) damaged female anchor inserts.

C. Any Anchor Inserts and Cementitious Grout remaining at the end of the project shall be turned over to DTC. The contractor cost of labor for uninstalled inserts shall be reimbursed to DTC at the end of the project. If additional inserts beyond 10 are required, DTC will reimburse the Contractor on a time and material basis using the unit price installation cost per insert, as bid for the initial 10 units.

4.02 PAYMENT

A. Procurement of anchor inserts and cementitious grout will be paid for at the contract unit price for anchor inserts and cementitious grout.

B. Replacement of female anchor inserts will be paid for at the Contract unit price for "Replacement of Female Anchor Inserts", in the Bid Form.

C. The Contractor price paid will be payment in full for furnishing all labor, Materials, tools, equipment and incidentals, and doing all Work necessary to complete the Work specified.

D. Pay items specified under this Section and incorporated into the Bid Items for this Contract are listed below:

Pay Item	Description	Pay Unit
34 11 30 – 1	Female Anchor Inserts	Each
34 11 30 – 2	Cementitious Grout	Package
34 11 30 – 3	Replacement of Female Anchor Inserts	Each

END OF SECTION

SECTION 34 11 40
RE-CONSTRUCTION OF
SPECIAL TRACKWORK SWITCH COMPONENTS

PART 1 – GENERAL

1.01 SUMMARY

A. The DTC Detroit People Mover Agency is soliciting for bids for the installation of new switch point rails with switch machine rods and accompanying stock rails, and refurbishment of the supporting direct fixation type pan fastener components for their Turnout No. 1

B. Turnout No 1 is a left hand turnout and is located just north of the Maintenance Facility Building and provides access to the building from the north. The location north of Grand River Avenue and the Times Square People Mover Station.

C. The special trackwork of concern was originally procured from Germany (Krupp Stahl AG) and is of European Standards using AREMA 115RE rail throughout the turnout with EN60E1A1 (formerly Zu 1-60) section switch points. The frog design is moveable point, but at this time the frog will not be replaced. The turnout is supported by direct fixation type plate/pan fasteners having resilient (rubber) pan inserts.

D. Part of materials to be installed will be furnished by DTC. All materials and components not listed as DTC furnished materials in Article 1.03 shall be furnished by the Contractor.

E. There will be a “Pre-bid” meeting to enable potential contractors to view the special trackwork in place, ask questions for the purpose of familiarization with the Work and the condition under which the Work will be performed. The date for this meeting will be announced 30 days in advance of the intended date of the meeting.

F. Related Sections:
   1. Section 34 11 00 – Rail Replacement Project
   2. Section 34 11 15 – Dismantling of Existing Track
   3. Section 34 11 20 – Refurbishing Existing Direct Fixation Fasteners
   4. Section 34 11 25 – Thermite Welding of Rail
   5. Section 34 11 45 – Procurement of Special Trackwork Switch Components
   6. Section 34 11 50 – 115RE Tee Rail

1.02 REFERENCES

A. American Railway Engineering & Maintenance of Way Association (AREMA)
   1. Manual for Railway Engineering
      a. Chapter 4 Rail
      b. Chapter 5 Track
   2. Portfolio of Trackwork Plans
      a. Plan No. 221, Details for Switch Points

B. European Committee for Standardization
   1. European Standard EN 13674-2, Railway Applications – track – Rail – Part 2: Switch and crossing rails used in conjunction with Vignole railway rails 46 kg/m and above

C. American Standards& Tests of Materials ASTM
   1. ASTM E19 Standard Test Method for Brinell Hardness of Metallic Metals

D. City of Detroit
   1. Traffic Barricade Manual

1.03 DTC FURNISHED MATERIALS

A. The following materials will be furnished by DTC. They will be available for the Contractor's inspection at the time of the pre-bid meeting.
   1. Switch point rails
   2. Stock rails
   3. Transition rails
   4. A set of switch throw rods and detector rods
   5. Fasteners: internal direct fixation fastener slide plates (as required),
      a. Vossloh clips and elastomer pan pads for the existing direct fixation pan frames will be DTC furnished new to suit and fit the in-place (to remain) direct fixation pan frames as shown in drawings P83122/DPM and P83129/DPM.

B. Material damaged by the contractor will be replaced by the contractor at his expense.

1.04 SUBMITTALS

A. Submit the following for approval to be in compliance with the general requirements stipulated within the Specifications in the form of Shop Drawings and a Work Plan narrative. All final shop installation drawings (11 x 17 inch size) shall be submitted electronically in pdf form for future records.

B. Submit the following Working Plan and accompanying Drawings for the complete description of the Work and installation:

1. Complete Work Plan description of the Work to be performed from initial inspection and review of the switch area, DTC materials, stock pile site, all handling, identification marking of the components for correct replacement, removal of components in the existing switch area, method of cutting the rail as required, installation of switch components, undertaking of Thermite welds, testing and acceptance procedures to final cleanup of complete working site and removal of replaced materials. Work Plan shall refer to the Working Drawings when describing the intended Work.
2. Complete layout of the special trackwork switch area outlining the limits of the retrofit Work and a Bill of Material itemizing and listing the parts and quantities to be changed out.

C. Work Plan: Prior to beginning the Work submit a detailed Work Plan describing the installation procedures required for the work, including but not limited to the following:

1. Undertake an alignment check to determine and mark the alignment prior to dismantling the turnout components, markings to be used to confirm replaced new turnout component positions.
2. Identification marking of direct fixation fastener plates for correct replacement.
3. Disassembly details showing limits of the work area and where Thermite welding is to be undertaken
4. Outline details of all applicable requirements as determined by the Site Examination, such as switch heater installations.
5. Specific application and installation procedures for transporting, lifting and work equipment required.
6. Mark locations where electro- thermite weld location for rail web connections.

D. Submit the following Transportation and Mobilization information:

1. Submit methods and location for the transporting and lifting materials to the guideway during off revenue hours.

2. Submit proper permit(s) authorization and concurrence from the City of Detroit to undertake such transporting and lifting on city streets (possibly Cass Street) approving the temporary closures of the street(s) involved.

E. Submit dimensions and weight of equipment that it is proposed to operate on the DPM system to ensure that it conforms to the DPM system clearance requirements and loading limitations, both per axle and in total. Verify that proposed equipment can be safely operated on the guideway to the parameters of the Contract without damage to the track, or other elements of the guideway system.

F. Submit the following Test and Inspection Reports:
1. Electric (Flash Butt) Welding procedures and independent testing procedures if this method is selected.
2. Thermite Welding procedures and independent testing procedures according to included Specification 34 11 25 Thermite Welding. Calorite weld material product will not be accepted.

