Specifications, Guidelines & Practices

Tower Requirements And General Specifications

ERICSSON

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1.0 GENERAL

1.1 SCOPE

This specification establishes minimum standards for the design, fabrication and installation of latticed steel guyed and self-supporting towers including Portland Cement concrete foundations.

1.2 QUALITY CONTROL

The Contractor shall employ a quality control program that will ensure that engineering, fabrication, erection and related activities meet the requirements of this specification.

1.3 CONTRACTOR'S WARRANTY

The Contractor shall guarantee all materials and workmanship under his contract against defects or incorrect installation for a period of one year after completion. Repair or replacement of any defective materials, correction of faulty workmanship, or correction of any items not in accordance with these specifications shall be made at the contractor's expense.

1.4 EXTENDED GUARANTEE

The Contractor shall further guarantee all material supplied under these specifications for a period of not less than twenty years against failure from structural defects.

2.0 APPLICABLE DOCUMENTS

2.1 GENERAL

The latest edition of the following documents shall be considered a part of this specification where referenced. In the event of conflict between any portion of this specification and the requirements set forth in any of the referenced documents, ***this specification shall govern.***

2.2 FEDERAL SPECIFICATIONS

RR-S-001301--Safety Equipment, Climbing.

2.3 ELECTRONICS INDUSTRIES ASSOCIATION & TELECOMMUNICATIONS INDUSTRIES ASSOCIATION (EIA/TIA)

EIA/TIA-222-E--Structural Standards for Steel Antenna Towers and Antenna Supporting Structures.

2.4 AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design, June 1, 1989.

2.5 AMERICAN CONCRETE INSTITUTE (ACI)

318 Building Code Requirements for Reinforced Concrete.

2.6 AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 Structural Welding code - Steel.

2.7 AMERICAN IRON AND STEEL INSTITUTE (AISI)

Specification for the Design of Cold-Formed Steel Structural Members.

2.8 FEDERAL AVIATION ADMINISTRATION ADVISORY CIRCULAR

AC-70/7460-1H Obstruction Marking and Lighting. Change 2

AC-150/5345-43 Specification for Obstruction Lighting Equipment.

AC-1560/5345-1 Approved Airport Lighting Equipment.

2.9 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

Publication No. 70, National Electrical Code.

Publication No. 78, Lightning Protection Code.

2.10 OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

OSHA Standards, 29 CFR, Part 1910.

2.11 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS

ASTM A-36 Structural Steel.

ASTM A-53 Welded and Seamless Steel Pipe.

ASTM A-123 Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.

ASTM A-153 Zinc Coating (Hot Dip) on Iron and Steel Hardware, Specification For.

ASTM A-307 Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

ASTM A-325 High-Strength Bolts for Structural Steel Joints.

ASTM A-449 Quenched and Tempered Steel Bolts and Studs.

ASTM A-475 Zinc Coated Steel Wire Strand.

ASTM A-572 High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality.

ASTM A-586 Zinc Coated Parallel and Helical Steel Wire Structural Strand.

ASTM A-615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

ASTM A-780 Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

AC1 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete

3.0 DESIGN AND MATERIAL CONSIDERATIONS

3.1 DESIGN PARAMETERS

Each tower and supporting concrete foundation shall be designed in accordance with the requirements as set forth in these specifications.

3.1.1 Design Wind Load

The design basic wind speed shall be as defined for the site in the Customer Tower Requirement Letter or by EIA/TIA-222-E but in no case shall it be less than 70 miles per hour (129 kilometers per hour).

3.1.2 Design Ice Load

The design shall include a minimum thickness of solid radial ice, as defined in EIA/TIA-222-E, Figure 1, of 0.5 inch (1.27 centimeters). Ice shall be included on the tower structure, antennas, appurtenances, waveguides, transmission lines, and guy strand.

3.1.3 Future Antennas

The Customer Tower Requirement Letter includes the antenna and waveguide/coax information required to calculate loading on the tower. The information provided includes quantity, elevation, type, and azimuth (where available) of antennas, and size of waveguide/coax. Information has been provided for future requirements as well as initial.

3.1.4 Wind Directions

The effects due to the wind blowing in two directions, toward and perpendicular to one tower face (face loading) and toward one tower leg (apex loading) must be considered in determining the maximum design loads.

3.1.5 Antenna Forces

The forces due to all antennas, initial and future, shall be considered in the design analysis. Antenna wind forces shall be developed for wind direction(s) relative to the tower and antenna distribution as a whole which will produce the maximum forces in the individual elements of the support structures for use in design. This requires the computation of antenna wind forces at various angles (azimuths) relative to the pointing direction(s) of each antenna.

3.1.5.1 Microwave Antennas

In the absence of more accurate data, the design wind load on microwave antennas/passive reflectors shall be determined using Appendix B of EIA/TIA-222-E.

3.1.5.2 800 MHz and other UHF or VHF Antennas

Antenna wind and gravity forces shall be based upon the load requirements for discrete appurtenances as defined in Para. 2.3.10 and elsewhere in EIA/TIA-222-E.

3.1.6 Effective Length of Compression Members

An effective length factor (K) of 1.0 shall be used to calculate the effective length and allowable stress for tower leg members and bracing members whose ends are attached by a single bolt.

Ends of compression members shall be supported in two directions orthogonal to the member at each end.

Intersection points of diagonals in X-braced sections shall not be considered as points of full lateral support for design unless an additional member is provided at the intersection to resist buckling out-of-plane.

3.1.7 Allowable Stress

All tower components and supporting elements shall be selected such that the unit stresses resulting from the specified loads shall not exceed allowable unit stresses of the "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design" issued by American Institute of Steel construction.

3.1.8 Sub-Standard Soils

Anchor and foundation designs shall be based upon the soil characteristics and parameters listed in the site geotechnical report supplied by the Customer. Foundation designs shall not be based upon EIA defined parameters for "normal soil" when sub-standard soils exist at the site.

3.1.9 Bolted Construction

Tower sections shall be of bolted construction to permit in-service replacement of members. Shop welding shall be kept to a minimum and field welding is not permitted.

3.1.10 Guyed Towers Design

3.1.10.1 Face Width Limitation

The nominal lattice guyed tower face width shall be at least .38 times the diameter of the maximum microwave antenna to be supported on the tower.

3.1.10.2 Design Considerations

A guyed tower shall be analyzed and designed as a beam column on elastic supports taking into effect the following with the previously listed wind and ice loads.

A. Variable guy spring constants.

B. Dead load of all tower and supported elements with ice.

C. Resultant components of all guy tensions at any level.

D. Torsion of tower shaft produced by wind load on eccentrically mounted antennas and other equipment.

E. Local moments at each guy level produced by the vertical component of the guy tensions acting through their connections.

F. The effects of eccentric loads at the connections of the tower members.

G. The loading due to both beam shear and twist on the diagonal members.

H. The loading due to bending and vertical axial loads on leg members.

3.1.10.3 Articulated Base

Each guyed tower base shall be of the articulated or pinned type.

