

# RAILROAD SIGNAL GENERAL NOTES

1. ALL MATERIALS AND CONSTRUCTION SHALL CONFORM TO THE STATE OF VERMONT, AGENCY OF TRANSPORTATION'S STANDARD SPECIFICATIONS FOR CONSTRUCTION, DATED 2011, AND ITS LATEST REVISIONS.
2. OVERHEAD SIGN/SIGNAL SUPPORTS SHALL CONFORM TO AASHTO'S PUBLICATION ENTITLED "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS", DATED 2009 OR ITS LATEST REVISION.
3. THE DESIGN CALCULATIONS SHALL TAKE INTO ACCOUNT THE FOLLOWING CRITERIA:
  - STRUCTURE CRITERIA  
DESIGN LIFE: 50 YEARS  
WIND LOAD - 90 MPH, UNLESS SPECIAL SITE CONDITIONS DICTATE  
ICE LOAD PER AASHTO'S PUBLICATION ENTITLED "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS", DATED 2009
  - FATIGUE CRITERIA  
FATIGUE CATEGORY:  
IFOR MAST ARM SIGN STRUCTURES, 2 FOR SIGNAL MAST ARMS  
VORTEX SHEDDING: INCLUDE  
NATURAL WIND GUSTS: INCLUDE  
TRUCK INDUCED WIND GUSTS: INCLUDE FOR ROADWAYS WHERE SPEED LIMIT IS 40 MPH OR GREATER.  
GALLOPING: DO NOT INCLUDE IN DESIGN CALCULATIONS
  - FOUNDATION CRITERIA  
CONCRETE: CONCRETE, HIGH PERFORMANCE CLASS B, STATE OF VERMONT, AGENCY OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, SECTION 501.  
REINFORCING STEEL: STATE OF VERMONT, AGENCY OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, SUBSECTION 713.01.  
ALLOWABLE BEARING CAPACITY: TO BE DETERMINED BY THE CONTRACTOR IN ACCORDANCE WITH MRE110-01. (SEE NOTE 19)  
INTERNAL SOIL FRICTION ANGLE,  $\phi$ : TO BE DETERMINED BY THE CONTRACTOR IN ACCORDANCE WITH MRE110-01. (SEE NOTE 19)
4. ANCHOR BOLTS  
FOUR STAINLESS STEEL ANCHOR BOLTS WITH TWO HEXAGON NUTS, ONE WASHER AND ONE LOCK WASHER PER BOLT SHALL BE FURNISHED WITH EACH POLE. ANCHOR BOLT PLATES, WHEN USED, SHALL ALSO BE STAINLESS STEEL. SEE STATE OF VERMONT, AGENCY OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, SUBSECTION 714.09.
5. FLANGE BOLTS  
ALL FLANGE BOLTS AND HEX NUTS SHALL BE HIGH STRENGTH STEEL AND SHALL CONFORM TO STATE OF VERMONT, AGENCY OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, SUBSECTION 714.05.
6. HORIZONTAL AND VERTICAL MEMBERS  
STEEL TUBES SHALL BE FORMED AND WELDED WITH ONE CONTINUOUS LONGITUDINAL WELD ONLY. AFTER FORMING AND WELDING THEY SHALL BE COLD ROLLED TO ENSURE UNIFORMITY OF SIZE AND SMOOTHNESS OF WELD. THERE SHALL BE NO TRANSVERSE WELDING EXCEPT AT THE FLANGE CONNECTIONS AND POLE BASE PLATES, WHERE THE TUBES SHALL TELESCOPE THE FLANGES AND PLATES AND BE CONTINUOUSLY WELDED BOTH SIDES, INSIDE AND OUT TO WITHSTAND THE FULL TRANSFER OF THE BENDING STRENGTH TO THE BOLTS. OPTIONALLY, THE MEMBERS MAY BE A SERIES OF TWO OR THREE DIFFERENT DIAMETER PIPES WELDED TOGETHER. STEEL TUBES SHALL BE CONSTRUCTED FROM MATERIALS CONFORMING TO STATE OF VERMONT, AGENCY OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, SUBSECTION 752.02.
7. GALVANIZING  
ALL STEEL COMPONENTS, EXCEPT CONCRETE REINFORCING AND STAINLESS STEEL HARDWARE, ARE TO BE HOT DIPPED GALVANIZED AFTER FABRICATION. THE ASSEMBLIES SHALL BE DESIGNED AND FABRICATED TO PERMIT GALVANIZING ON ALL INTERIOR AND EXTERIOR SURFACES AND SHALL BE FREE OF POCKETS AND OTHER STRUCTURAL OBSTRUCTIONS THAT WILL NOT PERMIT PROPER DEPOSITION OF ZINC COATING. GALVANIZING SHALL BE IN ACCORDANCE WITH STATE OF VERMONT, AGENCY OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, SUBSECTION 752.02.
8. WELDING  
ALL DESIGN DETAILS, WORKMANSHIP, PROCEDURES AND INSPECTION SHALL CONFORM TO VTRANS SPECIFICATIONS SUBSECTION 506.10.

