Power System Analysis

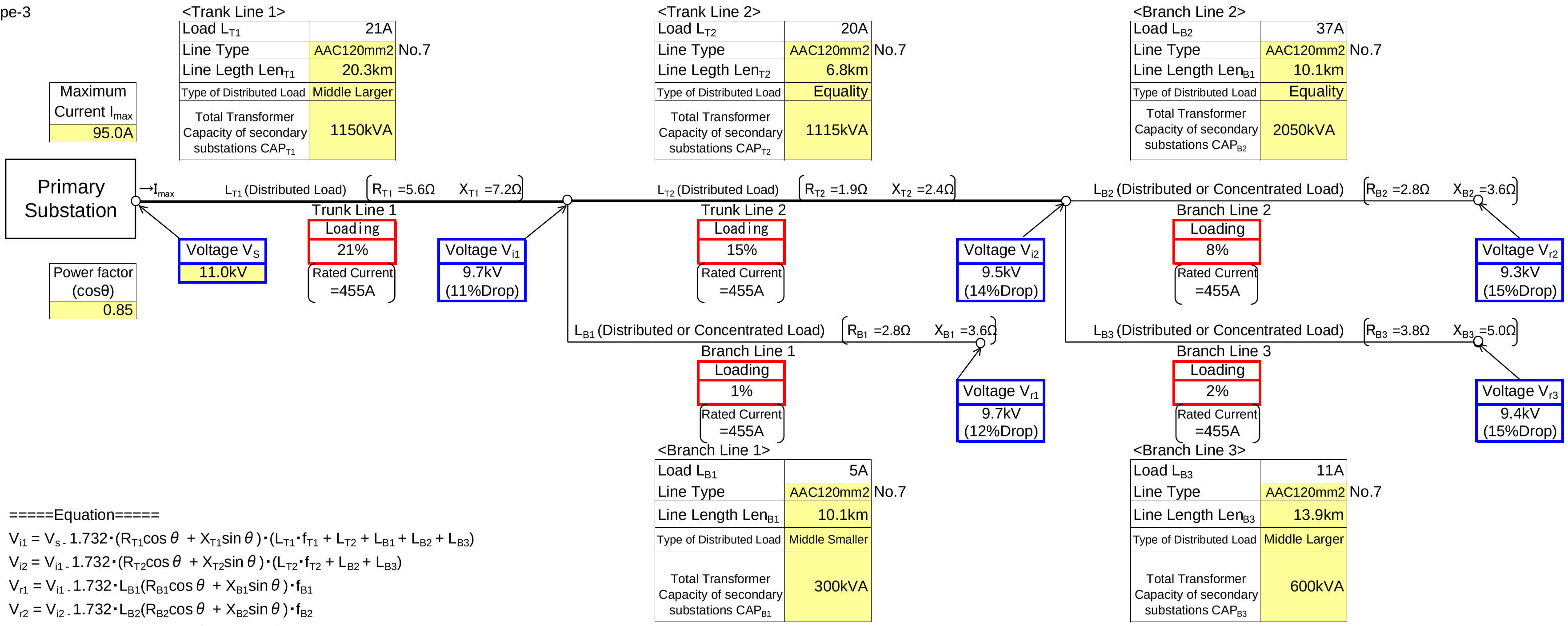
- Ashanti 11kV -

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	KONONGO
Feeder Name	AGOGO

🟨 : Input data in colored cells

Type-3



<Trank Line 1>

Load L_{T1}	21A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	20.3km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	1150kVA	

<Trank Line 2>

Load L_{T2}	20A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	6.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1115kVA	

<Branch Line 2>

Load L_{B2}	37A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	10.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	2050kVA	

<Branch Line 1>

Load L_{B1}	5A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	10.1km	
Type of Distributed Load	Middle Smaller	
Total Transformer Capacity of secondary substations CAP_{B1}	300kVA	

<Branch Line 3>

Load L_{B3}	11A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	13.9km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	600kVA	

=====Equation=====

$V_{i1} = V_s - 1.732\cdot(R_{T1}\cos\theta + X_{T1}\sin\theta)\cdot(L_{T1}\cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732\cdot(R_{T2}\cos\theta + X_{T2}\sin\theta)\cdot(L_{T2}\cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732\cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta)\cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732\cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta)\cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732\cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta)\cdot f_{B3}$

$L_{T1} = I_{max}\cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max}\cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max}\cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max}\cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max}\cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN C
Feeder Name	AIRPORT 1

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
365.0A

<Trank Line 1>

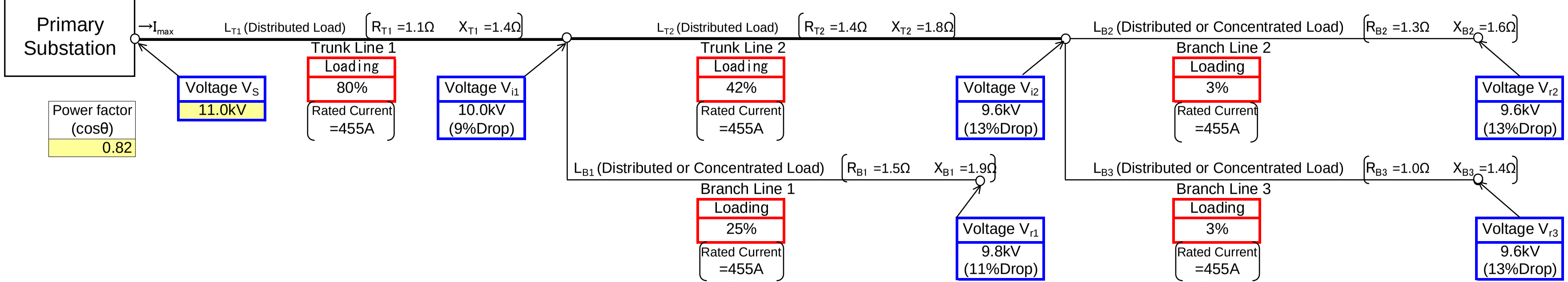
Load L_{T1}	61A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2030kVA	

<Trank Line 2>

Load L_{T2}	161A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5330kVA	

<Branch Line 2>

Load L_{B2}	14A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	4.6km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	450kVA	



<Branch Line 1>

Load L_{B1}	113A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	5.4km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	3740kVA	

<Branch Line 3>

Load L_{B3}	15A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	3.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	500kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3}$: Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN C
Feeder Name	AIRPORT 2

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}	405.0A
Power factor (cosθ)	0.82

<Trank Line 1>

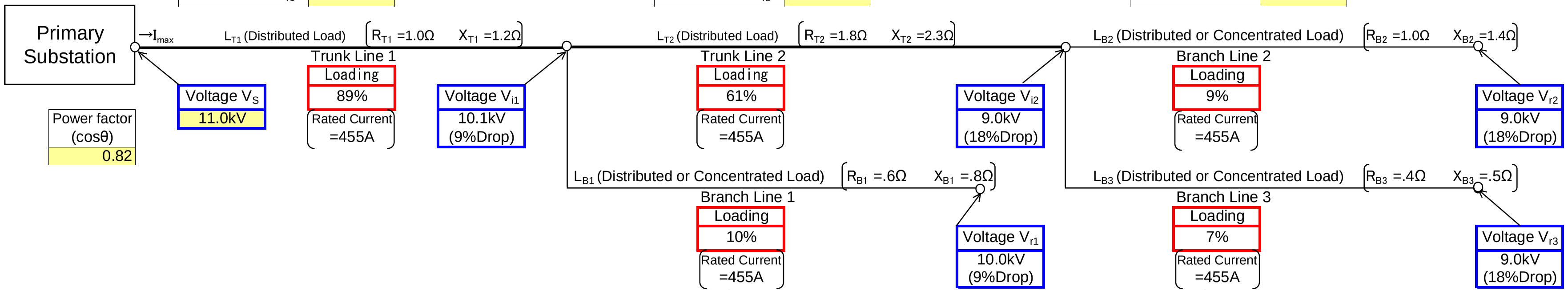
Load L_{T1}	84A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2600kVA	

<Trank Line 2>

Load L_{T2}	206A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	6.5km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	6425kVA	

<Branch Line 2>

Load L_{B2}	39A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	3.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	1215kVA	



<Branch Line 1>

Load L_{B1}	44A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1365kVA	

<Branch Line 3>

Load L_{B3}	32A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	1000kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN B
Feeder Name	B 11

🟨: Input data in colored cells

Type-3

Maximum Current I_{max}
335.0A

<Trank Line 1>

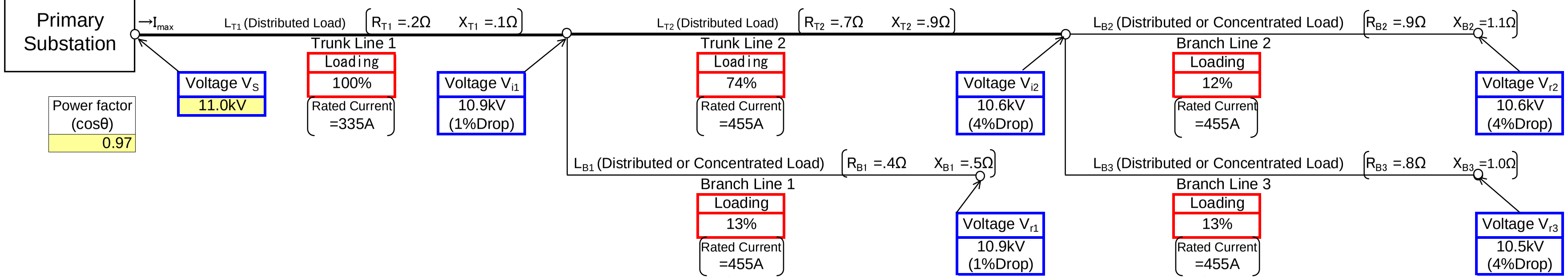
Load L_{T1}	28A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	630kVA	

<Trank Line 2>

Load L_{T2}	132A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2945kVA	

<Branch Line 2>

Load L_{B2}	55A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	3.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	1230kVA	



<Branch Line 1>

Load L_{B1}	59A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	1.4km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	1315kVA	

<Branch Line 3>

Load L_{B3}	61A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	2.8km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	1350kVA	

=====Equation=====

$V_{i1} = V_{s} - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	MAIN B
Feeder Name	B 21