3.1.11 Self-Supporting Tower Design

3.1.11.1 Anchorage

Self-supporting towers shall be designed to mount to concrete foundations by the use of cast-in-place anchor bolts. The practice of embedding mating tower members, special fixtures and other such unique methods shall not be permitted.

3.1.11.2 Design Considerations

A self-supporting tower shall be designed as a space truss, taking into effect the following with the previously listed wind and ice loads.

A. Dead load of all tower and supported elements with ice.

B. Torsion and shear effects produced by wind load on eccentrically mounted antennas and other equipment.

C. The effects of eccentric loads at the connections of the tower members.

D. Stresses due to lateral loads on members attached between panel points.

3.1.11.3 Straight Section Limitations

For tapered face towers that incorporate a straight segment at the top, the length of straight segment shall be limited to 5 times the face width of the straight segment when microwave antennas are located within the straight section.

For towers that do not support microwave antennas within the straight section, the height of the straight segment shall be limited to twelve times the face width of the straight segment.

3.1.11.4 Internal Bracing

All K-braced or reversed K-braced sections shall be designed to include a structurally stable configuration of internal bracing at the midpoint of horizontal members.

3.1.12 Eccentricity Minimized

Connections shall be detailed and designed to minimize stresses attributable to eccentricity.

3.1.13 Easy Inspection

All members and connections shall be selected and detailed to allow easy inspection of all surfaces and for ease in applying corrosion prevention materials. Proper drainage of all moisture and condensation shall be provided for all members.

3.2 MATERIALS

3.2.1 Tower Legs

Tower legs shall be fabricated from structural steel shapes or formed from plate having a minimum yield strength of 50,000 psi (344,737 kPa). The use of open shape legs facilitates subsequent strengthening and expandability of the tower, and promotes proper coverage and inspection of hot dipped galvanized surfaces, minimizing the possibility of premature corrosion.

3.2.2 Tower Bracing

The tower bracing shall be fabricated of structural steel or formed plate open shapes having a minimum yield strength of 36,000 psi (248,211 kPa). Diagonal "X-bracing" shall be provided in every tower section supporting a torque stabilizer or any microwave antenna.

3.2.3 Guy Strand

All strand provided for the tower guys shall be a minimum of 3/8 inch diameter Extra High-Strength in conformance with ASTM A475 Class A galvanized, or Bridge Strand in conformance with ASTM A576.

3.2.4 Guy Terminations

All guy terminations shall utilize "Big Grip" Preformed Dead Ends. PLP end sleeves shall be provided and installed over the end of each termination. Each guy shall be attached to the guy anchor plate by a separate fixture. One bolt or fixture shall not be used at the guy anchor plate to terminate more than one guy line.

3.2.5 Fasteners

All fasteners shall have been manufactured in North America. Certificates of origin shall be provided to the Customer.

3.2.5.1 Bolts

Bolts used in any calculated load carrying connection shall be a high strength bolt as defined below and a minimum of 1/2 inch in diameter. Under no circumstances shall a bolt less than 3/8 inch in diameter be utilized.

High strength bolts conforming to ASTM A-325 or A-449 shall be used in all calculated load carrying connections. Bolts other than high strength, shall conform to ASTM A-307.

All threaded fasteners shall be of adequate length that a minimum of two threads shall protrude beyond the nut or locking device when the nut is properly tensioned.

All hardware must be hot dipped galvanized in accordance with the provisions of ASTM A-153.

3.2.6 Minimum Thickness

The minimum thickness of any fabricated steel part shall be 1/8 inch (.32 centimeter).

3.2.7 Filler Plates

Spaces 1/8 inch (.32 centimeter) or greater between parallel or crossing members shall be filled with single thickness plates or ring fills. Stacked washers shall not be used for this purpose.

3.2.8 Oversized and Slotted Holes

Hardened flat washers shall be provided for all oversized or slotted holes.

3.2.9 Anchor Bolts

Anchor bolts shall be designed such that their projection above the concrete allows for one leveling nut below and two full-sized nuts above the base plate of the tower.

3.2.10 Dissimilar Metals

Contact between dissimilar metals shall not be permitted.

3.3 DESIGN CALCULATIONS AND DRAWINGS

Three complete sets of the tower drawings and one set of design calculations shall be furnished to the Customer. All submittals must bear a Professional Engineer's stamp. The engineer must be licensed in the State where the tower site is located.

3.3.1 Design Calculations

The Contractor shall submit structural calculations, foundation, and erection drawings for each tower site location. Complete structural calculations are required covering all parts of the structures and all related items. Actual stresses and corresponding allowable stresses shall be listed for the vertical, diagonal and, girt members of the tower. Tower twist, sway, and displacement calculations shall be made and identified for each microwave antenna. When computer printouts form a portion of the calculations, the Contractor shall include sufficient information to allow an independent engineer to thoroughly review the design.

3.3.2 Drawings

Drawings must include the station name, tower height, manufacturer's name, manufacturer's model number, antenna path azimuths, and elevation and plan views of the tower indicating the tower orientation. Guyed tower assembly drawings shall show the tabulated initial tensions in 10 degree increments between 0 and 100° F for each guy strand to be installed.

In addition, the Contractor shall furnish section assembly drawings showing all tower members with their part numbers, splice plates, ladder mounting details, bolt sizes and types, and any other information necessary to identify each tower component. Antenna mounting assembly drawings including all components necessary for supporting the antennas and their side arm struts plus miscellaneous drawings showing the supporting elements shall be provided.

4.0 TOWER ACCESSORIES

4.1 GENERAL

All pertinent requirements of Section 1, 2 and 3 of this Specification are applicable to the tower accessories listed in this Section.

4.2 CLIMBING LADDER

Provisions shall be made and all material provided for the installation of an internal climbing ladder from the base to the tower top. The rung width shall be at least 12 inches (30.48 centimeters) with the diameter being a minimum of 5/8 inch (1.54 centimeters). The maximum step spacing shall be 16 inches (40.64 centimeters). The step spacing shall be uniform throughout the ladder length.

4.3 SAFETY-CLIMB DEVICE

Fixed ladders which exceed 20 feet (6.1 meters) in height are required to be equipped with climbing protection. Each tower shall be provided with a flexible (cable) ladder safety device as manufactured by D B Industries, Inc., of Red Wing, Minnesota 55066, or equal. In addition to the necessary brackets, guides, and clamps, the following shall be provided: 3/8 inch (.95 centimeter)

diameter strand for the carrier to run the full height of the tower and a D-ring nylon safety belt with connectors and a detachable safety sleeve mechanism.

4.4 VERTICAL WAVEGUIDE/COAX SUPPORT

Support members shall be provided for all proposed waveguide/coax runs (those required now and those anticipated for future installation). The maximum vertical spacing shall be as prescribed by the waveguide/coax manufacturer, but under no circumstances shall the spacing exceed 4 feet (1.22 meters). The supporting members shall accommodate the attachment of either metal hangers ("butterfly straps") or Andrew "Snap-in" hangers without the need for angle adapters. The location of all waveguide/coax runs shall clearly be shown on the installation drawings. Attachment of waveguide/coax directly to tower legs is not acceptable.

