7DSM PROJECTS SDN BHD

Since 2013

3 Lintang Kurau 5
Taman Chai Leng
13600 Perai , Pulau Pinang ,
Malaysia
Tel : 604-3998577 / 016 4455789
Contact Person : Ms Khim

OUR SERVICES

TELECOMMUNICATION WORKS

Tower Preventative Maintenance
Tower Strengthening Using CFRP
CFRP Monopole Supply

FOUNDATION ENGINEERING

Piling Works
Underpinning Works
Soil settlement

PROJECT MANAGEMENT & DESIGN & BUILT

Factory Buildings
Heritage Conservation Works

STRUCTURAL REPAIR WORKS

Crack repair
Grouting
Soil Nailing
Protective Coating
Waterproofing

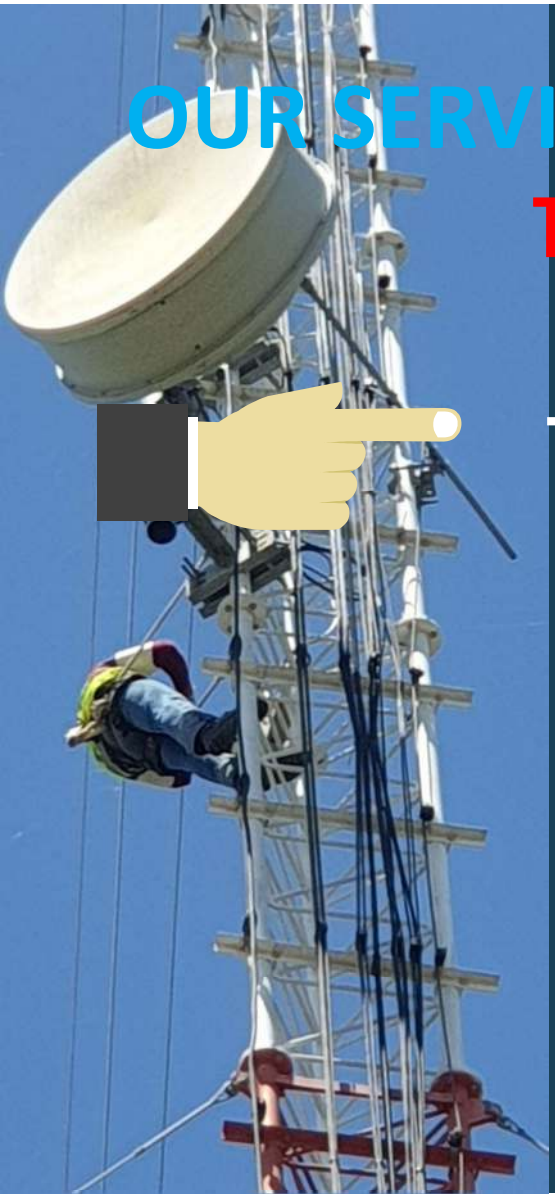
CONSTRUCTION & REFURBISHMENT

All type of developments
industrial & residential

OUR SERVICES

TELECOMMUNICATION WORKS

- Tower Preventative Maintenance
- Foundation Mapping
- Tower Strengthening Using CFRP
- Carbon Fibre Composites Monopoles Supply
- Smart Pole Supply