1.05 QUALITY ASSURANCE

A. The responsibility for all quality for this Contract lies with the Contractor.

B. The Quality Plan details shall be included within the overall Work Plan description.

C. Qualification of Trackwork Superintendent and Trackwork Foreman:
1. Not less than thirty days prior to commencing special trackwork construction, submit the names, qualifications and experience record of the proposed trackwork superintendent and the track foreman. Include a list of the railways and or transit agencies where proposed personnel have previously built track of the type of construction under this Contract. Provide for each assignment a reference name/phone number/e mail address for someone who is personally acquainted with each candidate's work.
2. Superintendent shall have at least 10 years experience in trackwork construction, with at least 7 years experience in special trackwork direct fixation construction and maintenance. No less than 5 years of the superintendent's experience shall have been at a level of foreman or above.
3. Foreman shall have at least 5 years experience in railway or transit construction.

D. Prior to commencement of switch and rail installation, the Contractor shall calibrate and test controlling equipment to be used with the Work.

E. Operational Tests of the new switch at completion of installation by manual operation at the site and by Operations Control Center (OCC) maneuvers to verify a properly functioning switch and switch machine installation with appropriate signal responses. A minimum sequence of four switch operational tests will be required. The switch machine test throws will include an actual car/train passing through the switch in both (facing and trailing) directions with switch in both switch thrown positions.

F. Switch/Vehicle Operational Tests:

1. Paint entire switch point (left curved point closed) rail head areas including both stock rail heads
2. Spot car or train in Maintenance Center to depart
3. Depart Maintenance Center on trailing point move, to clear switch area
4. Inspect painted switch components and wheel track markings (take pictures)
5. OCC under power performs switch throw for mainline operational position.
6. Confirm with OCC switch operations and signals are functioning in a proper manner.
7. Paint entire right switch point rail head area including both stock rail heads where previous wheel marking was noticed
8. Vehicle to proceed through switch on a facing point mainline move to clear turnout area
9. Inspect painted switch components and wheel track markings (take pictures)
10. Re-paint entire switch point rail head areas including both stock rail heads where marking was noticed
11. Vehicle to proceed through a trailing point mainline move to clear turnout area
12. Inspect painted switch components and wheel track markings (take pictures)
13. OCC under power performs switch throw for Maintenance Center entry operational position
14. Confirm with OCC switch operations and signals are functioning in a proper manner
15. Re-paint entire switch point rail head areas including both stock rail heads where marking was noticed
16. Vehicle to proceed through switch on a facing point Maintenance Center entry operation move to clear turnout
17. Inspect painted switch components and wheel track markings (take pictures)

18. OCC to undertake extra switch point rail throw tests
    a. OCC to throw switch to Maintenance Center entry position [do not operate car]
    b. OCC to return switch to mainline operation position.
19. End of physical tests.

G. Acceptance will be a complete operation of turnout and switch components indicting no abnormal unsatisfactory car maneuvers and proper engagement of switch points in both travel directions; and confirmation of OCC of satisfactory signal and controlled operations.

H. Should adjustment or corrections be required, undertake necessary corrective steps and begin a new series of tests disregarding any tests undertaken prior to adjustments.

1.06 DELIVERY, STORAGE, HANDLING, AND EQUIPMENT

A. Handle all special trackwork materials furnished by DTC in an appropriate manner using equipment and tools for track construction that are suitable for operation on the DPM system.

B. Tools and track construction equipment shall conform to the AREMA Manual for Railway Engineering, Volume 1 Chapter 5 Track, Part 6 Specifications and Plans for Track Tools, or as approved by Detroit Transportation Corporation.

C. On track equipment shall conform to AREMA Manual for Railway Engineering, Volume 3, Chapter 27 Maintenance of Way Work Equipment, Part 2 Roadway machines, except as required to be operable on the DPM system.

D. All equipment used shall be in good repair. Leaks of hydraulic fluid, fuel lubricants, or other fluids shall be corrected immediately and spillages shall be cleaned up before they can cause environmental damage or staining of construction materials and structure surfaces.

E. Calibrate all tools as appropriate for use. Calibrations shall be current to within one year.

1.07 DELIVERY LOCATION

A. The Work site is in the Detroit Central Business Area as shown in Site Plan in the Appendix 34 11 00 A. The Maintenance and Control Facility (MCF) where the Work will begin and terminate is located at:

1250 Park Place
Detroit, Michigan 48226

B. DTC provided special trackwork materials will be stockpiled within the MCF enclosed yard for Contractor inspection and use.

C. The transportation of the special trackwork materials and equipment to and from the overhead guideway Work site is the sole responsibility of the Contractor. DTC is not to be charged separately for any costs associated with transportation, traffic control, lifting and placing the materials, equipment and accessories.

D. The Contractor is responsible for movement and operations of his equipment on the elevated Detroit People Mover guideway structure.

1.08 CONTACT PERSON FOR MOBILIZATION / DEMOBILIZATION

A. The Contractor shall contact the following person at least 80 hours with notice of the Contractor's planned schedule and 48 hours prior to actual commencement of Work at the site.

Ernest Latham – Maintenance Manager,
1250 Park Place,
Detroit, Michigan 48226
Phone (313) 442-3594.

B. This advance notice is required to ensure adequate time is allowed for organizing material pickup, equipment and scheduling the lift time in non-revenue hours. The Detroit People Mover system will be "shut down" for the period the replacement work is taking place.

1.09 WARRANTY OF WORK

A. The Contractor warrants to DTC that all materials and equipment furnished under the Contract will be new unless otherwise specified by DTC, free from faults and defects and in conformance with the Contract Documents. The Warranty shall be in accordance with regulations as described in Appendix E – FTA Provisions, Bonding Requirements – Warranty of the Work and Maintenance Bonds of these Specifications.

1.10 SAFETY AND TRAINING

A. All safety related issues will be under the direction of and subject to the approval of the DPM Safety Manager, MR. Robert Cantalini, phone (313) 224-2212.

B. Prior to commencement of work on the DPM property, and at no additional cost to DTC, all Contractors personnel assigned to the project shall attend a three (3) hour guideway safety and awareness access training course to be held at the DTC Maintenance and Control Facility (MCF). The attendees will be issued proper access passes which shall be in their possession and available for DTC inspection at all times while on the DTC property.

PART 2 – PRODUCTS

2.01 DTC – FURNISHED MATERIALS

A. DTC furnished materials are listed in Section 1.03.

2.02 CONTRACTOR – FURNISHED MATERIALS

A. Contractor shall furnish all other materials for special trackwork installation, including but not limited to the following:
   1. Thermite weld kits to complete installation.
   2. Grease (for lubricating moving parts in turnouts and other trackwork): EM Kronoplate grease, or accepted equal. Slide surfaces of switch plates shall be greased before operations inspection. Two additional gallons shall be furnished to DTC for future field applications.
   3. Material for electrical and signal connections as needed to restore function of turnout.

