

TRAFFIC SIGNAL GENERAL NOTES

1. ALL MATERIALS AND CONSTRUCTION SHALL CONFORM TO VTRANS' "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, WITH CURRENT MODIFICATIONS.
2. OVERHEAD SIGN/SIGNAL SUPPORTS SHALL CONFORM TO AASHTO'S "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS", DATED 2013, AND ITS LATEST REVISIONS.
3. THE DESIGN CALCULATIONS SHALL TAKE INTO ACCOUNT THE FOLLOWING CRITERIA:

STRUCTURE CRITERIA

- DESIGN LIFE: 50 YEARS
- WIND LOAD: 90 M.P.H. , UNLESS SPECIAL SITE CONDITIONS DICTATE ICE LOAD

FATIGUE CRITERIA

- FATIGUE CATEGORY: 1 FOR 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 M.P.H. OR GREATER
- GALLOPING: DO NOT INCLUDE IN DESIGN CALCULATIONS

FOUNDATION CRITERIA

- CONCRETE: CONCRETE, CLASS B, VTRANS' "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, SECTION 541
- REINFORCING STEEL: VTRANS' "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, SECTION 713.01
- ALLOWABLE BEARING CAPACITY: PER GEOTECHNICAL REPORT INCLUDED IN CONTRACT DOCUMENTS
- INTERNAL SOIL FRICTION ANGLE, ϕ : PER GEOTECHNICAL REPORT INCLUDED IN CONTRACT DOCUMENTS

4. ANCHOR BOLTS

- A) GALVANIZED 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 GALVANIZED. SEE SECTION 714.09. AFTER INSTALLATION, A MINIMUM OF TWO THREADS ON THE BOLT SHOULD BE EXPOSED ABOVE THE NUT.
- B) ALL BOLTS SHALL BE CHECKED ON THE NUT SIDE AFTER INSTALLATION FOR CONSISTENCY OF PATTERN. ANY STICKOUTS GREATER THAN THE OTHER BOLTS SHALL BE DISCARDED AND REINSTALLED PROPERLY. THE END OF THE PROPERLY INSTALLED BOLT SHALL BE AT LEAST FLUSH WITH THE NUT OR STICK OUT NOT MORE THAN THREE THREADS.
- C) ALL BOLT TIGHTENING SHALL BE TURN-OF-THE-NUT METHOD. ALL BOLTS SHALL BE TIGHTENED TO 1/8 TURN PAST SNUG CONDITION FOR BOLTS LESS THAN OR EQUAL TO 1-1/2" DIAMETER AND 1/12 TURN PAST SNUG TIGHT CONDITION FOR BOLTS GREATER THAN 1-1/2" DIAMETER.

5. FLANGE BOLTS

ALL FLANGE BOLTS AND HEX NUTS SHALL BE HIGH STRENGTH STEEL AND SHALL CONFORM TO ASTM A325. THE FLANGE BOLTS SHALL BE CAPABLE OF RESISTING 133% OF THE FULL DESIGN STRESS OF THE TUBE AT ITS YIELD STRENGTH STRESS.

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. THEY SHALL HAVE A MINIMUM YIELD STRENGTH OF 55 KSI. 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 CONSTRUCTION FROM MATERIALS CONFORMING TO SECTION 752.02.

7. GALVANIZING

ALL STEEL COMPONENTS, EXCEPT CONCRETE REINFORCING, 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 SECTION 752.02.

8. WELDING

- A) ALL WELDING SHALL BE PERFORMED PER SECTION 506.10.
- B) ALL WELDS SHALL BE AT LEAST AS STRONG AS THE MATERIAL (S) BEING WELDED.

9. FOUNDATIONS

- A) FOOTINGS SHALL BE DESIGNED IN ACCORDANCE WITH VTRANS' MATERIALS & RESEARCH ENGINEERING INSTRUCTIONS - GEOTECHNICAL DESIGN PROCEDURES FOR MAST ARM AND OVERHEAD SIGN SUPPORT FOUNDATIONS (MRE1 10-01), DATED MARCH 9, 2010, A COPY OF WHICH CAN BE FOUND ON THE AGENCY'S WEBSITE: WWW.VTRANS.VERMONT.GOV.
- B) FOUNDATIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING NOTES:
 1. A MINIMUM EMBEDMENT DEPTH OF FIVE FEET SHALL BE USED FOR ALL SPREAD FOOTING FOUNDATIONS; MEASURED FROM THE GROUND SURFACE ELEVATION TO THE BOTTOM OF THE FOOTING ELEVATION.
 2. EXCEPT FOR THE UPPERMOST TWO FEET OF SOIL, DRILLED SHAFT FOUNDATIONS SHALL BE POURED AGAINST UNDISTURBED MATERIAL; THE TOP TWO FEET OF SOIL SHALL BE NEGLECTED FOR DESIGN PURPOSES. A DISPOSABLE CIRCULAR CONCRETE FORM, IF USED, SHALL NOT BE PLACED DEEPER THAN TWO FEET, IN ORDER NOT TO REDUCE THE FRICTION BETWEEN THE SOIL AND THE CONCRETE.
 3. AS AN ALTERNATIVE TO THE DRILLED HOLES, FOOTINGS MAY BE POURED IN EXCAVATED HOLES USING THE PROPER FORMS, WHICH MUST BE REMOVED. THE EXCAVATED HOLES SHALL BE AT LEAST TWO FEET CLEAR OF THE FOUNDATION SIDES AND ONE FOOT DEEPER THAN THE FOUNDATION. CARE SHALL BE TAKEN TO AVOID EXCAVATING AROUND THE TOP OF THE FOUNDATION. THE BACKFILL MATERIAL SHALL BE COMPACTED AS DESCRIBED IN SECTION 204.08. DESIGN LIMITS AS FOR AUGURED FOOTINGS APPLIES.
 4. ANY BACKFILL PLACED ADJACENT TO THE FOOTING SHALL BE GRANULAR MATERIAL MEETING THE REQUIREMENTS FOR GRANULAR BACKFILL FOR STRUCTURES, SECTION 704.08. IT SHALL BE COMPACTED AS DESCRIBED IN SECTION 204.08.
 5. CONCRETE FOR THE FOUNDATION SHALL CONFORM TO THE REQUIREMENTS OF CONCRETE, SECTION 541 STRUCTURAL CONCRETE. IF DRILLED SHAFT FOUNDATIONS ARE REQUIRED, THE CONCRETE SPECIFICATIONS MAY NEED TO BE ADJUSTED FOR CONSTRUCTIBILITY ISSUES. HOWEVER, IF REQUIRED, THE CONTRACTOR SHALL SUBMIT ANY CHANGES TO THE CONCRETE SPECIFICATION FOR REVIEW BY THE VTRANS PROJECT MANAGER.