OUR SERVICES

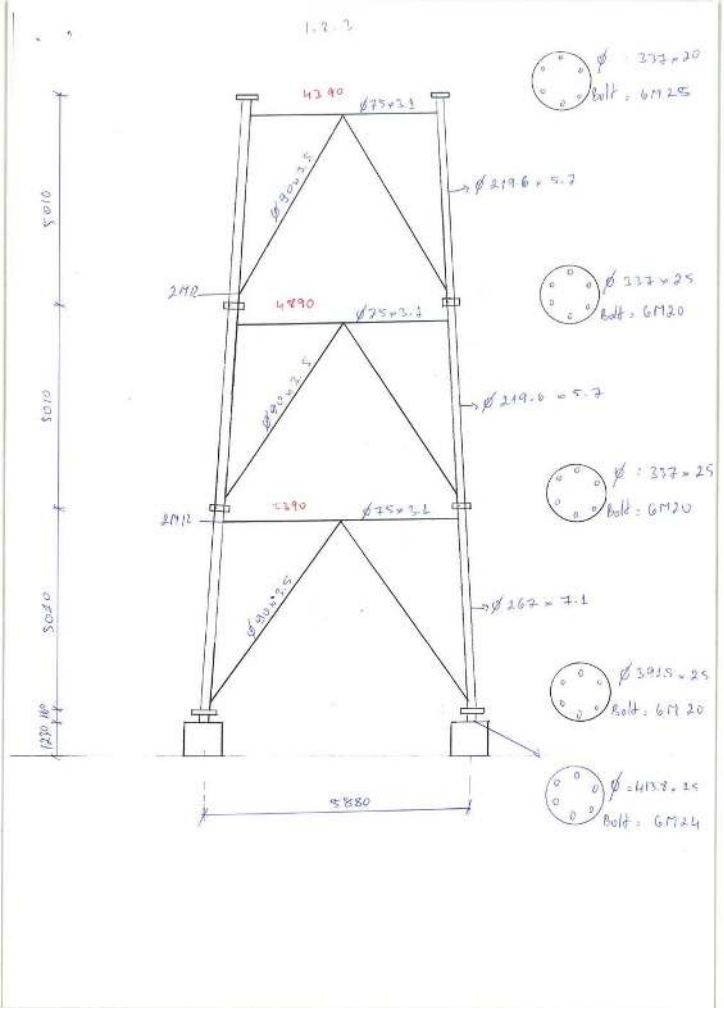
TELECOMMUNICATION WORKS

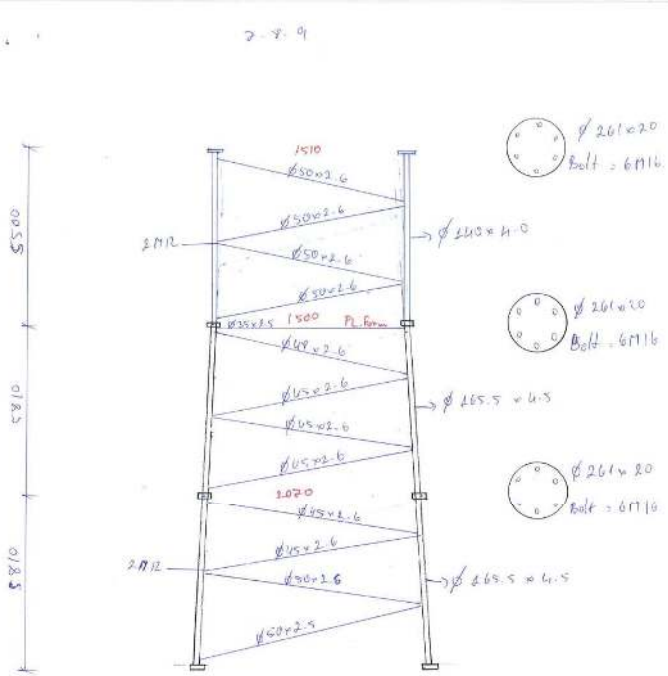
- Tower Preventative Maintenance

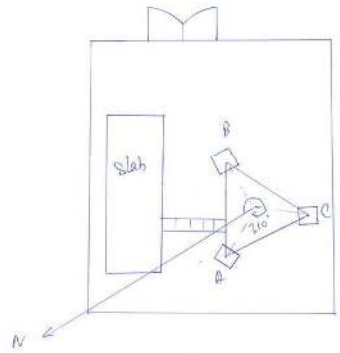
TOWER PREVENTATIVE MAINTENANCE

a. To clear vegetation and be able to access within the compound
b. Standard data sheet for checklist to record tower details
c. Theodolite to check verticality for guyed mast
d. Guy wire tension check. Loose guy wires will be tightened with additional cost.
e. Torque testing & if 10% bolts fails torque test, require to do 100%.
f. Aircraft warning light inspection only – no testing on functionality
g. Lighting protection system inspection only – no testing on functionality

TOWER PREVENTATIVE MAINTENANCE





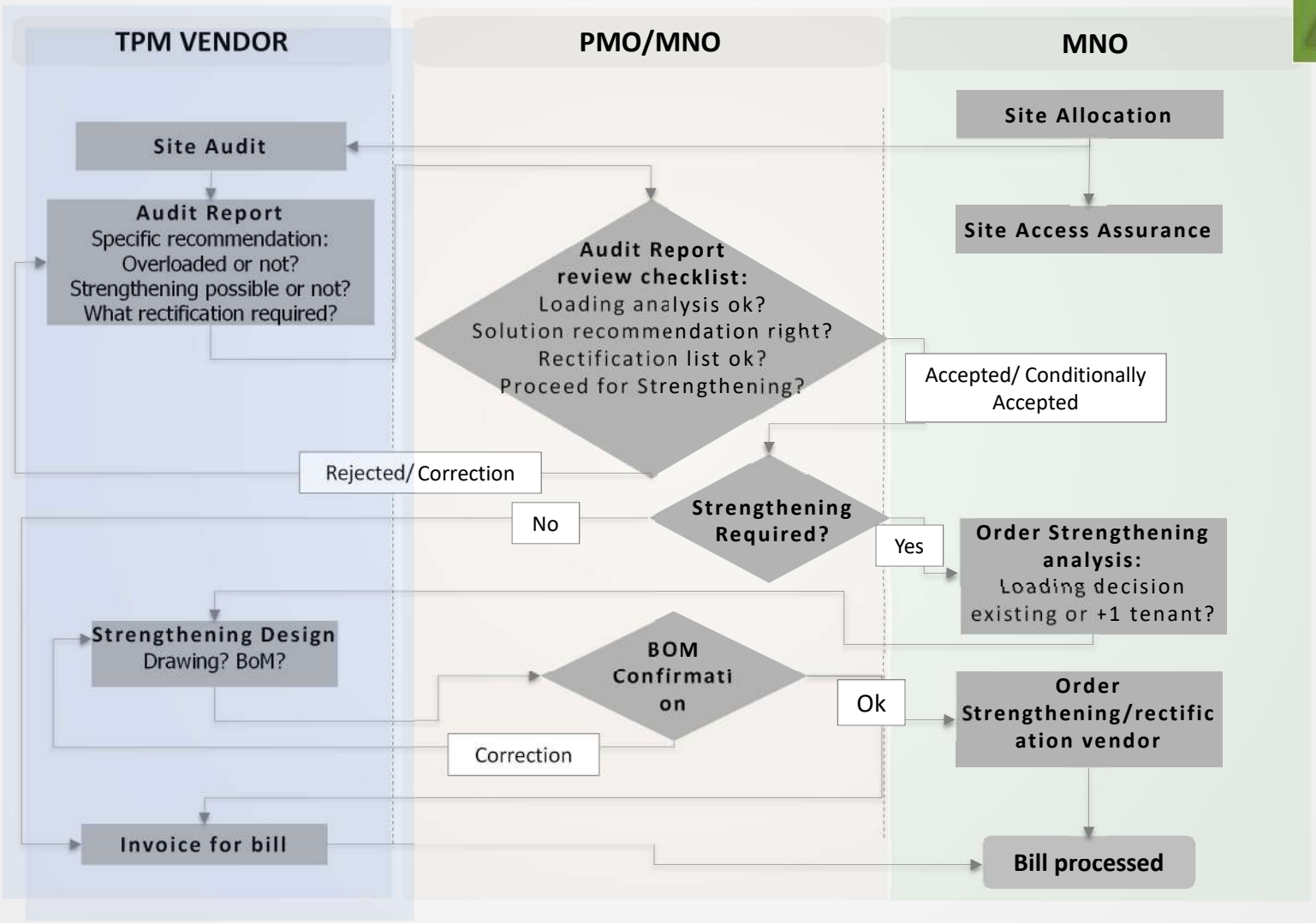


TOWER PREVENTATIVE MAINTENANCE

Bolt Torque Check

BOLT SIZE	TORQUE/ BOLTS GRADE (N.m) 5.6	6.8	8.8	SAMPLE 1 N.m	SAMPLE 2 N.m	REMARKS
M12	35-40	70-75	85-90			
M14	60-65	110-115	140-145			
M16	90-95	175-180	205-215			
M20	175-180	375-380	425-435			
M24	300-310	590-595	720-730			
M30	615-620	1200-1205	1410-1420			

