Fisheries and Oceans Canada | Pêches et Océans Canada

ADDEMDUM FOUR

December 19th, 2014
Design, Fabrication and Installation of a 61m Guyed VHF Tower,
Cape North, Nova Scotia
INVITATION TO TENDER
F5211-140388

This addendum is raised to amend the Tower Structure specifications and load conditions. See attached revised section 05020 and Appendix C.

ANY AMENDMENTS TO BIDS WILL BE ACCEPTED BY FAX AT 506 452-3676 PROVIDED THE ORIGINAL BID AND THE SUBSEQUENT AMENDMENT ARE RECEIVED PRIOR TO CLOSING TIME OF 2:00 PM WEDNESDAY, JANUARY 14TH, 2015. ALL OTHER TERMS AND CONDITIONS WILL REMAIN THE SAME.

Tower Structure

Section 05020

1.0 General

1.1.1 The design, supply and erection of the tower shall be in accordance with the latest version of the following codes and standards:

- CSA-S37	Antennas, Towers and Antenna Supporting Structures
- CSA B33.4	Galvanized Steel Tower Bolts and Nuts
- ASTM A325	High Strength Bolts for Structural Steel Joints
- CSA CAN3-A23.3	Design of Concrete Structures
- CSA W59	Welded Steel Construction
- CAN/CSA-G40.20	General Requirements for Rolled or Welded Structural Quality Steel
- CAN/CSA-G40.21	Structural Quality Steels
- CAN/CSA-G164	Hot Dip Galvanizing of Irregularly Shaped Articles
- CAN/CSA-S16.1	Limit States Design of Steel Structures
- CAN/CSA-B72	Installation of Lightening Rods
- CAN/CSA-C22.1	Canadian Electrical Code, Part 1
- CAN/CSA-G4	Steel Wire Rope for General Purpose and Mine Hoisting and Mine Haulage
- CSA-CAN3-G12	Zinc Coated Steel Wire Strand
- CSA W47.1	Certification of Companies for Fusion Welding of Steel Structures
- W47.1S1	Supplement No.1-M1989 to W47.1-1983
-Z259.2	Fall Arresting Devices, Personnel Lowering Devices and Life Lines
- Z259.1	Fall Arresting Safety Belts and Lanyards for the Construction and Mining Industries

- Canada Labour Code
- Health and Welfare Canada Limits of Exposure to Radio-Frequency Fields at Frequencies from 10 kHz-300 kHz, Safety Code 6
- Provincial Occupational Health & Safety Act and Regulations
- National Building Code of Canada
- Transport Canada Standard TP382 – Standards Obstruction Markings
- Canadian Coast Guard Safety Requirements

1.2 Tower Design

1.2.1 The tower, antennas, and antenna-supporting structures shall be designed in accordance with CSA Standard S37-13. If there is a conflict between CSA Standard S37-13 and Section 05020 (Tower Structure) of the technical specifications, the most rigorous requirement shall apply.

1.2.2 The tower should have a maximum serviceability response (tilt and/or twist) of less than 2.0 degrees under working loads. Tower to be designed to require no torsion resistors.

1.2.3 The tower design shall be analyzed for two different ice loads:
a) 50 mm of glaze ice over entire structure, including guys & attachments. Density of glaze ice shall be 900 kg per cubic metre.
b) 150 mm of rime ice over entire structure, including guys & attachments. Density of rime ice shall be 700 kg per cubic metre.

1.2.4 Design Wind Load: Use Site Specific Wind Data contained in Appendix C.

1.2.5 The importance factor shall be equal to 1.0 for all load combinations analysed under clause 6.3 of CSA Standard S37-13.

1.2.6 The loading imposed on the tower by transmission lines and auxiliary lines – feeder lines, attached to it shall be based on the actual dimensions of the lines as determined from the manufacturer's specifications.

1.2.7 Loading from auxiliary facilities and attachments such as ladders, fall arrest rails, feeder line supports, etc. must be considered in a similar fashion as that of the transmission lines and feeders outlined above.

1.2.8 The tower shall be of complete knock down, guyed, lattice design incorporating bolted angle sections. "All-welded" tower sections and welded round leg members are not acceptable.

1.2.9 Tower design to include a wave guide bridge assembly as required to elevate and protect (from falling ice etc.) transmission lines from the tower base point to the building transmission line entrance. Wave guide bridge to tie into existing where possible.

1.2.10 The foundation designs shall be based on the conditions contained in the Geotechnical Report contained in Appendix 'D'.

1.2.11 The Design Engineer accepting responsibility for the tower structure shall

a. Have a minimum of five (5) years design experience as it relates to guyed and self-support towers.
b. Be registered or eligible for registration with the Engineers Nova Scotia.
c. Seal all drawings issued that relate to the tower.

2.0 Antennas and Transmission Lines

2.1 The tower structure shall be designed for the antenna systems contained in Appendix B. All antennas are leg mount. All specified future antennas, lines and mounts should be incorporated into the tower design.