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}	190.0A

Power factor (cosθ)	0.97

<Trank Line 1>

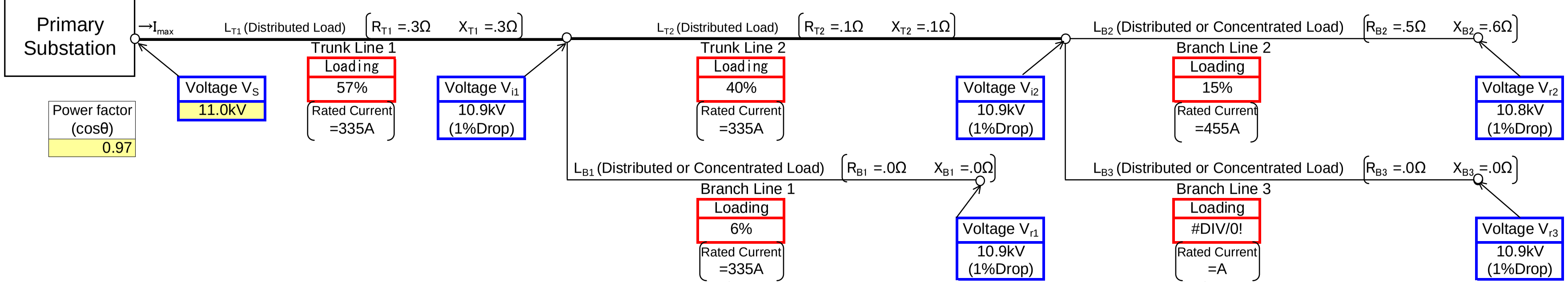
Load L_{T1}	34A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	500kVA	

<Trank Line 2>

Load L_{T2}	67A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1000kVA	

<Branch Line 2>

Load L_{B2}	68A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	1.8km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	1015kVA	



<Branch Line 1>

Load L_{B1}	21A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B1}	315kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Line Length Len_{B3}	.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_{s} - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN B
Feeder Name	B 31

▨ : Input data in colored cells

Type-2

Maximum Current I_{max}
107.0A

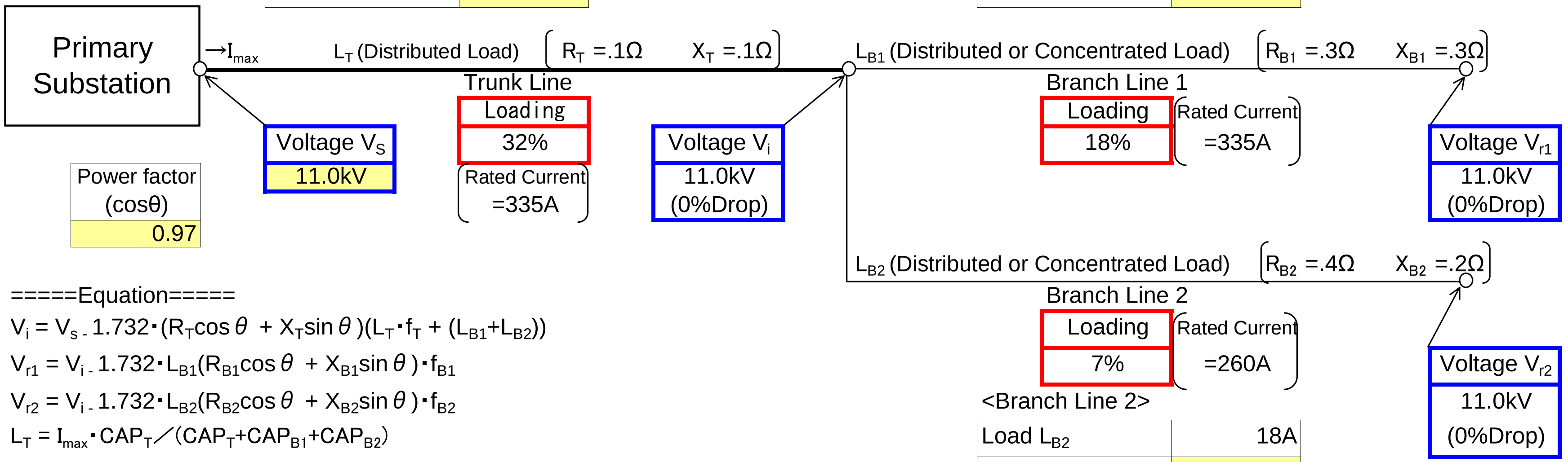
Power factor (cosθ)
0.97

<Trank Line>

Load L_T	30A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_T	.8km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_T	800kVA	

<Branch Line 1>

Load L_{B1}	60A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	2.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1600kVA	



<Branch Line 2>

Load L_{B2}	18A	
Line Type	AAC50mm2	No.11
Line Length Len_{B1}	.6km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	475kVA	

=====Equation=====

$V_i = V_S - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T + CAP_{B1} + CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage

I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)

R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
$CAP_T, CAP_{B1}, CAP_{B2}$: Total Transformer Capacity of secondary substations

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	MAIN B
Feeder Name	B41

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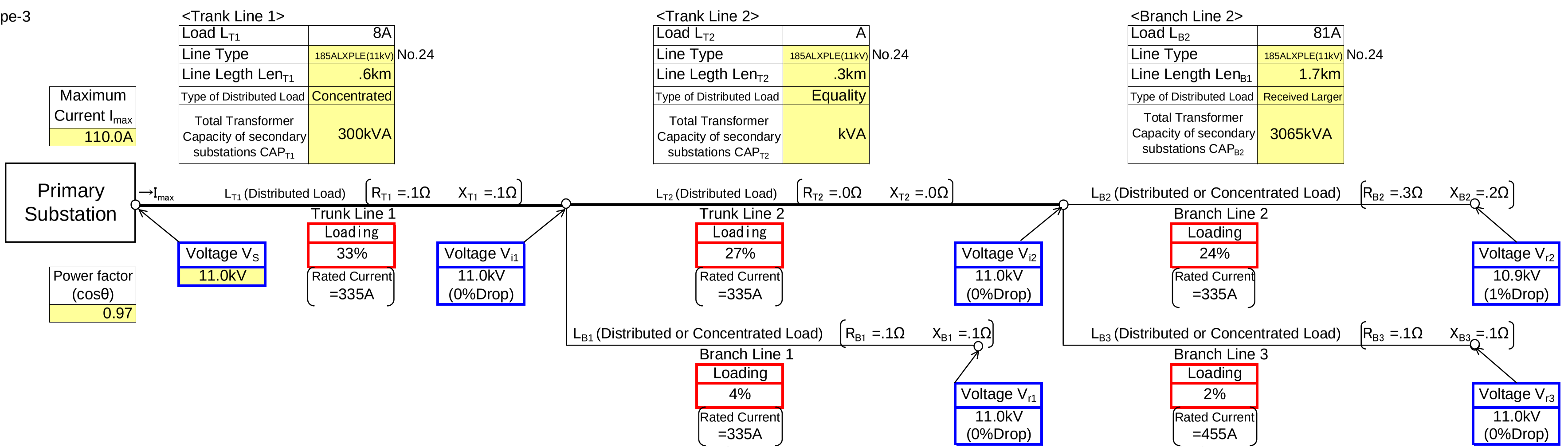
Type-3



<Trank Line 1>

Load L_{T1}	8A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	300kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	81A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	1.7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	3065kVA	

<Branch Line 1>

Load L_{B1}	13A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	.5km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B1}	500kVA	

<Branch Line 3>

Load L_{B3}	8A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B3}	315kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	MAIN B
Feeder Name	B 71

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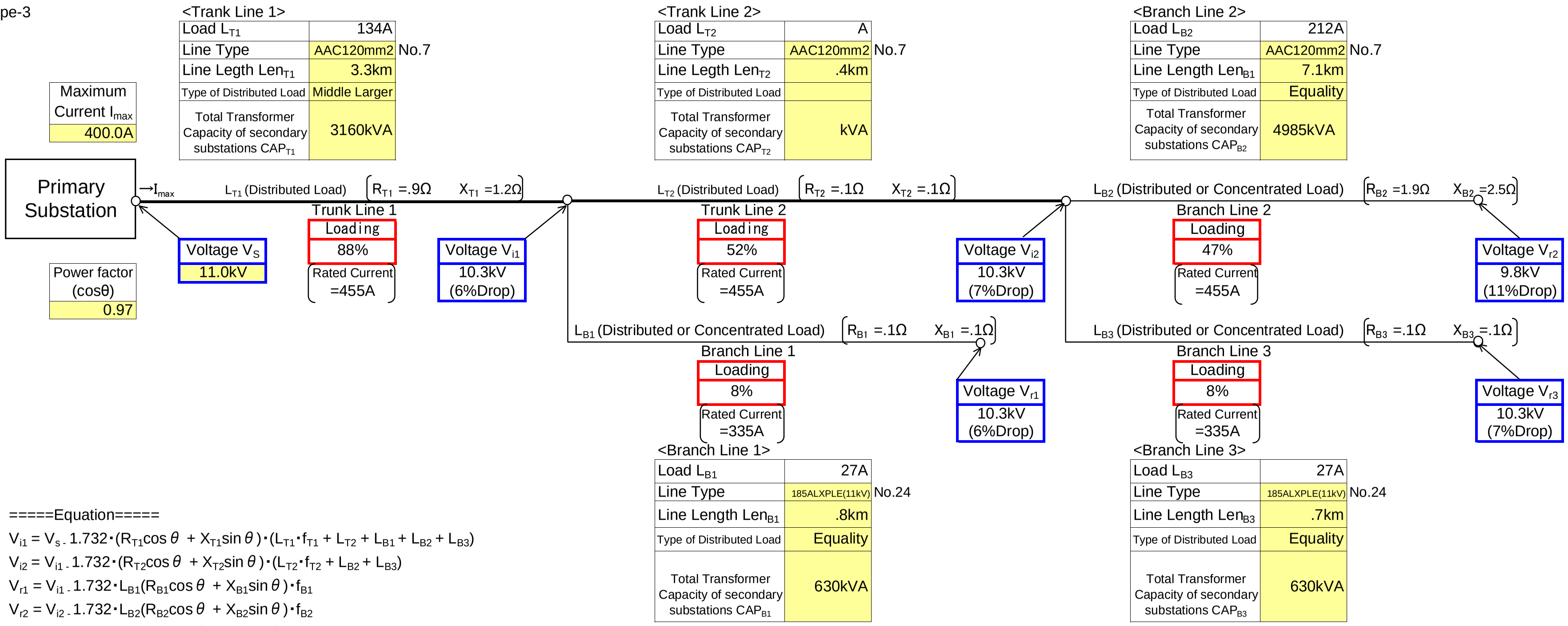
Type-3