TPM Audit & Reporting Process



TOWER PREVENTATIVE MAINTENANCE

Reporting will be carried out based on risk assessment which formed using matrix of

a. Tower Loading
b. Tower Condition
c. Business Risk

	RAG Reporting to be used in TPM Reporting			
	RAG Reporting	Significance	Observations from Audit reporting	Recommended Rectification Timeline
	Red Urgent	Critical	Any other findings which refers tower at high risk and it could collapse at anytime. Such as: Strengthening or replacement required for Tower Leg, Guy Wire etc.	Immediately
	Red	Major	Any findings which refers tower at high risk and the stability & safety in danger. Such as: Strengthening or replacement required for Tower member, bracing, guy wire shackle & other guy wire accessories. Severe corrosion for leg/guy wire & it's accessories. Major crack found in tower foundation/guy anchor. Major verticality error & tower twist found etc.	Urgently within 3 months from notification
	Amber	Minor	Any findings which refers tower at risk and if not rectified soon tower might become risky. Such as: Strengthening or replacement required for tower bolt, missing bolt, cranked/twisted member, improper hole, member tempered, severely corroded bolts/member. Over grown trees/vegetation to guy wire, mark founds for guy wire & anchor goes under water, minor twist & verticality error found for tower etc.	Within 3 to 6 months period
	Green	None	Any findings which refers tower not in risk and if not rectified in gradually tower health will deteriorate in long run. Such as: Mild corrosion, minor rectification for tower health improvement, painting required.	Within 6 to 12 months period

TPM SITE AUDIT REPORTS

Contents

Country	Cambodia	Region	Ratanakiri
Site Classification	Structure	Site Type	Guyed Mast
Number of Legs	3	Type of Legs	Tubular [CHS]
Base Width	0.89 m	Top Width	0.89 m
No. of Stay Wire Levels	5	No. of Stay Wires per Level	3 or 6
Height	85.0 m	No. of Stay Blocks	3
Base Elevation (above the ground)	0.50 m	Holding Down bolts (Stay blocks)	6 M32
Latitude	13.49053 °	Longitude	106.97903°

3. Design Criteria

Design Code	TIA-222-G	Country	Cambodia
Structure Class	2	A.M.S.L	105 m
Exposure Category	C	Steel Grade [Leg]	235
Topographic Category	1	Steel Grade [Brace]	235
Design Wind Speed	45 m/s	Bolt Grade	8.8

4. Capacity and Condition Statement

	STATUS	Legs	Brace	Wires	Bolts	Max EPA
Guyed Mast Capacity with Existing Loading	RED URGENT	201%	273%	174%	95%	24.20m²
Maximum Loading		n/a	n/a	n/a	n/a	n/a
		Guyed mast overstressed with Existing loading				
Guyed Mast Capacity with Existing Loading at Operational Wind Speed	RED	95%	129%	84%	44%	24.20m²
The Condition of the Structure	RED	Multiple issues observed. Please refer to the section 12 for further clarification.				

6. Equipment and Ancillary Loadings

Existing Equipment table — Site Audit Date: 05/09/2017

Equipment Type	No.	Dimensions [m] L	W	D	dia	FPA [m²]	EPA [m²]	Weight [kg]	Leg	Angle (deg)	Height * (m)
Panel Antenna	1	2.6	0.26	0.09		0.67	1.33	20	A	60	82.50
Panel Antenna	3	2.6	0.26	0.09		2.00	3.99	60	A/B/C	0/180/300	82.50
Panel Antenna	3	1.4	0.17	0.08		0.70	1.40	21	A/B/C	0/180/260	53.80
MW Dish A07S18HD	1				1.80	2.54	3.21	127	B	210	77.00
MW Dish	1				2.40	4.52	5.70	172	B	210	74.00
MW Dish A07S18HAC	1				1.80	2.54	3.21	98	A	20	72.50
MW Dish A07S18HAC	1				1.80	2.54	3.21	98	A	20	65.00
RRU	3	0.4	0.30	0.20		0.36	0.72	63	A/B/C	0/180/300	82.20
RRU	3	0.4	0.30	0.20		0.36	0.72	63	A/B/C	0/180/300	81.50
RRU	3	0.4	0.30	0.20		0.36	0.72	63	A/B/C	0/180/260	52.50
					Total	**16.60**	**24.20**	**785.0**			

** Heights of equipment are measured to the base of the antenna's and the mid-point of the dishes**
** Additional equipment marked as **bold** text*

Note: *Feeders: 2no. 7/8" dia. per Panel Antenna (up to 76m), 2no. 1 5/8" dia. per Panel Antenna (above 76m), 1no. 1/4"mm dia. per MW Dish and other antennas.*
FPA – Flat Panel Area calculated as L x W for panels; π x D²/4 for Dishes.
EPA – FPA x Cd. Cd = 2.0 for Panels; Cd = 1.26 for Dishes

TPM SITE AUDIT REPORTS

5. Table of Member Sizes, Bolts and Grades

Legs, Bracing & Horizontals

Sections are from No. 1 at the bottom of the structure upwards [refer to diagram]:

Section	Leg Type / Size	Leg Bolts	Bracing Type / Size	Bracing Bolts	Horizontal Type / Size	Horizont Bolts
1	CHS76.1x4.5	n/a	ROD19.0	n/a	ROD19.0/ FLAT150x15	n/a
2	CHS76.1x4.5	4 M12	ROD19.0	n/a	ROD19.0	n/a
3	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
4	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
5	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
6	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
7	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
8	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
9	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
10	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
11	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
12	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
13	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
14	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
15	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
16	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
17	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
18	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
19	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
20	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
21	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
22	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
23	CHS76.1x4.0	4 M12	ROD19.0	n/a	ROD19.0	n/a
24	CHS60.3x4.5	4 M12	ROD19.0	n/a	ROD19.0	n/a
25	CHS60.3x4.5	4 M12	ROD19.0	n/a	ROD19.0	n/a
26	CHS60.3x4.5	4 M12	ROD19.0	n/a	ROD19.0	n/a
27	CHS60.3x4.5	4 M12	ROD19.0	n/a	ROD19.0	n/a
28	CHS60.3x4.5	4 M12	ROD19.0	n/a	ROD19.0	n/a
29	CHS60.3x4.5	4 M12	ROD19.0	n/a	ROD19.0	n/a