4.5 HORIZONTAL WAVEGUIDE/COAX BRIDGE

A horizontal waveguide/coax bridge shall be provided between the tower and equipment shelter. It shall be supported from two 3 1/2 inch (8.89 centimeter) O.D. posts with concrete foundations. Connections to the shelter wall or tower shall not be permitted. The distance between tower face and shelter shall be as shown on the site plan. The bridge shall be capable of supporting and covering all the specified waveguide/coax runs between the tower and the entry ports within the shelter and shall provide protection against falling ice.

4.6 MICROWAVE ANTENNA MOUNTS

A drawing/drawings shall be provided for each antenna clearly showing the mounts and side arm strut supports. Interference with other antenna structures and the conformance to the antenna manufacturers requirements for feed horn clearance/waveguide transition, must be checked to insure that mounting problems will not occur.

4.6.1 Antenna Supports

Antenna mounts shall be provided for all antennas currently needed. The mounts shall be adequate to support the antennas and shall be detailed to meet the interfacing requirements as prescribed by the antenna manufacturer. The antennas shall be installed on 4 1/2 inch O.D. x 10 feet 6 inches (11.43 centimeters O.D. x 3.2 meters), Schedule 40 pipe which shall be made plumb in its major axis.

4.6.2 Antenna Sidearm Strut Supports

Supports shall be provided for the antenna side arm struts and shall be positioned such that the struts can be installed within the antenna manufacturers prescribed tolerances.

4.6.3 Feed Line Open Space

Care shall be taken to provide enough clear space free of tower bracing's legs, etc., behind the antenna for the feed horn and waveguide installation. For standard parabolic and high performance (2 port maximum) antennas, this space shall be at least 12 inches (30.48 centimeters) in diameter and 36 inches (91.44 centimeters) long.

4.7 ANTENNA ICE SHIELDS

Ice shields shall be provided for all antennas as specified in the ERICSSON Tower Requirements Letter.

4.7.1 Standard

When ice shields are specified to be provided by the Customer Tower Requirements Letter, the determination of the required ice shield locations will be in accordance with the following:

1. When the centerline of the highest antenna along a given azimuth is 40 feet (12.2 meters) or more below the top of the tower.
2. When an antenna is 35 feet (10.67 meters) or more below a higher antenna mounted on the same leg or face.
3. When otherwise specified by the Customer.

4.7.2 Specification

Ice shields shall be capable of preventing damage to the antenna from a block of solid ice weighing 50 pounds (22.68 kilograms) falling from a distance of 40 feet (2.2 meters).

4.7.3 Member Size

Ice shield fabric shall be constructed of 9 gauge stainless or galvanized expanded metal. Openings shall be diamond or rectangular shaped with a maximum opening of 1-1/2 inches (3.81 centimeters). The frame supporting the fabric shall be essentially rectangular in shape and shall contain a minimum of three (3) cross-members radiating from the attachment point.

4.8 TOWER PAINTING

4.8.1 Scope

This specification sets forth the requirements for painting steel towers requiring obstruction marking.

All painting shall comply with "Obstruction Marking and Lighting," FAA-STD-003, published by the U.S. Department of Transportation Federal Aviation Administration and be in accordance with the manufacturer's instructions.

4.8.2 Materials

4.8.2.1 Color Designation

The paint shall be aviation orange (Federal STD. #12197) and aviation white (Federal STD. #17875).

4.8.2.2 Muriatic Acid Rinse

The Contractor shall treat newly galvanized material with a muriatic acid wash, and a fresh water rinse, and allow the surfaces to completely dry prior to painting.

4.8.2.3 Paint Manufacturer

The paint shall be "Metalatex" Semi-Gloss in aviation colors as manufactured by the Sherwin Williams Company.

4.8.2.4 Paint Protection

Paint shall be protected against freezing during shipment and storage.

4.8.3 Coverage

4.8.3.1 Members Painted/Unpainted

Where towers are required to be painted, all tower members except conduit and waveguide/coax runs, antennas and mounting components, climbing ladder, guy wires, anchor rods, and walkways shall have their exposed surfaces completely covered.

4.8.3.2 Cold Weather Painting

Under no circumstances shall any surface be painted whose temperature is less than 35° F (2° C), nor shall any painting be done when the ambient temperature is less than 35° F (2° C), or when it is likely to fall below 35° F (2° C) within 3 hours after paint has been applied.

4.8.3.3 Wet Weather Painting

Paint shall not be applied under conditions where it is likely to be exposed to rain or dew within 3 hours after application.

4.8.3.4 Touch-Up Painting

After erection all previously unpainted surfaces, such as splice bolts, requiring paint must be painted. Likewise any painted surface damaged or scratched during transport or handling must be re-painted.

4.9 TOWER LIGHTING

4.9.1 Drawing Requirements

The Contractor shall submit schematic and installation drawings of the obstruction lighting system which shall be in accordance with FAA Advisory Circular AC 70n460-1H Change 2, and NFPA Publications Nos. 702 and 78. All equipment, conductors and their installation shall meet or exceed the requirements of the latest National Electric Code (NEC).

4.9.2 System Description

Items such as conduit, conductors, etc., shall be provided and installed for a complete working installation; this shall include final connections inside building or shelter housing the electronic equipment. The obstruction light controller shall be installed on the interior wall of the equipment shelter with a remote photo cell mounted on the north side of the building roof line. Contractor is responsible for running 3/4 inch (1.91 centimeters) EMT from the controller to the distribution panel and 1/2 inch (1.27 centimeters) rigid steel conduit to the remote photo cell.

4.9.3 Standard Red Obstruction Lighting

Red lighting systems shall be composed of a L-864 (red) omni-directional and L-810 side lights. The number, configuration, and operation shall comply with "Red Obstruction Lighting Standards, Chapter 5 of FAA Advisory Circular AC 70n460-1H Change 2. The controller as described in section 4.9.6 of this specification shall be used with the red lighting system.

4.9.4 Lighting Alternate 1 - Medium Intensity Strobe System

Obstruction lighting system is composed of L-865 (white) omni-directional lights. The number, configuration, and operation of lights shall comply with "Standards for Lighting Obstructions with Medium Intensity White Obstruction Lights," Chapter 6, FAA Advisory Circular AC 70/7460-1H Change 2. The controller as described in Section 4.9.7 of this specification shall be used with the medium intensity strobe system.

4.9.5 Lighting Alternate 2 - Dual Lighting System

Dual obstruction lighting systems include red lights that are used for nighttime, and medium intensity white obstruction lights for daytime or twilight. The number, configuration, and operation shall comply with "Dual Lighting Systems," Chapter of FAA Advisory Circular AC 70/7460-1H Change 2.

Both systems should be designed such that they will not be operated at the same time; however, there should be no more than a 2-second delay when changing from one system to the other.

Failure signals for the white and red obstruction lights must be separate signals. The signal for the individual system must be presented at the time of that system's failure, not when both systems fail.

The dual system requires both the red obstruction and medium intensity strobe white lighting controllers as described in sections 4.9.6 and 4.9.7 of this specification.

