Prepared by;
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Sample of Illumination, Power Points, and Networking and Telephone Points Design

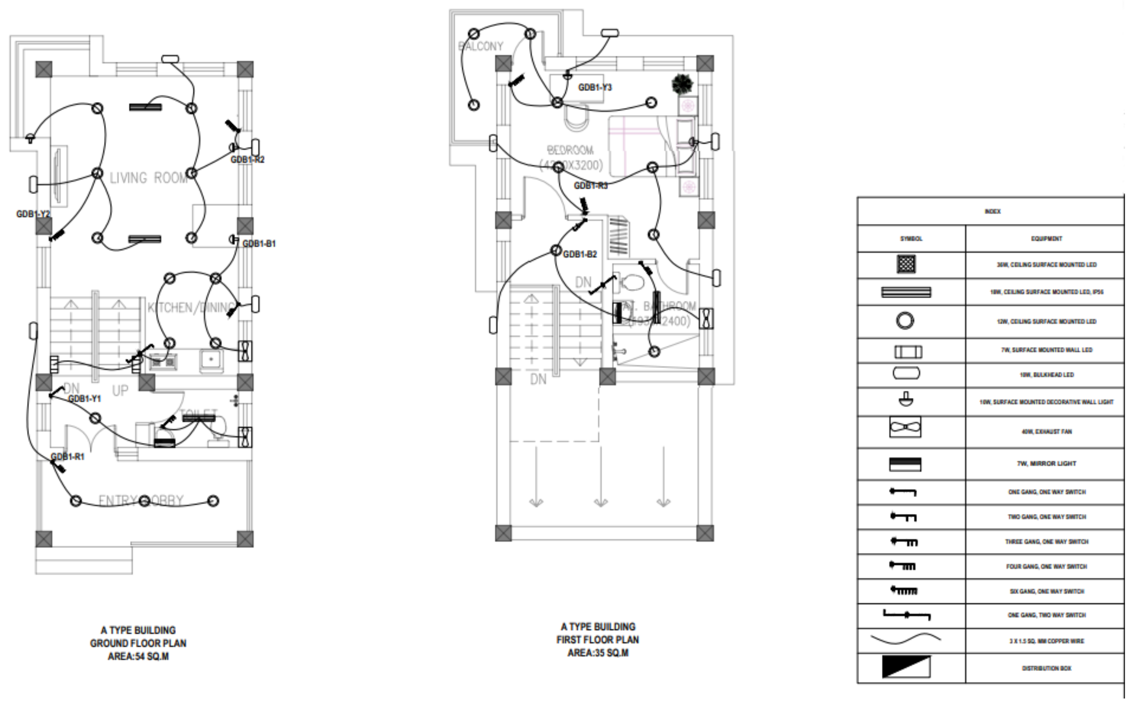

Figure 1: Illumination Design of a Type- A Building

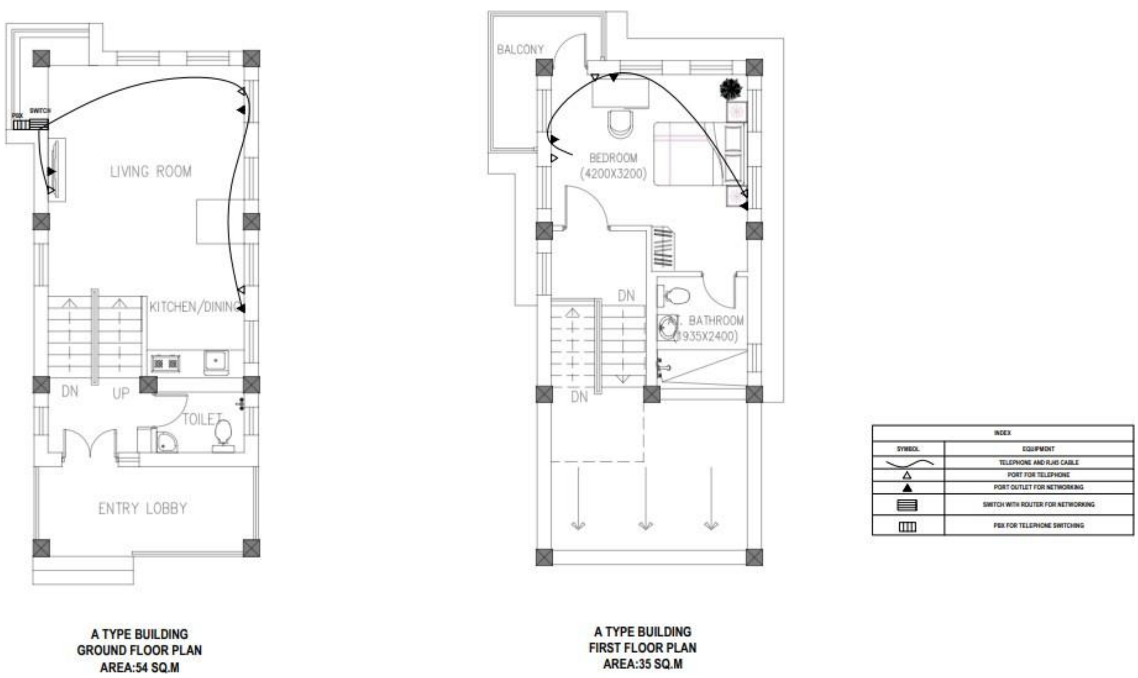

Figure 2: Networking and Telephone Points Design of a Type-A Building

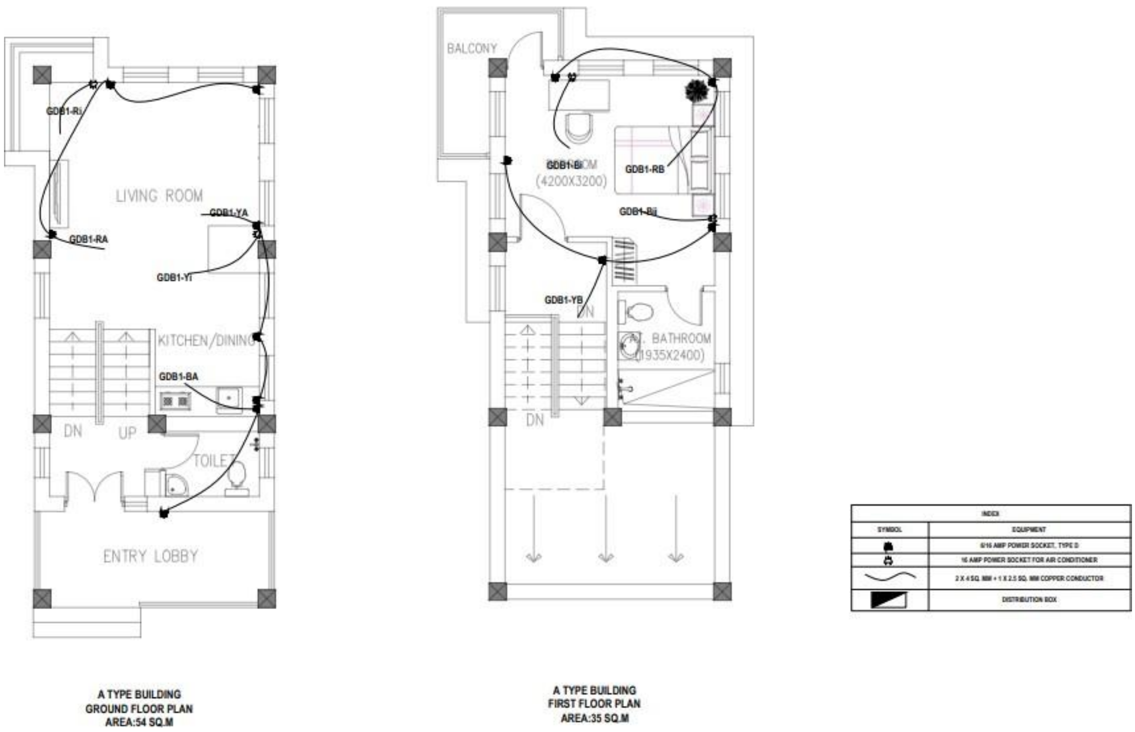

Figure 3: Power Points Design of a Type-A Building

2.1.2 Electrification of KAHEP Powerhouse

The Kimathanka Arun Powerhouse utilized various poles placed strategically during the electrification process, as designed using AutoCAD. The electrification employed ABC cables in conjunction with ADSS cables, and streetlights were installed at intervals not exceeding 30 meters apart. The placement of streetlights was simulated using DiaLux software. For buildings that were elevated over 5 meters from the ground level, two poles were employed - one at a higher elevation and the other at a lower elevation - to ensure the building was adequately supplied with electricity.