B. Contractor shall provide all materials and equipment incidental to the installation of special trackwork necessary to provide a complete and acceptable functional installation, having an appearance acceptable to DTC..

PART 3 – EXECUTION

3.01 SITE EXAMINATION

A. Perform an existing conditions review of the turnout site specifically the switch area and adjacent extensions where Work will overlap and be constructed.

B. Determine the limits for the transition slope on the switch point rail extensions based on the vertical wear at the toe of the moveable point frog rails - see Frog Drawing 21125/DPM. The transition slope shall extend more or less from beyond the heel of

switch at approximate fastener location 19 to toe of frog at approximate fastener location 24 for a distance of approximate 12 feet providing the flatness slope within the switch heel and the toe of frog restrictions. The bolted joints at the toe of the frog shall be cut off with minimum 2 inch clearance beyond last joint bar hole.

C. Undertake all engineering measurements required to confirm the Shop Drawings for application of replacement components. Key issues being the interface of internal rail anchors, matching of adjacent components and the entire assembly in a workable condition similar to the existing.

D. Mark the “point of switch” location extending beyond fastener location 5 permanently on the deck with a drilled epoxy glued pin adjacent to both stock rails before disassembly to duplicate installation of new components.

E. Mark the direct fixation plates if unidentifiable marked for replacement of existing plates or new plates to proper location.

F. Undertake all necessary review of conditions to prepare a Bill of Material of all components to be changed out and show same on overall Working Drawings, with identification number system reference to Shop Drawings of the components.

3.02 TURNOUT ALIGNMENT, PROFILE AND GEOMETRY

A. Construct and confirm geometry meets the alignment of the removed turnout components and the correct track alignment of the adjacent new rail head of the point of switch.

3.03 DISMANTLE SWITCH AREA

A. Disconnect electrical power to:
   1. The switch machine and confirm a “non-powered” condition.
   2. The stock rail switch heating system and confirm “non-powered” condition.

B. Disconnect switch rods at the switch point rail and the switch machine and remove. Provide protective cover and cover switch machine from further work in the area.

C. Disconnect switch heating system at the stock rails and remove. Place components in protected location for future application.

D. Disconnect all electro thermite weld connections to rail web.

E. Cutting Rails
   1. Cut switch point rails and stock rails to the predetermined locations and remove switch point rails and stock rails.
   2. Cut and remove extended rail ahead of point of switch to suit Track Curve P17 work.

F. Fasteners:
   1. Dismantle all fastener components within the Work zone.
   2. Remove each special trackwork fastener plate individually.
   3. Remove all residue, slide lubricant or surface rust and corrosion.
   4. Inspect for surface wear and tear to determine acceptable for reuse.
   5. Mark specific location on each plate after wire brush and power wash cleaning.
   6. Remove and discard elastomeric (rubber) pan pads from direct fixation pan frames.

3.04 PREPARATION OF EXISTING FASTENER PAN FRAMES

A. Cleanout all remaining in place direct fixation fastener pan frames.
   1. Cleaning shall be by wire brush and power wash removing slide lubricant residue, rust and corrosion.
   2. Confirm all pan frame anchor bolts are secured and holding the fastener frame.
   3. Clean all debris and fines on the deck surface generated by removal and cleaning of turnout components to provide a clean site for new special trackwork fastener internal pan installation.

3.05 INSTALLATION OF FASTENER COMPONENTS

A. Cut, fit and place elastomer (rubber) pads in the direct fixation pan frames to match and suit previous installation.

B. Replace cleaned acceptable existing steel plates within the elastometric pads to their designated marked locations.

C. Install new Vossloh spring clips Skl 4 and new bolting assembly to complete plate installation.

D. Place new 5 millimeter rail base pads (intermediate layer) on the standard special trackwork rail fasteners between fastener positions 20 to 25.

3.06 INSTALLATION OF STOCK RAILS, SWITCH POINT RAILS AND TRANSITION RAILS

A. Stock Rails

1. Cut, fit and place stock rails and transition rails to suit engineered installation for setting transitions to suit existing worn rail conditions matching internal anti-creep steel plugs, fasteners 4, 17, 18 and 19 positions.
2. Confirm alignment of stock rails and lengths to undertake Thermite welds.
3. Thermite weld the lifted rails, complete the weld finish and position rails in place on fastener plates.
4. Vossloh Spring Clips:
    a. Install new Vossloh spring clips Skl 3 and new bolting assembly to complete stock rail installation.
    b. Install new Vossloh spring clips SkI 3W and new bolting assembly to fasteners 19, 20, 21 and 23 as shown with “X” (12 required).
5. Confirm alignment of final position of straight stock rail.

B. Switch Point Rails

1. Cut, fit and place switch point rails to suit engineered installation for setting switch point at specifically pre-marked “point of switch” locations and transitions at toe of frog to suit existing conditions.
2. With secured heel of switch location hand throw switch point to confirm proper fit to stock rail and correct nesting of point area. Confirm continuous contact of switch point rail along machined undercut section of stock rail. Confirm alignment of straight switch point rail and curved stock rail. With acceptance of installation proceed to weld rails in place.
3. Thermite weld between the fasteners the lifted switch point rail and frog toe rails, complete the weld finish and position switch point rails in place with 5 millimeter pads in place and on switch plates.
4. Install new Vossloh spring clips SKl 3 and SKI 3W and new bolting assembly to complete switch point rail installation.
5. Confirm switch alignment using pre-marked alignment reference points.
6. Clean and dry switch slide plates, apply slide plate lubricant to slide plates in switch area with switch point rail in both the open and closed positions.
7. Confirm switch operation by manually throwing switch point to open and closed positions numerous times to confirm proper fit and switch point rail nesting under machined stock rail head for both point rails.

3.07 INSTALLATION OF SWITCH MACHINE RODS AND SWITCH MACHINE FUNCTION

A. Position and connect both switch throw rods to point rails and switch machine using new accessory connection components.

B. Position and connect both detector rods to point rails and switch machine using new accessory connection components.

C. Manually crank switch machine to confirm installation is in proper working order. Simulate operations by undertaking the opening and closing of the switch points and confirming proper switch point rail mating with stock rail by switch machine manual throw.

D. Connect electrical power to the switch machine.

E. Using powered switch machine through Operation Control Center (OCC) confirm total installation is in proper working order.
   1. Undertake the opening and closing of switch points confirming proper switch point mating with stock rail at each switch point rail by power operated switch machine throw and proper signal engagement.
   2. OCS will give final concurrence of a working switch with confirmation of proper signaling indicating or confirming switch points are in the correct nesting position under the stock rail head with completion of vehicle test series described in Article 1.05 F Switch/Vehicle Operational Tests of this Section.