4.9.6 Lighting Controller (Red Obstruction)

The obstruction light control and alarm system, shall employ solid state circuitry, shall be self-contained (except for AC power) and shall provide reliable control of obstruction lights with "fail safe" type alarming of all functions. In addition, the control system shall incorporate the following:

1. Automatic On-Off

   Adjustable automatic turn-on and turn-off of obstruction lights shall occur at a predetermined light level of 35 foot-candles turn-on and 60 foot-candles turn-off as required by FAA and FCC rules.

2. Flashing Beacons

   Flashes 1-864 red beacon at 30 flashes per minute with on period of 1 1/6 seconds, and off period of 5/6 seconds in accordance with FAA specifications.

3. Photo Electric Cell Indicator

   Indication of when lights turn-on and off shall be provided.

4. Beacon Lamp Failure Alarm

   Alarm indication of one or more beacon lamps burned-out shall be provided.

5. Side Light Failure Alarm

   Alarm indication of one or more side-lights burned-out shall be provided.

6. Beacon By-Pass Alarm

   Alarming of beacon flasher failure shall be provided with automatic turn-on to steady burning when failure of flasher occurs.

7. Power Failure Alarm

   Alarming of AC power failure to the unit shall be provided by combining alarms. All alarms shall come on to show primary power failure.

8. Automatic Circuit Restoration

   Immediate automatic restoration of all alarms and control circuits upon restoration of AC power without cycling shall be provided.

9. AC Power Line Isolation

   Control and alarm circuits shall be isolated from the AC power line for added protection from voltage spikes.

10. Load Ballast Resistor Option

    Controls shall be provided for the optional use of a load ballast resistor.

11. Solid State Relays

    Solid state relays shall be provided for light control to achieve zero voltage switching "soft turn-on"; this prevents RFI and increases lamp life.

12. Off-time Delay Circuit

    An off-time delay circuit shall be provided to bypass false input signals due to lightning flashes and other random interference.

13. NO and NC Alarm Contacts

    Controller to have normally open and normally closed independent alarm contacts for all alarm functions.

14. Led Status Indicators & Test Switches

    Controller to have led status indicators and test switches to allow checking controller functions at controller.

15. Circuit Breakers

    Controller to have resettable circuit breakers on outbound lines to protect system.

16. Controller Housing

    Controller Housing to be NEMA 4-4X indoor/outdoor so it can be mounted in an enclosure or outside.

17. Isolated Alarms

    Controller to have toroidal current sensing to isolate output lines from the sensing circuitry.

4.9.7 Lighting Controller (Medium Intensity Strobe System)

The controller for medium intensity white obstruction lights shall be of "solid state" design and shall contain a "LIGHT-OUT" alarm and signal function with a remote connection capability.

Adjustable automatic turn-on and turn-off of strobe lights shall occur at a predetermined light level of twilight to night between 5 and 2 foot-candles turn-on and night to day between 2 and 5 foot-candles turn-off as required by FAA and FCC rules. Alarm indication of strobe failure shall be provided.

4.9.8 Wiring Methods and Testing

4.9.8.1 Conduit Type

Wiring shall consist of insulated conductors installed in rigid zinc-coated steel conduit. Federal Specification WW-C-581. No electrical metallic tubing shall be allowed. Conduit fittings shall conform to Federal Specification WW-C-586.

4.9.8.2 Conduit Size

Conduit shall be 314 inch unless a larger size is required by code.

4.9.8.3 Conduit Installation

Exposed conduit shall be installed parallel with, or at right angles to, the object to which it is being attached unless shown otherwise on the drawings. Field bends shall be avoided where possible and, where necessary, shall be made with an approved hickey or conduit- bending device. Radius of field bends shall be not less than 10 times the inside diameter of the conduit. Each conduit run shall be complete before any conductors are drawn in. Pipe compound as required to insure a watertight connection shall be utilized on all conduit connections.

4.9.8.4 Conductor Type and Rating

Conductors shall be copper, type THWN, or THW, as required by Federal Specification J-C-30. All types shall be rated at 600 volts. Minimum size of wire, unless otherwise specified, shall be No. 12 AWG.

4.9.8.5 Color Coding

All wiring, including feeders, shall be color coded. Color coding shall be consistent throughout. In no case shall green be used for other than equipment grounding conductor, nor white for other than the neutral conductor.

4.9.8.6 Splices

No splices or joints shall be made in either feeders or branch circuits except at outlets, accessible junction boxes, or accessible raceways. Joints in circuit wiring shall be made mechanically and electrically secure and made with solderless connectors complying with Federal Specification WW-S-610. Unless properly insulated by the connector, all joints shall be taped with plastic tape in a manner which shall make their minimum insulation equal to the insulation of the conductors.

4.9.8.7 System Testing

Lighting equipment shall be operated to demonstrate suitability and compliance with approved shop drawings. An operational manual and warranty shall be provided for lighting equipment. The Contractor shall also provide bulbs in sufficient quantity for the initial installation plus one complete change-out.

4.9.8.8 Test Witness

The foregoing tests shall be witnessed by a Customer representative.

4.9.8.9 Local Government Inspection

Where local government bodies require inspection prior to the local Power Company hookup, the Contractor shall comply and be responsible for coordination of the inspection.

4.9.9 Beacon and Obstruction Lamp Bulbs

4.9.9.1 Specifications

All bulbs provided shall be manufactured by Duro-Test Corporation of North Bergen, New Jersey (or equal) as described below.

- Obstruction Lamp, Part A-21, 116W, 6000 Hour.
- Beacon Lamp, Part PS-40, 620W, 5000 Hour.

4.9.9.2 Bulbs - Two Sets

A complete set of spare or replacement bulbs shall be supplied in addition to all bulbs required for the initial installation.

4.10 TOWER GROUNDING

Grounding Requirements are Defined In The **Ericsson Grounding Manual, LBI-39067**. For the particular tower site conditions for each specific location. In the event that specific site soil conditions are not known at the time of bid. Bidders should be Instructed to Include Only EIA/TIA 222-E Grounding (minimal) for comparison purposes. Actual grounding requirements and cost data developed after receipt of site soil conditions.

5.0 TOWER MANUFACTURING

5.1 SCOPE

This section is to describe minimum requirements for fabrication of new towers. It is to be used in conjunction with Sections 1 through 4 of this Specification.

5.2 MATERIAL CERTIFICATION

All materials shall be new. Mill certificates shall be available for all materials furnished and shall be submitted to the Customer upon request. Where mill certificates are not available, and/or the Customer reasonably suspects that substandard materials were used in the fabrication, the manufacturer shall prepare coupons and other samples for testing, shall have these tested by a certified laboratory, and shall cause the results to be submitted directly to the Customer from said laboratory. The manufacturer shall pay all costs associated with such testing. Should the suspect material prove to have qualities below those of ASTM or other governing specifications, the manufacturer shall replace all substandard materials at own expense.

5.3 PART NUMBERS

Each fabricated structural member shall be stamped with a part number which shall be clearly legible after galvanizing and painting. The part numbers are to be a minimum of 1/2 inch (1.27 centimeters) in height and shall be as specified on the installation drawings.