2.2 All future antennas, lines and mounts should be incorporated in the tower design.

2.3 All new antennas shall be leg mounted to the tower at the azimuths indicated.

2.4 All transmission lines shall be new 22mm (7/8") Andrew's Heliax LDF5-50 Coaxial Cable or approved equal, with VSWR of 1.13, operating in the frequency of 156 MHz range. All

lines shall be supplied complete with connectors, hoisting grips, hangers, ground kits and other necessary hardware.

2.5 Transmission line connectors and end terminations (Type N) top and bottom, are to be supplied and installed by the Contractor.

2.6 The Contractor shall supply and install all new transmission lines as noted above. All lines will extend into the building three meters.

2.7 The Contractor shall be responsible for the installation of all systems as per the manufacturers' recommendations. All antenna / tower interface hardware not supplied by the antenna manufacturers shall be the responsibility of the tower contractor. It shall be the Contractors responsibility to determine any additional material required to mount the antennas to the tower structure. This shall include all antenna struts, mounts, special attachments, bolts, etc. The Contractor shall liaise with the antenna manufacturers or suppliers to obtain adequate information required to design proper mounting interface components.

2.8 The contractor shall be responsible for the installation of all lines and antenna systems, including line hangers, ground kits, connectors, power dividers, hoisting grips, threaded rod, and other necessary hardware. Installation shall be in accordance with the manufacturers recommendations. Line hangers shall be placed at a maximum distance of 762 mm centre to centre. All transmission lines shall be grounded with approved non-braided, solid copper grounding kits.

2.9 The Contractor shall design, supply and install new mounts for all antennas. All antenna mounts, mount hardware and line hangers shall be heavy duty hot dip galvanized or stainless steel. Materials prone to rust or corrosion are not acceptable.

2.10 The antenna elevations are referenced from ground level to the bottom of the antenna. Deviations from these centers of radiation greater than 0.5 m must be reported to the Owner.

2.11 Antenna assembly and installation must be completed in accordance with the manufacturers' instructions and acceptable industry standards. Antennas or antenna components damaged accidentally prior to full acceptance by the Owner shall be replaced at the Contractors expense. Replacement will be completed so as not to delay project completion.

2.12 A hoisting grip shall be installed and used to facilitate transmission line installation as recommended by the manufacturer of the transmission line. The hoist grip shall be connected to the tower after final placement of the line. The connection shall be made using a suitable galvanized connector. Connections may be made to secondary members such as transmission line support brackets, redundant horizontals, antenna mount members, or on primary members where special allowance has been made for such a connection.

3.0 Transmission Line Grounding

3.1 Ground kits shall be Andrews' or approved equivalent and constructed of solid copper wire and meet or exceed the requirements of the transmission line manufacturer. Ground assembly is to be installed with provided tapes and methods included in the ground kits. All

transmission lines shall be grounded in accordance with manufacturers recommendations but minimally at the antenna attachment elevation, at 60 m intervals (where applicable), at the tower base and at the building TX line entrance. Connect the terminal end of the ground kit conductor to predrilled purpose specific holes in the tower steel or ground bar as is appropriate to the specific installation. The holes shall be located so as not to weaken the structure. The connection surface must be free of paint providing a good metal-to-metal contact.

3.2 The connection point on the tower shall be lower than the connection point on the transmission line. The ground line shall run from the lower end of the taped connection. Ground kit lines are to be installed to eliminate any bends or turns in the grounding wire.

4.0 Materials

4.1 All steel CSA G40.21M – 350W u/n. Preference shall be given to the use of structural steels with improved resistance to brittle fracture. A36 modified steel is not acceptable. All materials to be used in the tower shall be new and in accordance with the requirements of CSA Standard S37-13.

4.2 Use of material sections less than 5 mm in thickness will not be permitted on primary or secondary structural members. Sections used for attachment or support of auxiliary facilities may be permitted subject to review by the Engineering Consultant.

4.3 Hollow sections will not be permitted on primary or secondary structural members which include tower legs, horizontals and diagonals.

4.4 Test Certificates

Two copies of mill test certificates for each lot of steel received from the mill by the Contractor shall be forwarded to the Owner. These certificates shall record results of tests indicating the following:

i) Yield Strength
ii) Ultimate Tensile Strength
iii) Percent Elongation
iv) Chemical Composition.

4.5 Mill Certificates may be requested to be forwarded to the Owner by the Contractor, at least two (2) weeks prior to the commencement of fabrication of structures incorporating the related material.

4.6 All guys shall be one continuous length Bridge Strand or Guy Strand (Grade 180) and guy attachment assemblies unless otherwise approved by the Owner. Cut ends of strand shall be capped with a stainless steel hose clamp or ear clips.

5.0 Connections

5.1. Connections in the shop may be bolted or welded. All site connections shall be bolted.

5.2 Make all welded connections in conformance with CSA Standard W59.1. Use only low hydrogen electrodes or processes of equivalent rating. All weld designs shall be clearly indicated on the design drawings.

5.3 Make all bolted connections with high strength bolts clearly marked A325 conforming to A.S.T.M. Standard Specification A325. Place a hardened washer in under the bolt element (nut or bolt head) turned in tightening the bolt. Tighten all bolts by the turn of the nut method as specified in CSA Standard S16.

