Draft

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टीईसी ४५XXX: २०२६

STANDARD FOR GENERIC REQUIREMENTS

TEC 45XXX:2026

दूरसंचार एप्लीकेशन के लिए ४० मीटर स्किड-आधारित टावर

40 meter SKID Based Tower for Telecommunication Applications

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

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FOREWORD

Telecommunication Engineering Centre (TEC) functions under Department of Telecommunications (DOT), Government of India. Its activities include:

- Issue of Standards for Generic Requirements (GR), Interface Requirements (IR) and Service Requirements (SR) as well as Test guides for Telecom Products and Services;
- Issue of Technical regulations in the form of essential Requirements (ER);
- Field evaluation of products and Systems;
- National Fundamental Plans;
- Support to DOT on technology issues;
- Testing & Certification of Telecom products; and
- Designation of Conformance Assessment Bodies (CABs) for testing.

For the purpose of testing, four Regional Telecom Engineering Centers (RTECs) have been established which are located at New Delhi, Bangalore, Mumbai, and Kolkata.

ABSTRACT

This document specifies the Generic Requirements (GR) for 40m Skid-Based Tower intended for rapid deployment in telecom and allied applications. This GR defines the reference architecture and generic technical requirements applicable to skid-mounted tower systems. It specifies the functional scope of the mast structure, skid base frame, load-bearing and stability mechanisms, and associated support systems, designed to enable installation, operation, and relocation without the need for permanent foundations. The document covers requirements related to structural configuration, load handling, wind resistance, safety, and ensuring reliable performance under varying environmental and operational conditions. The skid-based tower facilitates modular deployment for temporary and semi-permanent applications, supporting communication antennas, surveillance equipment, and monitoring systems across diverse terrains and infrastructure-limited environments.

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HISTORY SHEET

Sl. No.	*Standard / Document No.*	*Title*	*Remarks*
1.	TEC 45XXX:2026	40m SKID Based Tower for Telecommunication Applications	First Issue

REFERENCES

S. No.	Document No.	Title / Document Name
[1]	TEC10009:2024	Guidelines on Safety Requirements of Telecommunication Equipment
[2]	TEC 14016:2010 (Old No. QM-333)	Standard for Environmental Testing of Telecommunication Equipment
[3]	TEC 11016:2016 (Old Document No. TEC/SD/DD/EMC-221/05/OCT-16)	Standard for Electromagnetic Compatibility (EMC) for Telecommunication Equipment
[4]	ISO 9001:2015	Quality Management Systems — Requirements
[5]	IS 875 (Part 3):2015	Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures – Wind Loads
[6]	IS 1893 (Part 1):2016	Criteria for Earthquake Resistant Design of Structures – General Provisions and Buildings
[7]	IS 17740:2022	Isolated Towers, Masts and Poles Using Structural Steel — Code of Practice
[8]	IS 800:2007	General Construction in Steel — Code of Practice
[9]	IS 802 (Part 3):1978	Use of Structural Steel in Overhead Transmission Line Towers — Part 3: Testing
[10]	IS 2062:2011	Hot Rolled Medium and High Tensile Structural Steel
[11]	IS 1161:2014	Steel Tubes for Structural Purposes
[12]	IS 808	Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections

[13]	IS 1570	Schedules for Wrought Steels and Steel Products
[14]	IS 4923:2017	Hollow Steel Sections for Structural Use
[15]	IS 4759:1996	Specification for Hot-Dip Zinc Coating on Structural Steel and Other Allied Products
[16]	IS 2629:1985	Code of Practice for Hot-Dip Galvanizing of Iron and Steel
[17]	IS 1477 (Part 1 & Part 2)	Painting of Ferrous Metals in Buildings — Code of Practice
[18]	IS 2266:2024	Steel Wire Ropes for General Engineering Purposes
[19]	IS 2361:2002	Bulldog Grips — Specification (Third Revision)
[20]	IS 816:1969	Code of Practice for Use of Metal Arc Welding for General Construction in Mild Steel
[21]	IS 9595:1996	Metal Arc Welding of Carbon and Carbon Manganese Steels — Recommendations
[22]	ISO 898-1:2013	Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel — Part 1: Bolts, Screws and Studs with Specified Property Classes
[23]	IS 1363 (Relevant Parts)	Hexagon Head Bolts, Screws and Nuts of Product Grade C
[24]	IS 1367 (Relevant Parts)	Technical Supply Conditions for Threaded Steel Fasteners
[25]	IS 3757:1985	High Strength Structural Bolts
[26]	IS 6623:2004	High Strength Structural Nuts

[27]	IS 1852:1985	Rolling and Structural Steel Bolted Connections — Code of Practice
[28]	IS 3043:2018	Code of Practice for Earthing
[29]	IS 456:2000	Plain and Reinforced Concrete — Code of Practice
[30]	IEC 62305 Series / IS/IEC 62305 Series	Protection Against Lightning
[31]	TIA-222-I-2023	Structural Standard for Antenna Supporting Structures, Antennas and Small Wind Turbine Support Structures

Note- All referenced codes and standards shall be the latest editions, including all applicable amendments and revisions- unless otherwise explicitly stated.

CHAPTER 1

1.0 Introduction

Telecommunications, Surveillance, Environmental Monitoring and other elevated-device applications often require rapid, movable, temporary and semi-permanent deployments at geographical locations where permanent installations are not feasible or desirable, such as congested urban areas, remote locations, Oil & Gas installations, Defence fields and other infrastructure-limited sites. Such applications require special-purpose Mast-Tower systems provided with portable, modular, detachable, fully retrievable and relocatable foundation-support arrangements capable of providing the requisite stability against specified wind and other incidental loads through firm reaction support from the ground during the intended deployment period.

Skid-Based Mast-Towers are specially designed and engineered structural support systems intended to enable rapid and adaptive deployments without dependency on conventional permanent civil foundation systems. Being portable and rapidly deployable systems, they facilitate easy transportation, installation, de-installation and redeployment, while providing a reliable solution for temporary, semi-permanent and flexible-terrain applications across telecommunications, surveillance, environmental monitoring and other allied sectors.

The term ‘Skid-based Tower(s)’ and ‘Skid-based Mast Tower(s)’ is interchangeably used in this document and it carries the same meaning.

1.1 Scope

This Generic Requirement (GR) specifies the intended utilization of the Skid Based Mast-Tower system for telecommunication applications in emergency situations, temporary or semi-permanent needs or for flexible-terrain deployments, remote-location installations, at land-space limited sites, and for multiple field-application environments.

This GR specifies the Skid-based Mast-Tower requirements, such as, its functional requirements, dynamic effects of environment on its structure, the required structural mechanics; and also the logistics, installation, safety, and statutory compliances. This document outlines the comprehensive requirements governing the design of such Mast-Towers. This GR does not cover cow-based portable towers.

