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APPENDIX I: Sample Result Steps for Sag Tension Calculation

S	Sag (m)	7.809
H₂	Final Tension (N/mm ²)	47.73
UTS	Tensile Strength (kN)	131.9
m_c	Unit mass of the conductor (kg/m)	1.632
A	Cross section Area (mm ²)	484.5
E	Modulus of Elasticity (N/mm ²)	69000
α	Linear Coefficient (C ⁻¹)	0.0000193
P	Wind pressure on conductor (N/m ²)	970
d	Diameter of the conductor (mm)	28.62
H₁	Initial Tension (N/mm ²)	109.23
g	Gravitational Constant (m/s ²)	9.80665
S	Ruling Span Length (m)	300
t₁	Initial Temperature (°C)	7
t₂	Final Temperature (°C)	75
h	Level Difference (m)	0



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APPENDIX II: Sample Calculation for CCC

Heat Balance Equation; $P_j + P_{sol} = P_{rad} + P_{conv}$

- P_j = heat generated by joule effect
 P_{sol} = solar heat gain by conductor surface
 P_{rad} = heat loss by radiation
 P_{conv} = convection heat loss

Solar Heat Gain; $P_{sol} = \gamma D S_i$

 $P_{sol} = 14.31W/m$

- γ = Solar radiation absorption coefficient (0.5)
 D = Conductor Diameter (0.02862m)
 S_i = intensity of solar radiation (1000W/m²)

Radiated Heat Loss; $P_{rad} = S\pi D K_e (T_2^4 - T_1^4)$

- S = Stefan-Boltzmann constant (5.67 x 10⁻⁸ W/m²k⁴)
 D = conductor diameter (0.02862m)
 K_e = emissivity coefficient (0.5)
 T_2 = final equilibrium temperature (75°C)
 T_1 = ambient temperature (32°C)

Reynolds Number; $R_e = 1.644 * 10^9 vD [T_1 - 0.5(T_2 - T_1)]^{-1.78}$

 $R_e = 788.55$

- R_e = Reynolds number
 v = wind speed (0.5 m/s)
 D = conductor diameter (0.02862m)

Nusselt Number; $N_u = 0.65 R_e^{0.2} + 0.023 R_e^{0.61}$

 $N_u = 15.920$

Conventional Heat Loss; $P_{\text{conv}} = \lambda N_u (T_2 - T_1) \pi$

$$P_{\text{conv}} = 55.5927$$

λ = Thermal Conductivity of Air (0.02585W/m.k)

Joule Effect; $P_j = R_t I^2$

R_t = Resistance at t °C ($R_{25}=0.06841$, $R_{75}=0.06841$)

$$I = \left(\frac{P_{\text{rad}} + P_{\text{conv}} - P_{\text{sol}}}{R_t} \right)^{0.5}$$


$$I = 833A$$



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APPENDIX III: Energy Loss Calculation

Conductor	ACSR		ACCC
	ZEBRA		DUBLIN
Diameter (mm)	28.62		28.143
AC Resistance at 25°C (ohms/km)	0.06841		0.05534
AC Resistance at 75°C (ohms/km)	0.08149		0.06596
Ultimate Tensile Strength (kN)	132.3		183.3
Unit Mass of Conductor (kg/m)	1.621		1.5832
Cross Sectional Area (mm ²)	429.1		524.5
Modulus of Elasticity (N/mm ²)	69000		78000
Linear Coefficient (°C ⁻¹)	0.0000193		0.0000186
Conductors per phase:			
	1		1
Circuits:			
	2		2
@75	833.0	@68.27	833.0
@75	833	@180	1712
@100	1070	@200	1813
S-S Temp. (°C) at Peak Ampacity of ACSR Zebra:	75.00		68.27
Resistance at Peak Operating Amps (ohm/km)	0.08148		0.06453

	Environmental Factors
1000	Sun Radiation (W/m ²)
0.5	Wind Speed (ms ⁻¹)
0.5	Solar Radiation Absorption Coefficient
0.5	Emissivity coefficient
32	Ambient Temperature (°C)
0.02585	Air thermal Conductivity (Wm ⁻¹ K ⁻¹)
5.67E-08	Stefan- Boltzmann Constant (Wm ⁻² K ⁻⁴)

Load and Generation Cost (Source; Statistics Digest2014,CEB)	
1	Line Length (km)
132	Voltage (kV)
833	Peak Operating Amps (A)
57.3%	Load Factor
37.7%	Loss Factor
190	Peak Power per Circuit (MW)
3	Phases/Circuit
19.97	Cost of Energy Generation (LKR/kWh)
0.8	CO ₂ (kg/kWh)
0	Carbon Credit (LKR/MT)

First Year Line Loss

$$= \text{Phase current}^2 * \text{Unit Resistance} * \text{Line Length} \\ * \text{no. of conductors} * \text{Line Loss Factor} * 8760$$

$$\text{Load Factor} = \frac{\text{Average Demand}}{\text{Maximum Demand}}$$

$$\text{Loss Factor} = 0.2 * \text{Load Factor} + .8 * \text{Load Factor}^2$$

For ACSR Zebra Conductor;

Load Factor = 57.3%; from CEB Sources

Loss Factor = 37.7%

$$\text{First Year Line Loss} = 833^2 * .08148 * 1 * 6 * .377 * 8760$$

$$\text{First Year Line Loss} = 1121.09 \text{ MWh}$$

For ACCC Dublin Conductor;

$$\text{First Year Line Loss} = 833^2 * .06453 * 1 * 6 * .377 * 8760$$

$$\text{First Year Line Loss} = 887.87 \text{ MWh}$$

$$\text{Reduces First Year Line Losses by} = 1121.09 - 887.87$$

$$= 233.22 \text{ MWh}$$

$$\text{Reduces First Year Line Losses by (\%)} = 233.22/1121.09$$

$$= 20.80\%$$

$$\text{Saving} \left(\frac{\text{MLKR}}{\text{Year}} \right) = \text{Line Loss Saving} * \text{Cost of Energy Generation}$$

$$= 233.22 * 19.97$$

$$= 4.66$$

$$\text{Net Present Value} = \sum_{t=1}^n \frac{C}{(1+i)^n}$$

; i = discount rate(10%),

n = nos. of years (40)

$$= \sum_{t=1}^{40} \frac{4.66}{(1+.1)^n}$$

$$\text{Reduction in 40yrs Losses (MLKR)} = 45.54$$

APPENDIX IV: Sample Load Calculation for TDL Tower

TOWER: TDL

BASIC DATA

Deviation Angle = 0

Basic Span = 300 m

Wind/Weight Span

Condition	Wind Span (m)	Weight Span (m) Maximum	Weight Span (m) Maximum
Normal Condition	360	600	150
Broken wire Condition	270	450	112.5

Wind Load on Tower = $1640 \text{ N/m}^2 \times \text{Projected Area}$

Wind Load Wires = $970 \text{ N/m}^2 \times \text{Projected Area}$

Wind Load Insulator = $1170 \text{ N/m}^2 \times \text{Projected Area}$

sag-Tension Calculation” for mechanical properties and wire tension under different conditions for Conductor ACSR - Zebra (400mm²)/OPGW/GSW 7/3.25 (1000 Grade)

Information Relevant to Element Design

All dimensions are in mm and Loads are in N (Newton) wherever not specified.

Loading calculation for Conductor/ Earth wire / OPGW are done as per technical specification requirements.

Members indicated as MS are as per ISO 630 1995(E) Gr. E 275

With minimum Yield stress = 275 MPa (Thickness < 16mm)

265MPa (Thickness 16 to 40mm)

Member indicated as “HT” are as per ISO 630 1995(E) Gr. E 355

With minimum Yield stress = 355 MPa (Thickness < 16mm)

345MPa (Thickness 16 to 40mm)

Bolt & Nuts are as per ISO 898 - 1.1999 (E) Class 5.6

For design of bolts and nuts the following stresses are used.

$$\text{Ultimate shearing stress} = 0.25 \cdot F_{U1} = 0.62 \cdot 500 = 310 \text{ N/mm}^2$$

As per clauses 4.3.2 of ASCE 10-97

Tower Design Performed as per ASCE 10-97 using 3D models in “PLC Tower” version 12.0

Loads applied in PLS - TOWER software by multiplying with Factor of Safety as furnished in Specification.

Condition	Normal Condition	Broken Wire Condition
Factor of Safety	2.50	1.25

Enough safety margin maintained in Broken Wire Condition for Cross Arm members to achieve 2.00 factor of safety in main cross arm members (PKLM, TCLM, MC LM & BC LM)

For design of each member, maximum forces are derived from multiple analysis of tower with all loading conditions and all 3D models with various body extensions.



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Design Data

Earth Wire	7/3.25	Conductor ACSR 61/3.18		Insulators	
Number Ne	1.00	Number Nc	1.00	Number Ni	1.00
Diameter De (mm)	9.75	Diameter Dc (mm)	28.62	Diameter Di (mm)	255
Weight We (kg/m)	0.46	Weight Wc (kg/m)	1.62	Weight Wi (kg/m)	47.6
Tension Te (N)	18931	Tension Tc (N)	52920	Length Li (m)	2.10
OPGW				Insulators	
Number Ne	1.00	Clamp weight GSW	5.00	Number Ni	1.00
Diameter De (m)	12.50	Clamp weight OPGW	5.00	Diameter Di (mm)	255
Weight We (kg/m)	0.46			Weight Wi (kg/m)	47.6
Tension Te (N)	21620			Length Li (m)	2.10
Spans in m		Wind Pressure in kg/sqmm		Line Deviation	
Normal Sn (m)	300	Earth wire Pe (N/m ²)	970	Angle	0.00
Wind Span (m)	360	Conductor Pc (N/m ²)	970	Safety Factors	
Max. Wt. Swt1 (m)	600	Insulator Pi (N/m ²)	1170	Normal Case	2.50
Min. Wt. Swt2 (m)	150	Man with Tools in KGS	150	Broken Wire	1.25

Formulae Used In Load Calculation

Wind load on Conductor /Earth wire/ OPGW = Diameter * Wind Span*970N/m²

Angle pull Conductor / Earth wire = 2*Maximum Working Tension * sin (Deviation Angle/2)

Wind Load on insulator = 0.5*Length of Insulator String * Diameter of Insulator String *1170N/m²

Weight of conductor/ Earth wire = Unit weight * weight span

Earth wire Tension at broken wire condition = 1.0* Maximum Working Tension

Conductor Tension at broken wire condition =0.7*Maximum Working Tension

For Earth wire loads OPGW considered on Left Side & Earth wire GS 7/3.25(1000 Grade) Considered on Right Side.

Formulae Used In Tower Design

L/R = Maximum of Lxx/Rxx or Lw/Rw

KL/R = L/R if (curve No. = 1) and (0<=L/R<=120) ASCE 10 Eq 3.7.5

=30+ (0.75*(L/R)) if (curve No. =2) and (0<=L/R<=120) ASCE 10 Eq 3.7.6

=50+ (0.5*(L/R)) if (curve No. =3) and (0<=L/R<=120) ASCE 10 Eq 3.7.7

= L/R if (curve No. = 3) and (0<=L/R<=120) ASCE 10 Eq 3.7.8

= 28.6+ (0.762*(L/R)) if (curve No. 5))and (0<=L/R<=120) ASCE 10 Eq 3.7.9

=46.2+ (0.615*(L/R)) if (curve No. 6)) and (120<=L/R<=250) ASCE10Eq3.7.10

Allowable compression stress Fa

Fa = (1.0.5*(KL/R/Cc²)*Fy) if KL/R<= Cc ASCE 10 Eq . 3.6.1

Fa = (π²*E) KL) if KL/R>= Cc ASCE 10 Eq . 3.6.2

Cc = Fa (2*E) FY)^{1/2} ASCE 10 Eq . 3.6.3

Allowable tension stress on net cross section area Ft.