5.4 Power wrenches may be used in installing bolts, provided they are of the adjustable type capable of cutting-out at a pre-selected torque value.

5.5 After the tower has been complete, check all bolted connections, including those on miscellaneous metal work, and retighten all loose bolts. Exercise care that bolts adequately tightened are not subjected to additional rotation of the turned element. All damaged nuts or bolts to be replaced.

5.6 The minimum resistance of a splice shall not be less than the maximum design force in the member, and where practical should equal the design resistance of the member. The splice shall provide sufficient stiffness to ensure continuity of the member. For splices which transfer compression by bearing, the mating surface shall be finished to bear. The splice shall have a minimum tensile resistance equal to the maximum tensile force, but not less than 33% of the compression resistance of the member. For flange forces in tension, the effects of prying action shall be taken into account.

6.0 Workmanship

6.1 General

Workmanship and finish throughout shall be equal to the best modern practice for this class construction. All members shall be in accordance with the drawings and shall be straight and true as per CSA S37-13. All like parts shall be interchangeable. All punched holes must be accurately located so that the structure can be erected with a minimum of “drifting”. The ends of members shall be clipped as required to facilitate assembly. In any bending or reworking of any material, methods employed shall ensure that the physical properties of the material are not impaired.

6.2 Marking

Each separate member shall be distinctly identified by a number assigned to that member. Each member shall be clearly marked with its member number to facilitate erection and traceability. All like parts shall have the same number.

6.3 Punching

Punching shall be done by methods designed to ensure accuracy. The centre of any hole shall, in no case, be displayed more than1.5mm from its position shown on the drawings. Plugging or welding mis-punched holes will not be allowed. Punches and dyes shall be sharp and true and all punch holes shall be round, true to size, and free from ragged edges and

burrs. Where applicable, punching performed on bent members, shall be done after bending to avoid distortion of holes.

6.4 Welding

All welding shall be performed in accordance with CSA Standard W59 latest revision and shall be undertaken by a fabricator fully approved by the Canadian Welding Bureau to the requirements to CSA Standard W47, latest revision. Provide copy of CWB Certification to Owner.

6.5 Handling of Material

Materials shall be handled and stored in the plant and on the job site in such a manner that no damage shall be done to the materials of any existing building or structure. Special care shall be taken to ensure that galvanizing, priming, or painting is not damaged during handling and erection of materials. Storage of materials on the site will be the responsibility of the Contractor.

7.0 Galvanizing

7.1 All materials, structural steel, pipe and fittings, including bolts, nuts and washers shall be hot dip galvanized to the requirement of CSA S37-13 and the standards specified therein. Galvanizing applied to structural members is to have a minimum mass of Zinc coating of 610 g/m² (2 oz/ft²) equivalent to a thickness of 87 μm (3.40 mils). Galvanizing applied to bolts, nuts and threaded fasteners is to have a minimum mass of Zinc coating of 460 g/m² (1.5 oz/ft²) equivalent to a thickness of 65 μm (2.54 mils).

7.2 All materials shall be completely fabricated before galvanizing. No galvanizing shall be permitted on assemblies after being bolted. No machine or shop work shall be allowed after galvanizing (except the tapping of nuts).

7.3 Before galvanizing, the steel shall be thoroughly cleaned of all paint, grease, rust, scale or other materials that will interfere with proper binding of the zinc with the steel as per the requirement of CSA S37-13 and the standards specified therein.

7.4 Test for thickness and uniformity of coating shall be made, on at least 10 members, throughout the galvanization process and from time to time on as many samples as may be considered necessary by the Owner. Such tests shall be conducted in full accordance with the requirements of CSA S37 and the standard recording results of the foregoing tests shall be forwarded to the Owner by the Contractor. The Contractor shall engage an independent testing firm to complete this work. All costs are to be included in the tender price.

7.5 The Contractor shall field paint all steel members of the tower where the galvanized finish has been scrapped or chipped during erection in the field. This shall be done using Zinkrich paint, as supplied by the Zinkrich Company, 42 Broadway, New York, New York, U.S.A. or Galvicon or an approved equal. Steel members that have a slightly damaged finish shall be given three coats of Zinkrich Paint applied according to the manufacturer's printed instructions.

7.6 Contractor shall warranty all galvanizing work for a period of not less than three (3) years.

8.0 Painting

8.1 The tower shall be painted by a qualified painting facility subject to audit and approval by the Owner in 7 equal and alternating bands of International Orange (#12197) and White (# 17875) in accordance with latest edition of Transport Canada, Canadian Aviation Regulations, TP 382/621.9 – Standards Obstruction Marking.

All anchor shaft below assemblies to be coated with a heavy bituminous compound.

8.2 All surfaces of the tower are to be painted with exception of an area of the leg splice plates connection mating surfaces, thus to ensure a good electrical connection for grounding purposes

Care shall be taken to ensure galvanized members are kept clean and free of all oils and contaminates during material handling process.