(DS) – denotes double shear bolts
(*) – denotes double EAs not adequately connected
Steel grade for all EA120x120 members and greater assumed as grade 325, all others assumed as grade 235
Bolt grade of bolts as per section 3 unless stated otherwise in the table above

Plan Bracing and Anti-Twist Frames

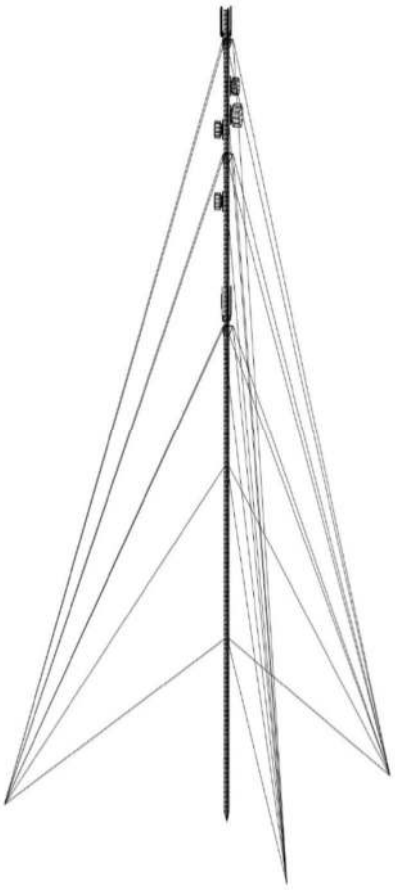
Section	Plan Bracing Type / Size	Plan Bracing Bolts	Frame (Diagonal) Type / Size	Frame (Diagonal) Bolts	Frame (Horizontal) Type / Size	Frame (Horizontal) Bolts
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18			EA65x65x10	2 M16	PFC125x65x15	2 M16
19						
20						
21						
22						
23						
24			EA65x65x10	2 M16	PFC125x65x15	2 M16
25						
26						
27						
28			EA65x65x10	2 M16	PFC125x65x15	2 M16
29						

Guy Wires

Level	Height [m]	Wire Type
1	19	3 no. 8mm
2	37	3 no. 8mm
3	52	6 no. 8mm
4	70	6 no. 8mm
5	82	6 no. 13mm

(DS) – denotes double shear bolts
(*) – denotes double EAs not adequately connected
Steel grade for all EA120x120 members and greater assumed as grade 325, all others assumed as grade 235
Bolt grade of bolts as per section 3 unless stated otherwise in the table above

8. Equipment Loading Diagram – Existing LOADING



TPM SITE AUDIT REPORTS

9. Summary of Analysis – Existing LOADING

Overall Member Capacities	Stress %	Status
Maximum Leg Stress Ratio	201%	FAIL
Maximum Bracing Stress Ratio	273%	FAIL
Maximum Guy Wire Stress Ratio	174%	FAIL

Overall Bolt Capacities		
Maximum Leg Bolt Stress Ratio	95%	PASS
Maximum Bracing Bolt Stress Ratio	86%	PASS

Section	Leg	Leg Bolts	Bracing	Bracing Bolts	Horizontal	Horizontal Bolts
1	115%	0%	79%		29%	
2	104%	0%	80%		17%	
3	118%	0%	80%		17%	
4	124%	0%	89%		20%	
5	139%	0%	100%		22%	
6	158%	0%	108%		23%	
7	180%	0%	115%		29%	
8	181%	0%	92%		18%	
9	175%	0%	84%		16%	
10	170%	0%	74%		15%	
11	170%	0%	80%		18%	
12	174%	0%	98%		22%	
13	181%	0%	113%		35%	
14	179%	0%	143%		29%	
15	146%	0%	131%		25%	
16	119%	0%	115%		22%	
17	107%	0%	98%		19%	
18	107%	0%	94%	45%	65%	
19	96%	0%	273%		94%	
20	121%	29%	223%		77%	
21	152%	65%	196%		61%	
22	174%	87%	164%		46%	
23	179%	92%	129%		25%	
24	201%	87%	121%	64%	39%	
25	169%	94%	194%		50%	
26	171%	95%	135%		46%	
27	150%	72%	179%		122%	
28	112%	22%	185%	86%	90%	
29	19%	14%	111%		1%	

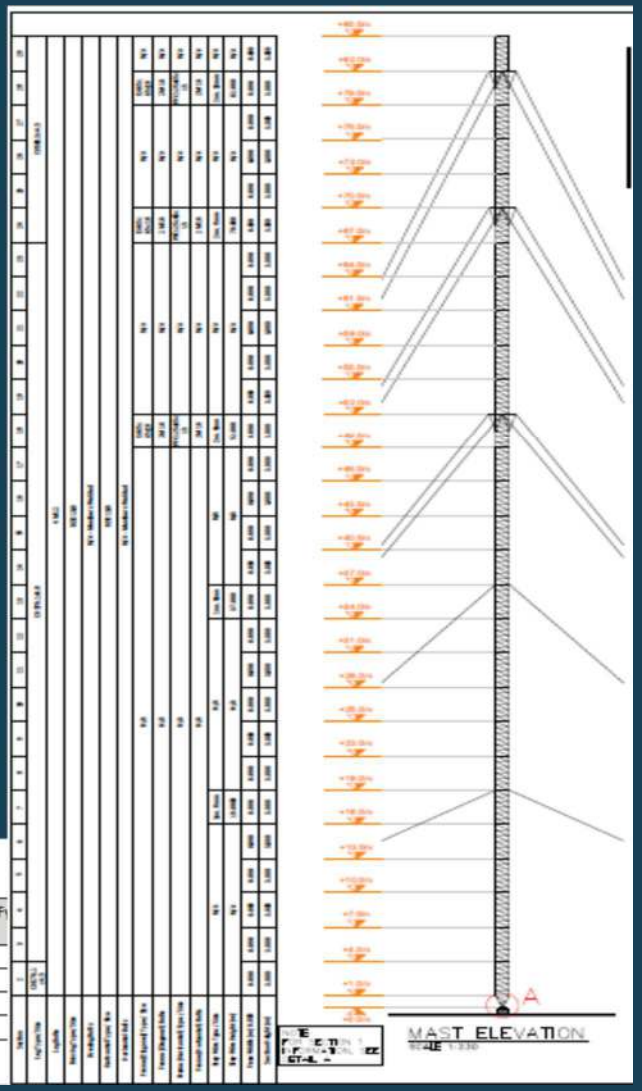
Guy Wire Capacities

Stay Level	Stress Ratio
1	105%
2	140%
3	174%
4	162%
5	113%

10. Reaction Summary – Existing LOADING

Maximum Reactions

Location	Down Force Fz [kN]	Uplift Force Fz [kN]	Shear Force Fx/Fy [kN]
Mast foundation	440.9	n/a	4.6
1st Stay Block	n/a	200.3	129.2
2nd Stay Block	n/a	199.5	129.3
3rd Stay Block	n/a	196.0	126.9



