

1. ALL MATERIALS AND CONSTRUCTION SHALL CONFORM TO THE STATE OF VERMONT AGENCY OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2006, WITH CURRENT MODIFICATIONS.

CONTRACTOR ANALYSIS AND DESIGN REQUIREMENTS

2. THE DESIGN OF OVERHEAD STRUCTURES, INCLUDING BOX TRUSS AND STRAIN POLES SHALL BE PERFORMED IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS, 2009 OR ITS LATEST REVISION. FURTHERMORE, THIS DOCUMENT DICTATES THE DESIGN OF FOUNDATIONS FOR THESE STRUCTURES TO BE CONDUCTED IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES 17TH EDITION, 2002. DESIGN OF STRUCTURE FOUNDATIONS BY CONTRACTOR SHALL BE COMPLETED IN ACCORDANCE WITH VTRANS' MRE1 10-01.

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.

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 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 2006, SECTION 501.
 REINFORCING STEEL: STATE OF VERMONT AGENCY OF
 TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION",
 DATED 2006, SUBSECTION 713.01.
 ALLOWABLE BEARING CAPACITY: TO BE DETERMINED
 INTERNAL SOIL FRICTION ANGLE, ϕ : TO BE DETERMINED

4. 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 AN ENGINEER REGISTERED IN THE STATE OF VERMONT PRIOR TO SUBMITTAL OF THE FABRICATION DRAWINGS TO THE VERMONT AGENCY OF TRANSPORTATION.
5. THE FINAL FOUNDATION TYPE AND DIMENSIONS ARE SELECTED BY THE CONTRACTOR AND THE DESIGN OF THIS FOUNDATION IS TO BE PROVIDED BY THE CONTRACTOR FOR THE VERMONT AGENCY OF TRANSPORTATION'S REVIEW AND ACCEPTANCE.
6. IN ADDITION TO THE FABRICATION DRAWINGS OUTLINED IN NOTE 26 THE CONTRACTOR SHALL SUBMIT ALL DESIGN CALCULATIONS TO THE STATE OF VERMONT AGENCY OF TRANSPORTATION SHOWING THE FOLLOWING INFORMATION FOR EACH OF THE VERTICAL AND HORIZONTAL COMPONENTS OF THE STRUCTURE AND FOUNDATION:
- THE DESIGN AXIAL AND SHEAR FORCES AND BENDING AND TORSIONAL MOMENTS.
 - THE DESIGN AXIAL, BENDING AND SHEAR STRESSES AND THE COMBINED STRESS RATIO.
 - VIBRATION AND FATIGUE CALCULATIONS AS SET FORTH IN SECTION 9 OF THE AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS, 2009, OR ITS LATEST REVISION.
 - THE ALLOWABLE AXIAL, BENDING, AND SHEAR STRESSES.
 - ITEMS A,B,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).
 - FAILURE TO SUPPLY THE PROPER DESIGN INFORMATION SHALL BE CAUSE FOR REJECTION OF THE STRUCTURE.
 - A MINIMUM OF FOUR (4) WEEKS SHALL BE REQUIRED FOR REVIEW BY THE VERMONT AGENCY OF TRANSPORTATION.
 - EVERY MEMBER AND CONNECTION IN AN OVERHEAD TRAFFIC SIGN SUPPORT SHALL HAVE A MAXIMUM DESIGN RATIO OF 85% TO PROVIDE RESIDUAL CAPACITY FOR FUTURE MODIFICATIONS TO SIGN SIZE OR CONFIGURATIONS.

GEOTECHNICAL DESIGN

7. FOR ALL GEOTECHNICAL DESIGN PROCEDURES, SEE MRE1 10-01, GEOTECHNICAL DESIGN PROCEDURES FOR MAST ARMS & OVERHEAD STRUCTURES, LOCATED ON THE AGENCY'S WEBSITE AT <http://www.aot.state.vt.us/mtrres/Documents/ACROBAT.pdf/R&Ddox/MRE1%20-%20overhead%20structures%20030910.pdf>

ADDITIONAL DESIGN CRITERIA

8. CONCRETE: HIGH PERFORMANCE CLASS B
- REINFORCING: AASHTO M31M/M31 GRADE 420 WIND LOAD AND ICE LOAD PER AASHTO "STANDARD SPECIFICATIONS". THE CONTRACTOR SHALL PERFORM SUBSURFACE EXPLORATION AS NECESSARY FOR THE DESIGN AND CONSTRUCTION OF THE MAST ARM AND SIGNAL POLE FOUNDATIONS.