9. FOUNDATIONS
  - A. FOUNDATIONS SHALL BE DESIGNED IN ACCORDANCE WITH THE MRE110-01 GUIDELINES ISSUED BY THE AGENCY.
  - B. FOUNDATIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING NOTES:
    1. EXCEPT FOR THE UPPERMOST 2 FT OF SOIL, THE DRILLED SHAFT FOUNDATION SHALL BE POURED AGAINST UNDISTURBED MATERIAL; THE TOP 2 FT OF SOIL SHALL BE NEGLECTED FOR DESIGN PURPOSES. A DISPOSABLE CIRCULAR CONCRETE FORM, IF USED, SHALL NOT BE PLACED DEEPER THAN 2 FT, IN ORDER NOT TO REDUCE THE FRICTION BETWEEN THE SOIL AND THE CONCRETE.
    2. BACKFILL MATERIAL PLACED ADJACENT TO THE FOUNDATION SHALL MEET THE REQUIREMENTS FOR GRANULAR BACKFILL FOR STRUCTURES, VAOT 2011 STANDARD SPECIFICATIONS FOR CONSTRUCTION SUBSECTION 704.08. BACKFILL MATERIAL SHALL BE COMPACTED AS DESCRIBED IN VAOT 2011 STANDARD SPECIFICATIONS FOR CONSTRUCTION SUBSECTION 204.08.
    3. CONCRETE FOR THE FOUNDATION SHALL CONFORM TO THE REQUIREMENTS OF SECTION 501, HPC STRUCTURAL CONCRETE. THE CONCRETE SPECIFICATIONS MAY NEED TO BE ADJUSTED FOR CONSTRUCTABILITY ISSUES. HOWEVER, IF REQUIRED, THE CONTRACTOR SHALL SUBMIT ANY CHANGES TO THE CONCRETE SPECIFICATION FOR REVIEW BY THE VTRANS PROJECT MANAGER.
    4. STEEL PILES SHALL MEET THE REQUIREMENTS OF SECTION 505.
    5. WHEN THE DESIGN DEPTH OF A FOUNDATION CANNOT BE OBTAINED DUE TO UNFORESEEN FIELD CONDITIONS, THE CONTRACTOR SHALL NOTIFY THE ENGINEER FOR THE MANUFACTURER TO OBTAIN A REVISED FOUNDATION DESIGN. SUCH A REVISION SHALL BE SUBMITTED TO THE VERMONT AGENCY OF TRANSPORTATION PROJECT MANAGER AND MAY REQUIRE UP TO A 4 WEEK REVIEW PERIOD BY VTRANS.
  - C. SIGNALS/SIGNS SHALL BE INSTALLED AND LEVELED AND POLES SHALL BE PLUMB PRIOR TO PLACING GROUT UNDER POLE BASE. GROUT MATERIAL SHALL BE NON-SHRINKING MORTAR CONFORMING TO SUBSECTION 707.03.
10. EACH OVERHEAD TRAFFIC SIGNAL/SIGN SUPPORT SHALL BE GROUNDED. THE GROUND SHALL CONSIST OF:
  - A. AN INTERNAL GROUND LUG OPPOSITE THE HAND HOLE.