Surface Preparation – Galvanized steel must be cleaned prior to blasting in accordance with SSPC-SP-1 – "Solvent Cleaning"

8.3 **Light Sweep blast all surfaces** in accordance with SSPC-SP-7 to remove any chromate treatment, or poorly adhered zinc salts that may be present to increase mechanical bonding through increased roughness. Care should be taken to remove as little zinc as possible while maintaining desired roughness. After sweep blasting, the coating system should be applied ideally the same day and a max of one day.
SPECIFICATION FOR ABRASIVE SWEEP-BLASTING

- Blast pressure - 300kPa maximum.
- Media grade 0.2 to 0.8 mm
- Media type(<5 mhos hardness) – clean silica and slags, alumina, limestone.
- Angle of blasting to surface 30-60°
- Distance from surface 300-600mm
- Nozzle type minimum – 10mm venturi type.
- Grit should not be recycled.

Coating System to be water based Acrylic (no Alkyds are acceptable)

8.4 To be applied as per manufacturers specifications.
Primer: Aqualux 523-613 @ 2.5 – 3.5 mils dft (or approved equivalent)
Finish: Aqualux 522-121white & 522-126 Orange @ 2.5 – 3.5 mils dft (or approved equivalent)

8.5 All paints must meet ASTM performance requirements for abrasion resistance, hardness, fading, flexibility and salt-spray resistance. Paint products must not contain Lead (pb) in their composition.

8.6 All paint shall be applied in shop conditions as per manufacturers instructions, evenly spread and free from all marks, stains, defects and flaws. No painting shall be done when the

temperature is lower than 10º C and humiditys above 50%. No painting shall be done in damp weather. No painting shall be done when the tower metal is hot enough to cause paint blister and produce a porous coating. No coat of paint shall be applied until the previous coat is thoroughly dry as per manufactures recommendations. Where painting or priming is done in the shop, any areas damaged during transit or erection shall be cleaned and touched up with new Zinc rich primers and/or paint as required.

8.7 The Contractor shall be responsible for damage done by paint spraying or dripping on the Owner's or other's property.

8.8 Contractor shall warrant all painted items for three (3) years for 90 % coverage. Any damage to the paint from normal environmental conditions prevalent at the site shall be repaired by the Contractor at no cost to the Owner in a manner approved by the Owner.

8.9 The Contractor shall be responsible for damage done to the tower's paint during shipping and erection.

9.0 Erection

9.1 The tower shall be erected in a manner that will not bend, scrape, distort, or injure the component parts of the galvanizing.
Upon award of contract, Contractor is to provide a detailed Erection Plan to include the use of gin poles, winches, cranes and erection equipment.

9.2 The use of iron sledges for hammering or driving any members will not be tolerated. All hammering is to be done with wooden mauls or hammers of plastic, lead or other soft material.

9.3 Every failure of the material to join together properly shall be reported to the Owner.

9.4 Upon completion of erection, the tower shall be inspected by the Contractor for member damage. Any damaged or missing items, including nuts, bolts, etc., shall be replaced.

9.5 The Contractor shall be responsible to ensure that no members of the tower are over stressed during erection. Any members damaged during erection shall be replaced. The Contractor shall be responsible for any damages done to the work of others, or to adjoining structures and property during erection.

9.6 The guy tensions shall be adjusted to within + 15% and –5% of the stipulated design tensions noted in the design drawings and as per the requirements of CSA S37-13. The tension calculations shall consider the ambient temperature at the time of adjustment. Full consideration of anchor location with respect to the tower base must be incorporated into the calculation of correct guy tensions. It shall be the Contractor's responsibility to obtain accurate measurements pertaining to elevation differences between the tower base and guy anchors.

9.7 The Contractor shall use a three-transit set up to complete final adjustment of vertical alignment and twist and to ensure it meets the requirements of CSA S37-13 for vertical alignment and twist.

9.8 Contractor is responsible for establishing temporary obstruction lighting in accordance with Transport Canada requirements.

10.0 Cathodic Protection of Anchor Shafts

All anchor shafts are to be protected from deterioration and/or corrosion by a properly installed cathodic protection system designed by the Contractor. Anodes to be zinc or magnesium and to last the performance life of the tower.

END OF SECTION

Appendix C

Site Specific Wind Pressure

T2215 Cape North, NS 60.2m Tower

Site Specific 10-yr. Hourly Wind Pressure Documentation Sheet

Site Information:

Name: T2215 Cape North, NS
Latitude: 47° 0' 38.0412" N
Longitude: 60° 25' 40.6554" W
Tower Height (m): 60.2
Elevation MSL (m): 408

UTM Coordinates:

Zone: 20
Easting (m): 695498
Northing (m): 5209549

Results:

Q_e (Pa): 1140
Uncertainty of Q_e: [20%, -25%]
Q_{nbc} (Pa): 460
Icing: ****Rime Icing May Occur****
Return Period: **10**

Wind Pressure Formula (for z in metres and result in Pa):

$$Q_h = 0.12919 \{[0.7725\, e^{(-0.0047\, z)} + 1.4748\, \ln(z/0.4500) / \ln(z/0.0250)]\, 61.44\}^2 \quad (z/10)^{0.2}$$

Profile Formula General Form:

$$Q_h = 0.12919 \{[a_1\, e^{(-a2\, z)} + a_3\, \ln(z/z_h) / \ln(z/z_{01})]\, v_{01}\}^2 \quad (z/10)^{0.2}$$