OVERHEAD TRAFFIC SIGN SUPPORT NOTES

ADDITIONAL DESIGN CRITERIA (CONTINUED)

9. ANCHOR BOLTS
- A MINIMUM OF SIX STAINLESS STEEL ANCHOR BOLTS WITH TWO HEXAGON NUTS, ONE LEVELING NUT, ONE WASHER AND ONE LOCK WASHER PER BOLT SHALL BE FURNISHED WITH EACH POLE. ANCHOR BOLT PLATES, WHEN USED, SHALL ALSO BE STAINLESS STEEL. STATE OF VERMONT, AGENCY OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2006, SUBSECTION 714.09. GALVANIZED ANCHOR BOLTS WILL NOT BE ACCEPTED.
10. 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 2006, SUBSECTION 714.05.
11. 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 2006, SUBSECTION 752.02.
12. 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 2006, SUBSECTION 752.02.
13. WELDING
- ALL DESIGN DETAILS, WORKMANSHIP, PROCEDURES AND INSPECTION SHALL CONFORM TO VTRANS SPECIFICATIONS SUBSECTION 506.10.
 - ALL WELDS SHALL BE AT LEAST AS STRONG AS THE MATERIAL (S) BEING WELDED.
14. FOUNDATIONS
- FOUNDATIONS SHALL BE DESIGNED IN ACCORDANCE WITH THE MRE1 10-01 GUIDELINES ISSUED BY THE AGENCY.
 - FOUNDATIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING NOTES:
 - A MINIMUM EMBEDMENT DEPTH OF 5 FEET SHALL BE USED FOR ALL SPREAD FOOTING FOUNDATIONS; MEASURED FROM THE GROUND SURFACE ELEVATION TO THE BOTTOM OF THE FOOTING ELEVATION.
 - EXCEPT FOR THE UPPERMOST 2 FT OF SOIL, DRILLED SHAFT FOUNDATIONS 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 2FT, IN ORDER NOT TO REDUCE THE FRICTION BETWEEN THE SOIL AND THE CONCRETE.
 - AS AN ALTERNATIVE TO THE DRILLED HOLES, FOUNDATIONS MAY BE POURED IN EXCAVATED HOLES USING THE PROPER FORMS, WHICH MUST BE REMOVED. THE EXCAVATED HOLES SHALL BE AT LEAST 2 FT CLEAR OF THE FOUNDATION SIDES AND 1 FT DEEPER THAN THE FOUNDATION. CARE SHALL BE TAKEN TO AVOID EXCAVATING AROUND THE TOP OF THE FOUNDATION. DESIGN LIMITS AS FOR AN AUGURED FOUNDATION APPLY.
 - BACKFILL MATERIAL PLACED ADJACENT TO THE FOUNDATION SHALL MEET THE REQUIREMENTS FOR GRANULAR BACKFILL FOR STRUCTURES, VTRANS SPECIFICATION SUBSECTION 704.08. BACKFILL MATERIAL SHALL BE COMPACTED AS DESCRIBED IN VTRANS' CONSTRUCTION SPECIFICATIONS SUBSECTION 204.08.
 - CONCRETE FOR THE FOUNDATION SHALL CONFORM TO THE REQUIREMENTS OF SECTION 501, HPC 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.
 - STEEL PILES SHALL MEET THE REQUIREMENTS OF SECTION 505.
 - 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 THE VERMONT AGENCY OF TRANSPORTATION.