  - B. A #6 AWG (MIN.) SOFT DRAWN COPPER GROUNDING ELECTRODE CONDUCTOR.
  - C. A 5/8 IN. X 8 FT (MIN) COPPER CLAD GROUNDING ELECTRODE. THE RESISTANCE TO GROUND SHALL BE 25 OHMS OR LESS. ADDITIONAL GROUNDING ELECTRODES MAY BE REQUIRED (MINIMUM SPACING SHALL BE 6 FT), WHEN A POWER SERVICE, METER AND DISCONNECT ARE ATTACHED TO A POLE, THERE SHALL BE A CONTINUOUS GROUNDING ELECTRODE CONDUCTOR FROM THE METER AND DISCONNECT WHICH MAY RUN INTERNAL TO THE UPRIGHT, THROUGH THE 1/2 IN. FLEXIBLE TUBING IN THE CONCRETE BASE TO THE REQUIRED GROUNDING ELECTRODE(S). THE GROUNDING ELECTRODE CONDUCTOR FROM THE POLE GROUNDING LUG, CONTROLLER CABINET AND/OR LUMINAIRE MAY ATTACH TO THIS CONTINUOUS GROUNDING ELECTRODE CONDUCTOR FROM THE SERVICE METER AND DISCONNECT. THE CONTRACTOR SHALL PERFORM A RESISTANCE TO GROUND TEST ON THE CONTINUOUS GROUNDING ELECTRODE CONDUCTOR FROM THE SERVICE METER AND DISCONNECT, AND PROVIDE A WRITTEN STATEMENT TO THE AREA ELECTRICAL INSPECTOR THAT THE GROUNDING ELECTRODE CONDUCTOR IS CONTINUOUS FROM THE SERVICE METER AND DISCONNECT AND THE RESISTANCE TO GROUND IS 25 OHMS OR LESS.
11. HORIZONTAL MEMBERS SHALL BE CAMBERED AND THE VERTICAL POLES BACK RAKED (WHERE APPLICABLE) TO THE ANTICIPATED DEAD LOAD DEFLECTION PLUS THE CAMBER, IF ANY, SPECIFIED ON THE PLANS.
12. AN EQUIVALENT ALTERNATE DESIGN MAY BE SUBSTITUTED FOR THE DETAILS AND MATERIALS SHOWN.
13. THE DETAILS OF DESIGN FOR THE STRUCTURE AND FOUNDATION ARE TO BE SUPPLIED BY THE CONTRACTOR AND/OR BY THE MANUFACTURER. THE STRUCTURE SHALL BE DESIGNED TO RESIST THE MAXIMUM LOADING AS OUTLINED IN THE AASHTO STANDARD SPECIFICATIONS (SEE NOTE 2). ALL DESIGN CALCULATIONS FOR THE STRUCTURE AND THE FOUNDATION SHALL BE CHECKED AND STAMPED BY A LICENSED PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF VERMONT PRIOR TO SUBMITTAL OF THE FABRICATION DRAWINGS TO THE VERMONT AGENCY OF TRANSPORTATION.