<Trank Line 1>

Load L_{T1}	134A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3.3km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3160kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	.4km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	212A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	7.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	4985kVA	

<Branch Line 1>

Load L_{B1}	27A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	630kVA	

<Branch Line 3>

Load L_{B3}	27A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B3}	.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	630kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN B
Feeder Name	B 61

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Type-3

<Trank Line 1>

Load L_{T1}	143A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4010kVA	

<Trank Line 2>

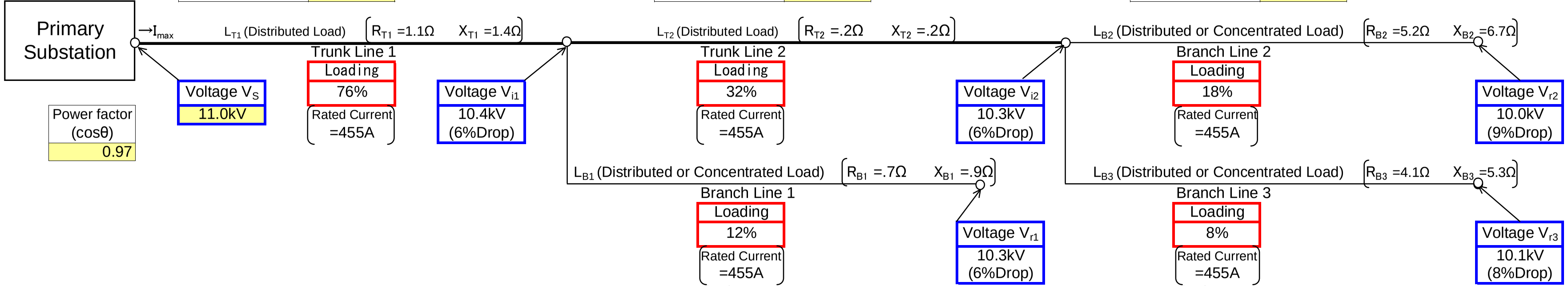
Load L_{T2}	31A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	.7km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T2}	880kVA	

<Branch Line 2>

Load L_{B2}	81A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	18.8km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	2270kVA	

Maximum Current I_{max}
344.0A

Power factor (cosθ)
0.97



<Branch Line 1>

Load L_{B1}	53A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	2.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1500kVA	

<Branch Line 3>

Load L_{B3}	36A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	14.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	1000kVA	

=====Equation=====

$V_{i1} = V_{s} - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN B
Feeder Name	B 81

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Type-3

<Trank Line 1>

Load L_{T1}	129A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	12.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	8045kVA	

<Trank Line 2>

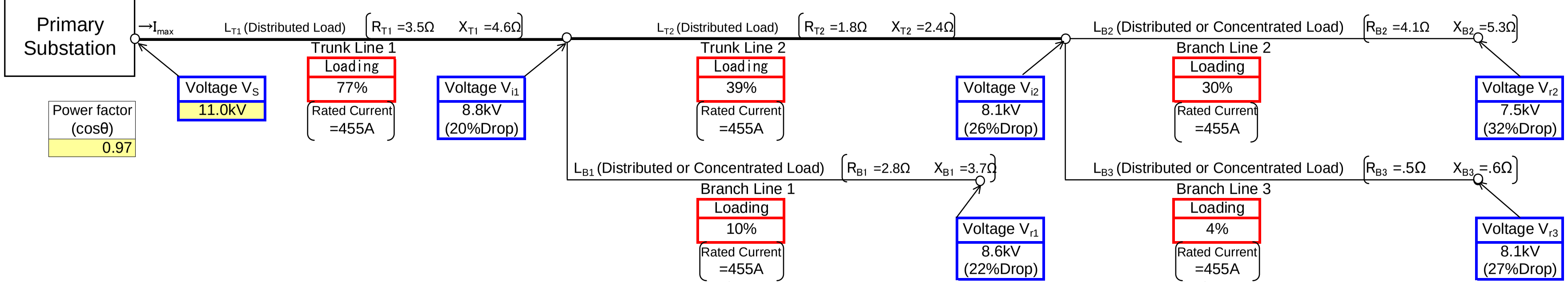
Load L_{T2}	21A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	6.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1340kVA	

<Branch Line 2>

Load L_{B2}	136A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	14.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	8495kVA	

Maximum Current I_{max}
350.0A

Power factor (cosθ)
0.97



<Branch Line 1>

Load L_{B1}	44A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	10.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	2755kVA	

<Branch Line 3>

Load L_{B3}	19A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	1.7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	1200kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	KUMAWU
Feeder Name	BODOMASE

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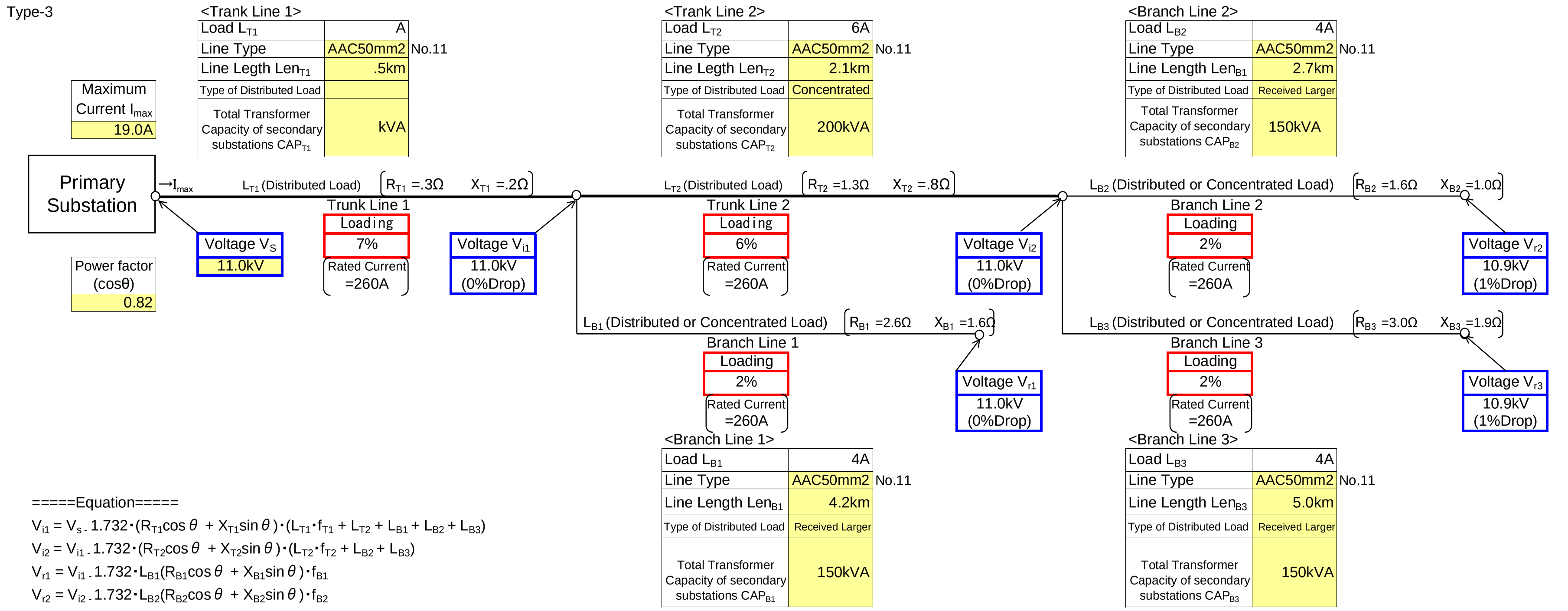

Maximum Current I_{max}	19.0A

Power factor (cosθ)	0.82

<Trank Line 1>

Load L_{T1}	A	
Line Type	AAC50mm2	No.11
Line Legth Len_{T1}	.5km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T1}	kVA	

<Trank Line 2>

Load L_{T2}	6A	
Line Type	AAC50mm2	No.11
Line Legth Len_{T2}	2.1km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	4A	
Line Type	AAC50mm2	No.11
Line Length Len_{B1}	2.7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	150kVA	

<Branch Line 1>

Load L_{B1}	4A	
Line Type	AAC50mm2	No.11
Line Length Len_{B1}	4.2km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	150kVA	

<Branch Line 3>

Load L_{B3}	4A	
Line Type	AAC50mm2	No.11
Line Length Len_{B3}	5.0km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	150kVA	

=====Equation=====

$V_{i1} = V_s - 1.732\cdot(R_{T1}\cos\theta + X_{T1}\sin\theta)\cdot(L_{T1}\cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732\cdot(R_{T2}\cos\theta + X_{T2}\sin\theta)\cdot(L_{T2}\cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732\cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta)\cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732\cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta)\cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732\cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta)\cdot f_{B3}$

$L_{T1} = I_{max}\cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max}\cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max}\cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max}\cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max}\cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN C
Feeder Name	C 21

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Type-3

<Trank Line 1>

Load L_{T1}	98A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	6.9km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	2675kVA	

<Trank Line 2>

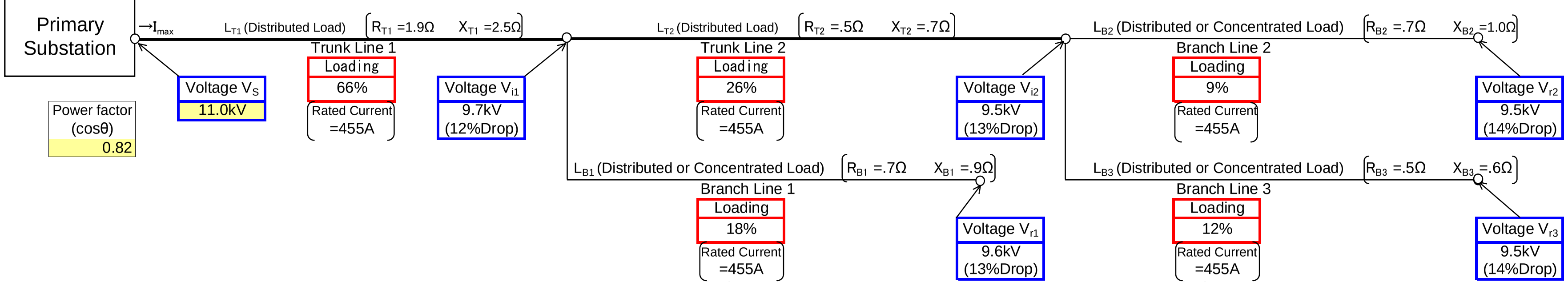
Load L_{T2}	23A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2.0km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	630kVA	