Figure 4: Upper Half of Kimathanka Arun HEP Powerhouse

Figure 5: Lower Half of Kimathanka Arun HEP Powerhouse

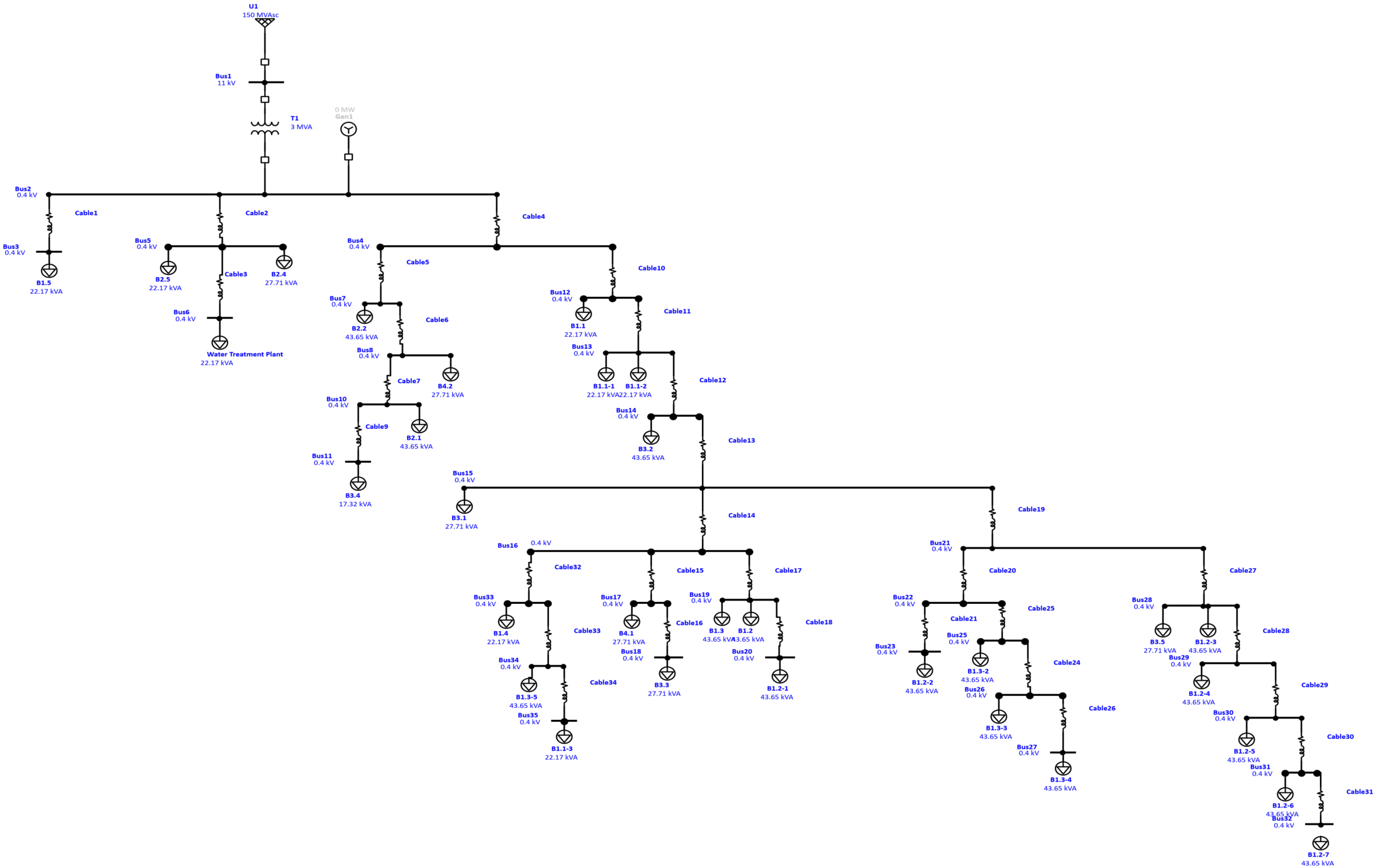

Figure 6: Modelling in Etap of Camp Facilities of KAHEP-PH for load flow analysis

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Load flow analysis was performed in above setup but the current flowing in individual bus and cables were too large that it exceeded the ampacity rating of the cable used for electrification process. So, in order to solve this problem different feeders were assigned for a group of buildings and load flow analysis was performed using six feeders.