3.08 CLEAN SITE

A. Structure deck cleanup shall include removal of all miscellaneous cutoff components, old components and weld grinding filings in the general Work area. The cleaning shall include intensive power washing of the complete deck area, the switch area, in and around the switch machine area and thoroughly cleaning all residue up to and including the drain openings.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The Measurement of Special Trackwork will be LUMP SUM. The Measurement will include the installation of the following:
   1. One pair of EN60E1A1 switch point rails and adjacent undercut 115RE stock rails consisting of a right hand switch point and undercut stock rail; a left hand switch

point rail and undercut stock rail; and all appurtenances associated with the installation and accepted.

2. Each switch point rail direct fixation slide plate fasteners to suit the right and left slide installation with all necessary appurtenances for each plate and accepted.
3. Each switch plate rail direct fixation slide plate fastener elastomer pad cut to suit the direct fixation pan and plate and accepted.
4. Each switch machine throw rods and detector rods to suit installation and accepted.
5. Installation of complete switch with switch machine throw rods in an accepted functioning manner.
6. Lubrication of switch point slide plates.
7. Thermite Welds for all trackwork is measured and included as a Pay Item in Section 34 11 25.

4.02 PAYMENT

A. The Work of this Section will be paid for at the Contract Price of LUMP SUM for the following Work:
   1. Pay Item 34 11 40 -01
      a. Installation of No 6 Turnout Switch complete with rails, plates, switch machine components and transition rails.

END OF SECTION

SECTION 34 11 45

PROCUREMENT OF SPECIAL TRACKWORK SWITCH COMPONENTS

PART 1 – GENERAL

1.01 SUMMARY

A. The Detroit People Mover (DPM) System serves the Greater Detroit Downtown business area providing convenient service to attractions including Detroit Opera House, Joe Louis Arena, Cobo Hall Convention Center, the Renaissance Center and Greek Town, along with various hotels and restaurants. The system is an aerial structure loop track as shown in Appendix 34 11 00 A - Site Plan consisting of a single mainline track 2.88 miles long. The aerial structure height varies and is approximately 35 to 45 feet above street level. The aerial structure consists of numerous ancillary components to the track, such as, the running rails and fasteners for the track; two ATC cables with conduits and wall mounted Traction Power Rail System as shown in Appendix B Typical Section Through Guideway Beam.

B. This section includes provision of replacements for fabricated components of rail in the special trackwork switch area only in the turnout identified as the Turnout No 1 site and details of the switch in DWG NO. 21114/DPM Turnout No. 1 (LH) with Movable Point Frog on Existing Fasteners.

C. The Turnout No. 1 special trackwork was originally procured from Germany (Krupp Stahl AG). As shown in DWG NO. Z631-TW-98 No. 6 Turnout Switch Details it was fabricated using AREMA 115RE rail throughout the turnout but with switch rails fabricated from the EN60E1A1 (formerly Zu.1-60) asymmetrical switch point section as shown in DWG NO. 44543K/DPM. The frog design is moveable point, but at this time the frog will not be replaced. The turnout is supported by direct fixation type plate/pan fasteners with an insert resilient (rubber) pan.

D. Turnout No 1 is located adjacent to the Maintenance Facility Building and provides access into the building. The location is the north end of the building, south of Times Square Station and adjacent to the Detroit City Club Apartments between Grand River Avenue and Clifford Street.

E. Related Sections
   1. Section 34 11 00 – Rail Replacement Project
   2. Section 34 11 15 – Dismantling of Existing Track
   3. Section 34 11 20 – Refurbishing Existing Direct Fixation Fasteners
   4. Section 34 11 25 – Thermite Welding of Rail
   5. Section 34 11 40 – Reconstruction of Special Trackwork Switch Components
   6. Section 34 11 50 – 115RE Tee Rail

1.02 REFERENCES

A. American Railway Engineering & Maintenance of Way Association (AREMA)
   1. Manual for Railway Engineering
      a. Chapter 4 Rail
   2. Portfolio of Trackwork Plans
      a. Plan No. 221, Details for Switch Points

B. European Committee for Standardization
   1. European Standard EN 13674-2, Railway Applications – track – Rail – Part 2: Switch and crossing rails used in conjunction with Vignole railway rails 46 kg/m and above.

C. American National Standards Institute (ANSI):
   1. ANSI B18.2.1 Square and Hex Bolts and Screws Inch Series
   2. ANSI B18.21.1 Lock Washers
   3. ANSI B18.22.1 Plain Washers

D. American Standards & Tests of Materials ASTM
   1. ASTM E19 Standard Test Method for Brinell Hardness of Metallic Metals

1.03 DESIGN REQUIREMENTS

A. Special Trackwork Rail and Materials conform to AREMA Manuals for Railway Engineering and German Federal Railways for Design and Assemblies.

B. Develop all required details not otherwise delineated on DWG NO. 21114/DPM Turnout No. 1 (LH) with Movable Point Frog on Existing Fasteners in accordance with these Specifications and good practice. The replacement components shall match the existing in design and quality as stated in Paragraph 2.01 A herein.

1.04 SUBMITTALS

A. Submit the following for approval to be in compliance with the general requirements stipulated within the Specifications in the form of Shop Drawings and a Procurement Work Plan narrative. All final shop fabrication drawings (11 × 17 inch size) shall be submitted electronically in pdf form for future records.

B. Submit the following special trackwork fabrication and material information:
   1. Shop Drawings for the details and methods of bending and machining the switch point rails, the forging details, and the process for post hardening of the forged and welded areas.
   2. Shop Drawings showing the counter bore drilling details for the internal rail base anchor inserts and the rail base drilling of mounting holes for switch rod connections.
   3. Shop Drawings of connecting 115RE transition rails extensions of the EN60E1A1 rails with appropriate transition length showing the length and nature of machining to match the switch point rail transition limits at the frog end.
   4. Shop Drawings for the details of the stock rails with undercut, the machining of the internal base anti-rail creep anchors and appropriate switch point rail stop mounting assemblies.
   5. Shop drawing of the transition rails showing length and method of planing to provide a smooth transition between the new material and the worn rails at the frog end of the turnout.
   6. Complete Procurement Work Plan description of the Work to be performed from initial inspection and review of component conditions of the switch area and identification marking of the components.
   7. Complete layout of the special trackwork switch area outlining the limits of the retrofit Work and a Bill of Material itemizing and listing the parts and quantities to be changed out.
   8. Submit methods of unloading and stock piling materials at a predetermined ground level storage site.