5.4 WELDING

5.4.1 Certification of Welders

Welding shall be performed to the requirements of AWS-D1.1. Welders employed in the fabrication of towers for the Customer shall be certified according to the type of welds being made, under the requirements of the AWS. Current qualification certificates for welders shall be made available to the Customer upon request. Accurate records of assigned welders on the Customer's towers shall be kept.

5.5 GALVANIZING

All ferrous metal shall be hot dip zinc galvanized according to the applicable ASTM Standards after fabrication. All surfaces (especially climbing ladders) shall be free of burrs and zinc "runs" which may form during the galvanizing process.

5.6 PACKAGING

Packaging shall comply with British Standards Institute BS1133 Packing code. Each pallet, bundle, barrel, reel, and container shall clearly be labeled with a number and site name corresponding to a tower packing list for the specific site. The container in which a weather proofed

packing list has been inserted shall be so identified and marked that the receiver can readily locate it.

5.6.1 Structural Member Bundles and Pallets

Structural members shall be banded together in bundles or on pallets with similar items to be field assembled in a unit such as for one tower section. No bundle or skid weight can exceed 15,000 pounds (6,804 kilograms). Adequate protection and support shall be provided to prevent shipping damage.

5.6.2 Hardware Containers

Hardware items and all threaded fasteners shall be packaged according to size in rugged weather resistant containers.

5.7 PACKING DOCUMENTATION

5.7.1 Detailed Material List

A detailed packing list shall accompany each shipment. Every item within the shipment shall be identified with part number and/or size description along with the unit weights. The list shall be weatherproofed to prevent moisture damage.

5.7.2 Container and Weight Summary

A summary sheet shall be included listing the total number of barrels, bundles, boxes, reels, pails and other container units. The total shipment weight and the weight of each container unit shall be shown.

6.0 TOWER INSTALLATION

6.1 CONTRACTOR RESPONSIBILITIES

6.1.1 Contractor Furnished Items

Contractor shall furnish all transportation, handling, storage materials, labor, tools, implements, machinery, supplies, and incidentals, and shall do all things necessary to perform and complete the Work at the tower site.

6.1.2 On-Site Suppression

The Contractor shall furnish to the Customer the name, local address, and telephone number of the on-site supervisor. Furthermore, he shall promptly notify the Customer of any changes in supervision or any changes in the supervisor's local address or telephone number.

6.1.3 Protection of Existing Assets

The Contractor shall protect all existing buildings, structures and equipment during the assembly, erection, and painting of the tower. Protective coverings shall be provided against falling objects, including paint. The Contractor shall be liable for any damage caused to such buildings and equipment.

6.1.4 Verification of Previous Work

Prior to any erection work, the Contractor shall check all foundations to ensure that size, location, alignment, and bolt spacing is in accordance with the site drawings.

6.1.5 Erection Dependent Upon Foundation Cure

No steel shall be erected on tower foundations for a period of at least 7 days after the last concrete has been poured and the results of the 7-day breaks are satisfactory.

6.1.6 OSHA Safety

The Contractor shall conduct the erection operation at all times within compliance of the OSHA Safety Act.

6.1.7 Equipment Maintenance

All erection equipment and tools shall be maintained in first class working condition and in sufficient sizes and quantities to efficiently and safely perform their intended functions and the requirements of this contract.

6.1.8 Equipment Calibration

All measuring devices such as transits and guy tension meters shall be in proper calibration. Written confirmation from a certified laboratory that such instruments have been calibrated within the prior 6-month period before erection is to commence may be required by the Customer. At least one transit shall be present and utilized throughout the erection process.

6.1.9 Antenna Azimuth Stakes

The contractor shall provide ground stakes on line with each antenna azimuth. Two stakes shall be provided for each path. The first stake will be placed at a distance from the tower approximately equal to the tower height. The second will be placed approximately 100 feet beyond the

first. Each stake shall be clearly marked showing the azimuth of that path.

6.1.10 Connection Inspection

The contractor shall inspect a representative random sample of not less than 10% of the bolted connections. If more than 5% of those connections tested are defective, the sampling frequency shall be increased to 20%. Only non-destructive testing methods shall be employed. Test results shall be submitted to the Customer.

6.1.11 Clean Work Area

Contractor shall ensure daily and at the completion of the installation that the working area is in order and clean. Contractor shall remove and properly dispose of all packing materials, shipping crates, concrete form work materials, and excess installation materials and hardware.

6.1.12 Site Maintenance and Restoration

The Contractor shall maintain the site in the same condition as existed prior to the commencement of his operations. Any damage, such as but not limited to fences, driving surfaces, crops or ground cover. which may occur as a result of his operations shall be retained

6.2 TEMPORARY OBSTRUCTION MARKING AND LIGHTING

For towers requiring lights, the tower steel shall be marked and/or lighted in accordance with the requirements of FAA Advisory Circular AC-70/7460-1 H Change

6.2.1 Nighttime Lighting

Temporary obstruction lighting during construction shall be provided in accordance with the requirements of FAA Advisory Circular AC 70/7460-1H Change 2. Lighting shall be operative from sunset and at times of low visibility as required by the FAA Circular. The customer shall make all arrangements for and furnish the required electrical power to the site.

6.3 ASSEMBLY

6.3.1 Bolt Installation

All bolts used for connecting vertical members shall be installed with their heads on the inside of the tower and the nuts on the outside. For vertically installed bolts, the nuts shall be installed on the upper side of the connected members. Bolts will be tensioned according to tower manufacturer's recommendation. In the absence of other instructions, the "turn-of-nut" method as specified in AISC's Manual of Steel Construction shall be utilized with A325 bolts and a "snug-tight" condition, as defined in the AISC Manual, shall be attained for A307 and A449 bolts.

6.3.2 Drift Pin Use Limited

Drift pins will be permitted only to bring several parts together. They shall not be used in a manner which will distort or damage the metal or to enlarge unfair holes.

6.3.3 Field Drilling Limited

Field drilling or reaming of holes in new tower material shall not be permitted except with the Customer's approval. Any non-galvanized ferrous metal surfaces shall be treated with two coats of a zinc rich paint in accordance with the provision of ASTM A 780 Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings. The dried film coating of the paint used must contain a minimum of 94% zinc dust by weight as required by the ASTM Specification.

6.3.4 Field Welding Prohibited

6.3.5 Cable Grips

The cable grips utilized in pulling and tensioning guys shall have smooth jaws. Grips with serrated jaws or any other type which may damage the wires or their zinc coating will not be permitted.

6.3.6 Power Line Safety

Guys shall not be erected over existing power lines without the power company's approval and then only after the power has been disconnected by the utility company's own personnel.

6.3.7 Turnbuckle Safety

After the tower has been plumbed and the guy tensions have been obtained, the turnbuckles shall be locked together at each guy anchor by a loop of 7/16 inch, seven wire, strand. All guy tails shall be cut and secured. Turnbuckles shall be positioned to allow for uniform adjustment in both directions.

6.3.8 Guyed Tower Plumb

The tower shall be plumbed according to EIA/TIA-222-E standards and maintained in proper position and alignment as it is being erected.