Figure 7: Upper Half of Kimathanka Arun HEP-PH with feeders

Figure 8: Lower Half of Kimathanka Arun HEP-PH with feeders

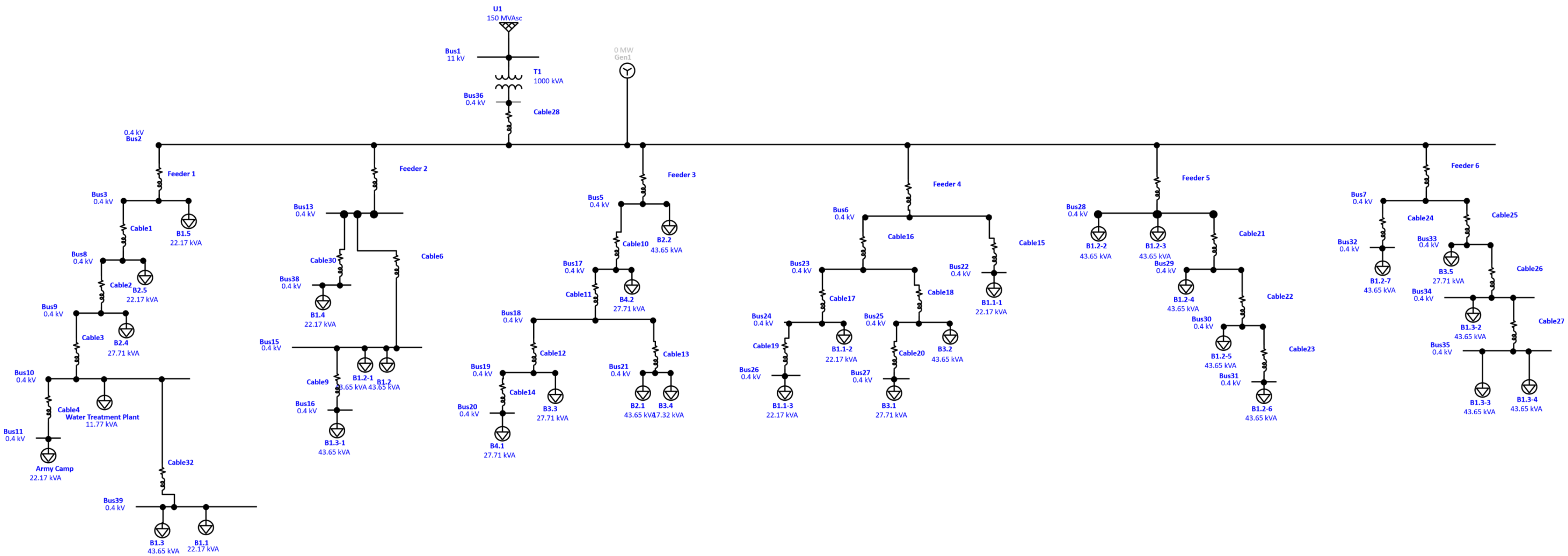

Figure 9: Modelling in Etap of Camp Facilities of KAHEP-PH for load flow analysis

Cable Sizing for PEB Workshop of Phukot-Karnali HEP

The PKHEP is situated in the Kalikot district of Karnali Province in Nepal. It will utilize the water flow from the Karnali River to generate electricity, which will be supplied to the national power grid at the nearest Regil grid substation. The project has a total installed capacity of 480 MW, which includes 6 MW from the dam's toe plant via environmental release. The project is expected to generate a total energy of 2447 GWh. The gross head of the project is 168.62 m, and the designed discharge rate is 348m^3/s.