Ft = 0.9*Fy

Applied shear stress on a bolt S.

S = Applied maximum force (minimum cross sectional area of bolt * number of bolts)

Applied Bearing Stress for one bolt B

B= Applied maximum force/ (Thickness of connected part * bolt normal diameter * Number of bolts)

Loading Calculation for Conductor

Condition	Normal Condition		Broken wire Condition	
Transverse Load				
Wind on wire	$1*360*(28.62/1000)*970*2.5$	24985.26	$1*270(28.62/1000)*970*1.25$	9369.47
Wind on Insulator string	$1*1*0.5*255*1170*2.5$	783.17	$1*1*.5*2.1*255*1170*1.25$	391.58
Deviation load/Angle pull	$1*2*52920*SIN(0)*2.5$	0.00	$1*2*52920*SIN(0)*1.25$	0.00
Total (N)		25768.43		9761.06
Max Vertical Load				
Weight of Wire	$1*600*(1.62*9.81)*2.5$	23860.31	$1*450(1.62*9.81)*1.25$	8947.62
Weight of insulator string	$1*(100*9.381)*2.5$	2453.25	$1*(100*9.81)*1.25$	1226.63
Weight of man with toolkit	$150*9.81*2.5$	3679.88	$(150*9.81)*1.25$	1839.94
Total (N)		29993.43		12014.18
Min Vertical load				
Weight of wire	$1*150*(1.62*9.81)*2.5$	5965.08	$1*1125*(1.62*9.81)*1.25$	2236.90
Weight of insulator string	$1*(100*9.8.1)*2.5$	2453.25	$1*(100*9.8.1)*1.25$	1226.63
TOTAL (N)		8418.33		3463.53
Longitudinal load				
Deviation load/Angle pull			$1*52257*\text{Cos}(0)$	46305.00
Total (N)				46305.00
Notes :- 1) F.O.S. for NC = 2.5 2) F.O.S for BWC = 1.25 and cross Arm Member in BWC = 2.0 3) Tower to be designed for single Circuit strung condition				

Loading Calculation for GSW

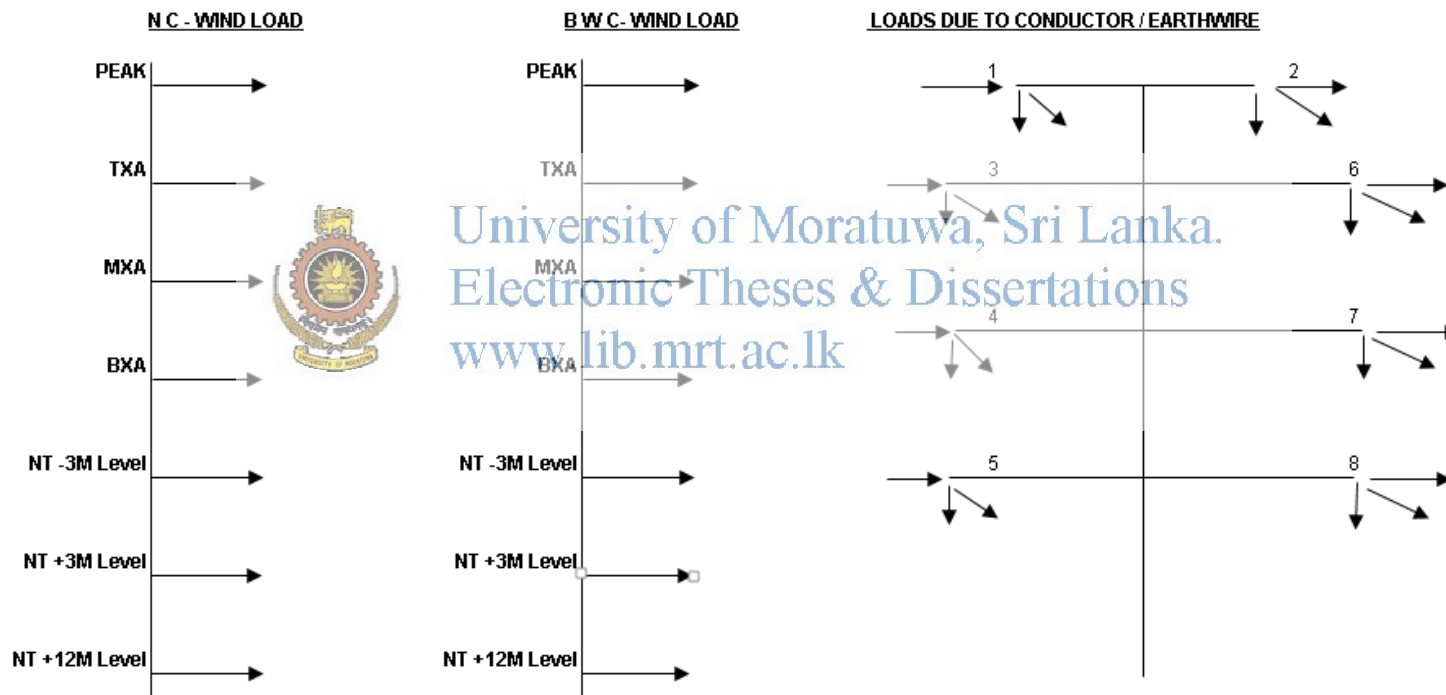
Condition	Normal Condition		Broken wire Condition	
Transverse Load				
Wind on wire	$1*360*(9.75/1000)*970*2.5$	8511.75	$1*270*(9.75/1000)*970*1.25$	3191.91
Deviation load/Angle pull	$1*2*18931*\sin(0)*2.5$	0.00	$1*8931*1.25$	0.00
Total (N)		8511.75		3191.91
Max Vertical Load				
Weight of Wire	$1*600*(1.632*9.81)*2.5$	6770.97	$1*450*(1.632*9.81)*1.25$	2539.11
Clamp	$1*(100*9.81)*2.5$	122.66	$1*(100*9.81)*1.25$	61.33
Weight of man with toolkit	$1*(150*9.81)*2.5$	3679.88	$1*(150*9.81)*1.25$	1839.94
Total (N)		10573.51		4440.38
Min Vertical load				
Weight of wire	$1*150*(1.632*9.81)*2.5$	1692.74	$1*1125*(1.632*9.81)*1.25$	634.78
Weight of Clamps	$1*(100*9.81)*2.5$	122.66	$1*(100*9.81)*1.25$	61.33
TOTAL (N)		1815.41		696.11
Longitudinal load				
Deviation load/Angle pull			$1*18931*\cos(0)*1.25$	23663.75
Total (N)		0.00		23663.75
Notes :-				
1) F.O.S. for NC = 2.5				
2) F.O.S for BWC = 1.25 and cross Arm Member in BWC = 2.0				
3) Tower to be designed for single Circuit strung condition				

Loading Calculation for OPGW

Condition	Normal Condition		Broken wire Condition	
Transverse Load				
Wind on wire	$1*360*(12.5/1000)*970*2.5$	10912.50	$1*270*12.5/1000*970*1.25$	4092.19
Deviation load/Angle pull	$1*2*21620*\text{SIN}(0) *2.5$	0.00	$1*21620*\text{SIN}(0)* 1.25$	0.00
Total (N)		10912.50		4092.19
Max Vertical Load				
Weight of Wire	$1*600*(0.46*9.81) *2.5$	6770.97	$1*450*(0.460*9.81) 1.25$	2539.11
Clamp	$1*(5*9.81) *2.5$	122.66	$1*(5*9.81) 1.25$	61.33
Weight of man with toolkit	$(150*9.81) *2.5$	3679.88	$(150*9.81) 1.25$	1839.94
Total (N)		10573.51		4440.38
Min Vertical load				
Weight of wire	$1*150*(0.46*9.81)*2.5$	1692.74	$1*112.5*(0.46*9.81) 1.25$	634.78
Weight of Clamps	$1*(5*9.81) *2.5$	122.66	$1*(5*9.81) 1.25$	61.33
TOTAL (N)		1815.41		696.11
Longitudinal load				
Deviation load/Angle pull			$1*21620*\text{COS}(0) 1.25$	27025.00
Total (N)		0.00		27025.00
Notes :-				
1) F.O.S. for NC = 2.5				
2) F.O.S for BWC = 1.25 and cross Arm Member in BWC = 2.0				
3) Tower to be designed for single Circuit strung condition				

Loading Trees and Loading Cases.

Load tree shows the loading points of the tower. Calculated loads will be applied respective points on the tower. In each load case different loads will be applied, and tower strength is modified accordingly.



Following table shows different loading cases due to breakage of different wires of the tower.

Broken (GSW and Top Conductor)				Broken (OPGW and Top Conductor)			
Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)	Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)
PGR	4440.38	3191.91	23663.75	PGR	5286.75	5456.25	0.00
POL	5286.75	5456.25	0.00	POL	4440.38	4092.19	27025.00
TCR	12014.18	9761.06	46305.00	TCR	14996.72	12884.21	0.00
TCR	14996.72	12884.21	0.00	TCR	14996.72	12884.21	0.00
TCL	14996.72	12884.21	0.00	TCL	12014.18	9761.06	46305.00
TCL	14996.72	12884.21	0.00	TCL	14996.72	12884.21	0.00
MCR	14996.72	12884.21	0.00	MCR	14996.72	12884.21	0.00
MCR	14996.72	12884.21	0.00	MCR	14996.72	12884.21	0.00
MCL	14996.72	12884.21	0.00	MCL	14996.72	12884.21	0.00
MCL	14996.72	12884.21	0.00	MCL	14996.72	12884.21	0.00
BCR	14996.72	12884.21	0.00	BCR	14996.72	12884.21	0.00
BCR	14996.72	12884.21	0.00	BCR	14996.72	12884.21	0.00
BCL	14996.72	12884.21	0.00	BCL	14996.72	12884.21	0.00
BCL	14996.72	12884.21	0.00	BCL	14996.72	12884.21	0.00



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Broken (GSW and Middle Conductor)				Broken (OPGW and Middle Conductor)			
Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)	Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)
PGR	4440.38	3191.91	23663.75	PGR	5286.75	5456.25	0.00
POL	5286.75	5456.25	0.00	POL	4440.38	4092.19	27025.00
TCR	14996.72	12884.21	0.00	TCR	14996.72	12884.21	0.00
TCR	14996.72	12884.21	0.00	TCR	14996.72	12884.21	0.00
TCL	14996.72	12884.21	0.00	TCL	14996.72	12884.21	0.00
TCL	14996.72	12884.21	0.00	TCL	14996.72	12884.21	0.00
MCR	12014.18	9761.06	46305.00	MCR	14996.72	12884.21	0.00
MCR	14996.72	12884.21	0.00	MCR	14996.72	12884.21	0.00
MCL	14996.72	12884.21	0.00	MCL	12014.18	9761.06	46305.00
MCL	14996.72	12884.21	0.00	MCL	14996.72	12884.21	0.00
BCR	14996.72	12884.21	0.00	BCR	14996.72	12884.21	0.00
BCR	14996.72	12884.21	0.00	BCR	14996.72	12884.21	0.00
BCL	14996.72	12884.21	0.00	BCL	14996.72	12884.21	0.00
BCL	14996.72	12884.21	0.00	BCL	14996.72	12884.21	0.00