1.2 Description-

a. Skid-Based Mast-Towers are designed with lattice-type steel structures having either angular or tubular sectioned members for main legs and bracings, that are assembled and mounted as the Mast-Tower structure on prefabricated steel Skid Base Frames. The Skid Base Frame serves as an independent, portable steel base foundation that supports the Mast-Tower structure, equipment payload and accessories in a robust and safe condition against specified wind loads, while effectively transferring the incidental loads to the supporting ground surface.

b. The Skid Base is not anchored to any permanent civil foundation, but is positioned on the ground through support stanchions and foot-plates that facilitate a horizontally levelled, firm and stable condition throughout the deployment period. The installation ground shall be selected based on the specified Soil Bearing Capacity (SBC), and suitable ground preparation may be carried out, as required, to ensure stable support of the Skid Base.

c. For resisting the toppling moment due to wind-generated forces, suitable ballast and counterweight arrangements may be provided within the Skid Base Frame. Additional counterweights may also be provided on the Skid Frame, on extended out-rigger arms, or on the ground through steel guy-rope supported arrangements, as required for ensuring the stability of the Mast-Tower system.

d. The Skid-Based Mast-Tower system facilitates easy transportation, rapid installation and redeployment while providing structural stability against wind and other loads during operation. The Skid Base Frame incorporates provisions for lifting, handling, mounting of the Mast-Tower and fixing of support guy ropes for ensuring operational flexibility, support and stability.

1.3 General Requirements

The Skid-Based Mast-Tower (SBMT) System shall be designed, manufactured, supplied, installed, and maintained to meet the functional, structural, operational, safety, and performance requirements for telecommunications and other allied applications. The system shall provide a stable, reliable, rapidly deployable, and relocatable elevated platform for mounting antennas, payloads, and associated equipment, while ensuring structural integrity, operational safety, durability, and serviceability throughout its intended design life.

The general requirements of the SBMT System shall include the following:

1.3.1 Basic Function and Purpose

1.3.2 Classification

1.3.2.1 Mast Construction / Structure

1.3.2.2 Stability Configuration

1.3.3 Loading Requirements

1.3.4 Environmental Requirements

1.3.5 Tower Height

1.3.6 Structural Requirements

1.3.6.1 Vertical Mast-Tower Structure

1.3.6.2 Steel Skid-Base Frame

1.3.6.3 Leg Members, Bracings and End Connections

1.3.6.4 Structural Interfaces and Ancillary Provisions

1.3.7 Mechanical Requirements

1.3.7.1 Mechanical Systems and Deployment Provisions

1.3.7.2 Design Wind Speed

1.3.7.3 Design Life

1.3.8 Logistics Requirements

1.3.8.1 Modular Sub-Assemblies and Parts

1.3.8.2 Packing and Loading Patterns

1.3.8.3 Types of Vehicles and Capacities and Capacities

1.3.9 Design Requirements

1.3.1 Basic Function and Purpose

a. Skid-Based Mast-Towers system shall provide the necessary structural stability and strength support, the requisite elevated height, the equipment mounting interfaces, cable management provisions, and the operational access for installations, commissioning, and maintenance.

b. It shall enable the achievement of the required ‘line-of-sight’ sight’ for radio path, vision-observation range, and data-monitoring reach and such other fundamental requirements of the planned applications; while maintaining positional stability and operational reliability under the specified wind and other types of loads as well as environmental conditions.

c. The system shall be capable of safely sustaining and transferring all incidental loads through its structural members, connections, interfaces, and support arrangements.

d. The system design and construction shall ensure personnel safety, equipment protection, ease of deployment and maintenance, logistical mobility, and adaptability to varied terrain and site conditions, while maintaining operational fitness throughout its intended design life.

1.3.2 Classification

Skid-Based Mast-Tower Systems are classified for ease of understanding and identifying the correct and result-oriented utilization of versions/models, based on particular site requirements and limitations, as well as to provide the ease and efficient of transportation and installations, with the support of rapidly deployable feasible, safe, efficient, built-to-suit passive infrastructure for achieving the eventual important objectives of dependable communications, surveillance, and environment monitoring.

1.3.2.1 Mast Construction/Structure

Lattice Mast-Tower structures shall comprise the following SBMT subtypes:

1.3.2.1.1 SBMT-L-CKD (Skid Based Mast Tower—Lattice-Completely-Knocked Down -)

The **SBMT-L-CKD** shall :

a. Be supplied as individual structural members, connection components, and accessories suitable for easy, efficient transportation and complete assembly work at site.
b. Ensure proper robust assembly and interchangeability of members and connection components.
c. Be provided with suitable identification and marking of structural members and components to facilitate correct relation, sequence and fast assembly and traceability.
d. Be capable of repeated assembling and dismantling without deterioration of the structural integrity or performance of the system

1.3.2.1.2 SBMT-L-SKD (Skid Based Mast-Tower-Lattice- Semi-Knocked Down)

The **SBMT-L-SKD** shall:

a. Be supplied in pre-assembled segments designed to eliminate part-level assembly and minimize site installation effort, erection time, and deployment

duration.

b. Incorporate suitable segment-to-segment connections to ensure robust assembly, alignment, and effective load transfer throughout the Mast-Tower.
c. Be designed with suitable lifting, handling, transportation, and installation provisions to permit safe movement and erection of the segments without damage to the structure or associated components.
d. Be capable of repeated assembly, dismantling, transportation, and relocation, where required, and shall be provided with suitable identification and marking of segments and associated components to facilitate correct assembly sequence, relationship, and traceability.

1.3.2.2 Stability Configuration

1.3.2.2.1 Skid-Based, Self-Supported Type Tower (SB-SST)

The SB-SST shall:

a. Derive its stability solely from the Mast-Tower structure, skid-base frame, ballast system, outriggers, and associated supporting components without reliance on external guying arrangements.
b. Be designed such that the Mast-Tower, skid-base frame, ballast system, outriggers, and supporting elements collectively provide adequate resistance against overturning, uplift, sliding, and all specified loading conditions, while safely transferring the resulting loads and reactions to the supporting ground.

1.3.2.2.2 Skid-Based, Guy-rope Supported Mast (SB-GSM)

The SB-GSM shall:

a. Be provided with an adequate number of guy ropes arranged in a suitable configuration to ensure equal, balanced stability under all specified loading and operating conditions.
b. Incorporate suitably designed guy ropes, anchorages with skid-frame / outriggers / ground-based counterweights; connection hardware; and associated components capable of safely transferring the applicable forces.
c. Incorporate suitable provisions for adjustment, tensioning, inspection, maintenance, and replacement of guy ropes and associated hardware to maintain the required strength, stability, and alignment of the Mast-Tower.
d. Be designed such that failure, loosening, or excessive elongation of any one guy rope does not result in unsafe conditions for the Mast-Tower.

e. Guy ropes shall conform to IS 2266, and wire-rope terminations, including Bulldog grips where used, shall conform to IS 2361 or other equivalent applicable standards.

f. Skid-Based, Guy-rope Supported Mast can have the following subtypes based on the anchoring arrangement of the guy-ropes.

