

- NATURAL WIND GUSTS: INCLUDE
- TRUCK INDUCED WIND GUSTS: INCLUDE FOR ROADWAYS WHERE SPEED LIMIT IS 40 M.P.H. OR GREATER
- GALLOPING: NOT REQUIRED

**FOUNDATION CRITERIA**

- CONCRETE: CONCRETE, CLASS B, VTrans' "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, SECTION 541.
- REINFORCING STEEL: REINFORCING STEEL, LEVEL I VTrans' "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, SECTION 507.
- GEOTECHNICAL SOIL RESISTANCES TO BE DETERMINED BY CONTRACTOR. GEOTECHNICAL DATA REPORT SUMMARIZING SUBSURFACE INVESTIGATION INCLUDED IN CONTRACT DOCUMENTS

**3. ANCHOR BOLTS**

- A) GALVANIZED ANCHOR BOLTS WITH TWO HEXAGON NUTS AND TWO WASHERS 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) A MINIMUM OF 6 ANCHOR BOLTS SHALL BE PROVIDED AT EACH SINGLE UPRIGHT POST FOUNDATIONS.
- C) PROCEDURE FOR TIGHTENING DOUBLE-NUT ANCHOR BOLT CONNECTIONS:
  1. VERIFY THAT THE NUTS CAN BE TURNED ONTO THE BOLTS PAST THE ELEVATION CORRESPONDING TO THE BOTTOM OF EACH IN-PLACE LEVELING NUT AND BE BACKED OFF BY THE EFFORT OF ONE PERSON ON A 12-IN. LONG WRENCH OR EQUIVALENT (I.E., WITHOUT EMPLOYING A PIPE EXTENSION ON THE WRENCH HANDLE).
  2. CLEAN AND LUBRICATE THE EXPOSED THREADS OF ALL ANCHOR BOLTS. CLEAN AND LUBRICATE THE THREADS AND BEARING SURFACES OF ALL LEVELING NUTS. RE-LUBRICATE THE EXPOSED THREADS OF THE ANCHOR BOLTS AND THE THREADS OF THE LEVELING NUTS IF MORE THAN 24 HOURS HAS ELAPSED SINCE EARLIER LUBRICATION, OR IF THE ANCHOR BOLTS AND LEVELING NUTS HAVE BECOME WET SINCE THEY WERE FIRST LUBRICATED.
  3. TURN THE LEVELING NUTS ONTO THE ANCHOR BOLTS AND ALIGN THE NUTS TO THE SAME ELEVATION.
  4. PLACE STRUCTURAL WASHERS ON TOP OF THE LEVELING NUTS (ONE WASHER CORRESPONDING TO EACH ANCHOR BOLT).
  5. INSTALL THE BASE PLATE ATOP THE LEVELING NUTS. PLACE STRUCTURAL WASHERS ON TOP OF THE BASE PLATE (ONE WASHER CORRESPONDING TO EACH ANCHOR BOLT), AND TURN THE TOP NUTS ONTO THE ANCHOR BOLTS.
  6. TIGHTEN TOP NUTS TO A SNUG-TIGHT CONDITION IN A STAR PATTERN. SNUG-TIGHT IS DEFINED AS THE MAXIMUM NUT ROTATION RESULTING FROM THE FULL EFFORT OF ONE PERSON ON A 12-IN. LONG WRENCH OR EQUIVALENT. A STAR TIGHTENING PATTERN IS ONE IN WHICH THE NUTS ON OPPOSITE OR NEAR-OPPOSITE SIDES OF THE BOLT CIRCLE ARE SUCCESSIVELY TIGHTENED IN A PATTERN RESEMBLING A STAR. (FOR EXAMPLE, FOR AN 8-BOLT CIRCLE WITH BOLTS SEQUENTIALLY NUMBERED 1 TO 8, TIGHTEN NUTS IN THE FOLLOWING BOLT ORDER: 1, 5, 7, 3, 8, 4, 6, 2.)
  7. TIGHTEN LEVELING NUTS TO A SNUG-TIGHT CONDITION IN A STAR PATTERN.
  8. BEFORE FINAL TIGHTENING OF THE TOP NUTS, MARK THE REFERENCE POSITION OF EACH TOP NUT IN A SNUG-TIGHT CONDITION WITH A SUITABLE MARKING ON ONE FLAT WITH A CORRESPONDING REFERENCE MARK ON THE BASE PLATE AT EACH BOLT. THEN INCREMENTALLY TURN THE TOP NUTS USING A STAR PATTERN UNTIL ACHIEVING THE REQUIRED NUT ROTATION SPECIFIED BELOW. TURN THE NUTS IN AT LEAST TWO FULL TIGHTENING CYCLES (PASSES). AFTER TIGHTENING, VERIFY THE NUT ROTATION.
  9. TOP NUTS FOR ASTM F1554 GRADE 55 ANCHOR BOLTS SHALL BE TIGHTENED TO 1/3 TURN BEYOND SNUG TIGHT CONDITION FOR BOLTS LESS THAN OR EQUAL TO 1 1/2" DIAMETER AND 1/6 TURN BEYOND SNUG TIGHT CONDITION FOR BOLTS GREATER THAN 1 1/2" DIAMETER. THE TOLERANCE FOR NUT ROTATION IS PLUS 20 DEGREES. USE A BEVELED WASHER IF THE NUT IS NOT IN FIRM CONTACT WITH THE BASE PLATE OR THE OUTER FACE OF THE BASE PLATE IS SLOPED MORE THAN 1:40.