OUR SERVICES

TELECOMMUNICATION WORKS

Foundation Mapping

FOUNDATION MAPPING

TPM analysis report showed some tower as highly overstressed in leg members with their actual loading condition.

Enviromental issues- flooding

Design issues – tower foundation designed to wrong Exposure & Windspeed

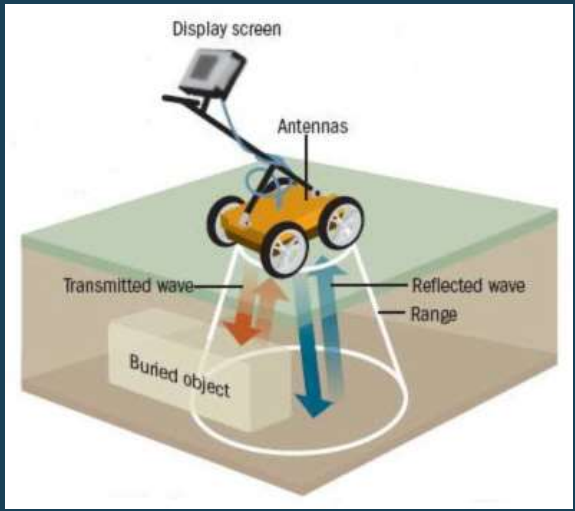
Commercial issues - Additional EPA required on some towers→ Increase in tower weight and resultant forces at times

Hence, existing foundation capacity needs to be checked

Steps of Foundation Audit

1. Reviewing the Existing Conditions

- Original Tower Foundation Design
- Original Soil Investigation Report



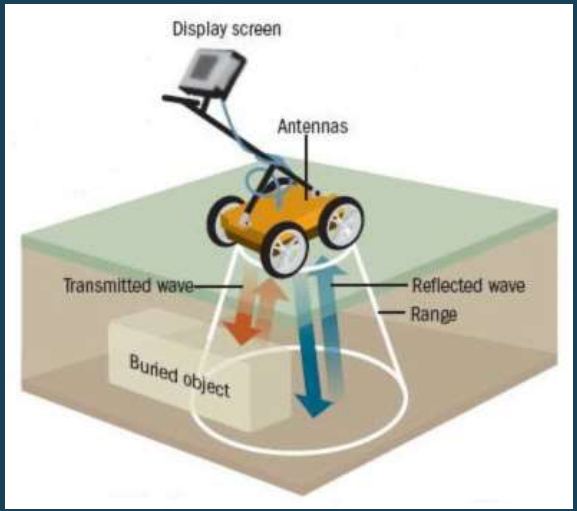
2. Obtaining Information from the Site

- Check existing foundation – use Ground Penetrating Radar/ to carry out excavation if possible.
- Foundation System Used - Isolated / Raft / Pile
- Evidence of Settlement Cracks or visible Distress
- Instrusive & Non-Destructive Tests
  - Schmidt Rebound Hammer (Concrete Strength)
  - Ultrasonic Pulse Velocity Test (Concrete Quality
  - Core Tests (Concrete quality and Strength)
  - Rebar Scanner (rebar quantity)
  - Pile integrity test (for pile length)

Steps of Foundation Audit

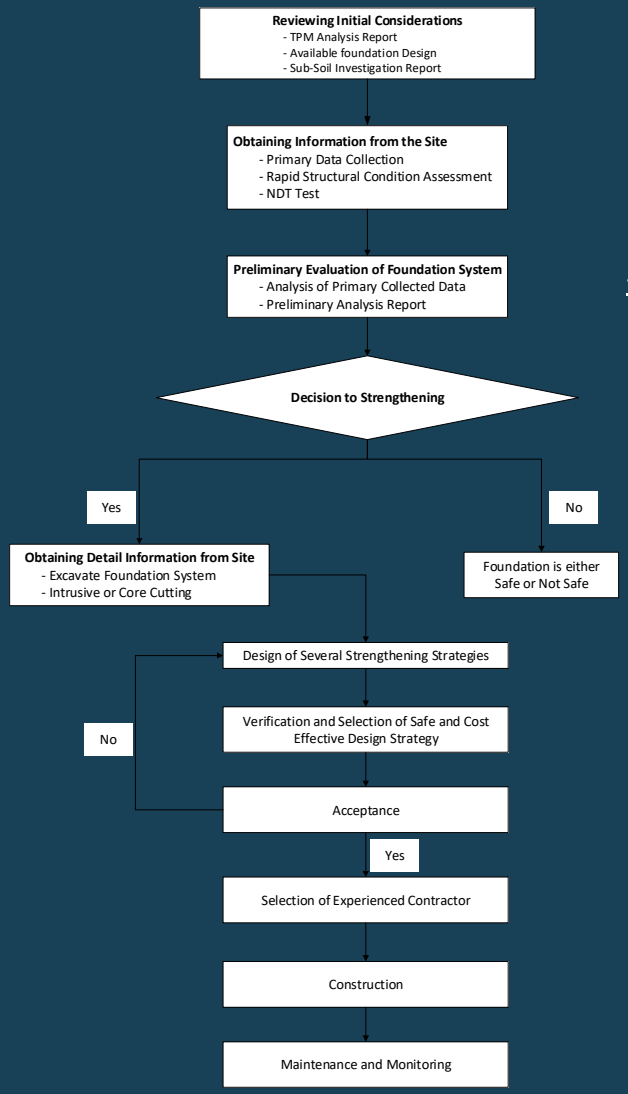
3. Assessment based on findings from site

- Initial Calculations
- Identification of potential weakness of foundation (if any)
- Preliminary Analysis Report will contain the analysis and recommendation of consultant about Strengthening.