(i) Guy-ropes connected to Outrigger-arms: A guyed Mast-Tower in which the guy ropes are anchored to designated anchorage points provided on the integral outrigger arms of the skid-base frame.

(ii) Guy-ropes connected to counterweights: A guyed Mast-Tower in which the guy ropes are anchored to ground-mounted modular and portable counterweights located around the skid-base frame.

Note 1 ***Indicative graphics of different structures of Skid-based Mast-towers are shown in Annexure – I of this document.***

1.3.3 Loading Requirements:

a. The structure shall be designed for the most critical combination of applicable loads and load cases as below, in accordance with the relevant provisions of IS 875 Part -3, TIA 222, IS 800, and other applicable standards.

b. The tower shall be able to support the minimum loading of the antennas as given below: 6 nos. of panel antennas (2.5m x 0.32m x 0.14m) for cellular systems 2.5m below the top and 3 Nos. of 0.6 diameter microwave solid dish antennas (with cylindrical shroud) at a top.

c. However, the Purchaser / Procurer shall specify the requirements related to the Antenna and The Effective Projected Area (EPA) of Tower with Payload along with peripheral accessories. The structure shall safely withstand all applicable dead, live, wind, equipment, and other incidental loads, including the combined effects of the specified payload and projected area, without exceeding the permissible stress, stability, and serviceability limits specified in the applicable design standards.

d. The tower design is considered to be safe in all seismic zones (2 to 5) subject to the condition that Wind/cyclone and earthquake do not occur simultaneously.

1.3.4 Environmental Requirements

a. The Skid-based Mast-Tower System shall be designed to withstand the detrimental effects of environmental influences and natural phenomena encountered during its design life.

b. The environmental influences to be considered shall include wind loads and associated dynamic effects, cyclonic loading (where applicable), seismic loads, varying temperature-induced effects, rainfall, humidity, dust, corrosive atmospheric conditions, snow or ice loading (if applicable), and other environmental influences that may affect the structural integrity, stability, durability, and operational performance.

c. The installation site shall have a minimum Soil Bearing Capacity (SBC) of 50 kN/m², subject to suitable ground condition shall be ensured by the procurer / purchaser to achieve the required support conditions.

1.3.5 Tower Height

The nominal tower height covered under this GR is 40 meter.

1.3.6 Structural Requirements

1.3.6.1 The Skid-Based Mast-Tower System shall be suitably designed with adequate footprint and concrete ballast, to ensure adequate stability under the specified loading conditions.

1.3.6.2 The tower structure shall maintain serviceability limits as below:

i. 0.5 degree at 70% of basic wind speed.
ii. Limit State of deformations as specified in IS: 17740:2022.

1.3.6.3 Main Structural Assemblies

This includes

1.3.6.3.1 Vertical Mast-Tower Structure

1.3.6.3.2 Steel Skid-Base-Frame

1.3.6.3.3 Leg Members, Bracings, End-connections

1.3.6.3.4 Structural Interfaces and Ancillary Provisions

1.3.6.3.1 Vertical Mast-Tower Structure

a. The vertical Mast-Tower Structures shall consist of a lattice-type structure constructed as a rigid, bolted structure, supplied in either completely-knocked down type (CKD) or semi-knocked down type (SKD) of construction, to suit diverse installation limitations and feasibilities, thereby, of particular site locations, apart from the facilitation for easy and economic transportation. These types of Mast-Tower structures shall be assembled at the deployment sites and shall be installable with the help of rigger-technicians or in combination with mobile cranes and rigger-technicians.
b. The Mast-Tower structures shall be designed as either ‘guy-ropes-supported’ or ‘self-supported’ structures, as suitably required in terms of, available space, inventory management, economics, scalability, soil-bearing-capacity (SBC) management and shall satisfy the stability and performance requirements under all specified loading conditions.
c. It shall be capable of withstanding all applicable loads in accordance with the loading design guidelines of IS 875 Part-3, IS 17740, and TIA 222; and in accordance with contingencies-factoring guidelines as per IS 800; all of latest editions.
d. It shall be fabricated from structural steel sections conforming to the IS 2062, IS 1161, and IS 4923; all of latest editions.
e. It shall be designed along with mounting bracketry, with connecting and clamping provisions, to safely support RF equipment, feeder cables, power cables, other related devices; as well as guy-rope wires (where applicable), climbing ladder, and other accessories or payloads; under all loading conditions.
f. It shall incorporate provisions for installation of lightning protection systems in

accordance with the applicable guidelines as per IS/IEC 62305 and related standards, as specified by the purchaser.

g. It shall incorporate provisions for the installation of aviation obstruction lighting, where specified by the purchaser and as required by the applicable regulatory requirements.
h. It shall incorporate suitable work platforms, fall arrestors, and ladder cages for personnel access and safety during installation, antenna-fixing, and maintenance activities, as specified by the purchaser.
i. It shall include suitable provisions for lifting, handling, loading/unloading, transportation, and deployment as compatible with standard material handling equipment such as hand tools, power tools, derricks, and cranes.
j. It shall be designed to facilitate safe transportation, assembly, erection, maintenance, dismantling, and relocation throughout its design life.

1.3.6.3.2 Steel Skid-Base-Frame:

a. It shall be a rigid, load-bearing geometrical structure, constructed out of horizontally arranged long, cross and diagonal members; forming an assembly frame designed to support the Mast-Tower structure, the antennae or other payloads, associated equipment and counterweights, while ensuring overall system strength and stability.
b. It shall be designed to withstand all operational, environmental, transportation, handling, erection, deployment, and maintenance loading conditions.
c. It shall be fabricated from structural steel sections conforming to IS 2062, IS 1161, and IS 4923; all of latest editions.
d. It shall ensure uniform distribution of loads to the supporting ground, through its structural geometry and nodes, such that the imposed bearing pressures remain compatible with the available soil bearing capacity for adequate support reactions.
e. It shall be designed with suitable adjustable jacks, footing plates, and other ground-supporting elements based on the site soil bearing capacity and the load transfer requirements of the Mast-Tower system.
f. It shall incorporate integral ballast in the form of concrete filled inside the structural voids of the Skid-Base Frame, using minimum M15 grade concrete as per IS 456.
g. It shall incorporate the supplementary counterweights suitably placed on the Skid-Base, including modular RCC counterweights, as required to achieve the total stabilizing weight under specified design loading conditions. The provisions for the placement of the counterweights may be on the Skid-Base, its extended members or separately placed directly on the ground with guy-rope connections to the Mast-Tower

for arresting its movement/toppling.

h. It shall be provided with bolted type, horizontally extended outrigger members to increase the effective base footprint and to enhance the stability of the Mast-Tower in its deployed condition.
i. It shall be structurally designed together in combination with the outrigger members and the counterweights (ballast system), to safely resist the compressive and tensile forces; as well as the uplift, overturning, and lateral forces encountered under all specified loading conditions.
j. It shall be capable of utilizing alternative stabilization arrangements, including external ground-based, modular and portable RCC counterweights connected to the Mast-Tower with guy-ropes.
k. It shall include suitable provisions for lifting, handling, loading/unloading, transportation and deployment, as compatible with standard material handling equipment such as hand-tools, power-tools, derricks and cranes.
l. It shall Provide suitable arrangements for secure mounting of the Mast-Tower, as well as mounting and fastening of all other associated equipment.