Broken (GSW and Middle Conductor)				Broken (OPGW and Middle Conductor)			
Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)	Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)
PGR	4440.38	3191.91	23663.75	PGR	5286.75	5456.25	0.00
POL	5286.75	5456.25	0.00	POL	4440.38	4092.19	27025.00
TCR	14996.72	12884.21	0.00	TCR	14996.72	12884.21	0.00
TCR	14996.72	12884.21	0.00	TCR	14996.72	12884.21	0.00
TCL	14996.72	12884.21	0.00	TCL	14996.72	12884.21	0.00
TCL	14996.72	12884.21	0.00	TCL	14996.72	12884.21	0.00
MCR	12014.18	9761.06	46305.00	MCR	14996.72	12884.21	0.00
MCR	14996.72	12884.21	0.00	MCR	14996.72	12884.21	0.00
MCL	14996.72	12884.21	0.00	MCL	12014.18	9761.06	46305.00
MCL	14996.72	12884.21	0.00	MCL	14996.72	12884.21	0.00
BCR	14996.72	12884.21	0.00	BCR	14996.72	12884.21	0.00
BCR	14996.72	12884.21	0.00	BCR	14996.72	12884.21	0.00
BCL	14996.72	12884.21	0.00	BCL	14996.72	12884.21	0.00
BCL	14996.72	12884.21	0.00	BCL	14996.72	12884.21	0.00

Broken (GSW and Bottom Conductor)				Broken (OPGW and Bottom Conductor)			
Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)	Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)
PGR	4440.38	3191.91	23663.75	PGR	5286.75	5456.25	0.00
POL	5286.75	5456.25	0.00	POL	4440.38	4092.19	27025.00
TCR	14996.72	12884.21	0.00	TCR	14996.72	12884.21	0.00
TCR	14996.72	12884.21	0.00	TCR	14996.72	12884.21	0.00
TCL	14996.72	12884.21	0.00	TCL	14996.72	12884.21	0.00
TCL	14996.72	12884.21	0.00	TCL	14996.72	12884.21	0.00
MCR	14996.72	12884.21	0.00	MCR	14996.72	12884.21	0.00
MCR	14996.72	12884.21	0.00	MCR	14996.72	12884.21	0.00
MCL	14996.72	12884.21	0.00	MCL	14996.72	12884.21	0.00
MCL	14996.72	12884.21	0.00	MCL	14996.72	12884.21	0.00
BCR	12014.18	9761.06	46305.00	BCR	14996.72	12884.21	0.00
BCR	14996.72	12884.21	0.00	BCR	14996.72	12884.21	0.00
BCL	14996.72	12884.21	0.00	BCL	12014.18	9761.06	46305
BCL	14996.72	12884.21	0.00	BCL	14996.72	12884.21	0.00

Broken (Top and Bottom Conductor)				Broken (Top and Bottom Conductor)			
Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)	Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)
PGR	5286.75	5456.25	0.00	PGR	5286.75	5456.25	0.00
POL	5286.75	5456.25	0.00	POL	5286.75	5456.25	0.00
TCR	12014.18	9761.06	46305	TCR	14996.72	12884.21	0.00
TCR	14996.72	12884.21	0.00	TCR	14996.72	12884.21	0.00
TCL	14996.72	12884.21	0.00	TCL	12014.18	9761.06	46305
TCL	14996.72	12884.21	0.00	TCL	14996.72	12884.21	0.00
MCR	12014.18	9761.06	46305	MCR	14996.72	12884.21	0.00
MCR	14996.72	12884.21	0.00	MCR	14996.72	12884.21	0.00
MCL	14996.72	12884.21	0.00	MCL	12014.18	9761.06	46305
MCL	14996.72	12884.21	0.00	MCL	14996.72	12884.21	0.00
BCR	14996.72	12884.21	0.00	BCR	14996.72	12884.21	0.00
BCR	14996.72	12884.21	0.00	BCR	14996.72	12884.21	0.00
BCL	14996.72	12884.21	0.00	BCL	14996.72	12884.21	0.00
BCL	14996.72	12884.21	0.00	BCL	14996.72	12884.21	0.00


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Broken (Middle and Bottom Conductor)				Broken (Middle and Bottom Conductor)			
Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)	Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)
PGR	5286.75	5456.25	0.00	PGR	5286.75	5456.25	0.00
POL	5286.75	5456.25	0.00	POL	5286.75	5456.25	0.00
TCR	14996.72	12884.21	0.00	TCR	14996.72	12884.21	0.00
TCR	14996.72	12884.21	0.00	TCR	14996.72	12884.21	0.00
TCL	14996.72	12884.21	0.00	TCL	14996.72	12884.21	0.00
TCL	14996.72	12884.21	0.00	TCL	14996.72	12884.21	0.00
MCR	12014.18	9761.06	46305	MCR	14996.72	12884.21	0.00
MCR	14996.72	12884.21	0.00	MCR	14996.72	12884.21	0.00
MCL	14996.72	12884.21	0.00	MCL	12014.18	9761.06	46305
MCL	14996.72	12884.21	0.00	MCL	14996.72	12884.21	0.00
BCR	12014.18	9761.06	46305	BCR	14996.72	12884.21	0.00
BCR	14996.72	12884.21	0.00	BCR	14996.72	12884.21	0.00
BCL	14996.72	12884.21	0.00	BCL	12014.18	9761.06	46305
BCL	14996.72	12884.21	0.00	BCL	14996.72	12884.21	0.00

Broken (Top and Bottom Conductor)				Broken (Top and Bottom Conductor)			
Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)	Join Label	Vertical Load/(N)	Transverse Load /(N)	Longitudinal Load /(N)
PGR	5286.75	5456.25	0.00	PGR	5286.75	5456.25	0.00
POL	5286.75	5456.25	0.00	POL	5286.75	5456.25	0.00
TCR	12014.18	9761.06	46305	TCR	14996.72	12884.21	0.00
TCR	14996.72	12884.21	0.00	TCR	14996.72	12884.21	0.00
TCL	14996.72	12884.21	0.00	TCL	12014.18	9761.06	46305
TCL	14996.72	12884.21	0.00	TCL	14996.72	12884.21	0.00
MCR	14996.72	12884.21	0.00	MCR	14996.72	12884.21	0.00
MCR	14996.72	12884.21	0.00	MCR	14996.72	12884.21	0.00
MCL	14996.72	12884.21	0.00	MCL	14996.72	12884.21	0.00
MCL	14996.72	12884.21	0.00	MCL	14996.72	12884.21	0.00
BCR	12014.18	9761.06	46305	BCR	14996.72	12884.21	0.00
BCR	14996.72	12884.21	0.00	BCR	14996.72	12884.21	0.00
BCL	14996.72	12884.21	0.00	BCL	12014.18	9761.06	46305
BCL	14996.72	12884.21	0.00	BCL	14996.72	12884.21	0.00



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APPENDIX V : Sample of Tower Simulation Report

Note: Only Three pages of 645pages simulation report are attached.

```

*****\par
*
* TOWER - Analysis and Design - Copyright Power Line Systems, Inc. 1986-2013 *\par
*
*****\par

\par
Project Name: MCs\par
Project Notes: Tower\par
Project File: H:\ACSR ZEBRA\TD1\+6M TD1.tow\par
Date run      : 3:12:57 PM Thursday, March 10, 2016\par
by           : Tower Version 13.20\par
Licensed to: Ceylon Electricity Board - Transmission Design\par
\par
Successfully performed linear analysis\par
}\par
\par
Member check option: ASCE 10\par
Connection rupture check: ASCE 10\par
Crossing diagonal check: Fixed \par
Included angle check: None \par
Climbing load check: None\par
Redundant members checked with Actual Model\par
\par
\par
\b Joints Geometry:\b0\par
\par
\b Joint      Symmetry X Coord. Y Coord. Z Coord. X Disp. Y Disp. Z Disp. X Rot.  Y
Rot.  Z Rot.\b0\par
\b Label      Code      (m)      (m)      (m)      Rest.  Rest.  Rest.  Rest.
Rest.  Rest.\b0\par
\b -----
\b0\par
1P  XY-Symmetry  2.73   2.73     0   Free   Free   Free   Free   Free
Free \par
2P  XY-Symmetry  1.19   1.19   10.19  Free   Free   Free   Free   Free
Free \par
3P  XY-Symmetry  0.75   0.75   23.04  Free   Free   Free   Free   Free
Free \par
4P  X-Symmetry   0      4.1    23.04  Free   Free   Free   Free   Free
Free \par
5P  X-Symmetry   0      4.1    19.04  Free   Free   Free   Free   Free
Free \par
6P  X-Symmetry   0      4.23   14.64  Free   Free   Free   Free   Free
Free \par
7P  X-Symmetry   0      4.62   10.19  Free   Free   Free   Free   Free

```



```

Free \par
  1X      X-GenXY      2.73      -2.73      0      Free      Free      Free      Free      Free
Free \par
  7X      X-Gen      0      -4.62      10.19      Free      Free      Free      Free      Free
Free \par
\par
\b Secondary Joints:\b0\par
\par
\b      Joint      Symmetry Origin      End Fraction Elevation X Disp. Y Disp. Z Disp. X
Rot. Y Rot. Z Rot.\b0\par
\b      Label      Code      Joint Joint      Rest.      Rest.      Rest.
Rest. Rest. Rest.\b0\par
\b      (m)
\par
\b -----\b0\par
-----\b0\par
  30S XY-Symmetry      1P      2P      0      4      Free      Free      Free      Free
Free Free \par
  31S XY-Symmetry      1P      2P      0      7.72      Free      Free      Free      Free
Free Free \par
  32S XY-Symmetry      2P      3P      0      11.34      Free      Free      Free      Free
Free Free \par
  33S XY-Symmetry      2P      3P      0      12.4      Free      Free      Free      Free
Free Free \par
  34S XY-Symmetry      2P      3P      0      14.68      Free      Free      Free      Free
Free Free \par
  35S XY-Symmetry      2P      3P      0      15.7      Free      Free      Free      Free
Free Free \par
  36S XY-Symmetry      2P      3P      0      16.68      Free      Free      Free      Free
Free Free \par
  37S XY-Symmetry      2P      3P      0      19.04      Free      Free      Free      Free
Free Free \par
  41Y      Y-Gen      40S      40X      0.5      0      Free      Free      Free      Free
Free Free \par
  42X      X-Gen      40S      40Y      0.5      0      Free      Free      Free      Free
Free Free \par
  43Y      Y-Gen      38S      38X      0.5      0      Free      Free      Free      Free
Free Free \par
  44X      X-Gen      38S      38Y      0.5      0      Free      Free      Free      Free
Free Free \par
  45Y      Y-Gen      35S      35X      0.5      0      Free      Free      Free      Free
Free Free \par
  46X      X-Gen      35S      35Y      0.5      0      Free      Free      Free      Free
Free Free \par
  47Y      Y-Gen      32S      32X      0.5      0      Free      Free      Free      Free
Free Free \par
  48X      X-Gen      32S      32Y      0.5      0      Free      Free      Free      Free
Free Free \par

```



```

      49X      X-GenXY      1P      2P      0      -4.17      Free      Free      Free      Free
Free      Free \par
      49XY     XY-GenXY      1P      2P      0      -4.17      Free      Free      Free      Free
Free      Free \par
      49Y      Y-GenXY      1P      2P      0      -4.17      Free      Free      Free      Free
Free      Free \par
      50X      X-GenXY      1P      2P      0      -10.17     Fixed      Fixed      Fixed      Free
Fixed     Fixed\par
      50XY     XY-GenXY      1P      2P      0      -10.17     Fixed      Fixed      Fixed      Free
Fixed     Fixed\par