**4. FLANGE BOLTS**

ALL FLANGE BOLTS, HEX NUTS, AND WASHERS SHALL CONFORM TO SUBSECTION 714.05. THE FLANGE BOLTS SHALL BE CAPABLE OF RESISTING 133% OF THE FULL DESIGN STRESS OF THE TUBE AT ITS YIELD STRENGTH STRESS. FLANGE BOLTS SHALL BE TENSIONED IN ACCORDANCE WITH SUBSECTION 506.19. DIRECT TENSION INDICATORS ARE REQUIRED.

**5. U-BOLTS**

U-BOLTS AND ASSOCIATED HARDWARE SHALL CONFORM TO SUBSECTION 714.04.

NON-CANTILEVERED OVERHEAD SIGN AND SIGNAL STRUCTURES:  
 ASTM 1500, GRADE B WELDED AND SEAMLESS STEEL PIPE (ROUNDS ONLY)  
 API 5L GRADE X42 AMERICAN PETROLIUM INSTITUTE SPECIFICATION 5L

**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 (MREI 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. FOR DRILLED SHAFT FOUNDATIONS, CONCRETE SHALL BE POURED AGAINST UNDISTURBED SOIL UNLESS A PERMANENT CASING IS DESIGNED FOR AND APPROPRIATE SUPPORTING CALCULATIONS ARE PROVIDED. 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 CONSTRUCTABILITY ISSUES. HOWEVER, IF REQUIRED, THE CONTRACTOR SHALL SUBMIT ANY CHANGES TO THE CONCRETE SPECIFICATION FOR REVIEW BY THE VTrans PROJECT MANAGER.
  6. STEEL PILES IF USED, 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 THE 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' (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 WITH 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 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 SUBSTITUED FOR THE DETAILS AND MATERIALS SHOWN.**

- B) THE DE RATIO.
- C) VIBRA1 AASHT
- D) THE AI
- E) ITEMS AND FC AASHT
- F) FAILUF REJEC
- G) A MINII
- H) EVERY SIGNAL CAPAC SIGNAL EXTEN TRAFFI OF 85%
- 15. FABRICATION DRA MANAGER FOR AP INCLUDE THE FOLI
  - A) DETAIL
  - B) MATER BY COI
  - C) NOTAT STATIC
  - D) DETAIL SUPPC
  - E) ALL EL RECOF
  - F) DEAD I
  - G) WELDII PROCE WELD I
  - H) BOLT T
- 16. THE TRAFFIC SIGN SYSTEM, UNLESS I MOUNTED ON A M/ OF THE SIGNAL HE
- 17. BASE PLATES SHA HEIGHT, YIELD ST/ MEMBER DIAMETE STAMPED ON A ME
- 18. SEE STANDARD E-