The headwater of the PKHEP catchment originates from the High Mountain of the Tibetan Plateau and then flows through Western Nepal into the Ganges river system in India. The catchment area of the PKHEP is 16,902 km2. To evacuate the power generated by the project to the nearest grid hub substation at Regil, 23 km long transmission line with a transmission voltage of 400 kV and a double circuit twin Moose configuration is planned[3].

Cable sizing was done for:

a. Transformer to Main Distribution Board (MDB)
b. Diesel Generator to Main Distribution Board
c. MDB to Zone A, B, C, D, E, F

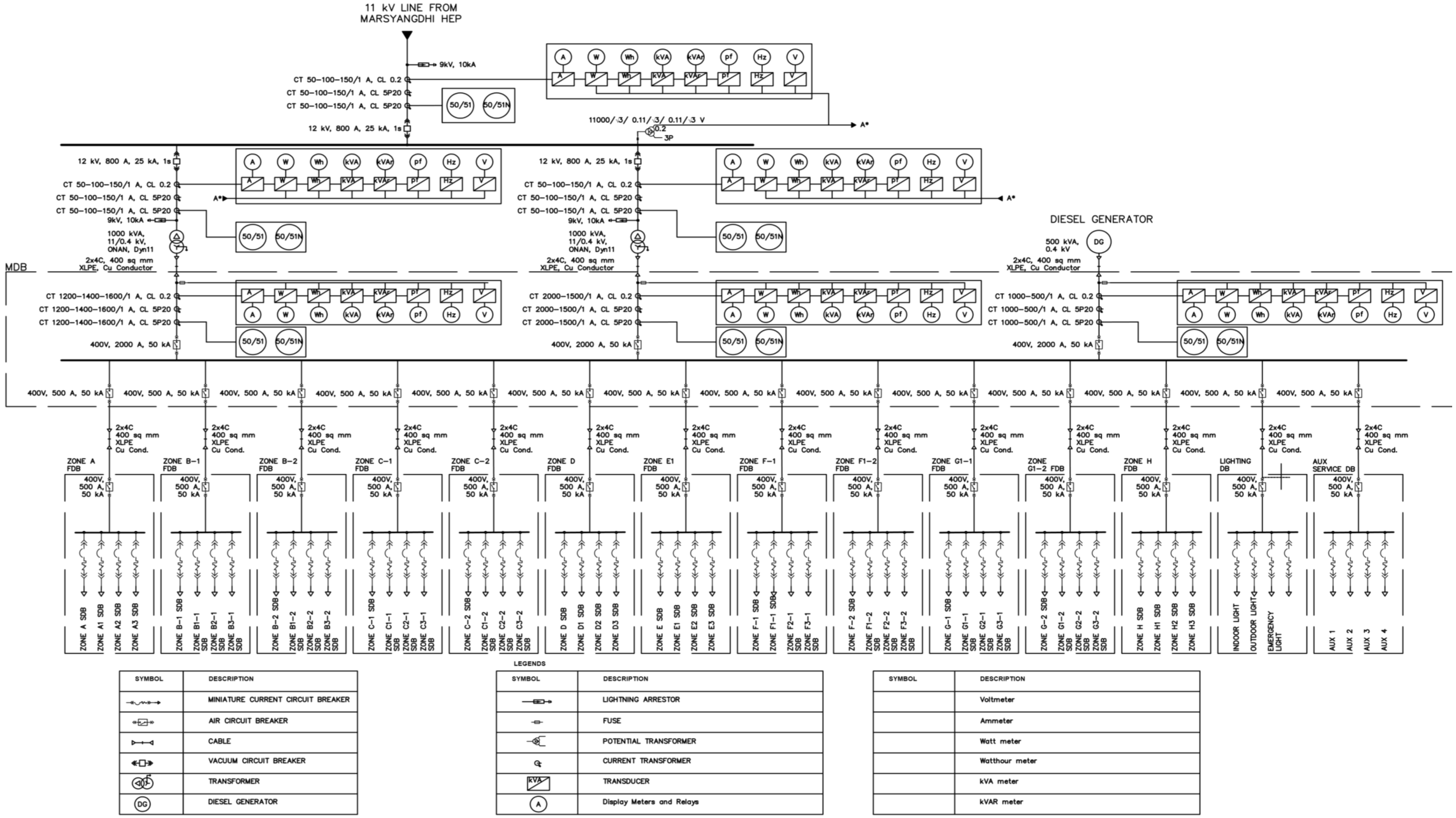

Figure 11: Single Line Diagram of Phukot-Karnali PEB Workshop Building

Cable (or conductor) sizing is the process of selecting appropriate sizes for electrical power cable conductors. Cable sizes are specifically described in terms of cross-sectional area, American Wire Gauge (AWG) or kcmil, depending on geographic region.