```

```

0i0.44E2X      X-Gen      30S      1Y      0.4377      0      Free      Free      Free      Free
Free      Free \par

```

\par

The model contains 20 primary and 100 secondary joints for a total of 120 joints.\par

\par

\b Steel Material Properties:\b0\par

\par

```

\b      Steel      Modulus      Yield Ultimate      Member      Member      Member      Member
Member Member\b0\par

```

Member	Steel	Modulus	Yield	Ultimate	Member	Member	Member	Member
C-LG-3	g31X	-1.074	82.478	-19.620	79.007	-16.428	12.237	7.785
C-LG-3	g31XY	-0.779	-82.535	17.298	-79.571	13.996	-13.001	-9.014
C-LG-3	g31Y	-34.625	17.268	-82.550	13.955	-79.479	-8.904	-13.036
D-LG-4	g32E	27.752	14.689	67.094	14.931	64.244	6.802	10.380
D-LG-4	g32X	0.593	67.540	-14.150	64.876	-11.503	10.837	7.375
D-LG-4	g32XY	0.811	-67.402	15.872	-64.460	13.330	-10.152	-6.454
D-LG-4	g32Y	26.872	16.887	66.895	14.355	-63.538	-5.574	-9.155
D-LG-4	g32BP	-28.189	7.544	-74.966	7.454	-61.455	-10.359	-22.780
D-LG-4	g32BX	-3.332	-75.859	6.644	-62.261	6.544	-23.660	-11.122

\par

*** Weight of structure (N)\par

Weight of Angles*Section DLF: 50857.9\par

Weight of Suspensions: 16600.0\par

Total: 67457.9\par

\par

\par

*** End of Report\par

\par

APPENDIX VI: Profile Design Summary Report

PLS-CADD Version 9.20 7:49:01 AM Sunday, March 27, 2016

Project Name: 'D:\Academic\MSC\2nd year\Profile Design\Flat\paddy\ACSR\flat paddy.DON'

Structure List Report

Struct. Number	Station	Line Angle (deg)	Ahead Span (m)	Height Adjust (m)	Offset Adjust (m)	Orient Angle (deg)	Name/Description/Comments/Material
1	0.00	0.00	361.35	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\tdl\tdl+03m TDL+03 embed len=0.30
2	361.35	0.00	329.95	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\tdl\tdl+09m TDL+09 embed len=0.30
3	691.30	0.00	322.21	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\tdl\tdl+00m TDL+00 embed len=0.30
4	1013.51	0.00	336.63	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\tdl\tdl+00m TDL+00 embed len=0.30
5	1350.14	0.00	361.04	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\tdl\tdl+09m TDL+09 embed len=0.30
6	1711.18	0.00	349.81	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\tdl\tdl+03m TDL+03 embed len=0.30
7	2060.99	0.00	315.88	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\tdl\tdl+03m TDL+03 embed len=0.30
8	2376.87	0.00	371.88	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\tdl\tdl+03m TDL+03 embed len=0.30
9	2748.75	0.00	344.75	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\tdl\tdl+00m



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							TDL+00 embed len=0.30
10	3093.50	29.55	303.52	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td3\td3+03m
							TD3+03 embed len=0.30
11	3397.02	0.00	268.59	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1-03m
							TDL-03 embed len=0.30
12	3665.61	-27.25	327.73	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td3\td3+06m
							TD3+06 embed len=0.30
13	3993.34	0.00	322.99	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1+00m
							TDL+00 embed len=0.30
14	4316.33	0.00	323.79	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1+06m
							TDL+06 embed len=0.30
15	4640.12	0.00	316.40	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1+00m
							TDL+00 embed len=0.30
16	4956.52	0.00	331.77	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1+03m
							TDL+03 embed len=0.30
17	5288.29	0.00	318.24	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1+00m
							TDL+00 embed len=0.30
18	5606.53	0.00	338.76	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1+03m
							TDL+03 embed len=0.30
19	5945.29	0.00	295.82	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1+00m
							TDL+00 embed len=0.30
20	6241.11	0.00	0.00	0.00	0.00	0.00	d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1-03m
							TDL-03 embed len=0.30



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```

1 3 1 tdl+03m P1-R 261412.17 256820.69 191.33 261414.97 256823.24
190.89 261547.02 256943.76 179.76 261558.57 256954.30 179.68 0.00 0.00
6.80 154.59 265874.28 260385.66 144.15 265888.51 260397.60 144.05 0.00 0.00
3 265744.78 260276.49 150.89 265744.78 260276.49
148.79 265874.54 260385.35 138.35 265888.77 260397.29 138.25 0.00 0.00

```

```

19 3 1 tdl+00m P1-R 266003.90 260494.69 158.68 266003.91 260494.68
156.58 266115.93 260588.34 152.68 266094.34 260570.29 152.44 0.00 0.00
2 266004.03 260494.54 152.93 266004.04 260494.53
150.83 266116.07 260588.17 146.85 266095.13 260570.67 146.63 0.00 0.00
3 266004.29 260494.23 147.13 266004.30 260494.21
145.03 266116.39 260587.79 140.95 266096.31 260571.03 140.75 0.00 0.00

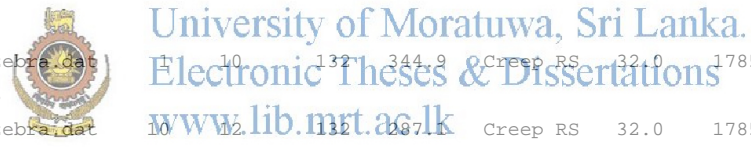
```

Section Sagging Data

```

Sec. Cable From To Voltage Ruling -----Sagging Data-----
Display
No. File Str. Str. Span Condition Temp. Catenary Horiz.
Catenary Name Constant Tension
Constant (kV) (m) (deg C) (m) (N)
(m)

```



```

1 zebra.dat 10 132 344.9 Creep RS 32.0 1785.6 28554.9
1488.3
2 zebra.dat 10 132 344.9 Creep RS 32.0 1785.6 28554.9
1412.2
3 zebra.dat 12 20 132 322.8 Creep RS 32.0 1785.6 28554.9
1461.6

```

Section Stringing Data