<Branch Line 2>

Load L_{B2}	43A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	1165kVA	

Maximum Current I_{max}
300.0A

Power factor (cosθ)
0.82



<Branch Line 1>

Load L_{B1}	81A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	2.5km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	2200kVA	

<Branch Line 3>

Load L_{B3}	54A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	1480kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

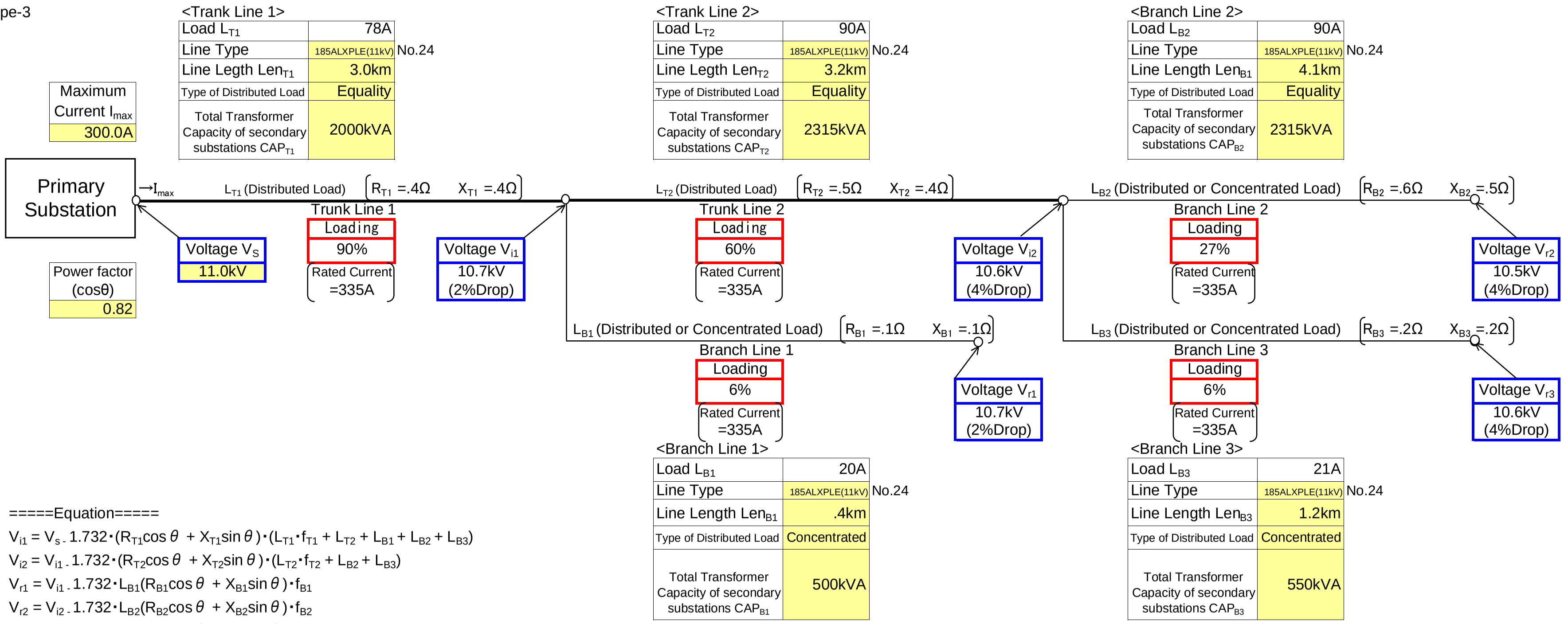
V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN C
Feeder Name	C 41

🟨 : Input data in colored cells

Type-3



<Trank Line 1>

Load L_{T1}	78A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2000kVA	

<Trank Line 2>

Load L_{T2}	90A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2315kVA	

<Branch Line 2>

Load L_{B2}	90A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	2315kVA	

<Branch Line 1>

Load L_{B1}	20A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B1}	500kVA	

<Branch Line 3>

Load L_{B3}	21A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B3}	1.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B3}	550kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN C
Feeder Name	C 51

🟨 : Input data in colored cells

Type-2

Maximum Current I_{max}
330.0A

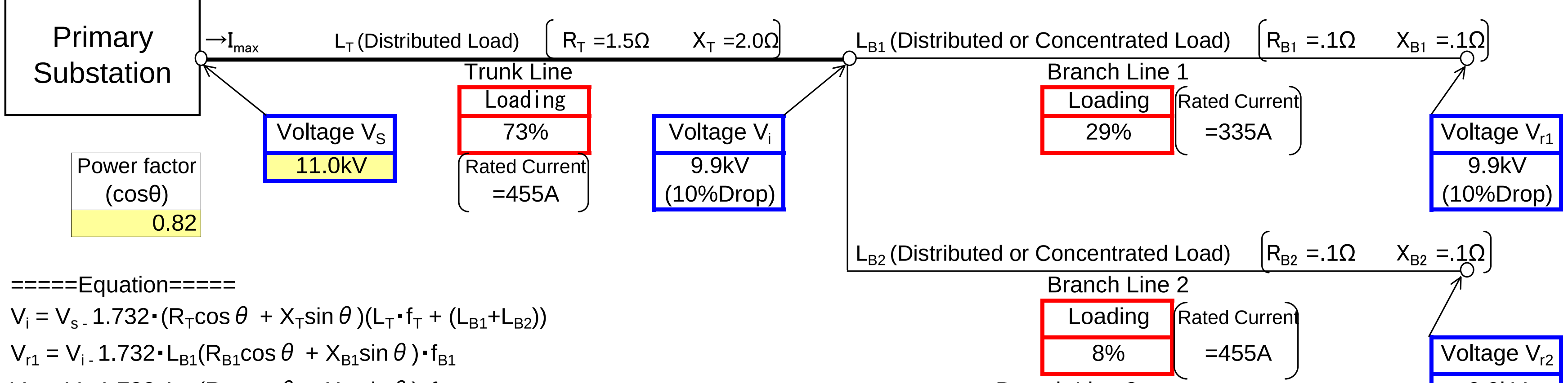
Power factor (cosθ)
0.82

<Trank Line>

Load L_T	198A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	5.5km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_T	2730kVA	

<Branch Line 1>

Load L_{B1}	95A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	1.0km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	1315kVA	



<Branch Line 2>

Load L_{B2}	36A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	

=====Equation=====

$V_i = V_{s\,-}\,1.732 \cdot (R_T\cos\theta + X_T\sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_{i\,-}\,1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i\,-}\,1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN C
Feeder Name	C 61

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
300.0A

<Trank Line 1>

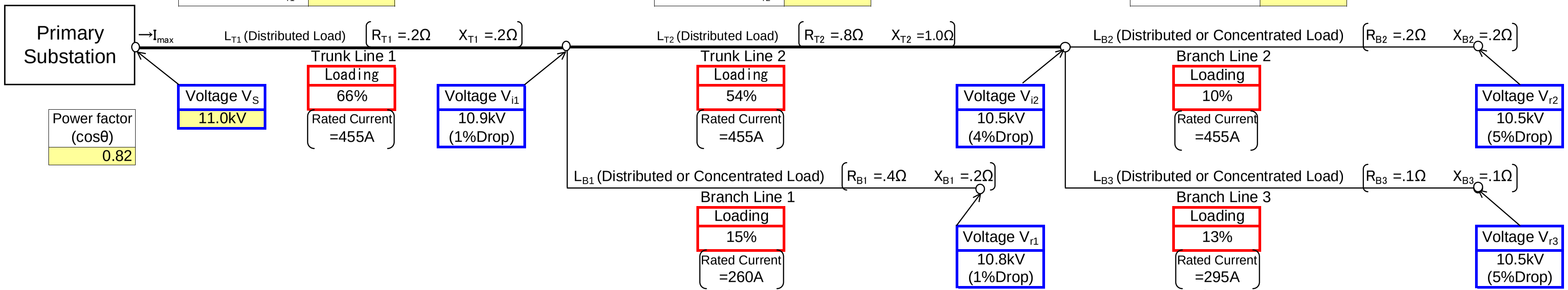
Load L_{T1}	15A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	315kVA	

<Trank Line 2>

Load L_{T2}	166A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2.9km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	3580kVA	

<Branch Line 2>

Load L_{B2}	44A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	945kVA	



<Branch Line 1>

Load L_{B1}	38A	
Line Type	AAC50mm2	No.11
Line Length Len_{B1}	.6km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	815kVA	

<Branch Line 3>

Load L_{B3}	38A	
Line Type	120CuPILC(11kV)	No.22
Line Length Len_{B3}	.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B3}	815kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	MAIN C
Feeder Name	C31

▭ : Input data in colored cells

Type-3

Maximum Current I_{max}
280.0A

Power factor (cosθ)
0.82

<Trank Line 1>

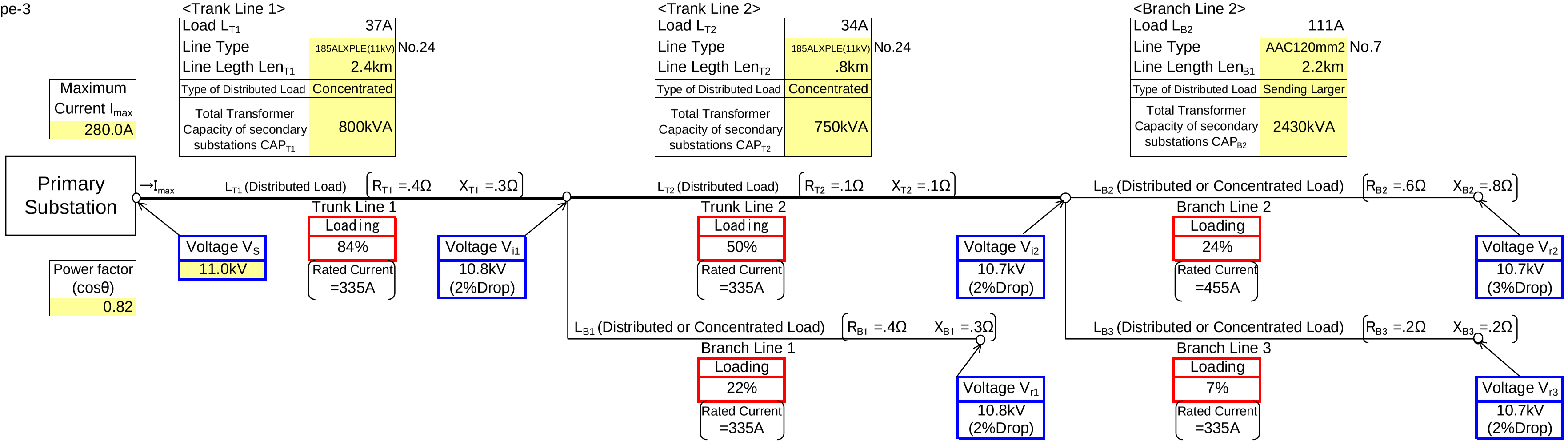
Load L_{T1}	37A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	800kVA	