The proper sizing of cables is important to ensure that the cable can:

a. Operate continuously under full load without being damaged.
b. Provide the load with a suitable voltage (and avoid excessive voltage drops).
c. Withstand the worst short circuits currents flowing through the cable.

Cable sizing methods do differ across international standards (e.g. IEC, NEC, BS, etc) and some standards emphasize certain things over others. However, the general principles that underpin all cable sizing calculation do not change. When sizing a cable, the following general process is followed generally:

Power Demand:

a. KVA to be supplied
b. Maximum Load Current

↓

Method of Installation

(Trench, On Air, On Ground, Tray, In Ducts, Conduit)

↓

Conductor Selection

a. Conductor Material
b. Conductor Insulation
c. Cores of conductor
d. Ampacity
e. Dimension of conductor
f. No. of rungs

↓

De-rating Factors

a. Ambient Temperature
b. Grouping of cables
c. Depth of laying
d. Soil Thermal Resistivity

↓

Voltage Regulation

a. VR= $\frac{\sqrt{3}\ I(R\cos\Phi + X\sin\Phi)}{1000}$
b. Within 5%

↓

Short Circuit Criteria

a. SC= $\frac{K*S}{\sqrt{t}}$
b. Cable short circuit capacity>> System Short Circuit

Figure 12: Flowchart for Cable Sizing

Validating Cable Sizing Calculation through Excel.

Cable Sizing Calculations		
From Transformer to MDB		
General Parameters		
	Unit	Value
Rating of System	kVA	1250
Rated Voltage	kV	0.4
Current Rating	A	1804.27
Circuit Breaker Rated Current	A	2000
Standard Conditions		
	Unit	Value
Ambient Ground Temperature	deg Celsius	40.00
Laying Type		Ground
Depth	mm	1,000.00
Thermal Resistivity of Soil	k.m/W	-
Selected Conductor		
	Unit	Value
Conductor Type		Copper
Conductor Cores		4.0
No. of rung		4.0
Conductor dimension	sq. mm	300.00
Conductor current carrying Capacity	A	741.00
Conductor Insulation		XLPE
Conductor Covering		m armored and extruded PVC Sheathed
Design Validations		
Current Carrying Capacity		
	Unit	Value
Current Rating of Conductor Before Applying Correction Factors (I)	A	741.00
Applicable Correction Factors Based on Actual Laying Conditions		
Ambient Air Temperature of 40 deg Celsius (ka)		0.91
group of more than one multi-core cable		0.82
Depth of Laying at 1000 mm (kc)		0.98
Equivalent Correction Factor (k=ka*kb*kc*kd)		0.73
Corrected Current Rating (k*I)	A	541.88
Remarks		
Resultant current rating is acceptable		
Voltage Regulation		
	Unit	Value
Line Current (I)	A	2,000.00
AC Resistance at 90 deg Celsius (R) approx.	ohm/km	0.1128
Reactance at 50 Hz (X) approx.	ohm/km	0.08
Length of Cable (L)	km	0.02
Line Voltage (V)	kV	0.40
cosØ (power factor)		0.90
sinØ		0.44
Voltage Regulation (VD= SQRT(3)*I*(R*cosØ + X*sinØ)*L*100/(V*1000))	%	2.36
Remarks		
Voltage Regulation is within limit.		
Short Circuit Limit		
	Unit	Value
Short Circuit Current of Selected Cable (from Catalogue)	kA	22.68
Time period for Short Circuit (t)	sec	3
Actual Short Circuit Current Flow	kA	<22.68
Remarks		
Short circuit current is within limit		

Figure 15: Cable Sizing Calculation in Excel Sheet