Site Values of Coefficients:

$$a_1 = 0.7725,\ a_2 = 0.0047,\ a_3 = 1.4748,\ z_h = 0.4500,\ z_{01} = 0.0250,\ v_{01} = 61.44 \text{ mph}$$

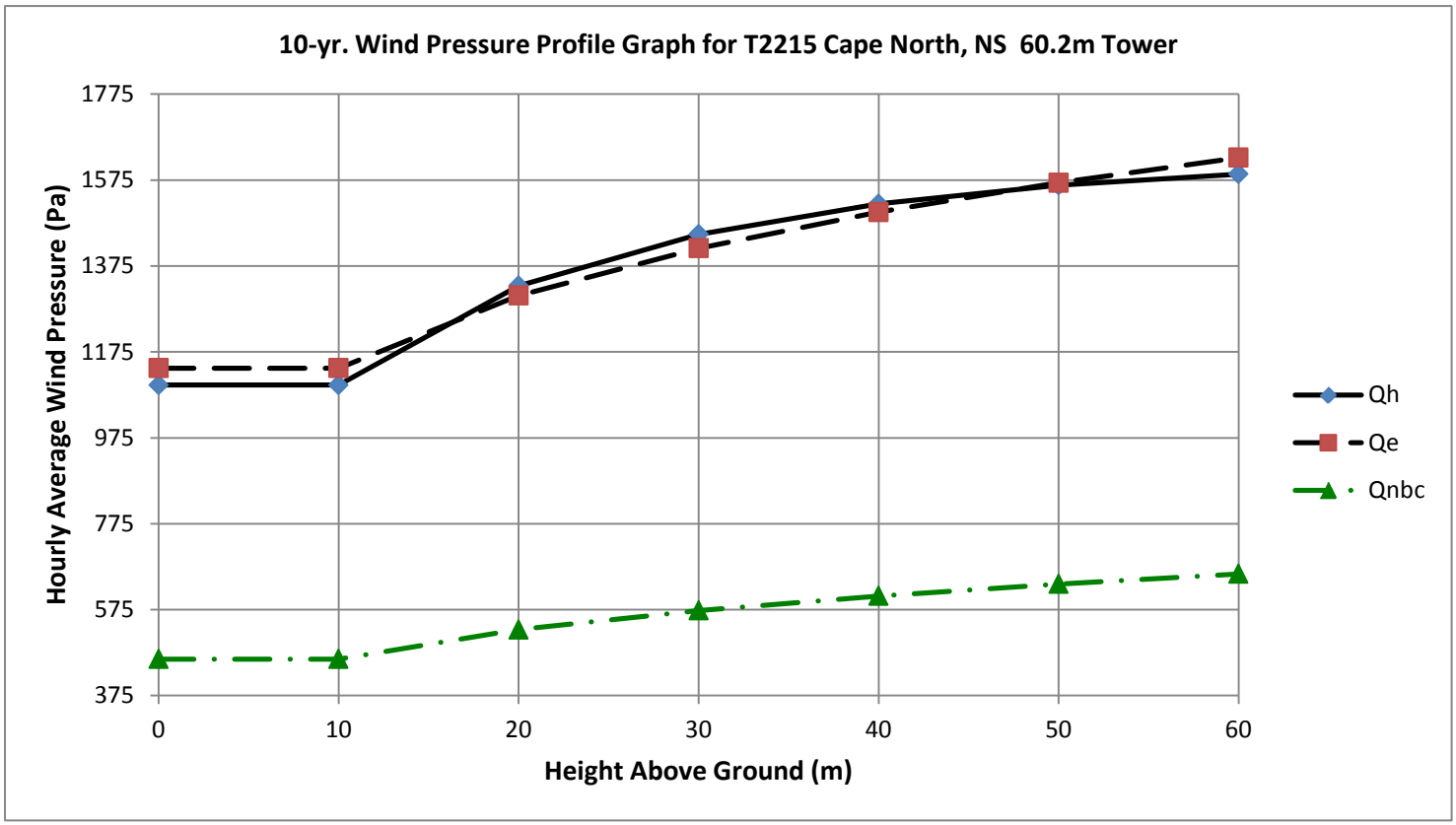
Definitions

Tower Height: Height of the tower from ground level at the base of the tower to the top of the structure.
Q_e: "Site Specific Equivalent Wind Pressure at 10 m" => the wind pressure which, when using the 2/10 power law yields the same average wind pressure over the height of the tower as the Wind Pressure Profile Formula.
Q_{nbc}: Regionally representative reference wind pressure at 10 m in the format of the National Building Code of Canada. As per the November 17, 1988 meeting of the CSA Antenna Tower Technical Committee, the Q_{nbc} value profiled with the 2/10 power law should comprise the minimum hourly average wind pressure at all heights above ground.
Wind Pressure Profile Formula: Formula for the design wind pressure as a function of height.
Height: the vertical distance (m) above ground level at the base of the tower.

Notes:

n.b. No wind pressure value less than 90% of the value at 10 m should be used for heights less than 10 m a.g.l.
This site will experience rime (in-cloud) icing during the cold season. We recommend that you consult with the tower owner and service personnel regarding icing severity and duration for design purposes.