C. Submit the following Test and Inspection Reports:
   1. Rail Reports from the selected rail mill providing processing information as heat numbers, strand, bloom for all the rails provided.
   2. Rail Test Reports or records listing mechanical properties tests, Brinell Hardness Numbers (BHN) and ultra-sonic test confirmation.

1.05 QUALITY ASSURANCE

A. The responsibility for all quality for this Contract lies with the Contractor.

B. The Quality Plan details shall be included within the overall Procurement Work Plan description.

1.06 DELIVERY, STORAGE, HANDLING, AND EQUIPMENT

A. Handling of all special trackwork materials furnished by the Contractor in an appropriate manner using suitable equipment.

B. Contractor shall provide all materials and equipment incidental to the handling, delivery and installation of special trackwork.

1.07 DELIVERY LOCATION

A. The delivery site is in the Detroit Central Business Area as shown in Appendix 34 11 00 – A Site Plan, the DPM (Detroit People Mover) Operations Center and Maintenance Building located at:

1250 Park Place
Detroit, Michigan 48226

B. The trackwork Contractor will be informed of an appropriate stockpile site for the unloading of the special trackwork turnout rail and components.

1.08 CONTACT PERSON FOR DELIVERY

A. The Contractor shall contact the following person at least 40 hours with notice of the Contractor's planned schedule and 24 hours prior to actual shipment delivery at the site.

Ernest Latham – Maintenance Manager,
1250 Park Place
Detroit, Michigan 48226
Phone: (313) 442 3594.

This is required to ensure adequate time is allowed for scheduling, delivery and storing the materials.

1.09 WARRANTY OF WORK

A. The Contractor warrants to DTC that all materials furnished under the Contract will be of the highest quality and new unless otherwise specified by DTC, free from faults and defects and in conformance with the Contract Documents. The Warranty shall be in accordance with regulations as described in Appendix C – FTA Provisions, Bonding Requirements – Warranty of the Work and Maintenance Bonds of these Specifications.

PART 2 – PRODUCTS

2.01 CONTRACTOR – FURNISHED MATERIALS

A. All materials shall be new

B. Materials to be furnished shall be:
   1. Two switch point rails
   2. Two stock rails
   3. Four transition rails
   4. Two switch machine throw rods and two switch machine detector rods

C. Switch point rails shall be of the EN60E1A1 (formerly known as Zu 1-60) section in accordance with European Standard EN 13674-2 and the following:
   1. Metallurgy shall be either
      a. R350HT, as given in EN 13674-2
      b. R350LH, as given in EN 13674-2
      c. An AREMA metallurgy for high strength rail as defined in the AREMA Manual Chapter 4 Part 2 and specification section 34 11 50
      d. A metallurgy having over 0.30 percent Chromium will not be accepted.
   2. Hardness shall be not less than 350 HBn
   3. Exhibit 1 presents shape, dimensions, and properties as given in EN 13674-2

D. Stock rails and other components to be fabricated of rails shall be of 115RE as specified in the AREMA Manual Chapter 4 and specification section 34 11 50

E. Provide two switch machine throw rods and two detector rods with accessory bolting assemblies at the switch machine and switch point rail connections as shown in DWG NO. 82001 01402 Point Machine L710H (Switch Rod Arrangement) and DWG NO. 82001 01402 Point Machine L710H (Switch Rod Detailed Assembly)

PART 3 – EXECUTION

3.01 SITE EXAMINATION

A. Perform an existing conditions review of the turnout site, specifically the switch area and adjacent extensions, where Procurement Work will overlap and be required. The inspection shall include complete requirements of new components of the existing worn switch rods and connections for replacement.

B. Determine the limits for the transition slope on the switch point rail and adjacent stock rail extensions based on the vertical wear at the toe of the moveable point frog rails – see

DWG NO. 21125/DPM Movable Frog Point Turnout Angle 9º31'38". The transition slope shall extend more or less from beyond the heel of switch rail at approximate fastener location 19 to toe of frog at approximate fastener location 24 for a distance of approximate 12 feet providing the flatness slope within the switch rail heel and the toe of frog restrictions. The bolted joints at the toe of the frog shall be cut off with minimum 2 inch clearance beyond last joint bar hole.

C. Undertake all engineering measurements required to support the Shop Drawings for fabrication of replacement components. Key issues being the interface of internal rail anchors, matching of adjacent components and the entire assembly in a workable condition similar to the existing.

3.02 SWITCH RAIL FABRICATION

A. Switch point rails shall each be approximately 30 feet long, the final length to be determined by the contractor to be sufficient to replace the existing switch rails.

B. Hardness of wheel contact of rail head shall be not less than 350 HBN. Area of hardness shall be as described in specification section 34 11 50, 115RE Tee Rail.

C. The switch rail will consist in part of the EN60E1A1 asymmetrical rail section and in part of 115RE rail section welded together

D. The movable end of the switch rail shall be machined into the shape of the Detail 5100 point (also known as the Samson Point) as shown on the AREMA Portfolio Plan 221, Details for Switch Points. Reinforcing bars as shown on Plan 221 are not needed with the EN60E1A1 rail section and shall not be used.

E. In the vicinity of the point, the bases of the switch rails shall be planed and drilled for attachment of the throw rods and detector rods at the locations shown on DWG NO. 82001 01402 Point Machine L710H.

F. The butt end of the EN60E1A1 section shall be forged to match the 115RE rail section.

G. The forged end of the EN60E1A1 section and the 115RE extension shall be welded together (preferably by electric flash butt welding). The location of this weld is to be based preliminarily on that shown on DWG NO. 21114/DPM Turnout No. 1 (LH) with Movable Point Frog on Existing Fasteners with the final location determined in the field, location approved by DPM.

H. The base of the 115RE extension rail shall be planed for to provide required controlled flexing of the switch point rail for switch throw. The location and length of this planed length is to be based preliminarily on that shown on DWG NO. 21114/DPM Turnout No. 1 (LH) with Movable Point Frog on Existing Fasteners with the final location determined in the field. There shall be no sharp corners in this planed length. Planing shall be by milling or grinding. No flame cutting permitted. with undercut rail base to provide required controlled flexing of the switch point rail for switch throw

I. Provide the 115RE rail extensions with the insert rail base anchors in the design for fastener locations 18 and 19 on both switch point.

3.03 STOCK RAIL FABRICATION

A. Stock rails shall each be approximately 50 feet long, the final length to be determined by the contractor to be sufficient to replace the existing stock rails and provide the length needed to provide for forming transitions to the existing rails.