4. Strengthening Methodology

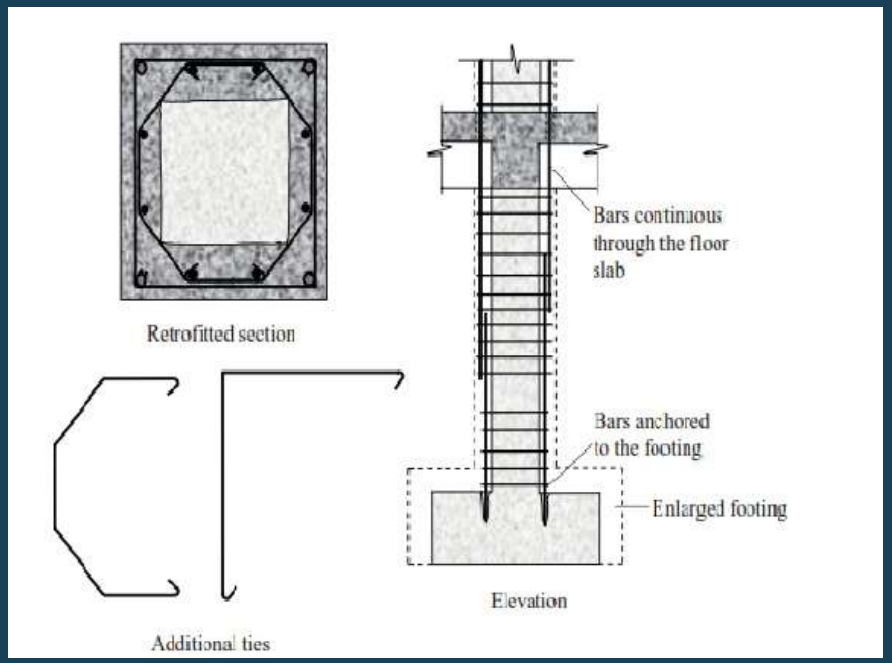
- Underpinning
- Foundation enlargement
- Concrete column jacketing
- Carbon fibre wrap



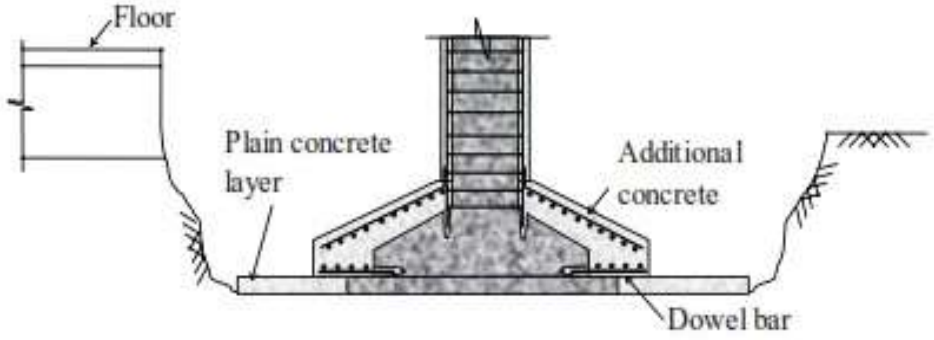
STAGE 1 : MAPPING WORKS

STAGE 2 : STRENGTHENING WORKS

CONCRETE COLUMN JACKETING



ENLARGING EXISTING FOUNDATION



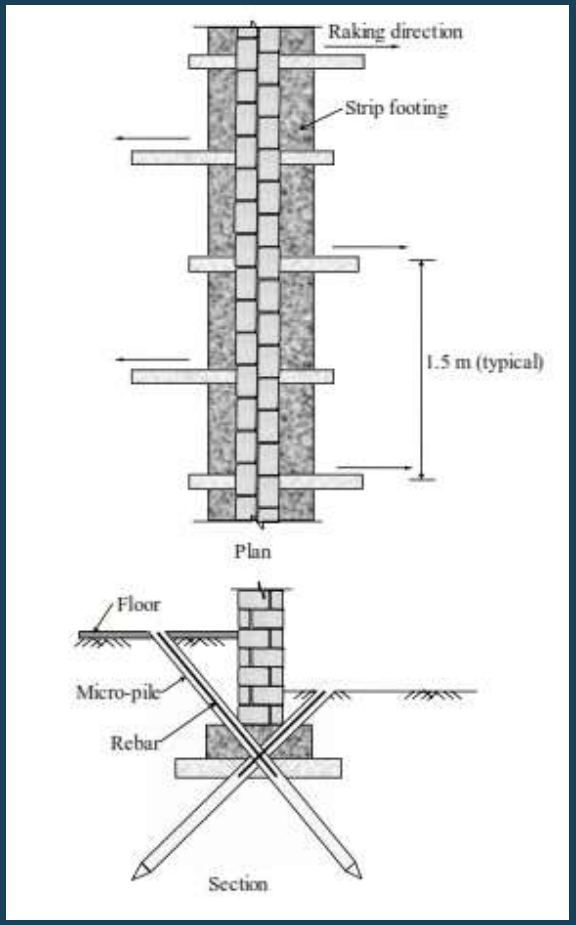
Excavating around the footing.

hardening the surface and installing the dowels.

Photo 15. Installing the main steel.

Photo 16. Completing the jacket.