<Trank Line 2>

Load L_{T2}	34A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	111A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	2.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	2430kVA	



<Branch Line 1>

Load L_{B1}	75A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	2.5km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	1630kVA	

<Branch Line 3>

Load L_{B3}	24A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B3}	1.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	515kVA	

=====Equation=====

$V_{i1} = V_{s} - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3}$: Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	MAIN D
Feeder Name	D11

🟨 : Input data in colored cells

Type-2

<Trank Line>

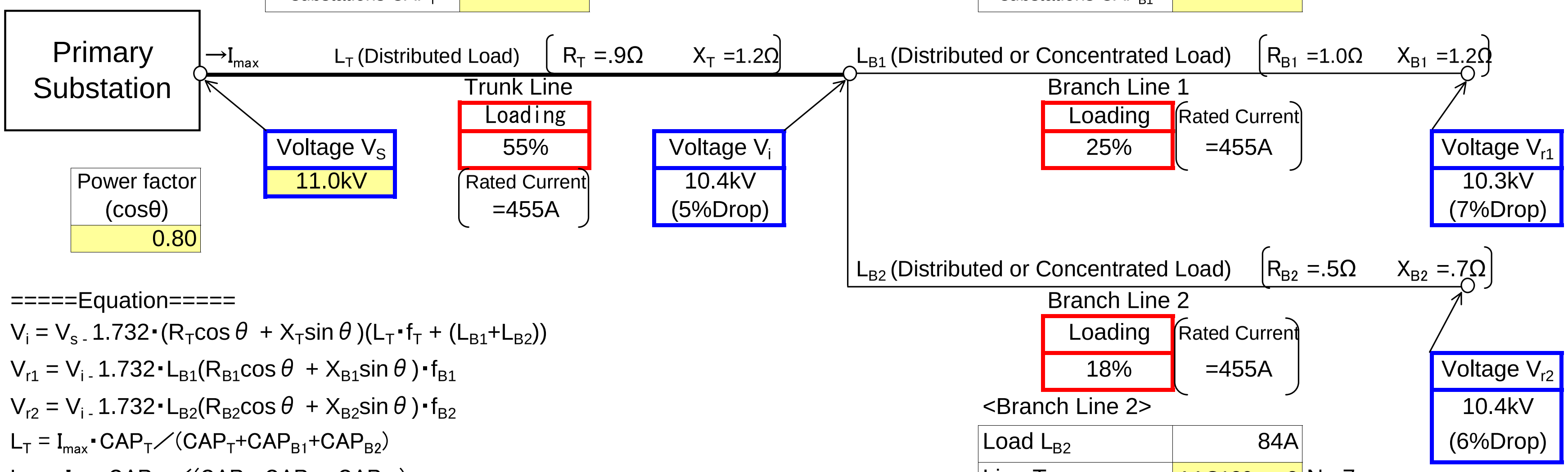
Load L_T	54A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	2315kVA	

<Branch Line 1>

Load L_{B1}	112A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	3.5km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	4760kVA	

Maximum Current I_{max}
250.0A

Power factor (cosθ)
0.80



<Branch Line 2>

Load L_{B2}	84A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	2.0km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	3550kVA	

=====Equation=====

$V_i = V_S - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_T, R_{B1}, R_{B2}	: Resistance
V_i	: Interim Voltage	L_T	: Load (Trunk line)	X_T, X_{B1}, X_{B2}	: Reactance
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	cosθ	: Power Factor
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	f_T, f_{B1}, f_{B2}	: Dispersal Load Factor

CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN D
Feeder Name	D 21

🟨 : Input data in colored cells

Type-2

<Trank Line>

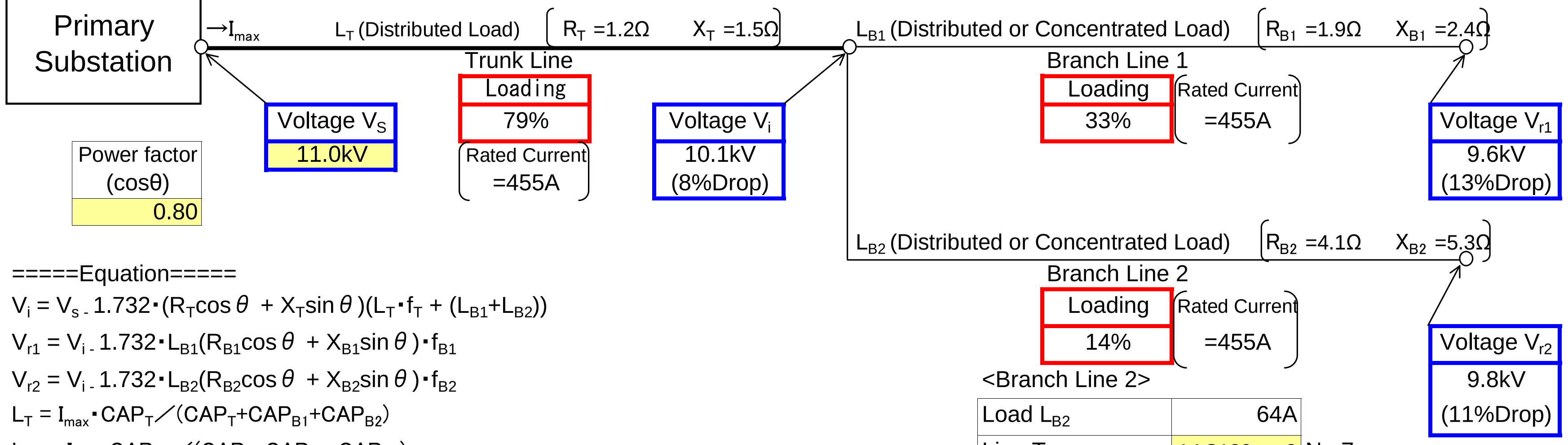
Load L_T	145A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	4.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	3350kVA	

<Branch Line 1>

Load L_{B1}	151A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	6.8km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	3475kVA	

Maximum Current I_{max}
360.0A

Power factor (cosθ)
0.80



<Branch Line 2>

Load L_{B2}	64A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	14.8km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	1480kVA	

=====Equation=====

$V_i = V_S - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T + CAP_{B1} + CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage

I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)

R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN D
Feeder Name	D 31

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
410.0A

Power factor (cosθ)
0.80

<Trank Line 1>

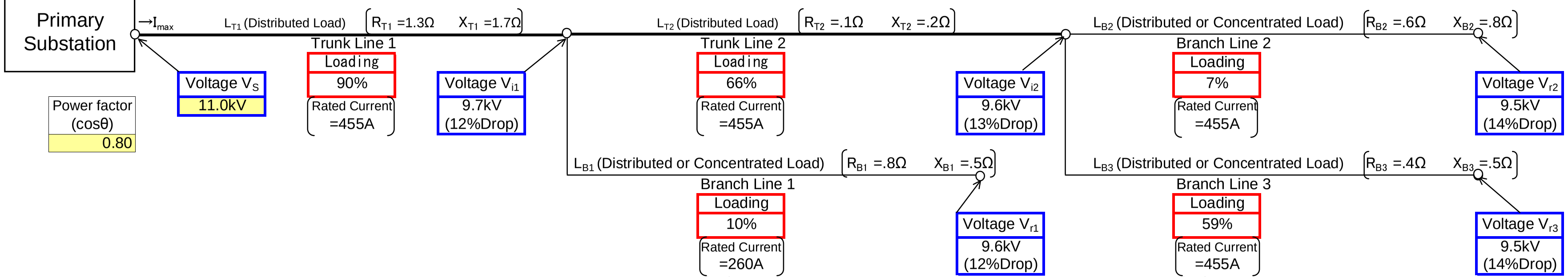
Load L_{T1}	83A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2200kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	31A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	2.3km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}	815kVA	



<Branch Line 1>

Load L_{B1}	27A	
Line Type	AAC50mm2	No.11
Line Length Len_{B1}	1.3km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	715kVA	

<Branch Line 3>

Load L_{B3}	270A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	1.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	7165kVA	

=====Equation=====

$$V_{i1} = V_{s} - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$$

$$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$$

$$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$$

$$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$$

$$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$$

$$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	MAIN D
Feeder Name	D 51

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
180.0A

Power factor (cosθ)
0.80

<Trank Line 1>

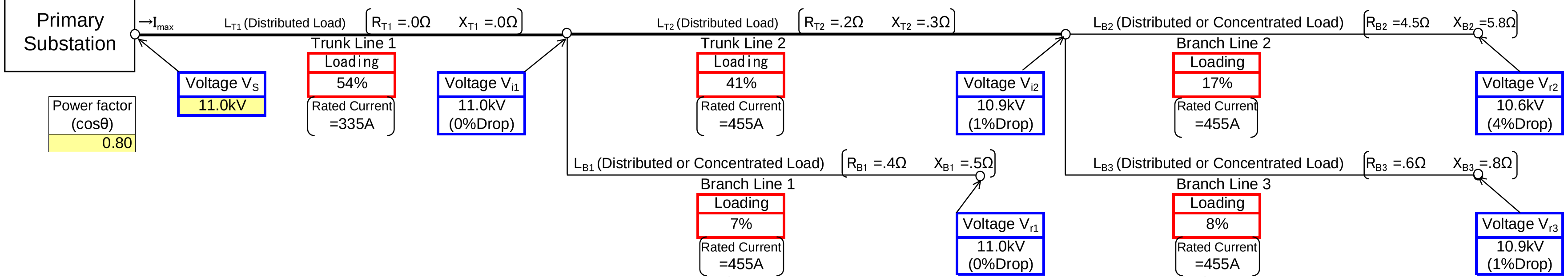
Load L_{T1}	12A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	750kVA	

<Trank Line 2>

Load L_{T2}	20A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	.9km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	1300kVA	

<Branch Line 2>

Load L_{B2}	79A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	16.3km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	5055kVA	



<Branch Line 1>

Load L_{B1}	31A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	1.4km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	2000kVA	

<Branch Line 3>

Load L_{B3}	38A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	2415kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN D
Feeder Name	D 41