```

Section CableStruct. Set Phasing Set
Number Name Number Number Label
-----
1 zebra.dat 1 3 123 P1-R
2 3 123 P1-R
3 3 123 P1-R
4 3 123 P1-R
5 3 123 P1-R
6 3 123 P1-R
7 3 123 P1-R
8 3 123 P1-R
9 3 123 P1-R
10 3 123 P1-R
2 zebra.dat 10 3 123 P1-R

```

	11	3	123 P1-R
	12	3	123 P1-R
3 zebra.dat	12	3	123 P1-R
	13	3	123 P1-R
	14	3	123 P1-R
	15	3	123 P1-R
	16	3	123 P1-R
	17	3	123 P1-R
	18	3	123 P1-R
	19	3	123 P1-R

Section Geometry Data

Notes: Lengths are arc lengths along the wire at 32 (deg C), Initial.
Lengths are adjusted for the number of phases, the number of subconductors and the length of strain insulators..

Sec. No.	Cable File Name	From Str.	To Str.	Number of Phases	Wires Per Phase	Min. Span (m)	Max. Span (m)	Ruling Span (m)	Total Cable Length (m)
----------	-----------------	-----------	---------	------------------	-----------------	---------------	---------------	-----------------	------------------------

1	zebra.dat	1	10	3	1	315.9	371.9	344.9	9263.9
2	zebra.dat	10	12	3	1	270.2	301.7	287.1	1694.5
3	zebra.dat	12	20	3	1	221.8	334.8	311.8	7716.9

Structure Material List Report

Structure File Name	Count
d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1+03m	1
d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1-03m	1
d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td3\td3+03m	1
d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td3\td3+06m	1
d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1+00m	7
d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1+03m	5
d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1+06m	1
d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1+09m	2
d:\academic\msc\2nd year\profile design\flat\paddy\acsr\td1\td1-03m	1
Total number of structures =	20

Cable Material List Report

Notes: Lengths are arc lengths along the wire at 32 (deg C), Initial.
Lengths are adjusted for the number of phases, the number of subconductors and the length of strain insulators.


Cable	Number
Cable Length	

APPENDIX VII : Material Schedules of Transmission Lines

Non Populated Flat Terrain

Description	Unit	ACSR	ACCC	ZTACIR /AW	ACSS/TW	ACCR	GTACSR	LL-ACSR/AS	LL-TACSR/AS	
Supply of Conductors including joints and jumper leads										
400 mm ² Zebra 61/3.18 mm ACSR conductor (Including mid span joints) units	km	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	
7/3.25 MM Galvanized earth wire including mid span units	km	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	
OPGW Conductors and OPGW Accessories	km	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	
Supply of Damping System (Vibration dampers)										
Vibration dampers for 400 mm ² Zebra (61/3.18 mm) conductor	Nos	450	450	462	462	450	450	450	450	
Vibration dampers for OPGW	Nos	76	76	76	76	76	76	76	76	
Vibration dampers for GSW	Nos	75	75	77	77	75	75	75	75	
Supply of Insulator sets										
Normal suspension insulator sets for 400 mm ² ACSR conductor	Nos	96	96	96	96	96	96	96	96	
Normal tension insulator sets for 400 mm ² ACSR conductor	Nos	48	48	48	48	48	48	48	48	
Jumper suspension insulator sets	Nos	0	0	0	0	0	0	0	0	
Light duty tension insulator sets for 400 mm ² ACSR conductor	Nos	12	12	12	12	12	12	12	12	
Supply of self-supporting towers and extended towers of the suspension type complete with all fittings										
Type TDL towers with -3m extension	Nos	1	1	1	1	1	2	2	2	
Type TDL towers with ± 0m extension	Nos	7	5	6	5	7	7	6	6	
Type TDL towers with +6m extension	Nos	2	2	3	2	5	4	5	6	
Type TDL towers with +6m extension	Nos	1	0	1	3	2	2	3	2	
Type TDL towers with +9m extension	Nos	2	0	2	2	1	1	0	0	
Type TDL towers with +12m extension	Nos	0	0	0	0	0	0	0	0	
Supply of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings										
Type TD1 towers with -3m extension	Nos	1	1	1	1	1	1	1	1	
Type TD1 towers with ± 0m extension	No	0	1	0	0	0	0	0	0	
Type TD1 towers with +3m extension	Nos	2	1	2	1	2	2	2	2	
Type TD1 towers with +6m extension	Nos	0	0	0	0	0	0	0	0	
Type TD1 towers with +9m extension	Nos	0	0	0	0	0	0	0	0	
Type TD1 towers with +12m extension	Nos	0	0	0	0	0	0	0	0	
Supply of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings										
Type TD3 towers with -3m extension	Nos	0	0	0	0	0	0	0	0	
Type TD3 towers with ± 0m extension	Nos	0	0	0	1	0	0	0	0	
Type TD3 towers with +3m extension	Nos	0	1	0	1	0	0	0	0	
Type TD3 towers with +6m extension	Nos	1	0	1	0	1	1	1	1	
Type TD3 towers with +9m extension	Nos	0	0	0	0	0	0	0	0	
Type TD3 towers with +12m extension	Nos	0	0	0	0	0	0	0	0	
CIVIL WORKS										
Foundation complete for TDL towers and all extensions										
Foundation type 3	Nos	16	16	16	16	16	16	16	16	
Foundation type 4A	Nos	0	0	0	0	0	0	0	0	
Foundation complete for TD1 towers and all extensions										
Foundation type 3	Nos	3	3	3	2	3	3	3	3	
Foundation type 4A	Nos	0	0	0	0	0	0	0	0	
Foundation complete for TD3 towers and all extensions										
Foundation type 3	Nos	1	1	1	2	1	1	1	1	
Foundation type 4A	Nos	0	0	0	0	0	0	0	0	

Survey										
	Preliminary Survey *	km	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
	Profile Survey	km	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
TOTAL										
INSTALLATIONS										
Erection of self-supporting towers and extended towers of the suspension type complete with all fittings & including Earthing System										
	Type TDL towers with ± 0m extension	Nos	1	9	1	0	1	2	2	2
	Type TDL towers with -3m extension	Nos	7	5	6	5	7	7	6	6
	Type TDL towers with +3m extension	Nos	5	2	6	6	5	4	5	6
	Type TDL towers with +6m extension	Nos	1	0	1	3	2	2	3	2
	Type TDL towers with +9m extension	Nos	2	0	2	2	1	1	0	0
	Type TDL towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Erection of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings including Earthing System										
	Type TD1 towers with ± 0m extension	Nos	1	1	1	1	1	1	1	1
	Type TD1 towers with -3m extension	Nos	0	1	0	0	0	0	0	0
	Type TD1 towers with +3m extension	Nos	2	1	2	1	2	2	2	2
	Type TD1 towers with +6m extension	Nos	0	0	0	0	0	0	0	0
	Type TD1 towers with +9m extension	Nos	0	0	0	0	0	0	0	0
	Type TD1 towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Erection of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings including Earthing System										
	Type TD3 towers with ± 0m extension	Nos	0	0	0	0	0	0	0	0
	Type TD3 towers with -3m extension	Nos	0	0	0	1	0	0	0	0
	Type TD3 towers with +3m extension	Nos	0	1	0	1	0	0	0	0
	Type TD3 towers with +6m extension	Nos	1	0	1	0	1	1	1	1
	Type TD3 towers with +9m extension	Nos	0	0	0	0	0	0	0	0
	Type TD3 towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Stringing										
		km	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2


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Description	Unit	ACSR	ACCC	ZTACIR /AW	ACSS/TW	ACCR	GTACSR	LL-ACSR/AS	LL-TACSR/AS	
Supply of Conductors including joints and jumper leads										
400 mm ² Zebra 61/3.18 mm ACSR conductor (Including mid span joints) units	km	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6	
7/3.25 MM Galvanized earth wire including mid span units	km	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	
OPGW Conductors and OPGW Accessories	km	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	
Supply of Damping System (Vibration dampers)										
Vibration dampers for 400 mm ² Zebra (61/3.18 mm) conductor	No	342	342	318	318	378	342	342	342	
Vibration dampers for OPGW	No	70	70	66	66	74	70	70	70	
Vibration dampers for GSW	No	57	57	53	53	63	57	57	57	
e) Supply of Insulator sets										
Normal suspension insulator sets for 400 mm ² ACSR conductor	No	30	30	36	36	30	30	30	30	
Normal tension insulator sets for 400 mm ² ACSR conductor	No	180	180	168	168	180	180	180	180	
Jumper suspension insulator sets	No	6	6	6	6	6	6	6	6	
Light duty tension insulator sets for 400 mm ² ACSR conductor	No	12	12	12	12	12	12	12	12	

Supply of self-supporting towers and extended towers of the suspension type complete with all fittings										
Type TDL towers with -3m extension	No	0	2	2	2	0	1	1	1	1
Type TDL towers with ± 0m extension	No	2	2	0	1	2	0	0	0	0
Type TDL towers with +3m extension	No	1	1	1	0	1	3	2	2	2
Type TDL towers with +6m extension	No	2	0	2	1	2	0	2	2	2
Type TDL towers with +9m extension	No	0	0	0	1	0	1	0	0	0
Type TDL towers with +12m extension	No	0	0	1	1	0	0	0	0	0
Supply of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings										
Type TD1 towers with -3m extension	No	0	1	0	0	0	0	0	0	0
Type TD1 towers with ± 0m extension	No	1	4	0	0	1	1	1	1	1
Type TD1 towers with +3m extension	No	3	0	6	6	4	4	4	4	4
Type TD1 towers with +6m extension	No	0	1	0	0	0	0	0	0	0
Type TD1 towers with +9m extension	No	0	0	0	0	1	0	0	0	0
Type TD1 towers with +12m extension	No	1	0	0	0	0	1	1	1	1
Supply of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings										
Type TD3 towers with -3m extension	No	0	1	0	1	1	1	1	1	1
Type TD3 towers with ± 0m extension	No	3	4	3	2	3	3	3	3	4
Type TD3 towers with +3m extension	No	3	1	2	3	1	1	1	1	0
Type TD3 towers with +6m extension	No	1	0	1	1	1	1	1	1	1
Type TD3 towers with +9m extension	No	0	0	1	0	0	0	0	0	0
Type TD3 towers with +12m extension	No	1	0	0	0	1	1	1	1	1
Supply of self-supporting towers and extended towers of the Tension (TD6) type complete with all fittings										
Type TD6 towers with -3m extension	No	0	1	1	1	0	2	2	2	2
Type TD6 towers with ± 0m extension	No	2	1	1	0	2	0	0	0	0
Type TD6 towers with +3m extension	No	0	0	0	1	0	0	0	0	0
Type TD6 towers with +6m extension	No	0	0	0	0	0	0	0	0	0
Type TD6 towers with +9m extension	No	0	0	0	0	0	0	0	0	0
Type TD6 towers with +12m extension	No	0	0	0	0	0	0	0	0	0
CIVIL WORKS										
Foundation complete for TDL towers and all extensions										
Foundation type 3	No	5	5	6	6	5	5	5	5	5
Foundation type 4A	No	0	0	0	0	0	0	0	0	0
Foundation complete for TD1 towers and all extensions										
Foundation type 3	No	6	6	6	6	6	6	6	6	6
Foundation type 4A	No	0	0	0	0	0	0	0	0	0
Foundation complete for TD3 towers and all extensions										
Foundation type 3	No	8	6	7	7	7	7	7	7	7
Foundation type 4A	No	0	0	0	0	0	0	0	0	0
Foundation complete for TD6 towers and all extensions										
Foundation type 3	No	2	2	2	2	2	2	2	2	2
Foundation type 4A	No	0	0	0	0	0	0	0	0	0
Survey										
Preliminary Survey *	km	6	6	6	6	6	6	6	6	6
Profile Survey	km	6	6	6	6	6	6	6	6	6
TOTAL										
INSTALLATIONS										
Erection of self-supporting towers and extended towers of the suspension type complete with all fittings & including Earthing System										
Type TDL towers with ± 0m extension	No	0	2	2	2	0	1	1	1	1
Type TDL towers with -3m extension	No	2	2	0	1	2	0	0	0	0