These wind pressures were evaluated using a version of the methods described by Taylor and Lee (1984) "Simple Guidelines for Estimating Wind Speed Variations Due to Small Scale Topographic Features", Climatological Bulletin 18 2, using the Boyd (1969) analysis of thirty year return period wind speeds (which is also used for the National Building Code of Canada), modified by a technique described by Wieringa (1980) "Representativeness of Wind Observations at Airports" Bulletin of the American Meteorological Society, 61 9, as input data. The uncertainty in NBCC regionally representative reference wind pressures is about [+15%,-15%].



Qe profile = Qe (the site-specific equivalent reference wind pressure) with the 2/10 power law profile.

Qh = site specific wind pressure directly from Taylor and Lee (1984) simple guidelines.

Qnbc profile = regionally representative wind pressure in the National Building Code format with the 2/10 power law profile

T2215 Cape North, NS 60.2m Tower

Site Specific 30-yr. Hourly Wind Pressure Documentation Sheet

Site Information:

Name: T2215 Cape North, NS
Latitude: 47° 0' 38.0412" N
Longitude: 60° 25' 40.6554" W
Tower Height (m): 60.2
Elevation MSL (m): 408

UTM Coordinates:

Zone: 20
Easting (m): 695498
Northing (m): 5209549

Results:

Q_e (Pa): 1360
Uncertainty of Q_e: [20%, -25%]
Q_{nbc} (Pa): 550
Icing: ****Rime Icing May Occur****
Return Period: **30**

Wind Pressure Formula (for z in metres and result in Pa):

$$Q_h = 0.12919 \{[0.7725\, e^{(-0.0047\, z)} + 1.4748\, \ln(z/0.4500) / \ln(z/0.0250)]\, 67.24\}^2 \quad (z/10)^{0.2}$$

Profile Formula General Form:

$$Q_h = 0.12919 \{[a_1\, e^{(-a2\, z)} + a_3\, \ln(z/z_h) / \ln(z/z_{01})]\, v_{01}\}^2 \quad (z/10)^{0.2}$$

Site Values of Coefficients:

$$a_1 = 0.7725,\ a_2 = 0.0047,\ a_3 = 1.4748,\ z_h = 0.4500,\ z_{01} = 0.0250,\ v_{01} = 67.24 \text{ mph}$$