🟨 : Input data in colored cells

Type-2

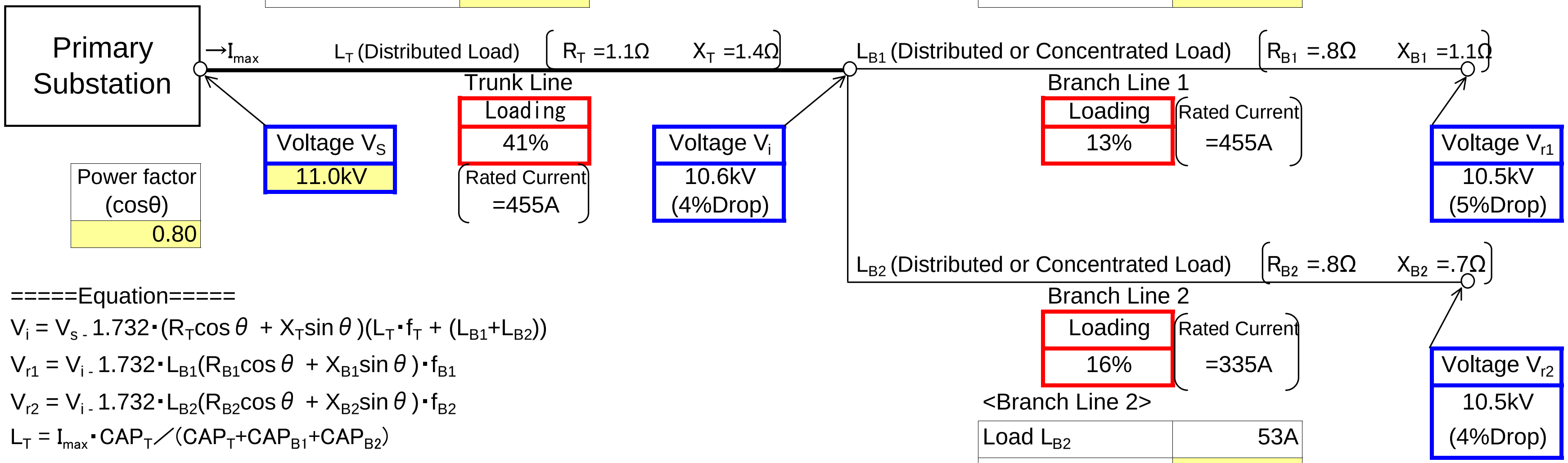
<Trank Line>

Load L_T	71A
Line Type	AAC120mm2 No.7
Line Legth Len_T	4.0km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_T	4750kVA

<Branch Line 1>

Load L_{B1}	60A
Line Type	AAC120mm2 No.7
Line Length Len_{B1}	3.0km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{B1}	4000kVA

Maximum Current I_{max}	185.0A
Power factor (cosθ)	0.80



<Branch Line 2>

Load L_{B2}	53A
Line Type	185ALXPLE(11kV) No.24
Line Length Len_{B1}	5.2km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{B2}	3545kVA

=====Equation=====

$V_i = V_S - 1.732 \cdot (R_T\cos\theta + X_T\sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN D
Feeder Name	D 41

🟨: Input data in colored cells

Type-3

Maximum Current I_{max}
185.0A

Power factor (cosθ)
0.80

<Trank Line 1>

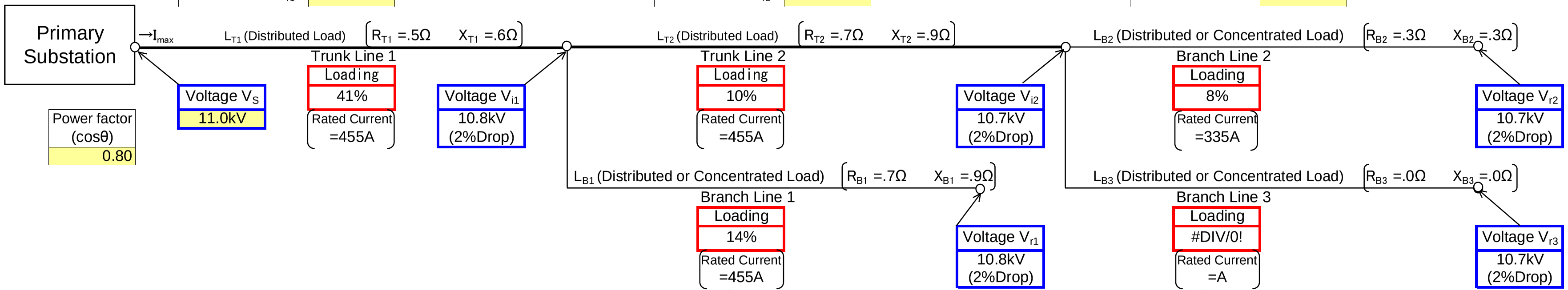
Load L_{T1}	75A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	1.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4750kVA	

<Trank Line 2>

Load L_{T2}	21A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1345kVA	

<Branch Line 2>

Load L_{B2}	27A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	2.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	1700kVA	



<Branch Line 1>

Load L_{B1}	63A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	2.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4000kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Line Length Len_{B3}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	STATION E
Feeder Name	E 11

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	kVA	

<Trank Line 2>

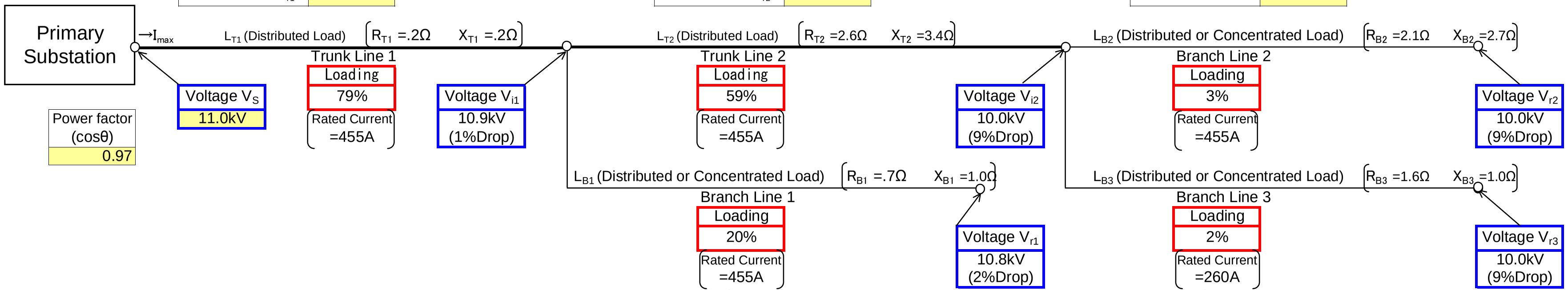
Load L_{T2}	250A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	9.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	8560kVA	

<Branch Line 2>

Load L_{B2}	14A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	7.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	475kVA	

Maximum Current I_{max}
360.0A

Power factor (cosθ)
0.97



<Branch Line 1>

Load L_{B1}	91A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	2.7km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	3115kVA	

<Branch Line 3>

Load L_{B3}	6A	
Line Type	AAC50mm2	No.11
Line Length Len_{B3}	2.7km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	200kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	STATION E
Feeder Name	E 21

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}	280.0A

<Trank Line 1>

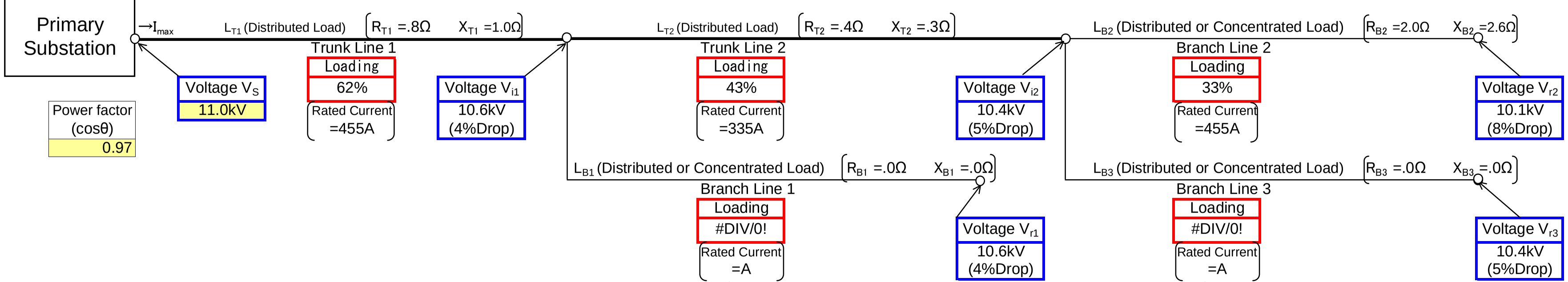
Load L_{T1}	83A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2.8km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3995kVA	

<Trank Line 2>

Load L_{T2}	48A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	2.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2315kVA	

<Branch Line 2>

Load L_{B2}	149A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	7.2km	
Type of Distributed Load	Middle Smaller	
Total Transformer Capacity of secondary substations CAP_{B2}	7140kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Line Length Len_{B1}	.0km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Line Length Len_{B3}	.0km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$$V_{i1} = V_s - 1.732\cdot(R_{T1}\cos\theta + X_{T1}\sin\theta)\cdot(L_{T1}\cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$$

$$V_{i2} = V_{i1} - 1.732\cdot(R_{T2}\cos\theta + X_{T2}\sin\theta)\cdot(L_{T2}\cdot f_{T2} + L_{B2} + L_{B3})$$

$$V_{r1} = V_{i1} - 1.732\cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta)\cdot f_{B1}$$

$$V_{r2} = V_{i2} - 1.732\cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta)\cdot f_{B2}$$

$$V_{r3} = V_{i2} - 1.732\cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta)\cdot f_{B3}$$

$$L_{T1} = I_{max}\cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{T2} = I_{max}\cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B1} = I_{max}\cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B2} = I_{max}\cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B3} = I_{max}\cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Step A (Type-2)

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	EFFIDUASE S/S
Feeder Name	EFFIDUASE