6.3.9 Guy Tension Reports Required

Contractor shall submit guy tension reports, including date, temperature, guy size and cable tension, upon completion of tower erection.

6.3.10 Guy Splices Prohibited

Each tower guy shall be one continuous piece of strand from the guy anchor point to the tower. Splicing of guy strand is not acceptable.

7.0 CONCRETE FOUNDATIONS INSTALLATION AND QUALITY CONTROL SPECIFICATION

7.1 STANDARDS. SPECIFICATIONS. AND TEST METHODS:

The following lists the organizations from which copies of the standards may be secured:

ACI American Concrete Institute, P.O. Box 19150, Redford Station, Detroit, Mich. 482

ASTM American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103

CRSI Concrete Reinforcing Steel Institute, 228 N. LaSalle St., Chicago, IL. 60601

NRMCA National Ready Mixed Concrete Association, 900 Spring St., Silver Spring, MD 20910

PCA Portland Cement Association, Old Orchard Rd., Skokie, IL. 60076

USCE Corps. of Engineers, U.S. Army Waterways Experiment Station, Vicksburg, MS 39180

Materials and construction will conform to the following unless otherwise specified.

7.1.1 Proportioning

ACI211.1 Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete.

7.1.2 Cement

ASTM C 150 Specification for Portland Cement (8 types)

7.1.3 Aggregates

ASTM C 33 Specification for Concrete Aggregates

ASTM C 125 Definitions of Terms Relating to Concrete and Concrete Aggregates

ASTM C 127 Test for Specific Gravity and Absorption of Coarse Aggregates

ASTM C 128 Test for Specific Gravity and Absorption of Fine Aggregate

7.1.4 STEEL FOR CONCRETE REINFORCEMENT AND PRE-STRESSED CONCRETE

ASTM A 82 Specification for Cold-Drawn Steel Wire for Concrete Reinforcement

ASTM A 185 Specification for Welded Steel Wire Fabric for Concrete Reinforcement

ASTM A 496 Specification for Deformed Steel Wire for Concrete Reinforcement

ASTM A 497 Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement

ASTM A 615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

7.1.5 OTHER MATERIALS

ASTM C 171 Specification for Sheet Materials for Curing Concrete

ASTM C 260 Specification for Air-Entraining Admixtures for Concrete

ASTM C 309 Specification for Liquid Membrane Forming Compounds for Curing Concrete

ASTM C 494 Specification for Chemical Admixtures for Concrete

7.1.6 CONSTRUCTION

ACI304 Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete

ACI305 Hot Weather Concreting

ACI306 Cold Weather Concreting

ACI308 Recommended Practice for Curing Concrete

ACI309 Recommended Practice for Consolidation of Concrete

ACI318 Building Code Requirements for Reinforced Concrete

ACI347 Recommended Practice for Concrete Form work

USCE CRD-C53 Calculation of Amount of Ice Needed to Produce Mixed Concrete of a Specified Temperature

7.1.7 TESTS ON CONCRETE

ACIC 214 Recommended Practice for Evaluation of Strength Test Results of Concrete

ASTM C 31 Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field

ASTM C 39 Test for Compressive Strength of Cylindrical Concrete Specimens

ASTM C 42 Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

ASTM C 143 Test for Slump of Portland-Cement Concrete

ASTM C 172 Method of Sampling Fresh Concrete

ASTM C 173 Test for Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C 192 Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Laboratory

ASTM C 231 Test for Air Content of Freshly Mixed Concrete by the Pressure Method

7.1.8 CONCRETE

ASTM C 94 Specification for Ready-Mix Concrete

ASTM C 125 Definitions of Terms Relating to Concrete and Concrete Aggregates

7.2 GENERAL

The following section covers the requirements for installing foundations and anchor blocks for steel towers.

The Contractor shall supply all personnel, supervision, equipment, tools and transportation necessary to install foundations and anchor blocks as specified on the Engineers drawings and/or the job specifications.

The Contractor is responsible for verifying, before any excavation begins, all tower base and guy anchor locations as shown on the site drawings even if they have previously been staked by others. Discrepancies shall be reported to the Customer before proceeding further.

If the concrete placed by the contractor is determined, by testing, to be defective in any way, the contractor will be responsible for one of the following courses of action;

The removal and replacement of all defective concrete.

The cost of design and construction changes necessary to incorporate the inferior concrete.

The cost to drill and test samples according to ASTM C 42 and ACI C 214-77.

The cost of load testing the foundation in place.

7.3 EXCAVATION

The contractor shall assure that each foundation excavation is accurately located, sized and plumbed as specified on the drawings.

All topsoil shall be separately removed and stockpiled for later use in the final Back-filling process. No waste from excavations shall be spread on the property without the approval of the Customer. Excavated material, unsuitable or not required for Back-filling shall be removed from the site and disposed of by the Contractor.

Sloping, shoring and/or casings shall be used in excavations where the walls of the excavation are unstable.

Any excavation that must be left open overnight shall be adequately barricaded or covered to prevent children or animals from falling into them.

Excavating and concrete pouring shall be planned so that excavations are not open more than 24 hours.

7.3.1 Rock Excavation

The method of rock excavation shall be approved by the Customer prior to any such excavating.

Shattered, loose, unstable rock or rock exhibiting signs of incipient disintegration will not be acceptable as a foundation medium.

7.4 READY-MIX CONCRETE

Ready-mix concrete shall conform to ASTM C 94, unless otherwise specified. In order to assure quality concrete, the contractor shall submit a copy of the Concrete Mix Characteristics form in Foundation ***Exhibit B*** to the concrete supplier with the purchase order.

Truck mixers shall be the revolving drum type and shall have a mixing water tank.

A delivery ticket shall be prepared by the ready-mix supplier for each truck load of concrete delivered to the site. A copy of this ticket shall be given to the inspector at the time of delivery. The ticket shall include the following information:

- Site location (name).
- Date
- Mix identification number or truck number.
- Quantity of concrete delivered.
- Quantity of water added at site (if any).
- Outdoor air temperature.
- Time truck left plant/time truck arrived at site.

7.4.1 Materials

The concrete materials listed below shall meet the specified requirements.

Cement	ASTM C 150, Type I or II
Fine Aggregate	Clean natural sand, ASTM C 33, evenly grade from fine to coarse.
Coarse Aggregate	Crushed stone or gravel, ASTM C 33, evenly graded from 1/4 inch (.64 centimeter) to 3/4 inch (1.9 centimeter).
Water	Potable, clean and free from mud, oil, organic matter, or other deleterious material.
Admixtures	Admixtures shall be classified according to ASTM C494. Only air-entraining admixtures shall be used unless authorized by the Customer. The air-entraining agent shall comply with ASTM C260, latest edition.

When a truck mixer is used to deliver concrete to the site, the mix shall be delivered, poured and completed within 60 minutes after the mixing water is added to the cement and aggregates.