1.3.6.3.3 Leg Members, Bracings, End-connections:

a. The Mast/Tower Main 'Leg' members shall be fabricated out of suitable cross-sections, thicknesses, and lengths to facilitate requisite strength, ease of handling, and assembly.
b. The bracing members along with the leg members shall be designed for optimized girth of Mast/Tower, that shall facilitate ease of assembly, as well as safety during installation.
c. The Bracing members, in case of tubular sections, shall be provided with end-connection-plates / cleats that are welded to the bracing ends and which shall be bolted to the connecting gusset plates of the leg members.

1.3.6.3.4 Structural Interfaces and Ancillary Provisions:

a. It shall incorporate suitable structural interfaces and connection arrangements as per standard design practices to provide ease of assembly and requisite strength.
b. All connecting interfaces shall be designed with appropriate dimensional tolerances, clearances, and fitment provisions to facilitate reliable assembly, geometrical alignments, interchangeability, and repeated deployment cycles without affecting

structural integrity or functionality.

c. It shall incorporate suitable attachment provisions for ancillary systems and accessories, including cable support systems, safety systems, lighting systems, earthing connection arrangements, and other equipment as specified by the purchaser.
d. All interfaces, attachment points, and ancillary provisions shall be designed to permit safe installation, inspection, maintenance, replacement, and servicing throughout the intended design life of the system.
e. All structural members' interfaces shall not have any sharp edges, gaps, surfaces, structural geometry, or construction that may pose dangerous and difficult working conditions to the workers/technicians engaged in the activities of Mast/Tower installations, fitting/removal of antennae and other equipment as well as during maintenance operations.

1.3.7 Mechanical Requirements

1.3.7.1 Mechanical Systems and Deployment Provisions

a. The system shall incorporate suitably engineered mechanical arrangements for deployment, erection, extension, retraction, tilting, folding, lowering, or other operational movements required by the specified configuration.
b. Mechanical systems shall include suitable guides, supports, actuating mechanisms, and positive locking arrangements to ensure safe, reliable, and controlled deployments / operations under all specified conditions.
c. Mechanical components and assemblies shall be designed to withstand the forces generated during deployment, operation, retrieval, transportation, and repeated deployment cycles without degradation of performance or safety.
d. Suitable provisions shall be incorporated for inspection, adjustment, maintenance, and replacement of mechanical components throughout the intended service life of the system.

1.3.7.2 Design Wind Speed

The design wind speed for different regions shall be as given below (Purchaser or Procurer shall specify the requirement):

Region Type	Basic Wind Speed as per IS: 875 (Part-3): 2015*
Low-I	120 km/h
Low-II	140 km/h
Medium-High	170 km/h
Non – Cyclonic/High	180 km/h
Cyclonic	180 km/h (k4 = 1.3)
Extremely High	200 km/h

Table 1 : Region-wise Basic wind speed

*Equivalent km/h values corresponding to IS 875 (Part-3) wind-zone classifications.

1.3.7.3 Wind loads on the tower shall be evaluated in accordance with IS 875 (Part 3): 2015. For determine the design wind velocity, the structure shall be classified as per the risk categories specified in IS 17740: 2022, and the corresponding design life shall be adopted as follows:

Category	Design Life / Mean Probable Design Life
Category II	50 years

Table 2: Design Life as per Risk Category (IS 17740:2022)

Note: The Purchaser / Procurer can specify their specific requirement of Category I & Category III structures with compliance as per IS 17740. The basic wind speed, gust factor, shape factor, and exposed area of antenna / microwave dishes, mounts, ladder cage, and cable trays shall be considered in the wind load calculations. Design wind pressures shall be taken from IS 875 (Part 3) and applied to all structural components and appurtenances.

1.4 Other Requirements

1.4.1 Platform Requirements

For easy access of rear of antenna, platforms are required to be provided as given below:

Sr. No.	Tower Height	Platform position	Remarks

1.	40 Meter	a) 37.5 meter b) 32.5 meter c) 28.0 meter	For panel & solid Dish antennas.

Table 3 : Platform Position Requirements for Skid-based Tower

1.4.2 Structure Design Requirements

a. The structural design of the Skid-Based Tower shall be based on established engineering principles and practices for Telecom Towers based on mathematical calculations/computations for requisite strength, stiffness, deflection, and stability.

b. The structural design shall be based on the critical design parameters specified by the purchaser, including tower height, operational and survival wind speeds, seismic zone, effective projected area (EPA), and weight of RF equipment. Based on these inputs and the site-specific conditions, the supplier shall determine the applicable design parameters and coefficients, including K1-K4, in accordance with IS 875 (Part 3). These inputs and derived parameters shall form the basis of the structural design.

c. The supplier shall be responsible for ensuring a safe and reliable design by complying with the applicable requirements of IS 875 (Part 3), TIA-222, IS 800, and other relevant standards, including the appropriate consideration of load combinations, load factors, material strength factors, and design checks.

d. The Skid-Based Mast-Tower System shall be designed for a minimum service life as per the prescribed risk category under the specified operational, environmental, and loading conditions. The design shall be based on validated engineering principles and applicable national and international standards to ensure adequate strength, stability, durability, serviceability, and safety throughout the intended design life.

1.4.3 Logistic and Transport Guidelines

1.4.3.1 Modular Sub-Assemblies and Parts

a. The Skid-based Mast-Tower Systems shall be designed as modular assemblies comprising transportable components and sub-assemblies or complete assemblies; suitable for efficient handling, transportation, storage, deployment, maintenance, and replacement.
b. The dimensions, mass, and configuration of individual modules shall be optimized to facilitate safe transportation and handling enabling use of commonly available logistics and material-handling equipment.
c. Sub-assemblies and parts shall be designed to minimize transportation volume, simplify assembly and disassembly operations, and reduce deployment and retrieval time.
d. Suitable identification, marking, and traceability provisions shall be provided for all major modules, assemblies, and critical components to facilitate inventory control and efficient assembly work.

1.4.3.2 Packing and Loading Patterns

a. The SBMT system shall incorporate suitable provisions for packing, stacking, securing, and protection of modules and components during storage and transportation.
b. Packing arrangements shall protect structural, mechanical, electrical, and ancillary components from damage arising from handling, vibration, shock, weather exposure, and transportation-related stresses.
c. Loading patterns shall facilitate safe loading, unloading, inventory management, transportation, deployment, and retrieval operations while ensuring stability of the transported load.
d. Suitable lifting, lashing, tie-down, and load-securing provisions shall be incorporated to enable safe transportation and handling.