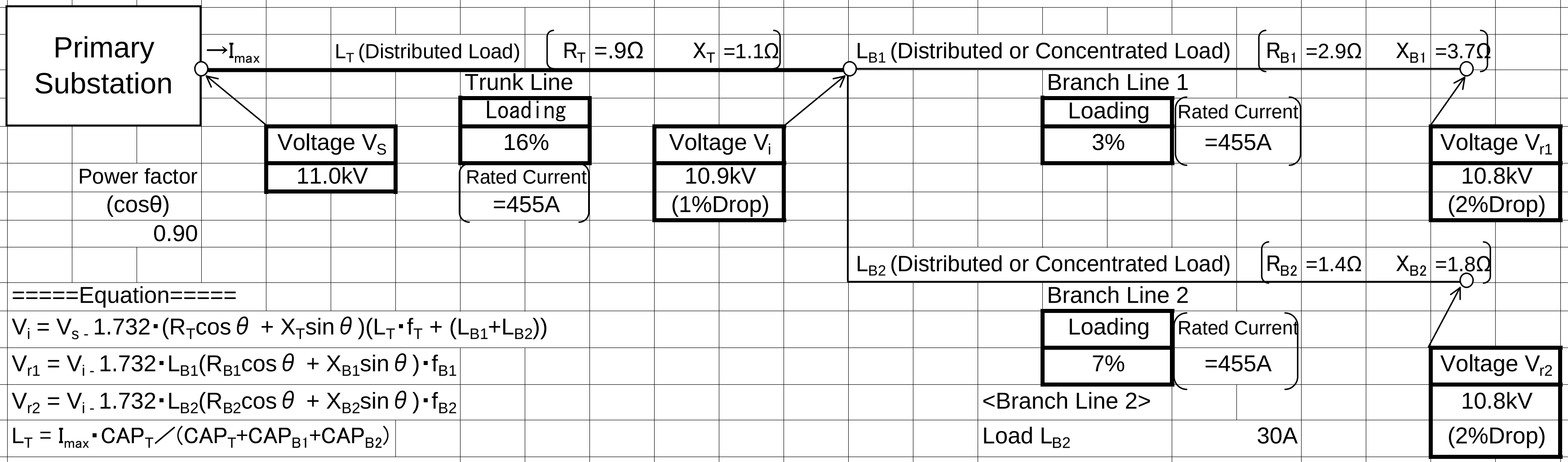
: Input data in colored cells

Type-2

<Trank Line>		
Load L_T	27A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	3.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1395kVA	

<Branch Line 1>		
Load L_{B1}	15A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	10.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

Maximum Current I_{max}
72.0A



Power factor
(cosθ)
0.90

<Branch Line 2>		
Load L_{B2}	30A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	5.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	1510kVA	

=====Equation=====

$V_i = V_S - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_T, R_{B1}, R_{B2}	: Resistance
V_i	: Interim Voltage	L_T	: Load (Trunk line)	X_T, X_{B1}, X_{B2}	: Reactance
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	cosθ	: Power Factor
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	f_T, f_{B1}, f_{B2}	: Dispersal Load Factor

CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	EFFIDUASE S/S
Feeder Name	EJISU

🟨 : Input data in colored cells

Type-2

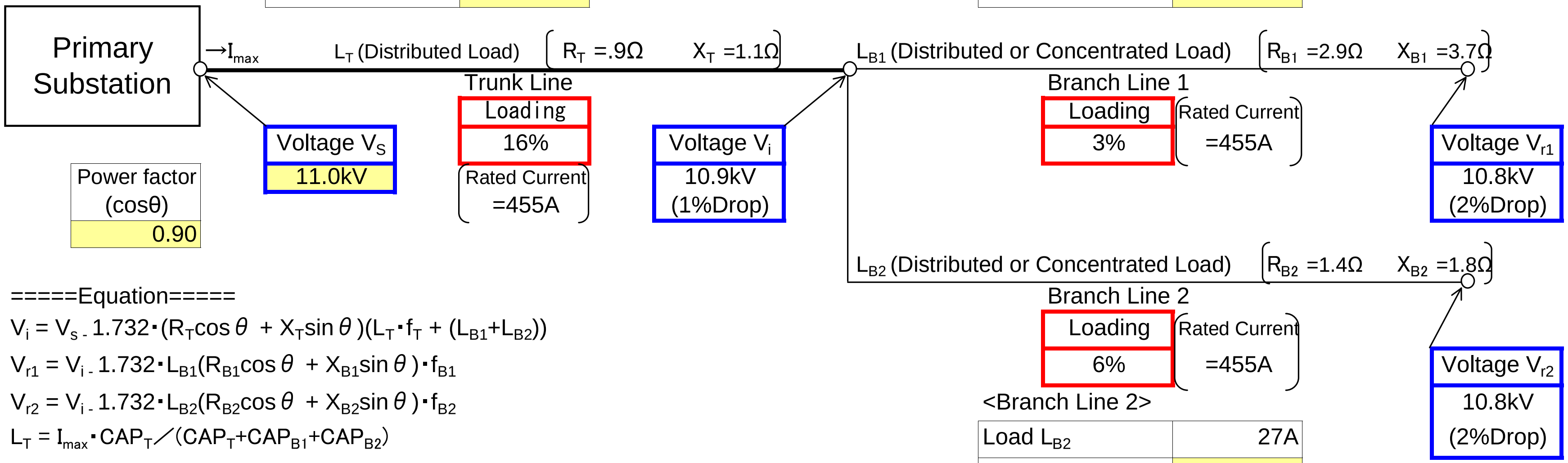
<Trank Line>

Load L_T	32A
Line Type	AAC120mm2 No.7
Line Legth Len_T	3.1km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_T	1810kVA

<Branch Line 1>

Load L_{B1}	13A
Line Type	AAC120mm2 No.7
Line Length Len_{B1}	10.5km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA

Maximum Current I_{max}	72.0A
Power factor (cosθ)	0.90



<Branch Line 2>

Load L_{B2}	27A
Line Type	AAC120mm2 No.7
Line Length Len_{B1}	5.0km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{B2}	1510kVA

=====Equation=====

$V_i = V_{S}$ - $1.732 \cdot (R_T\cos\theta + X_T\sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i$ - $1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i$ - $1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	EFFIDUASE
Feeder Name	EJISU

: Input data in colored cells

Type-3

Maximum Current I_{max}
109.0A

<Trank Line 1>

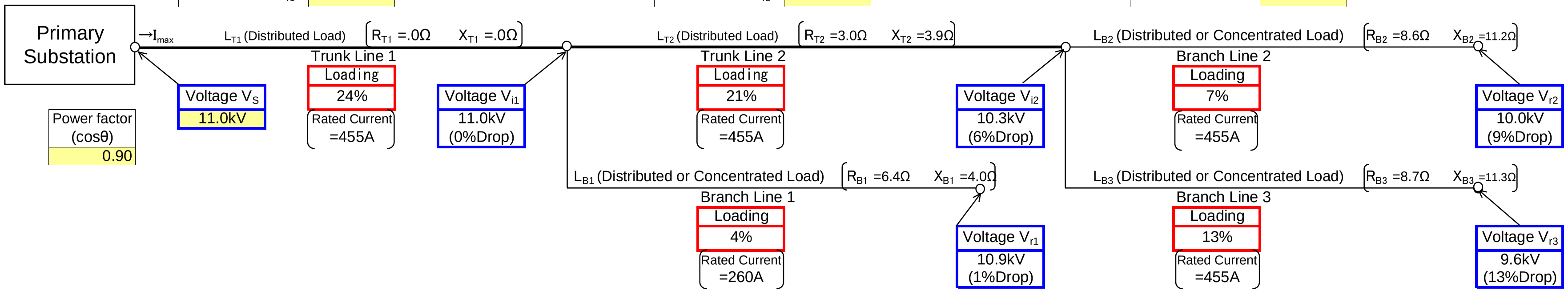
Load L_{T1}	A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	.1km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	kVA	

<Trank Line 2>

Load L_{T2}	8A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	10.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	575kVA	

<Branch Line 2>

Load L_{B2}	30A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	31.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	2230kVA	



<Branch Line 1>

Load L_{B1}	11A	
Line Type	AAC50mm2	No.11
Line Length Len_{B1}	10.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	850kVA	

<Branch Line 3>

Load L_{B3}	60A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	31.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	4500kVA	

=====Equation=====

$V_{i1} = V_{s} - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN F
Feeder Name	F 11

▭ : Input data in colored cells

Type-3

Maximum Current I_{max} 194.0A

<Trank Line 1>

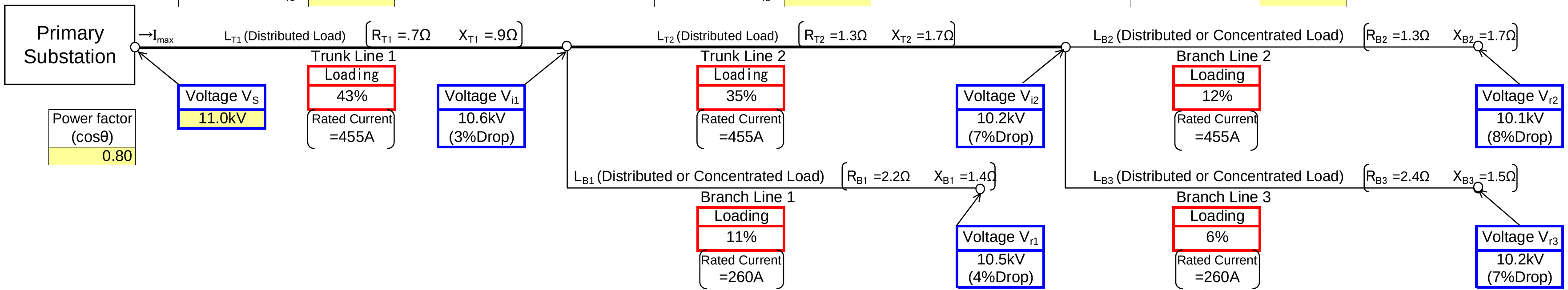
Load L_{T1}	7A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2.6km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	400kVA	

<Trank Line 2>

Load L_{T2}	89A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5310kVA	

<Branch Line 2>

Load L_{B2}	53A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	3175kVA	



<Branch Line 1>

Load L_{B1}	29A	
Line Type	AAC50mm2	No.11
Line Length Len_{B1}	3.6km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	1740kVA	

<Branch Line 3>

Load L_{B3}	17A	
Line Type	AAC50mm2	No.11
Line Length Len_{B3}	3.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	1000kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN F
Feeder Name	F 31