7.5 REINFORCEMENT

All reinforcement shall conform to ASTM A615, unless otherwise specified. All reinforcement (cages, anchor bolts, anchor rods, etc.) shall be accurately positioned and secured while concrete is being poured and vibrated. Reinforcing steel shall be free of loose rust and scale before concrete is poured. Exposed portions of anchor bolts shall be coated with tape or heavy grease prior to pouring concrete. The contractor shall supply all bar supports, ties, spacers and other materials required to keep the reinforcing in its proper position. A three inch minimum clear space is required between the reinforcing and excavation walls, floor, top and forms.

Heating of rebar in order to bend it and welding of rebar will not be permitted.

7.6 FORMS

The portion of concrete surfaces exposed above grade shall be formed in accordance with ACI 347. Unless otherwise specified, foundations shall be formed to a depth of 1 foot (30.5 centimeters) below grade.

Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings. Forms shall be substantial and sufficiently tight to prevent leakage of mortar and shall be adequately braced to maintain proper position and accurate alignment. Forms shall be thoroughly cleaned and oiled with an approved form oil before concrete is placed and shall not be removed until the concrete has set for a minimum of 12 hours.

Form ties, if used, shall be of the removable end, permanently embedded body type. Outer ends of the

permanently embedded portions of form ties shall be at least 1 inch (2.54 centimeters) back from adjacent outer concrete faces.

Where applicable, sono-tubes may be used to form round pier caps. However, care shall be taken to maintain a cylindrical shape during and after pouring operations.

7.7 PLACEMENT

All loose materials shall be removed from each excavation before any concrete is poured. Water shall not be permitted to accumulate nor flow through foundation excavations.

Concrete for the front wall of anchor blocks shall be placed against vertical excavations of undisturbed soil. A sloping trench shall be excavated to accommodate the anchor rod/head protrusion to the ground surface.

The tower guy anchor rods shall be installed with the anchor head a minimum of 12 inches (30. 1 centimeters) above existing grade. Furthermore, each anchor rod is to be installed such that its major axis is in line with the tower center and the point where the anchor head emerges above grade. The buried portion of all guy anchor rods shall be covered with bitumastic paint which will extend to 6 inches (15.2 centimeters) above grade.

The entire excavation, including voids in the sides of excavations caused by the removal of stones or debris, shall be filled with concrete to the required elevation indicated on the drawings.

For standard concrete anchor block and spread footing construction, concrete shall not be allowed to drop freely more than 5 feet (1.5 meters). If concrete is to be placed at a depth greater than five feet, it shall be placed with a tremie or funnel to prevent segregation. Concrete shall not be allowed to strike the sides of the excavation during pouring. All concrete shall be vibrated (ACI 309-72). During the pouring of concrete, if water begins to accumulate on the top of the concrete, the amount of water in succeeding batches shall be reduced. Should there be an accumulation of scum or Latinate on the top of the concrete, it shall be removed and additional concrete shall be placed to bring the concrete back to the proper elevation. For drilled pier construction, the concrete placement and compaction guidelines specified in ACI 304 shall be followed.

After the pouring of any foundation is started, it shall be completed in a continuous process.

Concrete, during and immediately after pouring, shall be thoroughly worked around all reinforcing and into the corners of the forms with the aid of mechanical vibrating equipment (ACI 309-72) supplemented by hand-spading, rodding and tamping.

7.7.1 Hot Weather Concreting

Except as modified below, hot weather concreting shall comply with ACI 305. At air temperatures of 90° F (32° C) or above, special procedures shall be adopted to keep the concrete below 90° F (32° C) during placement and curing. The Corps of Engineers standard for calculating added ice (USCE CRO-C53) may be used to keep the concrete cool.

7.7.2 Cold Weather Concreting

Except as modified below, cold weather concreting shall comply with ACI 306. The temperature of concrete at the time of mixing shall be not less than that indicated in the following table for corresponding outdoor temperature (in shade) existing at the time of placement.

Outdoor Temperature	Concrete Temperature
Below 30° F (-1° C)	70° F (21° C)
Between 30° F (-1° C) and 45° F (7° C)	60° F (16° C)
Above 45° F (7° C)	45° F (7° C)

When freezing temperatures are expected during the curing periods, provisions shall be made to maintain the concrete at temperatures of not less than 50° F (21° C) for five days or 70° F (21° C) for three days after the concrete is placed. Sudden cooling of concrete shall not be permitted.

The use of calcium chloride will not be permitted.

7.8 FIELD CONTROL TESTING

Field control tests, consisting of slump tests, air content test, temperature readings, and the securing of compression test cylinders, shall be made by qualified employees of the Contractor in the presence of the Inspector. One slump test, one air content test and one temperature reading shall be taken on each truck load of concrete before pouring begins. Three pairs of concrete compression test cylinders shall be made from each truck load of concrete. The most representative samples come from the middle of the load. Concrete test cylinders shall be made, cured, stored and delivered to the laboratory in accordance with ASTM C31 and tested in accordance with ASTM C39. Each set of test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the site name and location, the location on site where

cylinders were made, the delivery truck or batch number, the air content and the slump. This information shall be reported to the Customer.

The minimum acceptable compressive strengths as determined by ASTM C39 shall be:

Age	Minimum Strengths
7 days	2450 psi (16,892 Kpa)
2100 psi (14,479 Kpa)	2800 psi (19,305 Kpa)
28 days	3500 psi (24,132 kPa)
3000 psi (20,684 kPa)	4000 psi (27,579 kPa)

The Contractor shall provide all equipment and supplies and the services of one or more employees as necessary for the field control testing.

The contractor shall be responsible for obtaining an acceptable independent testing laboratory so that all tests for concrete quality can be made in a timely manner. The Contractor shall deliver all compression test cylinders to the testing laboratory.

The Contractor shall promptly submit certified test reports of all tests made by the testing laboratory to the Customer. The report shall include three copies of the results.

7.8.1 Slump

The slump test shall be performed according to ASTM C143. The allowable slump shall be four inches plus or minus one inch unless otherwise specified by the Andrew Engineer. If the slump is less than the specified 4 inches (10.2 centimeters), water can be added to the mix at the site. However, no more than 5 gallons (18.9 litres), in addition to water mixed in at the batch plant, should be added. Each set of compression test cylinders shall be marked or tagged with the slump.

7.8.2 Air Content

The air content test shall be performed according to ASTM C173. The allowable air content shall be 4 to 8 percent unless otherwise specified. Each set of compression test cylinders shall be marked or tagged with the air content.

7.8.3 Temperature

Under normal pouring conditions the temperature of the concrete shall not exceed 90° F (32° C) or go below 45° F (7° C). If the temperature of the concrete falls outside this range, proceed to pour in accordance with section 7.7.1 or section 7.7.2.

7.9 CONCRETE FINISHING AND CURING

7.9.1 Finishing Unformed Surfaces

The concrete top of tower piers shall be level within a maximum tolerance of 1/4 inch (.64 centimeter) total variation. The exposed top surfaces of the tower piers shall be broom finished. All corners and edges of the exposed concrete, unless otherwise noted, shall be beveled 1 inch (2.54 centimeters) on a 1/1 slope. The tower piers must be at least 6 inches (15.2 centimeters) above ground level when finished.

Immediately after removing forms, all metal fins or form ties on above grade or exposed surfaces shall be cut away and any minor voids, air holes or damaged surfaces shall be repaired.