1.4.3.3 Types of Vehicles and Capacities

a. The SBMT system shall be compatible for transportation by road using commercially available vehicles and logistics infrastructure, as applicable to the intended deployment requirements.
b. The dimensions, gross weight, load distribution, and capacity suitable for the transportation vehicles shall comply with the applicable provisions of the Central Motor Vehicles Rules (CMVR), Motor Vehicles Act - 1989 (latest edition), and other statutory regulations governing transportation of goods by road in the

intended area of operation. The complete Skid-Based Mast-Tower system may be transportable in a single vehicle load or distributed across multiple vehicle loads depending upon the specified Mast-Tower configuration, payload requirements, and deployment scenario.

c. The supplier shall specify the transportation configuration, vehicle type, load distribution, and associated logistics requirements for the complete system.

1.5 Safety Requirements:

1.5.1 Personnel Safety

a. Installation and deployment activities shall be carried out in accordance with approved Standard Operating Procedures (SOPs) and applicable safety regulations by trained rigger personnel authorized for working at heights.

b. Suitable provisions shall be made for personnel safety, including climbing gear, fall-arrestor systems, personal protective equipment (PPE), rescue arrangements, first-aid facilities, and other safety measures appropriate to the installation activity.

c. The design shall minimize exposure of personnel to hazards arising from lifting operations, working at height, moving equipment, suspended loads, stored energy systems, and adverse environmental conditions.

d. The complete procedure of installation shall be controlled through QMS-based documents, checklists, and verification records for ensuring reliable and safe deployment, as well as for the traceability of the complete installation project. The records thus established shall be provided to the Purchaser.

1.5.2 Structural Safety and Integrity

a. Installation procedures shall ensure correct assembly, fastening, alignment, levelling, and stabilization of all structural elements prior to commissioning and operation.

b. All structural connections, locking arrangements, and fastening systems shall be installed and verified in accordance with the specified methods, tolerances, and acceptance criteria.

c. The system shall incorporate suitable provisions to prevent structural instability, misalignment, deformations, unintended movement, or loss of structural integrity during the entire period of deployment and operations.

d. Suitable means and measures shall be provided for verification of critical alignments, fitments, tolerances, locking arrangements, and stabilization provisions prior to placing the system into service.

1.5.3 Aviation Obstruction Light

a. The Skid-based Mast/Tower System shall be provided with Aviation Obstruction Lighting, wherever required, in accordance with applicable DGCA requirements, ICAO Annex 14, and other relevant statutory regulations.
b. The aviation lighting system shall be suitably positioned, securely mounted, and designed to provide reliable operation under the specified environmental and operating conditions.
c. Suitable provisions shall be provided for power supply, protection, and maintenance of the aviation lighting system.

1.5.4 Lightning Arrestor

a. The Skid-based Mast/Tower System shall be provided with a Lightning Protection System, in accordance with the applicable provisions of IS/IEC 62305 and related standards.
b. The lightning protection arrangement shall include suitable air terminals, down conductors, bonding arrangements, and interfaces necessary to safely intercept and conduct lightning currents to the earthing system.
c. The Lightning Protection System shall be mechanically robust, corrosion resistant, and compatible with the structural and operational requirements of the Skid-based Mast/Tower System.

1.5.5 Earthing Arrangements

a. The earthing system shall be designed and installed in accordance with IS 3043 and shall provide a low-resistance path for safe dissipation of lightning currents, fault currents, leakage currents, and static charges.
b. Suitable earthing and bonding arrangements shall be provided for the Mast-Tower Structure, Skid-Base Frame, lightning protection system, electrical equipment, and associated metallic components.

c. The earthing system shall be designed to maintain electrical continuity, mechanical integrity, and durability under the specified environmental and operating conditions.

1.6 Testing Requirements

1.6.1 The Skid-based Mast-Tower System, including the Mast-Tower Structure, Skid-Base Frame, stabilization system, counterweight arrangements, Guy-ropes and anchors (wherever applicable), mechanical systems, and associated structural components, shall be designed and analyzed using the Limit State Method in accordance with IS 800 and other applicable standards. The design shall consider all applicable loads, load combinations, and environmental effects in accordance with IS 875 Part 3, IS 17740, TIA 222, and IS 1893, as well as other relevant codes and standards.

1.6.2 The Skid-based Mast-Tower structure shall be designed in detail using relevant Computer-Aided Design (CAD) software. The design shall be simulated and analyzed with the use of Computer-Aided Engineering (CAE) analysis software such as ANSYS or equivalent and shall be reviewed, verified, and certified by an Apex Government Technical Institution such as IIT, SERC, CPRI, or other equivalent institutions acceptable to the purchaser.

1.6.3 In addition, the design shall be verified by physical testing of an exactly design specifications-compliant physical prototype by National Accreditation Board for Testing and Calibration Laboratories (NABL)-accredited Tower Testing Stations as authorized by TEC that have the qualified infrastructure and equipment to simulate the specified design loads and to test the Mast/Tower's structural strength, deflection, and overall stability along with its prebuilt Skid-Base portable foundation as necessary to demonstrate compliance with the requirements and specifications governed by IS 802 Part 3.

1.6.4 The physical testing procedure shall be witnessed by the purchaser's technical representative as well as the TEC representative for joint confirmation of design validation. All detailed online and physical testing reports duly certified by the authorized testing organisations shall be submitted to the purchaser and to the respective authority while seeking necessary certification.

1.6.5 Destructive full scale testing shall be carried out for all tower heights of one wind speed of one prototype to approve the design philosophies of proposed designs in reputed tower test bed. All tower design calculations shall be approved by SERC or any other approved agency by Government / BSNL for this purpose. Foundation designs of corresponding towers shall be certified by such agency on generic foundations and individual site specific application of standard designs must be approved by Civil/Structural Engineer.

1.6.6 The following minimum tests shall be conducted:

Item	Requirement
Structural validation	As per IS 17740 – Verification of design strength and deflection limits
Galvanisation test	Zinc coating mass, thickness, and adhesion as per IS 2629 / IS 2633 , with measurements as per IS 6745

Table 4 : Details of Standards required for minimum prescribed tests

1.6.7 The Manufacturer / OEM shall demonstrate their product for particular type of Skid based tower as described above for the certification purpose.