B. Stock rails shall be 115RE in section

C. Curved side stock rail shall be pre-curved.

D. The straight stock rail shall be given machined voids for insert of rail base anchors for fastener locations 4, 17, and 19

E. The curved stock rail shall be given machined voids for insert of rail base anchors for fastener locations 4, 18, and 19

F. Stock rails shall be given stop blocks mounted to provide the lateral support of the switch point rail in the vicinity of fastener locations 13 and 15 on both left and right stock rails.

3.04 TRANSITION RAIL FABRICATION

A. Transition rails shall each be approximately 12 feet long, the final length to be determined by the contractor to be sufficient to replace the existing stock rails and provide the length needed to provide for forming transitions to the existing rails.

B. The head of the transition rail shall be planed from the full section on the switch end to the height of the worn rail at the frog end on the other.

C. Transition rails shall be 115RE in section

D. Two transition rails shall be straight and two transition rails shall be precurved

E. See DWG NO. 21114 I DPM Turnout No. 1 (LH) with Movable Point Frog on Existing Fasteners for radius and direction of curvature for the curved transition rails.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The Measurement of Special Trackwork will be LUMP SUM. The Measurement will include the following:
   1. One pair of EN60E1A1 switch point rails with 115RE rail extensions and adjacent undercut 115RE stock rails consisting of a right-hand switch point rail and undercut stock rail; a left-hand switch point rail and undercut stock rail; and all appurtenances associated with these components installation, furnished and accepted.
   2. Four transition head machined rails for connection to frog and turnout rails.
   3. One set of switch point rods consisting of two drive rods and two detector rods.

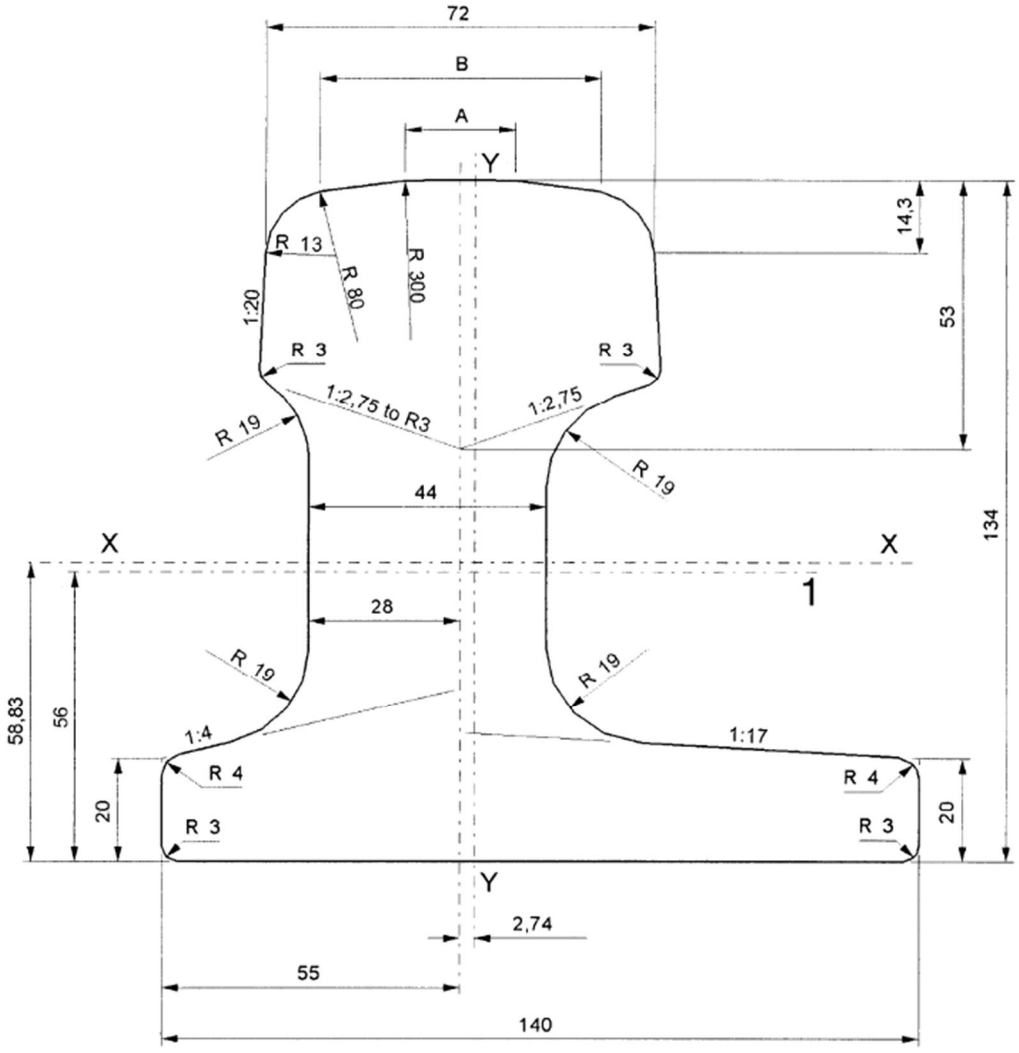
4.02 PAYMENT

A. The Work of this Section will be paid for at the Contract Price of LUMP SUM for the following work:
   1. Pay Item 34 11 45-02 Furnishing of Special Trackwork Components

EXHIBIT 1

EN 60E1A1 (formerly Zu 1-60) ASYMMETRICAL SWITCH RAIL

EN 13674-2:2006+A1:2010 (E) Figure A.5 – Rail profile 60E1A1



PROPERTIES					DIMENSIONS				
Cross-sectional area	:	92.95 cm^2	=	14.407 in^2	Total Height	:	134 mm	=	5.276 Inch
Mass per metre	:	72.97 kg/m	=	147.10 Lb/yd	Crown to gauge	:	14.3 mm	=	0.563 Inch
Moment of inertia x-x axis	:	1726.9 cm^4	=	41.49 in^4	Head height	:	53 mm	=	2.087 Inch
Section modulus – Head	:	229.7 cm^3	=	14.02 in^3	Edge base height	:	20 mm	=	0.787 Inch
Section modulus – Base	:	293.5 cm^3	=	17.91 in^3	Base width	:	140 mm	=	5.512 Inch
Moment of Inertia y-y axis	:	741.2 cm^4	=	17.81 in^4	Head width gauge	:	72 mm	=	2.834 inch
Section modulus y-y axis left	:	128.4 cm^3	=	7.84 in^3	Width crown “A”	:	20.456 mm	=	0.8054 inch
Section modulus y-y axis left	:	90.1 cm^3	=	5.50 in^3	Width shoulders “B”	:	52.053 mm	=	2.0493 inch

END OF SECTION

SECTION 34 11 50

115RE TEE RAIL

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:
   1. Provide 115 RE High Strength Rail to the Detroit Transportation Corporation's (DTC) The Detroit People Mover (DPM) System.
   2. Perform testing, shipping, delivery, unloading and placing into storage of 115 RE Rail at the Maintenance Center Yard in the Detroit downtown area.