6. IF STEEL PILES ARE USED THEY SHALL MEET THE REQUIREMENTS OF SECTION 505.

7. WHEN THE DESIGN DEPTH OF A FOUNDATION CANNOT BE OBTAINED DUE TO UNFORSEEN FIELD CONDITIONS, THE CONTRACTOR SHALL NOTIFY THE ENGINEER FOR THE MANUFACTURER TO OBTAIN A REVISED FOUNDATION DESIGN. SUCH A REVISION SHALL BE SUBMITTED TO VTRANS PROJECT MANAGER AND MAY REQUIRE UP TO A FOUR 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 SECTION 707.03, MORTAR TYPE IV.

10. EACH OVERHEAD TRAFFIC SIGNAL/SIGN SUPPORT SHALL BE GROUNDED. THE GROUND SHALL CONSIST OF THE FOLLOWING:

- A) AN INTERNAL GROUND LUG OPPOSITE THE HAND HOLE
- B) A #6 (MIN.) SOFT DRAWN COPPER GROUNDING ELECTRODE CONDUCTOR
- C) A 5/8" X 8 FOOT (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'). WHEN A POWER SERVICE, METER AND DISCONNECT ARE ATTACHED TO A POLE, THERE SHALL BE A CONTINUOUS GROUND WIRE FROM THE METER AND DISCONNECT WHICH MAY RUN INTERNAL TO THE UPRIGHT, THROUGH THE 1/2" FLEXIBLE TUBING IN THE CONCRETE BASE TO THE REQUIRED GROUNDING ELECTRODE(S). THE GROUND WIRE FROM THE POLE GROUNDING LUG, CONTROLLER CABINET AND/OR LUMINAIRE MAY ATTACH TO THE CONTINUOUS GROUNDING ELECTRODE CONDUCTOR FROM THE SERVICE METER AND DISCONNECT. THE CONTRACTOR SHALL PERFORM A RESISTANCE TO GROUND TEST ON THE CONTINUOUS GROUND 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 VTRANS.

14. THE CONTRACTOR SHALL SUBMIT ONE DIGITAL VERSION OF THE DESIGN CALCULATIONS TO VTRANS 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) VIBRATION AND FATIGUE CALCULATIONS AS SET FORTH IN SECTION 11 OF THE AASHTO PUBLICATION REFERENCED IN NOTE 2;
- D) THE ALLOWABLE AXIAL, BENDING, AND SHEAR STRESSES;
- E) ITEMS A, B, AND D 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 1.2.5 (D) (4);
- F) FAILURE TO SUPPLY THE PROPER DESIGN INFORMATION SHALL BE CAUSE FOR REJECTION OF THE STRUCTURE;
- G) A MINIMUM OF FOUR WEEKS SHALL BE REQUIRED FOR REVIEW BY VTRANS;
- H) 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 IN A DIGITAL FORMAT SHALL BE SUBMITTED TO VTRANS PROJECT MANAGEMENT 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 SECTION 506.10.
- H) BOLT TENSIONING REQUIREMENTS.

16. THE TRAFFIC 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 POLE INFORMATION INCLUDING: POLE DIAMETER, HEIGHT, YIELD STRENGTH, AND GAUGE; ARM INFORMATION SHALL INCLUDE: HORIZONTAL MEMBER DIAMETER, LENGTH, YIELD STRENGTH, AND GAUGE. THE INFORMATION SHALL BE STAMPED ON A METAL TAG RIVETED TO THE POLE NEAR THE HAND HOLE.

18. SEE STANDARD E-171B FOR ADDITIONAL NOTES.

19. CONTRACTOR TO SCHEDULE FINAL INSPECTION AND OBTAIN WRITTEN APPROVAL OF WORK FROM VTRANS TRAFFIC SIGNAL TECHNICIAN.

PROJECT NAME:	EAST MONTPELIER
PROJECT NUMBER:	BRF 037-1(17)
FILE NAME: 26c_Mast arm notes.dgn	PLOT DATE: 2/17/2017
PROJECT LEADER: T. KNIGHT	DRAWN BY: S. NEELY
DESIGNED BY: D. DEBAIE	CHECKED BY: K. RICHARDSON
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