14. THE CONTRACTOR SHALL SUBMIT THREE(3) COPIES OF THE DESIGN CALCULATIONS TO THE VERMONT AGENCY OF TRANSPORTATION, PROJECT MANAGER, SHOWING THE FOLLOWING INFORMATION FOR EACH OF THE VERTICAL AND HORIZONTAL COMPONENTS OF THE STRUCTURE AND FOUNDATION:
  - A. THE DESIGN AXIAL AND SHEAR FORCES AND BENDING AND TORSIONAL MOMENTS ACTING AT THE TOP OF THE FOUNDATION.
  - B. THE DESIGN AXIAL, BENDING AND SHEAR STRESSES AND THE COMBINED STRESS RATIO.
  - C. THE ALLOWABLE AXIAL, BENDING, AND SHEAR STRESSES.
  - D. ITEMS A, B, C SHALL BE SHOWN FOR EACH OF THE GROUP LOADINGS (I, II, III) AND FOR THE BASIC WIND LOAD APPLIED TO THE TWO CASES OUTLINED IN THE AASHTO STANDARD SPECIFICATIONS (SEE NOTE 2) SECTION I.2.5(D)(4).
  - E. FAILURE TO SUPPLY THE PROPER DESIGN INFORMATION SHALL BE CAUSE FOR REJECTION OF THE STRUCTURE.
  - F. A MINIMUM OF FOUR (4) WEEKS SHALL BE REQUIRED FOR REVIEW BY THE VERMONT AGENCY OF TRANSPORTATION.
  - G. EVERY MEMBER AND CONNECTION IN AN OVERHEAD TRAFFIC SIGNAL SUPPORT SHALL BE DESIGNED TO PROVIDE ADDITIONAL RESIDUAL CAPACITY FOR FUTURE MODIFICATION EQUIVALENT TO A 5-SECTION TRAFFIC SIGNAL HEAD WITH A 5 INCH LOUVERED BACKPLATE LOCATED ON THE OUTERMOST EXTENT OF THE MAST ARM.
15. FABRICATION DRAWINGS (6 COPIES OF EACH) SHALL BE SUBMITTED TO THE STATE OF VERMONT, AGENCY OF TRANSPORTATION, PROJECT MANAGER FOR APPROVAL PRIOR TO FABRICATION. THE FABRICATION DRAWINGS SHALL INCLUDE THE FOLLOWING INFORMATION:
  - A. DETAILED DRAWING OF EACH COMPONENT OF THE STRUCTURE.
  - B. MATERIAL SPECIFICATION FOR EACH COMPONENT OF THE STRUCTURE, EITHER BY COMPLETE SPECIFICATION OR REFERENCE TO APPLICABLE ASTM STANDARDS.
  - C. NOTATION OF PROJECT NAME, PROJECT NUMBER, ROUTE NUMBER, AND STRUCTURE STATIONING (TO BE INCLUDED ON EACH SHEET).
  - D. DETAILS FOR LOCATION OF SIGNS/SIGNALS AND ATTACHMENT HARDWARE FOR THE SUPPORT STRUCTURE.
  - E. ALL ELEVATIONS AND DIMENSIONS NECESSARY TO PROVIDE A COMPLETE SET OF RECORD PLANS.
  - F. DEAD LOAD DEFLECTION AND CAMBER INFORMATION.
  - G. WELDING DETAILS AND PROCEDURES ARE REQUIRED FOR ALL WELDS. PROCEDURES SHALL BE SUBMITTED FOR APPROVAL WITH REFERENCE TO EACH WELD IDENTIFIED ON THE FABRICATION DRAWINGS. (SEE SUBSECTION 506.10).
16. THE RAILROAD SIGNALS SHALL BE MOUNTED TO THE ARM OR POLE USING A FIXED MOUNT SYSTEM, UNLESS OTHERWISE NOTED ON THE CROSS SECTION SHEET. FOR SIGNALS MOUNTED ON A MAST ARM, THE MAST ARM AND MOUNTING POINT SHALL BE IN THE MIDDLE OF THE SIGNAL HEAD.
17. BASE PLATES SHALL BE STAMPED WITH THE VERTICAL POLE DIAMETER, HEIGHT, YIELD STRENGTH, GAUGE AND THE HORIZONTAL MEMBER DIAMETER, LENGTH, YIELD STRENGTH, AND GAUGE. ALTERNATELY, THE INFORMATION MAY BE STAMPED ON A METAL TAG RIVETED TO THE POLE NEAR THE HAND HOLE.
18. SEE STANDARD E-171A FOR ADDITIONAL NOTES.
19. SOIL BORINGS FOR THE RAILROAD SIGNAL FOUNDATION AND THE SUBSEQUENT GEOTECHNICAL ANALYSIS ARE THE RESPONSIBILITY OF THE CONTRACTOR. ALL DESIGN CRITERIA, ANALYSIS AND PROPOSALS SHALL BE IN ACCORDANCE WITH MRE110-01. ALL COSTS ASSOCIATED WITH THE SCHEDULING, PROCUREMENT AND ANALYSIS OF THE SOIL BORING INFORMATION SHALL BE INCLUDED IN THE UNIT PRICE BID FOR ITEM 900.645 SPECIAL PROVISION (RAIL-HIGHWAY CROSSING ACTIVE WARNING SYSTEM) (AARDOT 850-920X).

NOT TO SCALE

**AARDOT #850-920X**

**RAILROAD  
CROSSING  
DETAIL  
SHEET #5**

PROJECT NAME: ST. JOHNSBURY-LYNDON

PROJECT NUMBER: STP 2928(1)

FILE NAME: p10c262.dgn

PLOT DATE: 10/17/2013

PROJECT LEADER: JLL

DRAWN BY: STANTEC

DESIGNED BY: MCF

CHECKED BY: JLL

IPARM FILE: p10c262r05.i

SHEET 26 OF 133