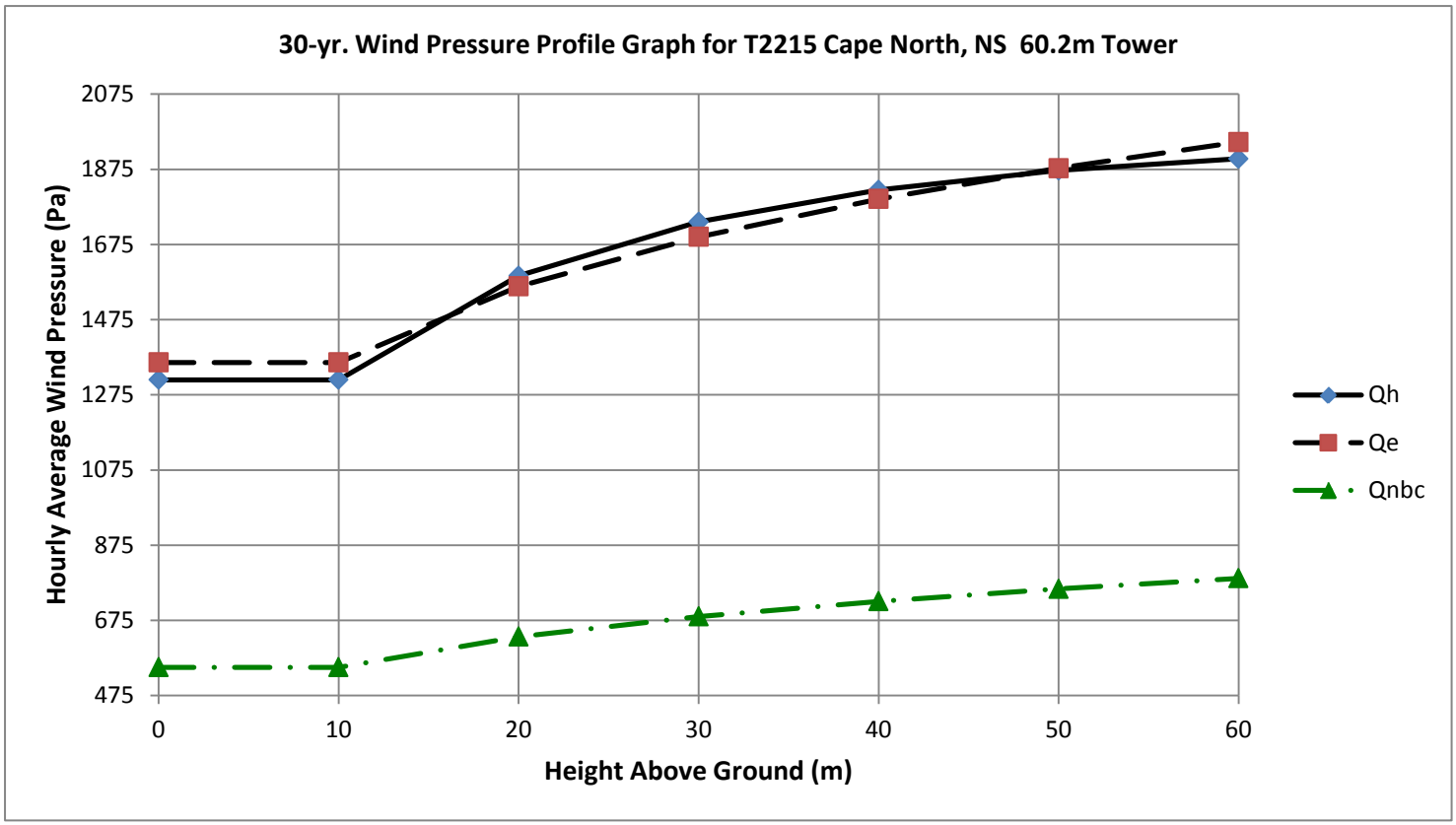
Definitions

Tower Height: Height of the tower from ground level at the base of the tower to the top of the structure.
Q_e: "Site Specific Equivalent Wind Pressure at 10 m" => the wind pressure which, when using the 2/10 power law yields the same average wind pressure over the height of the tower as the Wind Pressure Profile Formula.
Q_{nbc}: Regionally representative reference wind pressure at 10 m in the format of the National Building Code of Canada. As per the November 17, 1988 meeting of the CSA Antenna Tower Technical Committee, the Q_{nbc} value profiled with the 2/10 power law should comprise the minimum hourly average wind pressure at all heights above ground.
Wind Pressure Profile Formula: Formula for the design wind pressure as a function of height.
Height: the vertical distance (m) above ground level at the base of the tower.

Notes:

n.b. No wind pressure value less than 90% of the value at 10 m should be used for heights less than 10 m a.g.l.
This site will experience rime (in-cloud) icing during the cold season. We recommend that you consult with the tower owner and service personnel regarding icing severity and duration for design purposes.

These wind pressures were evaluated using a version of the methods described by Taylor and Lee (1984) "Simple Guidelines for Estimating Wind Speed Variations Due to Small Scale Topographic Features", Climatological Bulletin 18 2, using the Boyd (1969) analysis of thirty year return period wind speeds (which is also used for the National Building Code of Canada), modified by a technique described by Wieringa (1980) "Representativeness of Wind Observations at Airports" Bulletin of the American Meteorological Society, 61 9, as input data. The uncertainty in NBCC regionally representative reference wind pressures is about [+15%,-15%].



Qe profile = Qe (the site-specific equivalent reference wind pressure) with the 2/10 power law profile.

Qh = site specific wind pressure directly from Taylor and Lee (1984) simple guidelines.

Qnbc profile = regionally representative wind pressure in the National Building Code format with the 2/10 power law profile

T2215 Cape North, NS 60.2m Tower

Site Specific 50-yr. Hourly Wind Pressure Documentation Sheet

Site Information:

Name: T2215 Cape North, NS
Latitude: 47° 0' 38.0412" N
Longitude: 60° 25' 40.6554" W
Tower Height (m): 60.2
Elevation MSL (m): 408

UTM Coordinates:

Zone: 20
Easting (m): 695498
Northing (m): 5209549

Results:

Q_e (Pa): 1470
Uncertainty of Q_e: [20%, -25%]
Q_{nbc} (Pa): 600
Icing: ****Rime Icing May Occur****
Return Period: **50**

Wind Pressure Formula (for z in metres and result in Pa):

$$Q_h = 0.12919 \{[0.7725\, e^{(-0.0047\, z)} + 1.4748\, \ln(z/0.4500) / \ln(z/0.0250)]\, 69.90\}^2 \quad (z/10)^{0.2}$$

Profile Formula General Form:

$$Q_h = 0.12919 \{[a_1\, e^{(-a2\, z)} + a_3\, \ln(z/z_h) / \ln(z/z_{01})]\, v_{01}\}^2 \quad (z/10)^{0.2}$$

Site Values of Coefficients:

$$a_1 = 0.7725,\ a_2 = 0.0047,\ a_3 = 1.4748,\ z_h = 0.4500,\ z_{01} = 0.0250,\ v_{01} = 69.90 \text{ mph}$$