ADDITIONAL DESIGN CRITERIA (CONTINUED)


14. FOUNDATIONS (CONTINUED)
- 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 SUB-SECTION 707.03 (MORTAR TYPE IV).
15. 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.
16. AN EQUIVALENT ALTERNATE DESIGN MEETING ALL APPLICABLE AASHTO DESIGN CODES AND STANDARDS MAY BE SUBSTITUTED FOR THE DETAILS AND MATERIALS SHOWN. ADDITIONAL TIME MAY BE REQUIRED FOR REVIEW.
17. THE CONTRACTOR/MANUFACTURER SHALL BE RESPONSIBLE FOR COMPLETION OF THE STRUCTURE AND FOOTING DATA ON THE DETAIL SHEET (S).
18. 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.
19. THE VERTICAL OFFSET IS THE DISTANCE FROM THE GROUND SURFACE TO THE TOP OF THE FOUNDATION. THIS IS ASSUMED TO BE 6 INCHES UNLESS OTHERWISE DEPICTED.
20. ASSUME THAT THE GROUNDWATER TABLE (GWT) IS AT THE GROUND SURFACE UNLESS A DIFFERENT GWT CAN BE REASONABLY DETERMINED FROM A SUBSURFACE INVESTIGATION, MONITORING WELLS, OR LABORATORY MOISTURE CONTENTS.
21. NEGLECT A MINIMUM OF THE UPPER 2 FEET OF SOIL SURROUNDING THE FOUNDATION FOR CONTRIBUTIONS TO TORSION AND SKIN FRICTION RESISTANCE. THIS IS DUE TO POTENTIAL FOR FUTURE DISTURBANCE. NOTE: THE USE OF A "SONOTUBE" AS A FORM MAY NEGATE OR REDUCE SKIN FRICTION RESISTANCE FOR DESIGN PURPOSES.
22. A MINIMUM DEPTH OF 5 FEET TO THE BOTTOM OF SPREAD FOOTING FOUNDATIONS ON SOIL SHALL BE USED TO MITIGATE THE POTENTIAL FOR MOVEMENT FROM FROST EFFECTS.
23. TO SIMPLIFY CALCULATIONS OF TORSION FOR SQUARE FOOTINGS THE SQUARE FOOTING CAN BE ASSUMED TO BE CIRCULAR, I.E. AN 8 FOOT WIDE SQUARE FOOTING IS MODELED AS AN 8 FOOT DIAMETER FOOTING. THIS IS A CONSERVATIVE ASSUMPTION.
24. UPLIFT (NEGATIVE CONTACT PRESSURE) OF A SPREAD FOOTING IS RESTRICTED. THE FOOTING MUST HAVE A MINIMUM CONTACT PRESSURE EXCEEDING 0 PSF. IN EXTREME CASES WHERE THE FOOTING WIDTH AND COST IS EXCESSIVE THE VERMONT AGENCY OF TRANSPORTATION MAY CHOOSE TO ALLOW UPLIFT ON ONE CORNER ONLY. HOWEVER, THE CONTRACTOR WILL HAVE TO DOCUMENT THE COMPUTED CONTACT PRESSURE AT ALL FOUR CORNERS.
25. SEE VAOT STANDARD E-171A FOR ADDITIONAL NOTES.

ADDITIONAL DESIGN GUIDELINES

FABRICATION DRAWINGS

26. 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:
- DETAILED DRAWING OF EACH COMPONENT OF THE STRUCTURE.
 - MATERIAL SPECIFICATION FOR EACH COMPONENT OF THE STRUCTURE, EITHER BY COMPLETE SPECIFICATION OR REFERENCE TO APPLICABLE ASTM STANDARDS.
 - NOTATION OF PROJECT NAME, PROJECT NUMBER, ROUTE NUMBER, AND STRUCTURE STATIONING (TO BE INCLUDED ON EACH SHEET).
 - DETAILS FOR LOCATION OF SIGNS/SIGNALS AND ATTACHMENT HARDWARE FOR THE SUPPORT STRUCTURE.
 - ALL ELEVATIONS AND DIMENSIONS NECESSARY TO PROVIDE A COMPLETE SET OF RECORD PLANS.
 - DEAD LOAD DEFLECTION AND CAMBER INFORMATION.
 - 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 SUB-SECTION 506.10).

NOT TO SCALE

OVERHEAD TRAFFIC SIGN SUPPORT DETAIL SHEET #2	PROJECT NAME: MONTPELIER	PLOT DATE: 26-MAY-2011
	PROJECT NUMBER: NH 290(1)	
	FILE NAME: pl0dl6.dgn	DRAWN BY: STANTEC
	PROJECT LEADER: JLL	CHECKED BY: STANTEC
	DESIGNED BY: STANTEC	SHEET 57 OF 79
IPARM FILE: p09b316otssd2.1		