7.9.2 Curing

Exposed concrete shall be protected from loss of moisture for at least seven days in compliance with ACI 308-71 and/or ASTM C309. Membrane curing compound, if used, shall be applied as recommended by the manufacturer.

7.10 BACKFILL

7.10.1 Material for Backfill

Backfill shall be furnished by the Contractor from the excavated site material to the extent available. Additional backfill, similar to the site material, shall be furnished by the Contractor where required. All backfill shall be free of wood, grass, roots, trash, rocks larger than 6 inches (15.24 centimeters) in diameter, or other debris. No frozen soil shall be used for fill. If excavated material is not suitable as backfill, Contractor will replace it with acceptable material. The final 6 inches (15.24 centimeters) of backfill material shall be from stockpiled topsoil removed during excavation.

7.10.2 Method of Backfilling and Compaction

Unless noted otherwise in contract drawings and specifications, fill materials shall be placed in horizontal layers of 9 inch (22.86 centimeters) lifts and each layer compacted with vibrating compactors such as tampers, rammers, or vibro plates to 95% modified proctor density.

7.10.3 Finished Grade

The finished grade at backfilled and other disturbed areas shall conform to the lines and grades of the site. Areas around buildings and towers shall be graded so as to cause surface water to flow away from them.

7.11 INSPECTOR'S CHECKLIST

The following is a list of general guidelines for inspectors to note when supervising foundation construction:

Check the following:

1. Foundation location.
2. Excavation clean, no water.
3. Formwork dimensions, quality, and chamfer.
4. Rebar placement, dimensions, quality.
5. Anchor bolt locations.
6. Minimum rebar spacing from excavation.
7. Concrete field tests (slump, air content, temperature).
8. Tremies or funnels.
9. Careful placement of concrete.
10. Test Cylinders.
11. Concrete batch plant tickets.
12. Finishing and curing (i.e. surface protection and prep).
13. Foundation protection.
14. Backfill material and compaction.

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Ericsson Inc.
Private Radio Systems
Mountain View Road
Lynchburg, Virginia 24502
1-800-528-7711 (Outside USA, 804-528-7711)

Printed in U.S.A.

FOUNDATION EXHIBIT *A*

SUGGESTED CHECKLIST FORM

Site Name:_____

Foundation:_____

Inspector:_____

ITEM:		DATE CHECKED/COMPLETED
1.	Foundation location	_____
2.	Excavation clean, no water	_____
3.	Formwork dimensions, quality, and chamfer	_____
4.	Rebar placement, dimensions, quality	_____
5.	Anchor bolt locations	_____
6.	Minimum rebar spacing from excavation	_____
7.	Top and bottom pier elevation	_____
8.	Concrete field tests (slump, air content, temperature)	_____
9.	Tremies or funnels	_____
10.	Careful placement of concrete	_____
11.	Test Cylinders	_____
12.	Concrete batch plant tickets	_____
13.	Finishing and curing (i.e. surface protection and prep)	_____
14.	Foundation protection	_____
15.	Backfill material	_____
16.	Compaction of Backfill	_____

FOUNDATION EXHIBIT *B*

Tower Design Data Sheet

Following is a worksheet that should be completed for each tower in the system. Include the site survey coordinates with the completed submittal. Because this specification is of a general nature, it is necessary that Ericsson or our customers furnish to the tower vendor the information listed below along with the general specifications to assure the towers meet the requirements of each project and site application:

- Tower type (guyed or self-supporter)
- Tower height
- Any future increase in tower height
- Basic wind speed for design
- Exposure coefficient, Kz, and gust response factor, Gh, *if* other than recommended by EIA/TIA-222-E.
- Basic wind speed for rigidity limits
- Design ice load
- Antenna type (manufacturer and model)
- Antenna size
- Antenna angular deflection limits (twist and sway)
- Initial and future antenna elevations, azimuths and their operating frequencies
- Horizontal separation and sectorization angle (normally 120 degrees) for 800 MHz or cellular antennas
- Ice shields for initial and future antennas
- Initial and future waveguide and routing
- Tower lighting and marking requirements
- Grounding (earthing) requirements
- Type of climbing facility and safety device required.
- Tower base topography and details
- Soil reports for ground mounted structures
- Implementation schedule

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ERICSSON

Tower Design Data Sheet

All information on this form is necessary for vendor to prepare an accurate tower quotation.

Design Load (EIA/TIA RS-222-E or the most current standard/Spec.)

Customer _____
Telephone No. _____
Contact Name _____
Site Name _____

County State _____
Due Date _____

Special Design Codes _____
(BOCA, SSBC, UBC, SFBC, etc.)
GPS or NAD83 Coordinates: **Lat**___,___,___ **N. Lon**___,___,___**W.**
Tower Type: SST_____Guyed_____

Tower Height: Feet_____Meters_____

Standard Design Code

EIA RS 222 C
_____lb/ft^2 (PSF)+_____Ice

EIA-222-D/E
_____mph +_____ Ice

EIA/TIA RS-222-E Standard Unless Specified Otherwise !
EIA/TIA RS-222-E Standard Unless Specified Otherwise !
EIA/TIA RS-222-E Standard Unless Specified Otherwise !

Rigidity Specifications

_____Standard 20 lb/ft^2 + O Ice (EIA RS-222-C)
_____Other____ lb/ft^2 + _____ Ice

_____Standard 50 mph + O Ice (EIA RS-222-D/E)
_____Other _____mph + _____ Ice

_____***Standard 70 mph + 1/2" radial ice*** ☐
_____***Standard 80 mph + 1/2" radial ice*** ☐
_____***Standard 90 mph + 1/2" radial ice*** ☐

Antenna Load

Qty	Size	Type	Radome	Level	Azimuth	Wg/Coax	Initial/future

Tower Mounts	Qty.
Tower Antenna Pipe Mount	_____
6-ft Side Arms	_____
3-ft VHF Side Arms	_____
Platform /Star Mounts	_____
Cellular Platform	_____
Cellular Platform with retractable arms	_____
Star Mount 20 ft separation	_____
Star Mount 30 ft separation	_____
Universal Mount	_____
Sectorized 20 ft separation Star Mount	_____
Rest/Work Platform	_____

Climbing Devices	Yes	No
Step Bolts	☐	☐
Climbing Ladder	☐	☐
Cable Safety Climb	☐	☐
Rigid Safety Climb	☐	☐
Waveguide Support Ladders	☐	☐
Waveguide Bridges		
4 1/2" x 10 ft (4 Runs)	☐	☐
13 1/2" x 10 ft (12 Runs)	☐	☐
20" x 10 ft (24 Runs)	☐	☐
Cable Support Kit	☐	☐

FAA Lighting/Paint	Yes	No
Strobe Lighting System	☐	☐
FAA Lighting	☐	☐
Dual Lighting System	☐	☐
Latex Field-applied Paint	☐	☐
Latex Factory-applied Paint	☐	☐
Other Accessories		
ANCO Lock Nuts	☐	☐
EIA Grounding	☐	☐
Ice Shields	☐	☐