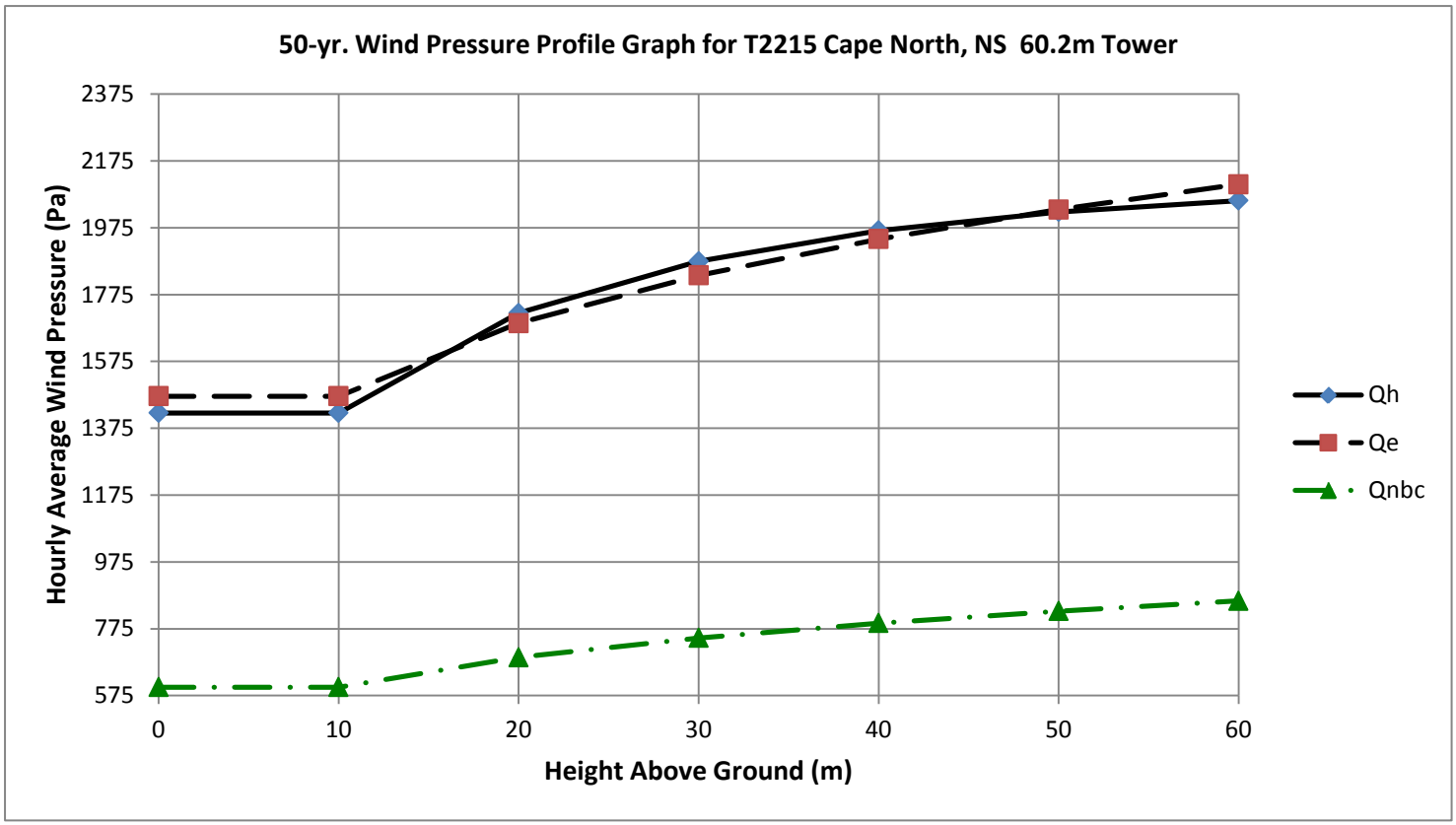
Definitions

Tower Height: Height of the tower from ground level at the base of the tower to the top of the structure.
Q_e: "Site Specific Equivalent Wind Pressure at 10 m" => the wind pressure which, when using the 2/10 power law yields the same average wind pressure over the height of the tower as the Wind Pressure Profile Formula.
Q_{nbc}: Regionally representative reference wind pressure at 10 m in the format of the National Building Code of Canada. As per the November 17, 1988 meeting of the CSA Antenna Tower Technical Committee, the Q_{nbc} value profiled with the 2/10 power law should comprise the minimum hourly average wind pressure at all heights above ground.
Wind Pressure Profile Formula: Formula for the design wind pressure as a function of height.
Height: the vertical distance (m) above ground level at the base of the tower.

Notes:

n.b. No wind pressure value less than 90% of the value at 10 m should be used for heights less than 10 m a.g.l.
This site will experience rime (in-cloud) icing during the cold season. We recommend that you consult with the tower owner and service personnel regarding icing severity and duration for design purposes.

These wind pressures were evaluated using a version of the methods described by Taylor and Lee (1984) "Simple Guidelines for Estimating Wind Speed Variations Due to Small Scale Topographic Features", Climatological Bulletin 18 2, using the Boyd (1969) analysis of thirty year return period wind speeds (which is also used for the National Building Code of Canada), modified by a technique described by Wieringa (1980) "Representativeness of Wind Observations at Airports" Bulletin of the American Meteorological Society, 61 9, as input data. The uncertainty in NBCC regionally representative reference wind pressures is about [+15%,-15%].



Qe profile = Qe (the site-specific equivalent reference wind pressure) with the 2/10 power law profile.

Qh = site specific wind pressure directly from Taylor and Lee (1984) simple guidelines.

Qnbc profile = regionally representative wind pressure in the National Building Code format with the 2/10 power law profile