1.7 Quality Requirements

1.7.1 QMS-controlled Manufacturing

a. The manufacturer shall operate and maintain a Quality Management System (QMS) conforming to ISO 9001 and shall implement documented procedures to ensure effective control of design, procurement, manufacturing, inspection, testing, handling, storage, and traceability of materials and components used in the skid-based mast tower system.
b. All materials used in the skid-based mast tower system shall conform to applicable Indian Standards such as IS 2062, IS 1161, IS 4923, IS 808, and IS 1570, as applicable to the respective component and intended application.
c. Manufacturing processes, including cutting, forming, welding, machining, and

assembly, shall be carried out in accordance with approved engineering practices, IS standards, and controlled quality procedures.

d. Welding shall be performed by qualified personnel in accordance with IS 816 and IS 9595 using approved welding procedures, and welds shall be free from cracks, undercuts, porosity, incomplete fusion, and other visible defects.
e. All structural members, welded joints, connections, and load-bearing components shall be inspected for dimensional accuracy, fitment, fabrication quality, and compliance with approved drawings.
f. Corrosion protection treatment such as hot-dip galvanization shall conform to IS 4759, IS 13229, and IS 2629 wherever galvanization is specified. Paint coating systems, wherever applicable, shall conform to relevant provisions of IS 1477.
g. Fasteners shall conform to applicable standards such as ISO 898, IS 1363, IS 1367, IS 3757, and IS 6623 and shall be verified for proper installation, tightening, and locking arrangement functionality.
h. Telescopic (where applicable), locking, and stabilization mechanisms shall operate smoothly without jamming, excessive play, wear, or deviation.
i. The completed skid-based mast tower system shall be free from sharp edges, structural distortion, unsafe projections, loose components, and surface defects affecting safety or functionality.
j. Mill Test Certificates (MTCs), Welding Procedure Specifications (WPS), Welder Qualification Records (WQR), Welder Performance Qualification (WPQ), galvanization test certificates, dimensional inspection reports, load test reports, assembly drawings, and inspection records shall be maintained and made available for verification, as required.
k. The manufacturer shall establish documented inspection and testing procedures to ensure compliance with specified structural, operational, safety, and performance requirements of the skid-based mast tower system.
l. All structural steel components of the Skid-Based Mast-Tower System shall be protected by hot-dip galvanization with a coating thickness of 86–120 microns, in accordance with the applicable provisions of IS 4759 and IS 2629, to provide long-term corrosion resistance and durability under the specified environmental conditions.

1.7.2 QMS-controlled Installations

a. Installation, deployment, retrieval, and relocation activities shall be carried out in accordance with installation procedures, method statements, risk assessments, and Standard Operating Procedures (SOPs), complying with IS 17740, prepared by the supplier and approved by the purchaser.
b. Installation personnel shall be suitably trained, qualified, and authorized for the activities being performed, including working at height, lifting operations, and structural assembly.
c. All critical structural connections, bolted joints, locking arrangements, guy-wire systems (where applicable), alignments, levels, and tolerances shall be verified during installation in accordance with IS 1852, approved drawings, manufacturer's requirements, and other applicable standards.
d. In the case of telescopic Mast-Tower systems, if payloads and associated equipment are installed in the retracted position, all mounting arrangements, fasteners, cable routings, clearances, interfaces, and locking provisions shall be inspected and verified for robust fitments and ensured clear movement that will happen during mast elevation without any interferences and damages, to ensure safe deployment.
e. Measuring instruments, torqueing devices, lifting equipment, and safety equipment used during installation shall be suitably maintained, inspected, and calibrated, as required.
f. Installation records, inspection reports, checklists, and commissioning reports shall be maintained and made available for verification. The installation organization shall establish documented inspection and acceptance procedures to demonstrate compliance with the specified structural, safety, and operational requirements of the Skid-based Mast/Tower system.

1.7.3 Documentation

Technical literature in English with complete layout, detailed construction diagram and detailed block schematic wherever applicable shall be provided in hard copy. All aspects of installation, operation, maintenance, trouble shooting and replacement shall be covered in this manual. Additionally, a soft copy /QR code on the system in respect of technical literature shall also be provided both in Hindi and English.

CHAPTER 2

Information for the Procurer / Purchaser

2.1 The following clause are for the reference of the purchaser only and clause it not be tested during Type Approval testing.

2.1.1 The number of antenna fixture required shall be clearly mentioned at the time of ordering.

2.1.2 Details of the antenna Fixtures/Mounts, given in the GR, are for reference only and purchaser may specify the details of /mount /Fixture at the time placing of purchaser order as per their needs. Further, if the actual site requirement is not decided at the time of placing purchase Order, the tower may be ordered without antenna Fixtures.

2.2 Requirement of the external or internal ladder shall to be clearly mentioned at the time of ordering.

2.3 Requirement of wind speed bearing capacity of the skid based tower for design shall be specified by the Purchaser / Procurer.

2.4 Antennae may be specified by Purchaser OR The Effective Projected Area (EPA) of Tower with Payload and peripheral accessories may be specified by Purchaser.

2.5 Suitable soil and ground condition is required to be ensured to support the specified requirements of the tower.

2.6 In the document, some features ((including those requirements which have been marked as per purchaser / procurer requirements) need to be examined by the purchaser / procurer and shall be suitably specified in the tender conditions / ordering information as per their requirement.

ABBREVIATIONS

For the purpose of this document the following abbreviations apply:

AGL	:Above Ground Level
CAD	:Computer-Aided Design
CAE	:Computer-Aided Engineering
CKD	:Completely Knocked Down
CoW	:Cell on Wheels
CPRI	:Central Power Research Institute
DCDB	:Direct Current Distribution Board
DG	:Diesel Generator
DL	:Dead Load
DOT	:Department of Telecommunications
EMC	:Electromagnetic Compatibility
EMI	:Electromagnetic Interference
EPA	:Effective Projected Area
EQ	:Seismic Load (Earthquake Load)
ER	:Essential Requirements
FASD	:Fall Arrestor Safety Device
FIG	:Figure
FOS	:Factor of Safety
GBT	:Ground-Based Tower
GR	:Generic Requirements
GSP	:Ground Support Pad
HCV	:Heavy Commercial Vehicle (40 Feet Trailer)
IIT	:Indian Institute of Technology
ITU-T	:International Telecommunication Union – Telecommunication Standardization Sector
LA	:Lightning Arrestor
LL	:Live Load
m/s	:Meter per Second
M	:Meter
MCV	:Medium Commercial Vehicle
MoCoW	:Multi Operator Cell on Wheels (for 3 Operators)

MT	:Metric Ton
MTC	:Mill Test Certificate
MW	:Microwave
NABL	:National Accreditation Board for Testing and Calibration Laboratories
ODC	:Outdoor Cabinet
PCC	:Plain Cement Concrete
PPE	:Personal Protective Equipment
QMS	:Quality Management System
RTEC	:Regional Telecom Engineering Centre
RRH	:Remote Radio Head
RWH	:Regional Warehouse
SB-SST	:Skid-Based, Self-Supported Type Tower
SB-GSM	:Skid-Based, Guy-rope Supported Mast
SBC	:Safe Bearing Capacity
SBMT	:Skid-Based Mast Tower
SBMT-L-CKD	:Skid Based Mast Tower- Lattice-Completely Knocked Down
SERC	:Structural Engineering Research Centre
SKD	:Semi Knocked Down
SBMT-L-SKD	:Skid Based MastTower Lattice- Semi Knocked Down
SOP	:Standard Operating Procedure
TEC	:Telecommunication Engineering Centre
WL	:Wind Load
WPR	:Welding Procedure Specification
WPQ	:Welder Performance Qualification
WQR	:Welder Qualification Record