B. Related sections:
   1. Section 34 11 05 Reconstruction of Direct Fixation Track
   2. Section 34 11 10 Installation of Rails for Expansion Joints
   3. Section 34 11 40 Reconstruction of Special Trackwork Switch Components
   4. Section 34 11 45 Procurement of Special Trackwork Switch Components

1.02 REFERENCES

A. The following Codes, Reference Standards and Specifications apply to the Work of this Section.
   1. American Railway Engineering and Maintenance of Way Association (AREMA)
      a. Manual for Railway Engineering, Chapter 4, Rail
   2. American Society for Testing and Materials (ASTM)
      a. ASTM E8 Test Methods for Tension testing of Metallic Materials
      b. ASTM E10 Test Method for Brinell Hardness for Metallic Materials
      c. ASTM A578/A578M Specification for Straight-Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications

1.03 SUBMITTALS

A. Submit Certified Documentation of rail fabrication for Approval in compliance with common Submittals as specified below:
   1. a) Source of the rail, (Manufacturer's name and location).
      b) Description of the steel metallurgy and the identity of each rail provided.
   2. Description of the methods and procedures to be used to remove hydrogen from the steel.
   3. Description of the ultrasonic testing method and equipment together with mill test report certificates of rails tested for this order.

4. Description of the method and verification testing to achieve the required rail hardness together with reports indicating the actual hardness achieved.
5. Quality Control Program description, as outlined in Article 1.04.
6. Method of handling, shipping, unloading, and stacking rail from the time it is loaded onto the transportation vehicles at the rolling mill and fabrication component site until it is to be stockpiled at the Maintenance Center Yard, including:
   a. Method of dunnage support for rails and stocking sequence for high strength special trackwork rail and transition rails.
7. Description of method for pre-curving stock rail.
8. Provide rail test records, including mechanical properties tests, hardness measurements, ultrasonic test records and all other required test documentation, for informal review during the in-plant inspection in addition to formal submittal.
9. In the event that on-line ultrasonic testing is not undertaken, provide Ultrasonic Inspector's qualification certification for the individuals actually conducting the testing at least 30 days before the commencement of the in-plant inspection.

1.04 QUALITY CONTROL

A. Submit the in-place Quality Control Program regulating methods, procedures and processes to ensure compliance with standards of quality required by the Contract Documents.

B. Within 15 days after the effective date of Notice to Proceed, submit for approval of DTC a detailed narrative explaining the Quality Control Program and procedures to be utilized for the work and a description of the organization to be used on the Contract.
   1. All work undertaken prior to approval of the quality control program will be at the Contractor's risk.
   2. DTC will review the Contractor's methods, procedures, and processes for compliance with the approved program.

C. Keep all records of inspection work performed by the Contractor complete and available to DTC during the performance of the Contract; and to such other agencies and for longer periods as may be specified elsewhere in the Contract.

D. Inspection and Testing:
   1. The Products and Material incorporated into the work will be subject to inspection by DTC at the Contractor's and Subcontractor's facilities, place of manufacture, the shipping point, or at the shipping destination in Detroit.

2. Inspection and tests by DTC will be performed in such a manner as not to unduly delay the work.
3. Whether or not DTC inspects or tests any Materials, the Contractor will not be relieved from any responsibility regarding defects or other failures to meet the Contract requirements, nor will such inspection or testing be considered as a guarantee of acceptance of any Material which may be delivered later.
4. Perform all tests and analyses specified in Chapter 4, Part 2, of the American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering and submit the results.
5. Ultrasonically test all rail for internal defects in accordance with ASTM A578, as modified herein.
    a. Construe references to "plate thickness" in ASTM A578 to mean rail depth from head to base for measurements from top of the railhead, or rail web thickness for measurements laterally through the rail web.
    b. Replace "Acceptance Standards" in ASTM A578 by a defect in the occurrence of one of the following readings:
        1) Complete loss of back reflection
        2) A reflection from a defect (i.e. not attributable to a reflecting surface of the rail exterior) greater than 5 percent of the back reflection.
    c. Reject any rail if a defect is detected.
    d. Conduct ultrasonic inspection for the full length of each rail with a 1-inch diameter, 45 degree probe from the top of the railhead, directed along the length of the rail, positioned such that the rail base generates the back reflection.
    e. Conduct ultrasonic inspection within 12 inches of each rail end with the 1 inch diameter 45 degree probe, as in Subparagraph 1.04D.5.d, and also with a 1 inch diameter, 0 degree probe from the top of the rail head, vertically, and through the rail web, laterally.
        1) The back reflection for the lateral measurement through the rail web is the web surface opposite the probe side.
    f. Conduct ultrasonic inspection by a qualified technician, and provide qualification certification of each individual conducting ultrasonic inspection of the Material.
    g. Permanently mark all indications on the railhead directly over the defect location with the percentage amplitude relative to the back reflection.
    h. Certified mill test reports must include, at a minimum, the following information:
        1) Chemical composition
        2) Macroetch result
        3) Brinell Hardness Number (BHN)
        4) Tensile strength

5) Yield strength
6) Elongation percentage

6. As an alternative to the requirements of Subparagraph 1.05D.5 above, ultrasonically test all rails 100 percent in-line with a fully computerized DAPCO 200 testing unit or approved equal.
   a. Test rails in conformance to the requirements of AREMA Manual for Railway Engineering, Chapter 4, Part 2, Section 2.1.8, Ultrasonic Testing
   b. Use a calibration test rail of the same section as being tested with the following calibration reference standard:
      1) Head 3/32 inch wide × 1/2 inch long slot
      2) Web 1/16 inch wide
      3) Base 1/16 inch wide × 1/2 inch long slot
7. Make all rail tests and inspections at the mill prior to shipment for pre-curving or machining of the rail.
8. Assume full responsibility for all testing indicated.
9. Give DTC sufficient notice when testing in any form is proposed so they may witness the tests, and provide DTC free entry at all times to the manufacturer's mill to inspect the processing and testing of rail while work on this Contract is being performed.
10. Perform all tests specified herein at no additional cost.
11. Testing, witnessed and certified by the mills quality control manager, must include the following AREMA testing at a minimum:
    a. Chemical composition testing of the rail steel.
    b. Testing rail heats for hydrogen content.
    c. Testing rail for Brinell hardness.
    d. Testing a specimen for longitudinal tension.
    e. Verifying that the section of the rails conforms to the design specified subject to dimensional tolerances allowed.
    f. Testing rails ultrasonically for internal imperfections.
    g. Macro etching all test pieces as required by AREMA.