Type TDL towers with +3m extension	No	1	1	1	0	1	3	2	2	2
Type TDL towers with +6m extension	No	2	0	2	1	2	0	2	2	2
Type TDL towers with +9m extension	No	0	0	0	1	0	1	0	0	0
Type TDL towers with +12m extension	No	0	0	1	1	0	0	0	0	0

Erection of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings including Earthing System									
Type TD1 towers with ± 0m extension	No	0	1	0	0	0	0	0	0
Type TD1 towers with -3m extension	No	1	4	0	0	1	1	1	1
Type TD1 towers with +3m extension	No	3	0	6	6	4	4	4	4
Type TD1 towers with +6m extension	No	0	1	0	0	0	0	0	0
Type TD1 towers with +9m extension	No	0	0	0	0	1	0	0	0
Type TD1 towers with +12m extension	No	1	0	0	0	0	1	1	1
Erection of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings including Earthing System									
Type TD3 towers with ± 0m extension	No	0	1	0	1	1	1	1	1
Type TD3 towers with -3m extension	No	3	4	3	2	3	3	3	4
Type TD3 towers with +3m extension	No	3	1	2	3	1	1	1	0
Type TD3 towers with +6m extension	No	1	0	1	1	1	1	1	1
Type TD3 towers with +9m extension	No	0	0	1	0	0	0	0	0
Type TD3 towers with +12m extension	No	1	0	0	0	1	1	1	1
Erection of self-supporting towers and extended towers of the Tension (TD6) type complete with all fittings including Earthing System									
Type TD6 towers with ± 0m extension	No	0	1	1	1	0	2	2	2
Type TD6 towers with -3m extension	No	2	1	1	0	2	0	0	0
Type TD6 towers with +3m extension	No	0	0	0	1	0	0	0	0
Type TD6 towers with +6m extension	No	0	0	0	0	0	0	0	0
Type TD6 towers with +9m extension	No	0	0	0	0	0	0	0	0
Type TD6 towers with +12m extension	No	0	0	0	0	0	0	0	0
Stringing									
	km	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8

Paddy Flat Terrain

Description	Unit	University of Moratuwa, Sri Lanka.					GTACSR	LL-ACSR/AS	LL-TACSR/AS
		ACSR	ACCC	ZTACR /AW	ACSS/TW	ACCR			
Supply of Conductors including joints and jumper leads									
400 mm ² Zebra 61/3.18 mm ACSR conductor (Including mid span joints) units	km	36	36	36	36	36	36	36	36
7/3.25 MM Galvanized earth wire including mid span units	km	6	6	6	6	6	6	6	6
OPGW Conductors and OPGW Accessories	km	6	6	6	6	6	6	6	6
Supply of Damping System (Vibration dampers)									
Vibration dampers for 400 mm ² Zebra (61/3.18 mm) conductor	No	450	450	462	462	450	450	450	450
Vibration dampers for OPGW	No	76	76	76	76	76	76	76	76
Vibration dampers for GSW	No	75	75	77	77	75	75	75	75
Supply of Insulator sets									
Normal suspension insulator sets for 400 mm ² ACSR conductor	No	96	96	96	96	96	96	96	96
Normal tension insulator sets for 400 mm ² ACSR conductor	No	48	48	48	48	48	48	48	48
Jumper suspension insulator sets	No	0	0	0	0	0	0	0	0
Light duty tension insulator sets for 400 mm ² ACSR conductor	No	12	12	12	12	12	12	12	12
Supply of self-supporting towers and extended towers of the suspension type complete with all fittings									
Type TDL towers with -3m extension	No	1	9	1	0	1	2	2	2
Type TDL towers with ± 0m extension	No	7	5	6	5	7	7	6	6
Type TDL towers with +3m extension	No	5	2	6	6	5	4	5	6
Type TDL towers with +6m extension	No	1	0	1	3	2	2	3	2

Type TDL towers with +9m extension	No	2	0	2	2	1	1	0	0
Type TDL towers with +12m extension	No	0	0	0	0	0	0	0	0
Supply of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings									
Type TD1 towers with -3m extension	No	1	1	1	1	1	1	1	1
Type TD1 towers with ± 0m extension	No	0	1	0	0	0	0	0	0
Type TD1 towers with +3m extension	No	2	1	2	1	2	2	2	2
Type TD1 towers with +6m extension	No	0	0	0	0	0	0	0	0
Type TD1 towers with +9m extension	No	0	0	0	0	0	0	0	0
Type TD1 towers with +12m extension	No	0	0	0	0	0	0	0	0
Supply of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings									
Type TD3 towers with -3m extension	No	0	0	0	0	0	0	0	0
Type TD3 towers with ± 0m extension	No	0	0	0	1	0	0	0	0
Type TD3 towers with +3m extension	No	0	1	0	1	0	0	0	0
Type TD3 towers with +6m extension	No	1	0	1	0	1	1	1	1
Type TD3 towers with +9m extension	No	0	0	0	0	0	0	0	0
Type TD3 towers with +12m extension	No	0	0	0	0	0	0	0	0
CIVIL WORKS									
Foundation complete for TDL towers and all extensions									
Foundation type 3	No	0	0	0	0	0	0	0	0
Foundation type 4A	No	16	16	16	16	16	16	16	16
Foundation complete for TD1 towers and all extensions									
Foundation type 3	No	0	0	0	0	0	0	0	0
Foundation type 4A	No	3	3	3	2	3	3	3	3
Foundation complete for TD3 towers and all extensions									
Foundation type 3	No	0	0	0	0	0	0	0	0
Foundation type 4A	No	1	1	1	2	1	1	1	1
Survey									
Preliminary Survey *	km	6	6	6	6	6	6	6	6
Profile Survey	km	6	6	6	6	6	6	6	6
TOTAL									
INSTALLATIONS									
Erection of self-supporting towers and extended towers of the suspension type complete with all fittings & including Earthing System									
Type TDL towers with ± 0m extension	No	1	9	1	0	1	2	2	2
Type TDL towers with -3m extension	No	7	5	6	5	7	7	6	6
Type TDL towers with +3m extension	Ns	5	2	6	6	5	4	5	6
Type TDL towers with +6m extension	No	1	0	1	3	2	2	3	2
Type TDL towers with +9m extension	No	2	0	2	2	1	1	0	0
Type TDL towers with +12m extension	No	0	0	0	0	0	0	0	0
Erection of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings including Earthing System									
Type TD1 towers with ± 0m extension	No	1	1	1	1	1	1	1	1
Type TD1 towers with -3m extension	No	0	1	0	0	0	0	0	0
Type TD1 towers with +3m extension	No	2	1	2	1	2	2	2	2
Type TD1 towers with +6m extension	No	0	0	0	0	0	0	0	0
Type TD1 towers with +9m extension	No	0	0	0	0	0	0	0	0
Type TD1 towers with +12m extension	No	0	0	0	0	0	0	0	0
Erection of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings including Earthing System									
Type TD3 towers with ± 0m extension	No	0	0	0	0	0	0	0	0
Type TD3 towers with -3m extension	No	0	0	0	1	0	0	0	0
Type TD3 towers with +3m extension	No	0	1	0	1	0	0	0	0
Type TD3 towers with +6m extension	No	1	0	1	0	1	1	1	1
Type TD3 towers with +9m extension	No	0	0	0	0	0	0	0	0
Type TD3 towers with +12m extension	No	0	0	0	0	0	0	0	0
Stringing									
	km	6	6	6	6	6	6	6	6

Non Populated Hilly Terrain

Description	Unit	ACSR	ACCC	ZTACIR /AW	ACSS/TW	ACCR	GTACSR	LL-ACSR/AS	LL-TACSR/AS
Supply of Conductors including joints and jumper leads									
400 mm ² Zebra 61/3.18 mm ACSR conductor (Including mid span joints) units	km	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6
7/3.25 MM Galvanized earth wire including mid span units	km	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
OPGW Conductors and OPGW Accessories	km	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Supply of Damping System (Vibration dampers)									
Vibration dampers for 400 mm ² Zebra (61/3.18 mm) conductor	Nos	336	348	336	336	336	336	348	336
Vibration dampers for OPGW	Nos	64	64	64	66	64	64	64	64
Vibration dampers for GSW	Nos	56	58	56	56	56	56	58	56
Supply of Insulator sets									
Normal suspension insulator sets for 400 mm ² ACSR conductor	Nos	12	12	12	12	12	12	12	6
Normal tension insulator sets for 400 mm ² ACSR conductor	Nos	204	204	204	204	204	204	204	216
Jumper suspension insulator sets	Nos	6	6	6	6	6	6	6	6
Light duty tension insulator sets for 400 mm ² ACSR conductor	Nos	12	12	12	12	12	12	12	12
Supply of self-supporting towers and extended towers of the suspension type complete with all fittings									
Type TDL towers with -3m extension	Nos	0	1	0	0	1	1	1	1
Type TDL towers with ± 0m extension	Nos	1	1	1	0	0	0	0	1
Type TDL towers with +3m extension	Nos	1	0	1	1	0	1	1	0
Type TDL towers with +6m extension	Nos	0	0	0	0	0	0	0	0
Type TDL towers with +9m extension	Nos	0	0	0	0	0	0	0	0
Type TDL towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Supply of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings									
Type TD1 towers with -3m extension	Nos	1	3	1	0	0	1	0	1
Type TD1 towers with ± 0m extension	Nos	0	2	0	1	2	1	2	1
Type TD1 towers with +3m extension	Nos	3	0	3	1	1	3	1	3
Type TD1 towers with +6m extension	Nos	2	2	1	2	2	1	2	1
Type TD1 towers with +9m extension	Nos	1	1	1	0	2	2	2	2
Type TD1 towers with +12m extension	Nos	4	3	5	7	4	3	4	3
Supply of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings									
Type TD3 towers with -3m extension	Nos	1	2	1	0	1	1	1	1
Type TD3 towers with ± 0m extension	Nos	2	2	3	2	3	2	3	3
Type TD3 towers with +3m extension	Nos	1	0	0	1	0	1	0	0
Type TD3 towers with +6m extension	Nos	0	0	0	0	0	0	0	0
Type TD3 towers with +9m extension	Nos	0	0	0	1	0	0	0	0
Type TD3 towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Supply of self-supporting towers and extended towers of the Tension (TD6) type complete with all fittings									
Type TD6 towers with -3m extension	Nos	1	1	0	0	1	1	1	1
Type TD6 towers with ± 0m extension	Nos	0	0	1	1	0	0	0	0
Type TD6 towers with +3m extension	Nos	0	1	1	0	1	1	1	0
Type TD6 towers with +6m extension	Nos	1	0	0	1	0	0	0	1
Type TD6 towers with +9m extension	Nos	0	0	0	0	0	0	0	0
Type TD6 towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Type TDT towers with +12m extension(TDT + 12)	Nos	0	0	0	0	0	0	0	0

CIVIL WORKS										
Foundation complete for TDL towers and all extensions										
	Foundation type 3	Nos	2	2	2	2	2	2	2	2
	Foundation type 4A	Nos	0	0	0	0	0	0	0	0
Foundation complete for TD1 towers and all extensions										
	Foundation type 3	Nos	11	11	11	11	11	11	11	11
	Foundation type 4A	Nos	0	0	0	0	0	0	0	0
Foundation complete for TD3 towers and all extensions										
	Foundation type 3	Nos	4	4	4	4	4	4	4	4
	Foundation type 4A	Nos	0	0	0	0	0	0	0	0
Foundation complete for TD6 towers and all extensions										
	Foundation type 3	Nos	2	2	2	2	2	2	2	2
	Foundation type 4A	Nos	0	0	0	0	0	0	0	0
Survey										
	Preliminary Survey	km	6	6	6	6	6	6	6	6
	Profile Survey	km	6	6	6	6	6	6	6	6
TOTAL										
INSTALLATIONS										
Erection of self-supporting towers and extended towers of the suspension type complete with all fittings & including Earthing System										
	Type TDL towers with ± 0m extension	Nos	0	1	0	0	1	1	1	1
	Type TDL towers with -3m extension	Nos	1	1	1	0	0	0	0	1
	Type TDL towers with +3m extension	Nos	1	0	1	1	0	1	1	0
	Type TDL towers with +6m extension	Nos	0	0	0	1	1	0	0	0
	Type TDL towers with +9m extension	Nos	0	0	0	0	0	0	0	0
	Type TDL towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Erection of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings including Earthing System										
	Type TD1 towers with ± 0m extension	Nos	1	3	1	0	0	1	0	1
	Type TD1 towers with -3m extension	Nos	0	2	0	1	1	1	2	1
	Type TD1 towers with +3m extension	Nos	3	0	3	1	1	3	1	3
	Type TD1 towers with +6m extension	Nos	2	2	2	2	2	1	2	1
	Type TD1 towers with +9m extension	Nos	1	1	1	0	2	2	2	2
	Type TD1 towers with +12m extension	Nos	4	3	5	7	4	3	4	3