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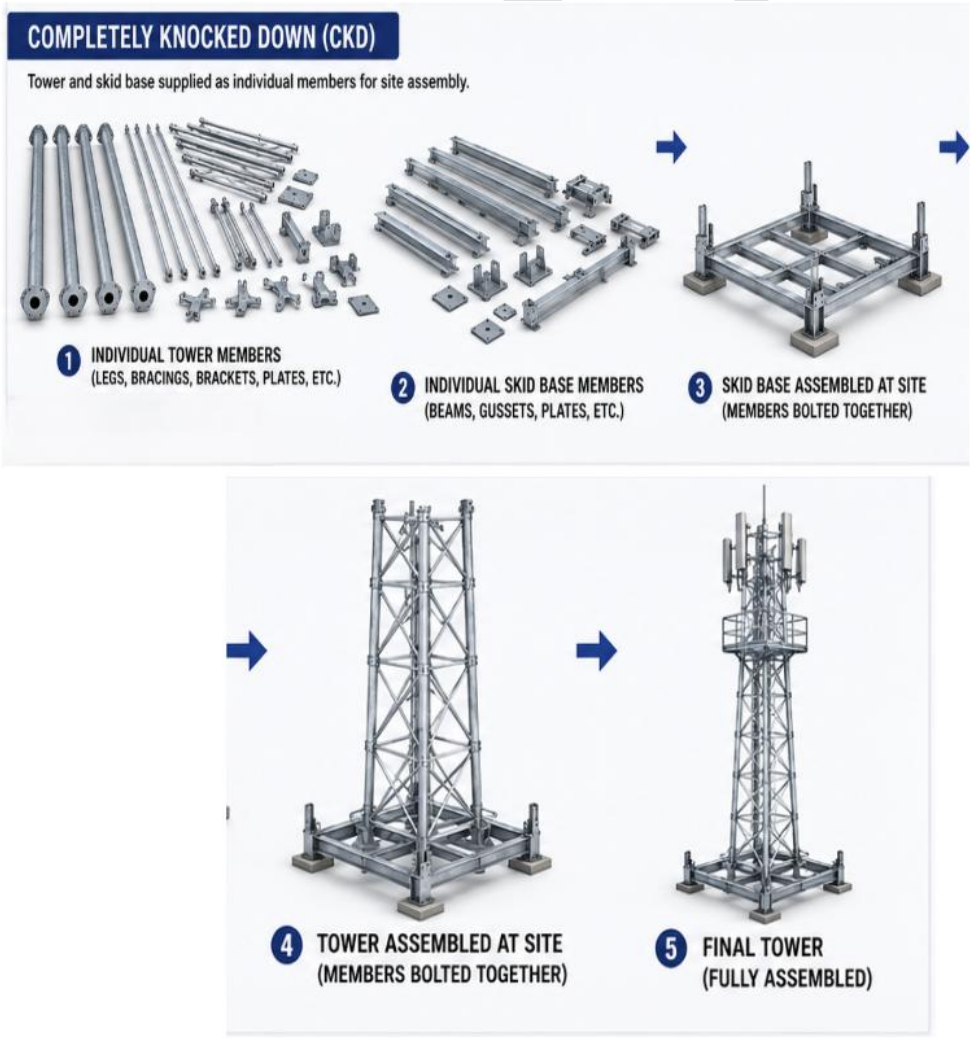
ANNEXURE -I

(This Annexure does not form an integral part of this document and is for information purpose)



(*Indicative Graphics—for representative purposes only, not to scale, not accurate in its form and design.)

Figure 1: Assembly parts and structure of Skid-Based, Completely Knocked Down (Rigid Structure) Lattice Type Mast or Tower (SBMT-L-CKD 40m)

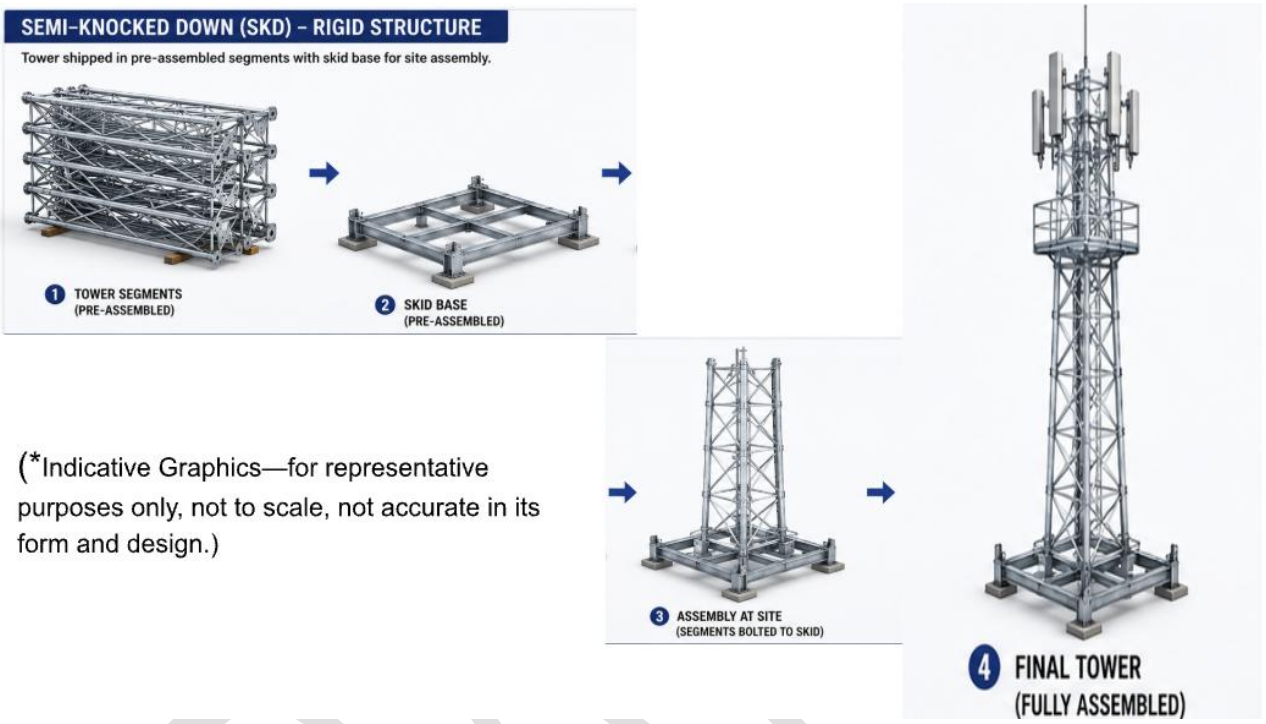


Figure 2: Assembly parts and structure of
Skid-Based, Semi- Knocked Down (Rigid Structure) Lattice type Mast or Tower
(SBMT-L-SKD 40m)

*Indicative Images—for representative purposes only.