UNDERPINNING FOUNDATION



CARBON FIBRE REINFORCED POLYMER

OUR SERVICES

TELECOMMUNICATION WORKS

- STRENGTHENING WORKS USING CARBON FIBRE REINFORCED POLYMER

PIONEER IN WORLD TO USE CFRP FOR STRENGTHENING WORKS

PIONEER IN WORLD TO USE CFRP FOR STRENGTHENING WORKS

OUR SERVICES

TELECOMMUNICATION WORKS

- CARBON FIBRE COMPOSITES MONOPOLE SUPPLY

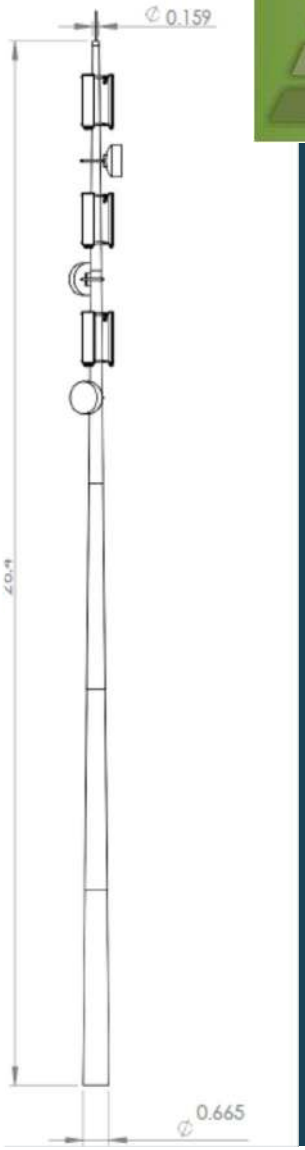
a. Lower Installation Cost (20 – 30 % difference)
b. Less Weight Compared to Steel (80% lighter compared to equivalent)
c. Less Environmental Effect (recyclable materials)
d. Non Corrosive

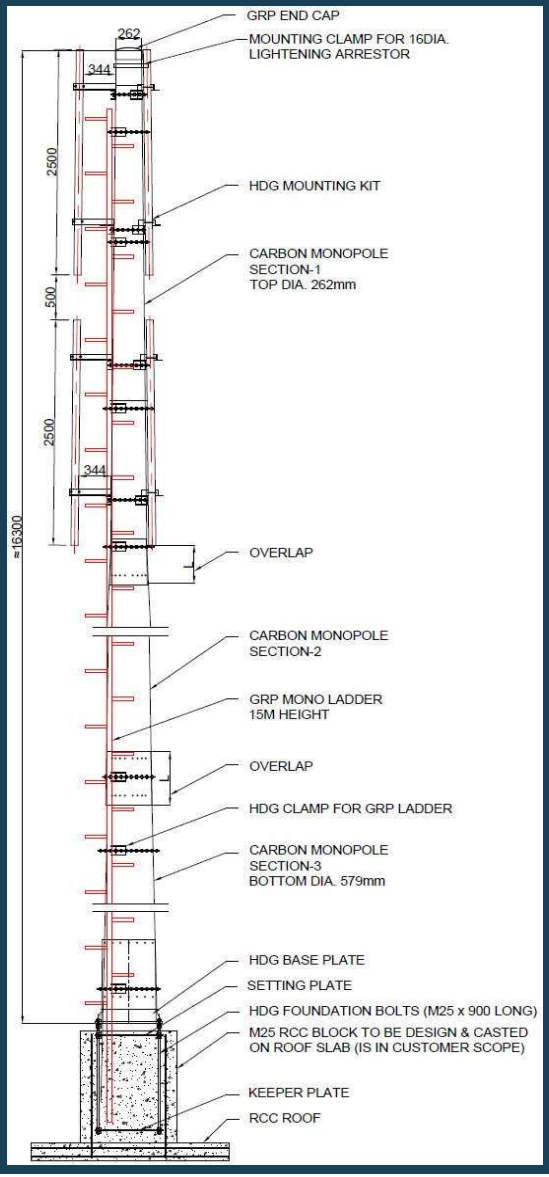
MODULAR SECTION

Variable height between 9m to 30m (depending on MNO)

Windspeed designed to 50 m/s

EPA 10-20 sq.m (depends on MNO)




GRP END CAP
262
MOUNTING CLAMP FOR 16DIA.
LIGHTENING ARRESTOR
344
2500
HDG MOUNTING KIT
CARBON MONOPOLE
SECTION-1
TOP DIA. 262mm
500
2500
344
≈16300
OVERLAP
CARBON MONOPOLE
SECTION-2
GRP MONO LADDER
15M HEIGHT
OVERLAP
HDG CLAMP FOR GRP LADDER
CARBON MONOPOLE
SECTION-3
BOTTOM DIA. 579mm
HDG BASE PLATE
SETTING PLATE
HDG FOUNDATION BOLTS (M25 x 900 LONG)
M25 RCC BLOCK TO BE DESIGN & CASTED
ON ROOF SLAB (IS IN CUSTOMER SCOPE)
KEEPER PLATE
RCC ROOF