Erection of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings including Earthing System										
	Type TD3 towers with ± 0m extension	Nos	1	2	1	0	1	1	1	1
	Type TD3 towers with -3m extension	Nos	2	2	3	2	3	2	3	3
	Type TD3 towers with +3m extension	Nos	1	0	0	1	0	1	0	0
	Type TD3 towers with +6m extension	Nos	0	0	0	0	0	0	0	0
	Type TD3 towers with +9m extension	Nos	0	0	0	1	0	0	0	0
	Type TD3 towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Erection of self-supporting towers and extended towers of the Tension (TD6) type complete with all fittings including Earthing System										
	Type TD6 towers with ± 0m extension	Nos	1	1	0	0	1	1	1	1
	Type TD6 towers with -3m extension	Nos	0	0	1	1	0	0	0	0
	Type TD6 towers with +3m extension	Nos	0	1	1	0	1	1	1	0
	Type TD6 towers with +6m extension	Nos	1	0	0	1	0	0	0	1
	Type TD6 towers with +9m extension	Nos	0	0	0	0	0	0	0	0
	Type TD6 towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Stringing										
		km	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1

Hilly Populated Hilly Terrain

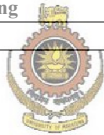
Description		Unit	ACSR	ACCC	ZTACR /AW	ACSS/TW	ACCR	GTACSR	LL-ACSR/AS	LL-TACSR/AS
Supply of Conductors including joints and jumper leads										
	400 mm ² Zebra 61/3.18 mm ACSR conductor (Including mid span joints) units	km	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6
	7/3.25 MM Galvanized earth wire including mid span units	km	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
	OPGW Conductors and OPGW Accessories	km	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Supply of Damping System (Vibration dampers)										
	Vibration dampers for 400 mm ² Zebra (61/3.18 mm) conductor	Nos	336	336	336	342	342	336	354	336
	Vibration dampers for OPGW	Nos	64	66	64	64	64	64	64	64
	Vibration dampers for GSW	Nos	56	56	56	57	57	56	59	56
Supply of Insulator sets										
	Normal suspension insulator sets for 400 mm ² ACSR conductor	Nos	6	6	6	6	12	6	6	6
	Normal tension insulator sets for 400 mm ² ACSR conductor	Nos	216	216	216	216	204	216	228	216
	Jumper suspension insulator sets	Nos	6	6	6	6	6	6	6	6
	Light duty tension insulator sets for 400 mm ² ACSR conductor	Nos	12	12	12	12	12	12	12	12
Supply of self-supporting towers and extended towers of the suspension type complete with all fittings										
	Type TDL towers with -3m extension	Nos	0	0	0	0	1	0	0	1
	Type TDL towers with ± 0m extension	Nos	1	1	0	0	0	1	1	0
	Type TDL towers with +3m extension	Nos	0	0	0	0	0	0	0	0
	Type TDL towers with +6m extension	Nos	0	0	0	0	1	0	0	0
	Type TDL towers with +9m extension	Nos	0	0	0	0	0	0	0	0
	Type TDL towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Supply of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings										
	Type TD1 towers with -3m extension	Nos	0	1	0	0	2	0	0	0
	Type TD1 towers with ± 0m extension	No	1	2	1	0	1	2	1	2
	Type TD1 towers with +3m extension	Nos	1	1	1	1	1	3	3	1
	Type TD1 towers with +6m extension	Nos	3	1	3	1	1	0	2	2
	Type TD1 towers with +9m extension	Nos	3	2	2	3	1	3	3	2
	Type TD1 towers with +12m extension	Nos	3	4	5	7	5	4	4	5
Supply of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings										
	Type TD3 towers with -3m extension	Nos	1	4	1	0	2	1	1	1
	Type TD3 towers with ± 0m extension	Nos	1	0	1	1	1	2	1	1
	Type TD3 towers with +3m extension	Nos	1	1	1	1	0	1	2	2
	Type TD3 towers with +6m extension	Nos	1	0	1	1	1	0	0	0
	Type TD3 towers with +9m extension	Nos	0	0	0	0	0	0	0	0
	Type TD3 towers with +12m extension	Nos	1	0	0	1	0	0	0	0
Supply of self-supporting towers and extended towers of the Tension (TD6) type complete with all fittings										
	Type TD6 towers with -3m extension	Nos	1	1	1	0	1	1	1	1
	Type TD6 towers with ± 0m extension	Nos	0	0	0	1	0	0	0	0
	Type TD6 towers with +3m extension	Nos	0	1	0	0	0	0	0	1
	Type TD6 towers with +6m extension	Nos	1	0	1	1	0	1	1	0
	Type TD6 towers with +9m extension	Nos	0	0	0	0	1	0	0	0
	Type TD6 towers with +12m extension	Nos	0	0	0	0	0	0	0	0
CIVIL WORKS										
Foundation complete for TDL towers and all extensions										
	Foundation type 3	Nos	1	1	1	1	2	1	1	1
	Foundation type 4A	Nos	0	0	0	0	0	0	0	0

Foundation complete for TD1 towers and all extensions										
	Foundation type 3	Nos	11	11	12	12	11	12	13	12
	Foundation type 4A	Nos	0	0	0	0	0	0	0	0
Foundation complete for TD3 towers and all extensions										
	Foundation type 3	Nos	5	5	4	4	4	4	4	4
	Foundation type 4A	Nos	0	0	0	0	0	0	0	0
Foundation complete for TD6 towers and all extensions										
	Foundation type 3	Nos	2	2	2	2	2	2	2	2
	Foundation type 4A	Nos	0	0	0	0	0	0	0	0
Foundation complete for TDT towers and all extensions										
	Foundation type 3	Nos	0	0	0	0	0	0	0	0
	Foundation type 4A	Nos	0	0	0	0	0	0	0	0
Survey										
	Preliminary Survey *	km	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
	Profile Survey	km	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
TOTAL										
INSTALLATIONS										
Erection of self-supporting towers and extended towers of the suspension type complete with all fittings & including Earthing System										
	Type TDL towers with ± 0m extension	Nos	0	0	0	0	1	0	0	1
	Type TDL towers with -3m extension	Nos	1	1	0	0	0	1	1	0
	Type TDL towers with +3m extension	Nos	0	0	1	1	0	0	0	0
	Type TDL towers with +6m extension	Nos	0	0	0	0	1	0	0	0
	Type TDL towers with +9m extension	Nos	0	0	0	0	0	0	0	0
	Type TDL towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Erection of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings including Earthing System										
	Type TD1 towers with ± 0m extension	Nos	0	1	0	0	2	0	0	0
	Type TD1 towers with -3m extension	Nos	1	2	1	0	1	2	1	2
	Type TD1 towers with +3m extension	Nos	1	1	1	1	1	3	3	1
	Type TD1 towers with +6m extension	Nos	3	1	3	1	0	2	2	2
	Type TD1 towers with +9m extension	Nos	3	2	2	3	3	3	3	2
	Type TD1 towers with +12m extension	Nos	3	4	5	7	5	4	4	5
Erection of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings including Earthing System										
	Type TD3 towers with ± 0m extension	Nos	1	4	1	0	2	1	1	1
	Type TD3 towers with -3m extension	Nos	1	0	1	1	1	2	1	1
	Type TD3 towers with +3m extension	Nos	1	1	1	1	0	1	2	2
	Type TD3 towers with +6m extension	Nos	1	0	1	1	1	0	0	0
	Type TD3 towers with +9m extension	Nos	0	0	0	0	0	0	0	0
	Type TD3 towers with +12m extension	Nos	1	0	0	1	0	0	0	0
Erection of self-supporting towers and extended towers of the Tension (TD6) type complete with all fittings including Earthing System										
	Type TD6 towers with ± 0m extension	Nos	1	1	1	0	1	1	1	1
	Type TD6 towers with -3m extension	Nos	0	0	0	1	0	0	0	0
	Type TD6 towers with +3m extension	Nos	0	1	0	0	0	0	0	1
	Type TD6 towers with +6m extension	Nos	1	0	1	1	0	1	1	0
	Type TD6 towers with +9m extension	Nos	0	0	0	0	1	0	0	0
	Type TD6 towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Stringing										
		km	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8

Paddy Hilly Terrain

Description	Unit	ACSR	ACCC	ZTACIR /AW	ACSS/TW	ACCR	GTACSR	LL-ACSR/AS	LL-TACSR/AS
Supply of Conductors including joints and jumper leads									
400 mm ² Zebra 61/3.18 mm ACSR conductor (Including mid span joints) units	km	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5
7/3.25 MM Galvanized earth wire including mid span units	km	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
OPGW Conductors and OPGW Accessories	km	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
Supply of Damping System (Vibration dampers)									
Vibration dampers for 400 mm ² Zebra (61/3.18 mm) conductor	Nos	288	288	288	288	288	288	288	288
Vibration dampers for OPGW	Nos	58	58	58	58	58	58	58	58
Vibration dampers for GSW	Nos	48	48	48	48	48	48	48	48
Supply of Insulator sets									
Normal suspension insulator sets for 400 mm ² ACSR conductor	Nos	30	24	30	24	24	24	24	24
Normal tension insulator sets for 400 mm ² ACSR conductor	Nos	132	144	132	144	144	144	144	144
Jumper suspension insulator sets	Nos	0	0	0	0	0	0	0	0
Light duty tension insulator sets for 400 mm ² ACSR conductor	Nos	12	12	12	12	12	12	12	12
Supply of self-supporting towers and extended towers of the suspension type complete with all fittings									
Type TDL towers with -3m extension	Nos	0	0	0	0	0	0	0	0
Type TDL towers with ± 0m extension	Nos	0	1	0	0	0	0	0	0
Type TDL towers with +3m extension	Nos	0	0	0	1	0	1	1	1
Type TDL towers with +6m extension	Nos	3	1	3	2	3	2	2	2
Type TDL towers with +9m extension	Nos	0	0	0	0	0	0	0	0
Type TDL towers with +12m extension	Nos	2	1	2	1	1	1	1	1
Supply of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings									
Type TD1 towers with -3m extension	Nos	2	3	2	2	2	2	2	2
Type TD1 towers with ± 0m extension	No	0	2	0	1	1	1	1	1
Type TD1 towers with +3m extension	Nos	1	1	1	1	1	1	1	1
Type TD1 towers with +6m extension	Nos	3	1	3	2	3	3	3	3
Type TD1 towers with +9m extension	Nos	0	0	0	1	0	0	0	0
Type TD1 towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Supply of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings									
Type TD3 towers with -3m extension	Nos	0	2	0	0	0	0	0	1
Type TD3 towers with ± 0m extension	Nos	1	1	1	1	1	1	2	0
Type TD3 towers with +3m extension	Nos	2	1	2	2	2	2	1	2
Type TD3 towers with +6m extension	Nos	1	1	1	1	1	1	1	1
Type TD3 towers with +9m extension	Nos	1	0	1	1	1	1	1	1
Type TD3 towers with +12m extension	Nos	0	0	0	0	0	0	0	0
CIVIL WORKS									
Foundation complete for TDL towers and all extensions									
Foundation type 3	Nos	0	0	0	0	0	0	0	0
Foundation type 4A	Nos	5	4	5	4	4	4	4	4
Foundation complete for TD1 towers and all extensions									
Foundation type 3	Nos	0	0	0	0	0	0	0	0
Foundation type 4A	Nos	6	7	6	7	7	7	7	7
Foundation complete for TD3 towers and all extensions									
Foundation type 3	Nos	0	0	0	0	0	0	0	0
Foundation type 4A	Nos	5	5	5	5	5	5	5	5

Survey										
	Preliminary Survey *	km	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
	Profile Survey	km	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
TOTAL										
INSTALLATIONS										
Erection of self-supporting towers and extended towers of the suspension type complete with all fittings & including Earthing System										
	Type TDL towers with ± 0m extension	Nos	0	0	0	0	0	0	0	0
	Type TDL towers with -3m extension	Nos	0	1	0	0	0	0	0	0
	Type TDL towers with +3m extension	Nos	0	1	0	1	0	1	1	1
	Type TDL towers with +6m extension	Nos	3	1	3	2	3	2	2	2
	Type TDL towers with +9m extension	Nos	0	0	0	0	0	0	0	0
	Type TDL towers with +12m extension	Nos	2	1	2	1	1	1	1	1
Erection of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings including Earthing System										
	Type TD1 towers with ± 0m extension	Nos	2	3	2	2	2	2	2	2