1.05 PRODUCT DELIVERY, HANDLING AND STORAGE

A. General
   1. Deliver the special trackwork fabricated rails to the Maintenance Center Yard.
   2. Load, transport, unload and stock pile special trackwork rail for storage and handle rail so as to prevent damage.

3. Load, unload, handle and store rail by accepted methods to prevent kinking, bending, nicking, or otherwise damaging the rail.
    a. In unloading operations, do not drop rails, but place each length of rail with the head up and with sufficient support under the base.
    b. Do not subject individual rails or rail bundles to excessive static loading.
    c. Avoid sudden impact or dynamic loading, and prevent high stressing arising from point or line loading.
    d. Spanner beams are required.
    e. Avoid excess cantilever of the rail end beyond the slinging points in order to prevent permanent bending and excessive stressing of the rail.
    f. Locate three slinging points at uniform lengths along the load so that the pre-curved rails are in a horizontal position at all times. Single point slinging of rail is prohibited.
    g. Any rail support, handling, clamping or pinch rollers must be contoured properly to match the particular rail profile and thus avoid localized point or line contact.
4. Use only slings that do not cause surface damage or notching.
    a. Terylene or nylon strapping is recommended, with an additional sleeve where the sling is in contact with the rail.
    b. Flat profile chain link slings with a protective sleeve are also recommended.
5. The use of chains and wires that may cause surface damage is not allowed.
6. Use sufficient timber dunnage at all time and take particular care when extracting slings from around rail lifts in order to ensure they are not “ripped out.”
7. Sort switch and stock rails and load, deliver and stock pile in a separate tier.
8. Sort transition rails and load; deliver and stock pile in a separate tier.

B. Warranty
1. Provide an unconditional manufacturer’s warranty for the special trackwork rails, pre-curved rails and transition rails against defects in workmanship.
2. If it should be necessary to retire these special trackwork rails, pre-curved rails or transition rails from service during the warranty period due to fracture or a defect, jointly inspect the failed rails in the presence of a DTC representative.
3. If the inspection and examination establishes that cause of the failure is attributable to a defect of rail fabrication, then replace the faulty rails free of charge.
4. If a delivery of substitute special trackwork rails, pre-curved rails or transition rails is difficult or cannot be executed within a reasonable period of time, compensation is payable to the DTC.
5. Warranties from third-party contract will be accepted only if also accepted and endorsed in writing by the Contractor and Subcontractors.

PART 2 – PRODUCTS

2.01 RAIL

A. General:
   1. The rail shall be 115 RE Section High Strength Rail conforming to the requirements of the AREMA Manual for Railway Engineering, Volume I, Chapter 4 Rail except as modified by this Section:
   2. Rail shape shall be in accordance with Figure 4-1-1. 115 RE Rail Section
   3. Fabricate all rails from continuous cast blooms or hot-topped ingots.
   4. Use classifications, markings, brandings, and stampings conforming to AREMA specifications.
   5. Supply rail in nominal 80 foot lengths or cut to appropriate lengths for Turnout requirements.
   6. Allowable tolerances for rail lengths:
      a. Un-drilled rails: plus or minus 2 inches
      b. Shop curved rails shall be per calculated lengths as shown on the approved Shop Drawings plus or minus 1/2 inch.
      c. Rails for Turnouts: plus 1 inch minus zero.

B. Chemical, hardness, and tensile properties shall meet the requirements for High Strength Rail specified in the AREMA Manual for Railway Engineering, Chapter 4, Part 2.
C. Head Hardening of Rail:
   1. Head hardening shall conform to AREMA Manual for Railway Engineering Chapter 4, Part 2, except that the head hardening shall have a depth of effective hardening not less than 5/8 inch as measured vertically from the top of the head on centerline of rail.
   2. Make a hardness traverse pattern on a rail section conforming to the requirements of AREMA Manual for Railway Engineering, Chapter 4.
   3. Use monitoring and recording controls on all heat-treating machines to assure proper and continuous heating and quenching of rail.
      a. Use equipment capable of making a permanent record of the heat-treating operation.
      b. Scrap any rail involved in a machine malfunction or variation from normal heat-treating operation.
   4. Keep an identifiable record of each rail heat treatment.
   5. Finish: After final treatment and acceptance, condition the rails by straightening to meet finish requirements of AREMA Specifications for Steel Rails, AREMA Manual for Railway Engineering, Chapter 4, and Part 2, Section 2.1.13.

D. Hydrogen Content:
   1. Take samples for the hydrogen determination of the molten steel at the tundish to represent the first third and last third of the pour of each heat. Record both values and use the higher vale to determine conformance with the Specifications.
   2. Provide rails free from shatter cracks (hydrogen flaking).

E. Ultrasonic Testing
   1. Prior to delivery of rail, ultrasonically test each rail over its full length to determine its interior condition in accordance with AREMA Manual for Railway Engineering, Chapter 4, and Section 2.1.8.
   2. A calibration test rail containing the following calibration reference standards is acceptable:
      a. Head: 3/32 inch flat bottom hole
      b. Web: 1/16 inch wide
      c. Base: 1/16 inch deep by 1-1/2 inch long slot

F. Pre-curving of Rail:
   1. All rails shall be straight before pre-curving.
   2. Uniformly curve rail, such that the deviation of the interior mid-ordinate offset from the theoretical offset is within the tolerances for straight rail using the appropriate chord distance required by the straight rail specification.
      a. Pre-curved rail bases shall be level when laid out on a flat surface.
      b. Distortion to laying flat in pre-curved rail base will not be acceptable.
   3. Identify pre-curved rail with painted identity numbering per approved Shop Drawing code at end of each rail, and paint identity numbers so that they are visible from both the top side and the side of the rails.

G. Transition Rails
   1. Transition rail shall be used to compensate for vertical rail head wear at toe of frog and closure rails as shown in Appendix 34 11 45 E.
   2. Identify transition rail with painted identity numbering per approval of Shop Drawing code at end of each rail, and paint identity numbers so that they are visible from both sides of the rail.
   3. Transition slope shall be determined by vertical wear in existing frog rails and adjacent closure rails and determined length of final transition rail in place.

PART 3 – EXECUTION

3.01 GENERAL

A. Manufacture, deliver, and stockpile rail in accordance with the requirements of this Section and Section 34 11 45 Procurement of Special Trackwork Components.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The rail procurement Work in this Section will be considered as incidental to the overall Work of Procuring Materials for Special Trackwork Turnout No. 3 Switch.

4.02 PAYMENT

A. The Work of this Section will be considered as incidental to the Work of Procurement Materials for Special Trackwork.

END OF SECTION