FIRST


25.06.2014 11

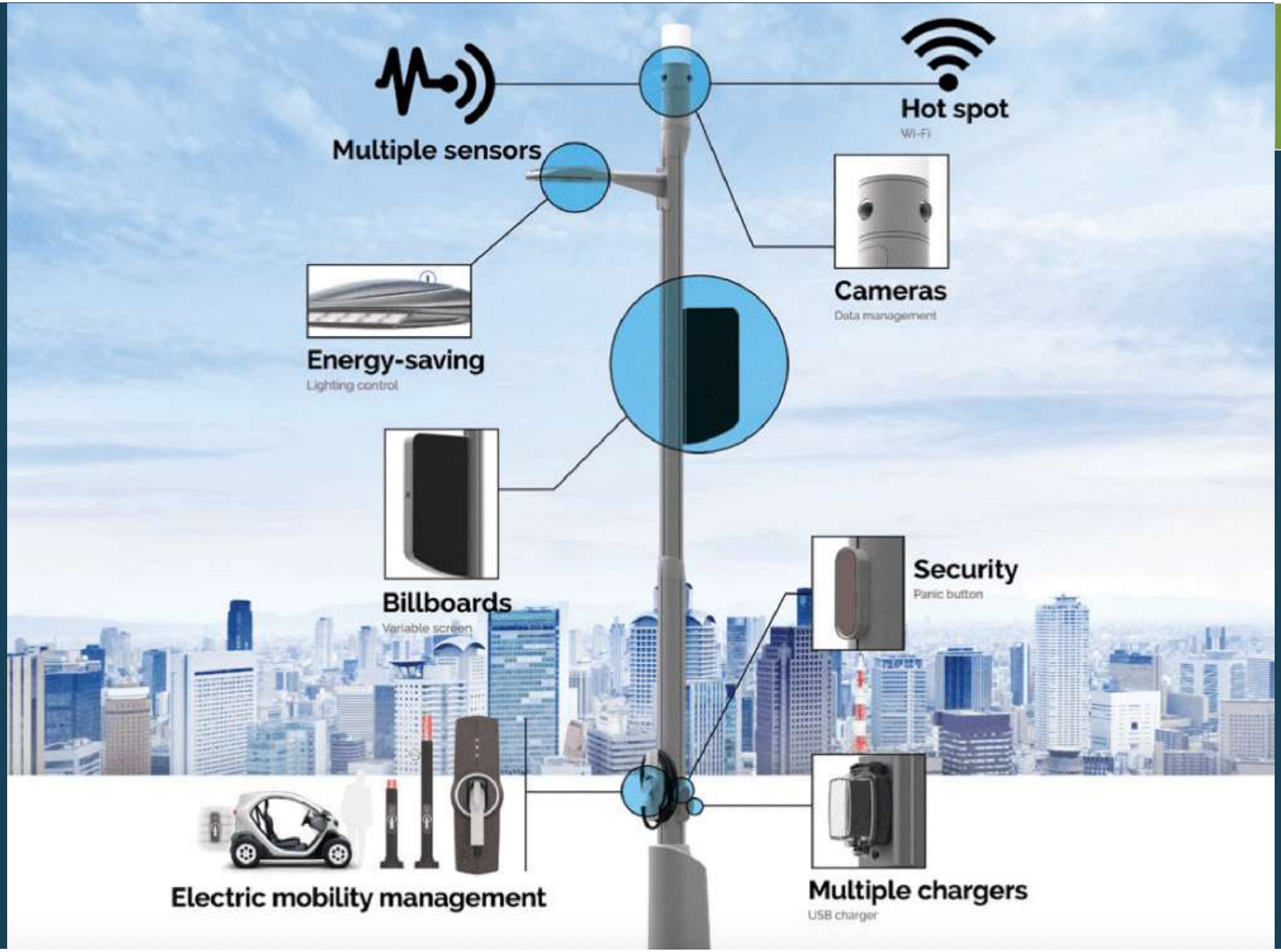
OUR SERVICES

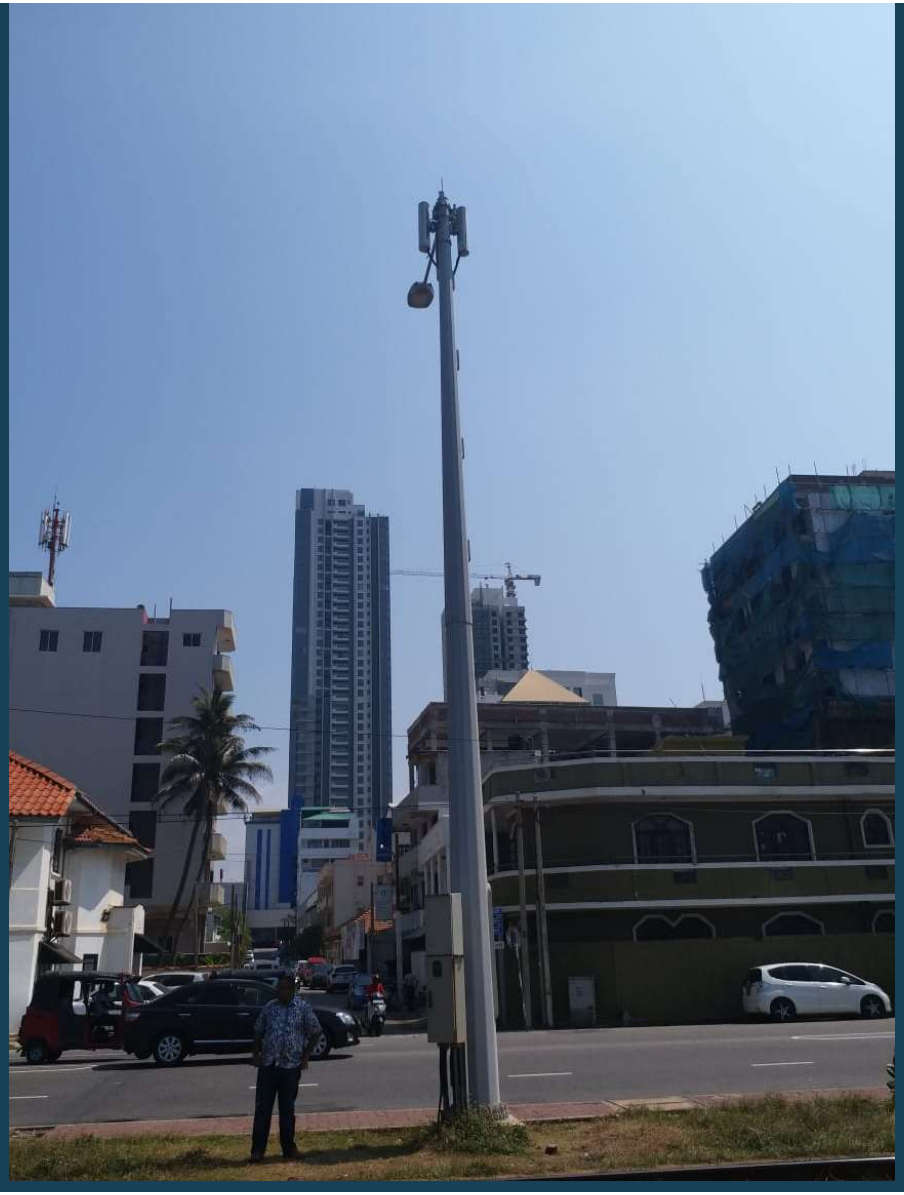
TELECOMMUNICATION WORKS

- SMART POLE SUPPLY

20m SINGLE ARM SMART POLE

a. FOR SMART CITY USAGE
b. Designed based on TIA -222G
c. 3sec Gust windspeed 120km/hr – Topography Cat 1 ; Terrain Cat 3
d. 2.5 sq.m spread within top 5m for Class 02
e. 5.0 sq.m EPA for 6.0m level for Advertisement Panel
f. Cabling and Light arm (by others)


Multiple sensors
Hot spot
Wi-Fi
Cameras
Data management
Energy-saving
Lighting control
Billboards
Variable screen
Security
Panic button
Electric mobility management
Multiple chargers
USB charger



CONSTRUCTION WORKS







THANK
YOU