	Type TD1 towers with -3m extension	Nos	0	2	0	1	1	1	1	1
	Type TD1 towers with +3m extension	Nos	1	1	1	1	1	1	1	1
	Type TD1 towers with +6m extension	Nos	3	1	3	2	3	3	3	3
	Type TD1 towers with +9m extension	Nos	0	0	0	1	0	0	0	0
	Type TD1 towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Erection of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings including Earthing System										
	Type TD3 towers with ± 0m extension	Nos	0	2	0	0	0	0	0	1
	Type TD3 towers with -3m extension	Nos	1	1	1	1	1	1	2	0
	Type TD3 towers with +3m extension	Nos	2	1	2	2	2	2	1	2
	Type TD3 towers with +6m extension	Nos	1	1	1	1	1	1	1	1
	Type TD3 towers with +9m extension	Nos	1	0	1	1	1	1	1	1
	Type TD3 towers with +12m extension	Nos	0	0	0	0	0	0	0	0
Stringing										
		km	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7



APPENDIX VIII: Sample Price Schedule

Description		Unit	Qty.	Unit Price	Total Price
ACSR				LKR	LKR
Supply of Conductors including joints and jumper leads					
	400 mm ² Zebra 61/3.18 mm ACSR conductor (Including mid span joints) units	km	6.24	770,000.00	28,833,928.20
	7/3.25 MM Galvanized earth wire including mid span units	km	6.24	243,000.00	1,516,589.73
	OPGW, Conductors and OPGW Accessories	km	6.24	675,778.00	4,217,604.83
Supply of Damping System (Vibration dampers)					
	Vibration dampers for 400 mm ² Zebra (61/3.18 mm) conductor	Nos	450.00	5,198.62	2,339,379.00
	Vibration dampers for OPGW	Nos	76.00	7,328.62	556,975.12
	Vibration dampers for GSW	Nos	75.00	4,772.62	357,946.50
Supply of Insulator sets					
	Normal suspension insulator sets for 400 mm ² ACSR conductor	Nos	96.00	46,718.00	4,484,928.00
	Normal tension insulator sets for 400 mm ² ACSR conductor	Nos	48.00	63,190.00	3,033,120.00
	Jumper suspension insulator sets	Nos	0.00	44,674.62	
	Light duty tension insulator sets for 400 mm ² ACSR conductor	Nos	12.00	104,740.62	1,256,887.44
Supply of self-supporting towers and extended towers of the suspension type complete with all fittings					
	Type TDL towers with -3m extension	Nos	1.00	1,047,938.96	1,047,938.96
	Type TDL towers with ± 0m extension	Nos	7.00	1,162,088.56	8,134,619.89
	Type TDL towers with +3m extension	Nos	5.00	1,292,983.80	6,464,918.99
	Type TDL towers with +6m extension	Nos	1.00	1,420,151.84	1,420,151.84
	Type TDL towers with +9m extension	Nos	2.00	1,562,552.23	3,125,104.45
	Type TDL towers with +12m extension	Nos	0.00	1,748,828.09	
Supply of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings					
	Type TD1 towers with +3m extension	Nos	1.00	1,369,897.08	1,369,897.08
	Type TD1 towers with ± 0m extension	No	0.00	1,462,065.63	
	Type TD1 towers with +3m extension	Nos	2.00	1,627,929.79	3,255,859.57
	Type TD1 towers with +6m extension	Nos	0.00	1,718,585.04	
	Type TD1 towers with +9m extension	Nos	0.00	1,871,023.13	
	Type TD1 towers with +12m extension	Nos	0.00	1,985,534.50	
Supply of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings					
	Type TD3 towers with -3m extension	Nos	0.00	2,056,200.96	
	Type TD3 towers with ± 0m extension	Nos	0.00	2,367,693.37	
	Type TD3 towers with +3m extension	Nos	0.00	2,567,637.32	
	Type TD3 towers with +6m extension	Nos	1.00	2,768,788.85	2,768,788.85
	Type TD3 towers with +9m extension	Nos	0.00	3,020,926.32	
	Type TD3 towers with +12m extension	Nos	0.00	3,224,775.81	
Supply of self-supporting towers and extended towers of the Tension (TD6) type complete with all fittings					
	Type TD6 towers with -3m extension	Nos	0.00	2,439,113.93	
	Type TD6 towers with ± 0m extension	Nos	0.00	2,730,981.86	
	Type TD6 towers with +3m extension	Nos	0.00	3,184,089.98	
	Type TD6 towers with +6m extension	Nos	0.00	3,565,410.68	
	Type TD6 towers with +9m extension	Nos	0.00	3,987,399.37	
	Type TD6 towers with +12m extension	Nos	0.00	4,377,555.28	
	ACSR Zebra Conductors and Earth Wires-7/3.25				30,350,517.93
	OPGW Conductors and OPGW Accessories				4,774,579.95
	Insulator sets, and Insulator h/w + conductor, GSW h/w				11,472,260.94
	Towers				27,587,279.63
	Other Supply (6% of Total Supply)				4,451,078.31
CIVIL WORKS					

Foundation complete for TDL towers and all extensions					
	Foundation type 3	Nos	16	715,098.25	11,441,572.00
	Foundation type 4A	Nos		2,028,051.56	
Foundation complete for TD1 towers and all extensions					
	Foundation type 3	Nos	3	1,094,929.11	3,284,787.33
	Foundation type 4A	Nos		2,805,487.45	
Foundation complete for TD3 towers and all extensions					
	Foundation type 3	Nos	1	1,594,323.59	1,594,323.59
	Foundation type 4A	Nos		3,449,671.00	
Foundation complete for TD6 towers and all extensions					
	Foundation type 3	Nos	0	4,051,615.75	
	Foundation type 4A	Nos		8,113,809.00	
Survey					
	Preliminary Survey	km	6.24	27,898.57	174,118.07
	Profile Survey	km	6.24	127,773.33	797,447.43
INSTALLATIONS					
Erection of self-supporting towers and extended towers of the suspension type complete with all fittings & including Earthing System					
	Type TDL towers with ± 0m extension	Nos	1	181,111.31	181,111.31
	Type TDL towers with -3m extension	Nos	7	166,155.45	1,163,088.17
	Type TDL towers with +3m extension	Nos	5	206,778.53	1,033,892.65
	Type TDL towers with +6m extension	Nos	1	232,278.39	232,278.39
	Type TDL towers with +9m extension	Nos	2	261,929.04	523,858.07
	Type TDL towers with +12m extension	Nos	0	291,970.45	
Erection of self-supporting towers and extended towers of the Tension (TD1) type complete with all fittings including Earthing					
	Type TD1 towers with ± 0m extension	Nos	1	265,284.96	265,284.96
	Type TD1 towers with -3m extension	Nos	0	237,872.79	
	Type TD1 towers with +3m extension	Nos	2	297,830.76	595,661.51
	Type TD1 towers with +6m extension	Nos	0	335,666.26	
	Type TD1 towers with +9m extension	Nos	0	386,379.99	
	Type TD1 towers with +12m extension	Nos	0	416,938.05	
Erection of self-supporting towers and extended towers of the Tension (TD3) type complete with all fittings including Earthing					
	Type TD3 towers with ± 0m extension	Nos	0	312,698.75	
	Type TD3 towers with -3m extension	Nos	0	276,653.03	
	Type TD3 towers with +3m extension	Nos	0	352,311.47	
	Type TD3 towers with +6m extension	Nos	1	402,209.61	402,209.61
	Type TD3 towers with +9m extension	Nos	0	453,742.78	
	Type TD3 towers with +12m extension	Nos	0	499,597.84	
Erection of self-supporting towers and extended towers of the Tension (TD6) type complete with all fittings including Earthing System					
	Type TD6 towers with ± 0m extension	Nos	0	444,588.25	
	Type TD6 towers with -3m extension	Nos	0	403,846.84	
	Type TD6 towers with +3m extension	Nos	0	501,771.85	
	Type TD6 towers with +6m extension	Nos	0	576,441.59	
	Type TD6 towers with +9m extension	Nos	0	661,230.14	
	Type TD6 towers with +12m extension	Nos	0	718,526.96	
Stringing					
	Stringing	km	6.24	784,705.35	4,897,432.43
Summary Table					
Foundation and Surveying					17,292,248.41
Tower Erection					4,397,384.68
Stringing					4,897,432.43
Other Works					2,658,706.55

	Conductor Cost	30,350,517.93
	Total Supply	48,285,198.83
	Total Civil Works	29,245,772.07
	Total Other Services	4,315,259.55
	Total Cost	112,196,748.39
	Per Km Cost	17,977,050.30

Conductor Cost Factor for same sized conductors; Source [6]	
1.0	ACSR
2.5	ACCC
3.0	ZTACIR/AW
1.5	ACSS/TW
5.0	ACCR
1.5	GTACSR
1.4	LL ACSR
1.5	LL TACSR



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APPENDIX IX : Total Cost Summary for Respective Terrain Models

Non Populated Flat Terrain

Conductor Type		ACSR	ACCC	ZTACIR/ AW	ACSS/TW	ACCR	GTACSR	LL- ACSR/AS	LL- TACSR/AS
Description		Rs.(Mn)							
Total Supply	Conductor	30.35	73.60	88.02	44.77	145.69	44.77	41.88	44.77
	Other Supply	48.29	48.69	53.56	55.27	55.61	52.36	50.42	53.05
Total Civil Works		29.25	29.19	30.08	32.03	29.48	31.19	30.02	31.26
Total Other Services		4.32	6.06	6.87	5.28	9.23	5.13	4.89	5.16
Total Cost		112.20	157.54	178.53	137.35	240.01	133.45	127.21	134.24
Per km Cost		17.98	25.24	28.61	22.01	38.46	21.38	20.38	21.51

Populated Flat Terrain

Conductor Type		ACSR	ACCC	ZTACIR/ AW	ACSS/TW	ACCR	GTACSR	LL- ACSR/AS	LL- TACSR/AS
Description		Rs.(Mn)							
Total Supply	Conductor	28.04	68.01	81.33	41.36	134.61	41.36	38.70	41.36
	Other Supply	67.20	65.52	73.99	72.28	75.66	73.58	69.91	73.63
Total Civil Works		45.63	46.33	49.16	49.43	47.36	51.25	48.56	50.92
Total Other Services		5.63	7.19	8.18	6.52	10.31	6.65	6.29	6.64
Total Cost		146.51	187.05	212.65	169.6	267.93	172.85	163.46	172.55
Per km Cost		25.41	32.44	36.88	29.41	46.46	29.97	28.35	29.92

Paddy Flat Terrain

Conductor		ACSR	ACCC	ZTACIR/ AW	ACSS/TW	ACCR	GTACSR	LL-ACSR/ AS	LL- TACSR/AS
Description		Rs.(Mn)							
Total Supply	Conductor	30.35	73.60	88.02	44.77	145.69	44.77	41.88	44.77
	Other Supply	48.29	48.69	53.56	55.27	55.61	52.36	50.42	23.79
Total Civil Works		60.04	60.33	62.10	66.64	60.58	65.24	62.06	65.47
Total Other Services		5.55	7.30	8.15	6.67	10.48	6.49	6.17	5.36
Total Cost		144.22	189.92	211.83	173.34	272.35	168.86	160.54	139.39
Per km Cost		23.11	30.43	33.94	27.77	43.64	27.06	25.72	22.33

Non Populated Hilly Terrain

Conductor		ACSR	ACCC	ZTACIR/ AW	ACSS/ TW	ACCR	GTACSR	LL-ACSR/ AS	LL- TACSR/ AS
Description		Rs.(Mn)							
Total Supply	Conductor	28.06	68.04	81.37	41.39	134.68	41.39	38.72	41.39
	Other Supply	63.89	65.92	68.40	71.36	70.40	68.68	65.66	69.43
Total Civil Works		57.77	61.67	59.59	62.07	58.91	63.74	60.22	63.25
Total Other Services		5.99	7.83	8.37	6.99	10.56	6.95	6.58	6.96
Total Cost		155.71	203.46	217.74	181.81	274.56	180.76	171.18	181.03
Per km Cost		26.99	35.26	37.74	31.51	47.59	31.33	29.67	31.38

Populated Hilly Terrain

Conductor		ACSR	ACCC	ZTACIR/A W	ACSS/TW	ACCR	GTACSR	LL-ACSR/ AS	LL- TACSR/AS
Description		Rs.(Mn)							
Total Supply	Conductor	28.06	68.04	81.37	41.39	134.68	41.39	38.72	41.39
	Other Supply	69.47	72.53	76.59	77.75	76.59	76.92	76.83	77.20
Total Civil Works		61.40	67.22	65.31	66.27	63.71	69.33	67.77	69.09
Total Other Services		6.36	8.32	8.93	7.42	11.00	7.51	7.33	7.51
Total Cost		165.29	216.21	232.20	192.82	285.98	195.14	190.66	195.19
Per km Cost		28.65	37.47	40.24	33.42	49.57	33.82	33.04	33.83

Paddy Hilly Terrain

Conductor		ACSR	ACCC	ZTACIR /AW	ACSS/T W	ACCR	GTACS R	LL- ACSR/A S	LL- TACSR/ AS
Description		Rs.(Mn)							
Total Supply	Conductor	23.06	55.93	66.89	34.02	110.71	34.02	31.83	34.02
	Other Supply	51.13	52.98	56.99	55.52	58.81	57.49	54.40	57.14
Total Civil Works		79.74	86.93	85.51	86.86	84.90	91.80	86.72	91.87
Total Other Services		6.16	7.83	8.38	7.06	10.18	7.33	6.92	7.32
Total Cost		160.09	203.68	217.76	183.46	264.60	190.64	179.87	190.35
Per km Cost		33.75	42.94	45.91	38.68	55.79	40.20	37.92	40.13