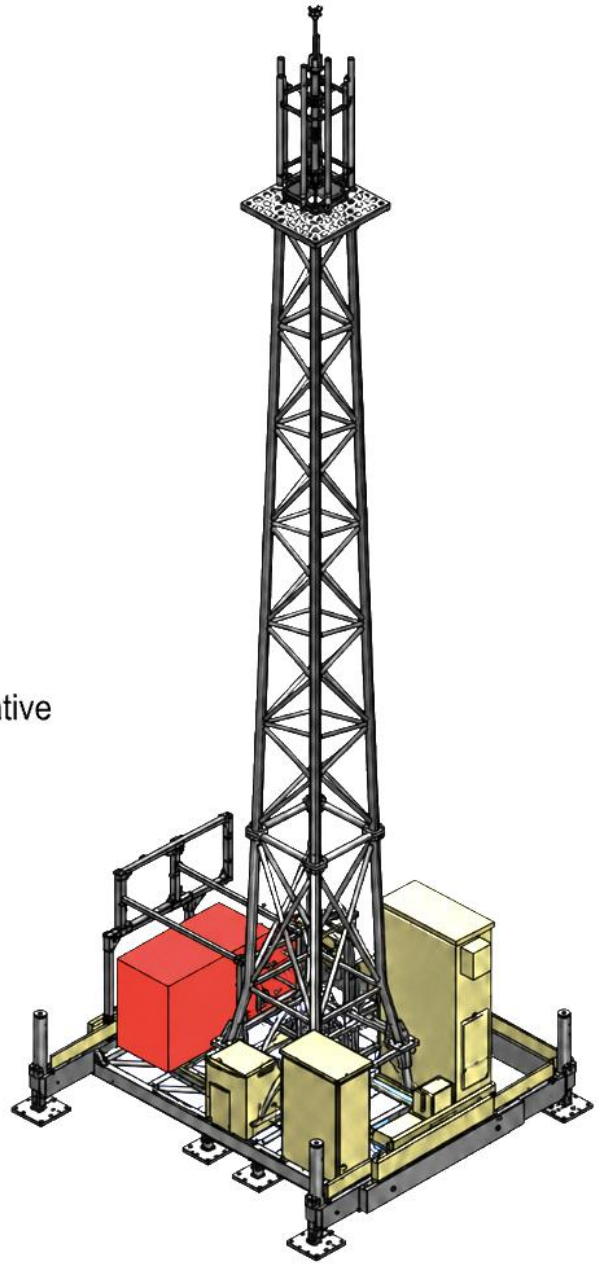
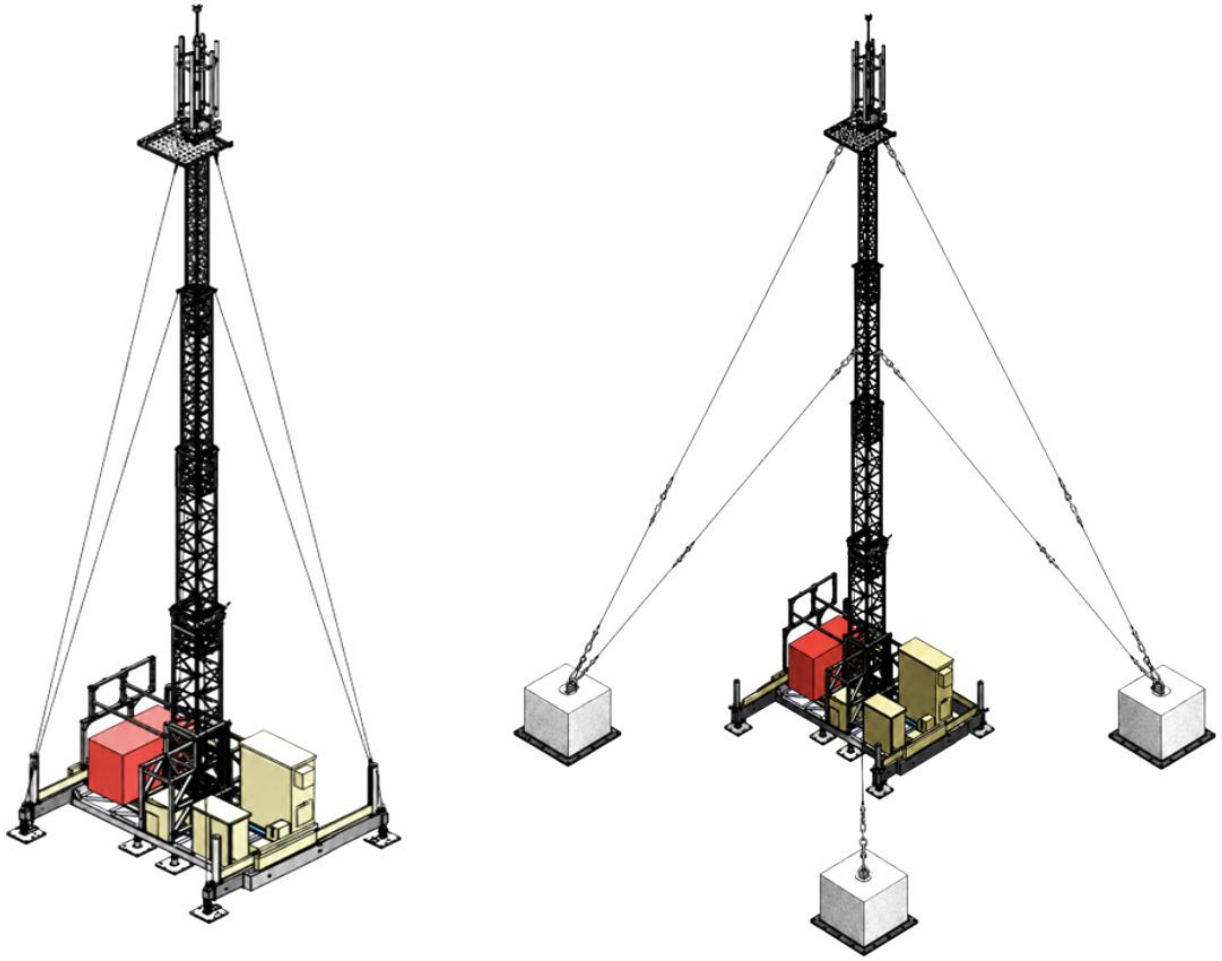


Figure 3: Assembly parts and structure of Skid-Based, Self-Supported Type Tower (SB-SST- 40m)



Note: The graphical figures are indicative only.
They are not to scale or engineered to be adopted
as it is.

Figure 4 : Assembly parts and structure of Skid-Based, Guy-rope Supported Mast (SB-GSM-40m)