▨ : Input data in colored cells

Type-2

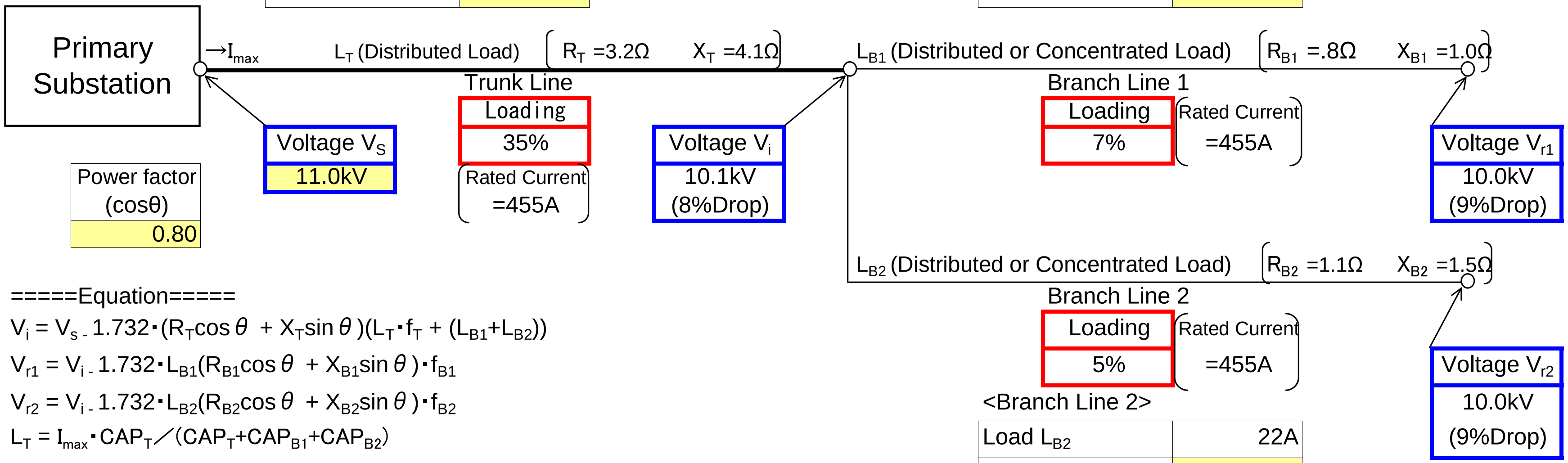
Maximum Current I_{max}
159.0A

<Trank Line>

Load L_T	106A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	11.5km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_T	1905kVA	

<Branch Line 1>

Load L_{B1}	31A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	2.8km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	565kVA	



Power factor (cosθ)
0.80

<Branch Line 2>

Load L_{B2}	22A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	400kVA	

=====Equation=====

$V_i = V_S - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN F
Feeder Name	F 41

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
113.0A

Power factor (cosθ)
0.80

<Trank Line 1>

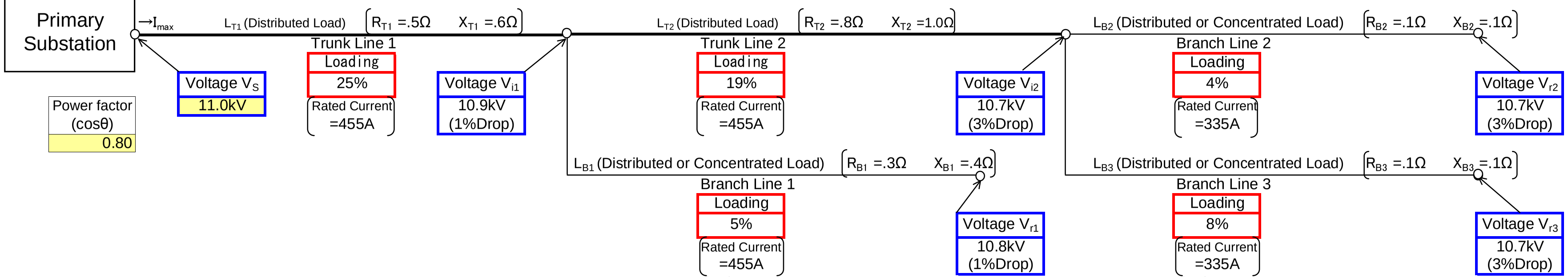
Load L_{T1}	3A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	1.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	100kVA	

<Trank Line 2>

Load L_{T2}	47A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1695kVA	

<Branch Line 2>

Load L_{B2}	14A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	.5km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	



<Branch Line 1>

Load L_{B1}	22A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	1.2km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	800kVA	

<Branch Line 3>

Load L_{B3}	28A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B3}	1.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	1000kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	OBUASI
Feeder Name	FOMENA

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
270.0A

<Trank Line 1>

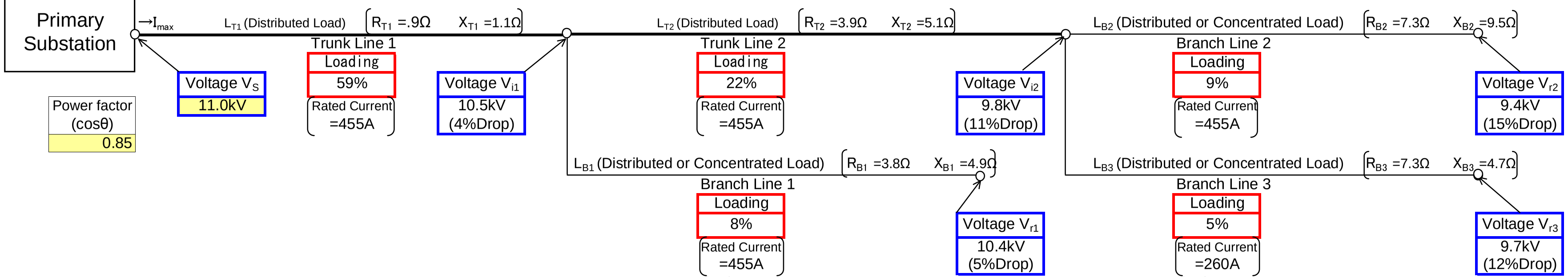
Load L_{T1}	133A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6350kVA	

<Trank Line 2>

Load L_{T2}	46A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	14.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	2200kVA	

<Branch Line 2>

Load L_{B2}	42A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	26.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	2025kVA	



<Branch Line 1>

Load L_{B1}	35A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	13.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	1690kVA	

<Branch Line 3>

Load L_{B3}	13A	
Line Type	AAC50mm2	No.11
Line Length Len_{B3}	12.1km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	600kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	MAIN A
Feeder Name	GBC

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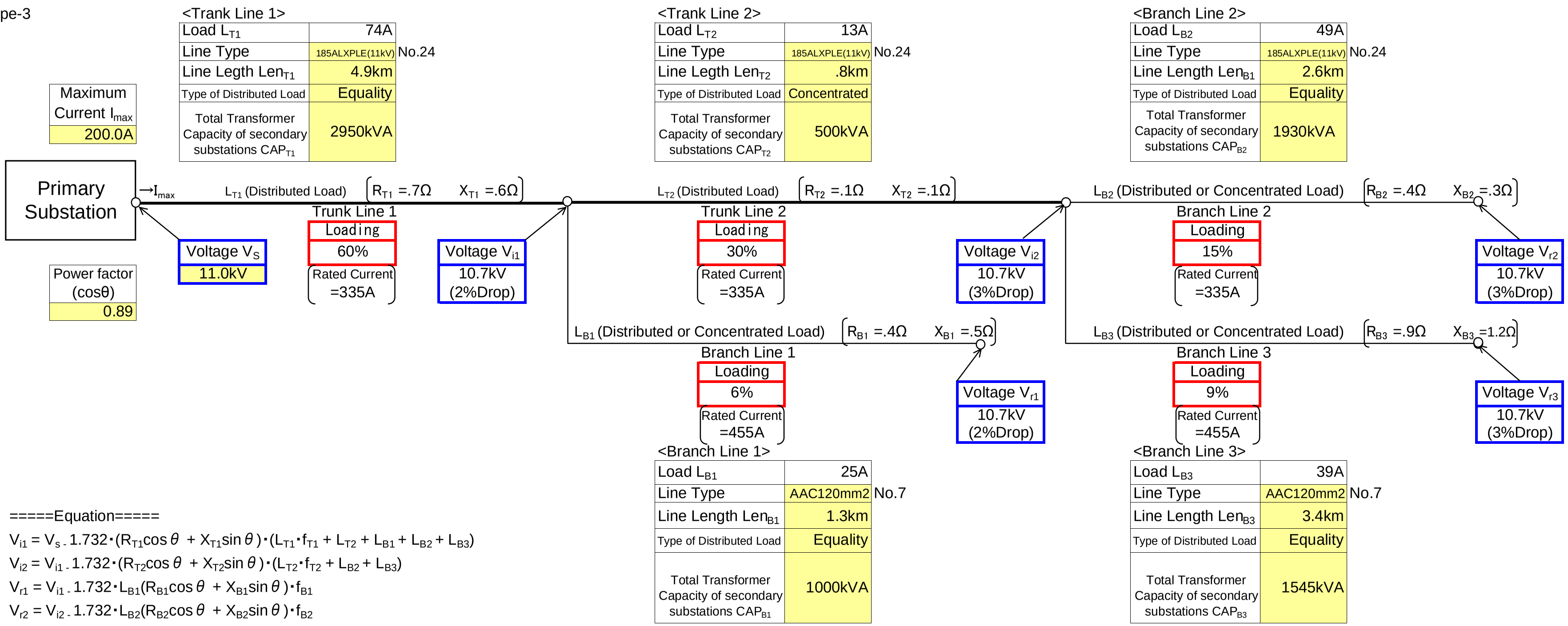
Type-3



Maximum Current I_{max}	200.0A
Power factor (cosθ)	0.89

Voltage V_s	11.0kV
Voltage V_{i1}	10.7kV (2%Drop)
Voltage V_{i2}	10.7kV (3%Drop)
Voltage V_{r1}	10.7kV (2%Drop)
Voltage V_{r2}	10.7kV (3%Drop)
Voltage V_{r3}	10.7kV (3%Drop)

	Loading	Rated Current
Trunk Line 1	60%	=335A
Trunk Line 2	30%	=335A
Branch Line 1	6%	=455A
Branch Line 2	15%	=335A
Branch Line 3	9%	=455A

<Trank Line 1>

Load L_{T1}	74A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

<Trank Line 2>

Load L_{T2}	13A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T2}	500kVA	

<Branch Line 2>

Load L_{B2}	49A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	1930kVA	

<Branch Line 1>

Load L_{B1}	25A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1000kVA	

<Branch Line 3>

Load L_{B3}	39A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	1545kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN A
Feeder Name	GUINNESS 1

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Type-3

<Trank Line 1>

Load L_{T1}	24A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2.5km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	945kVA	

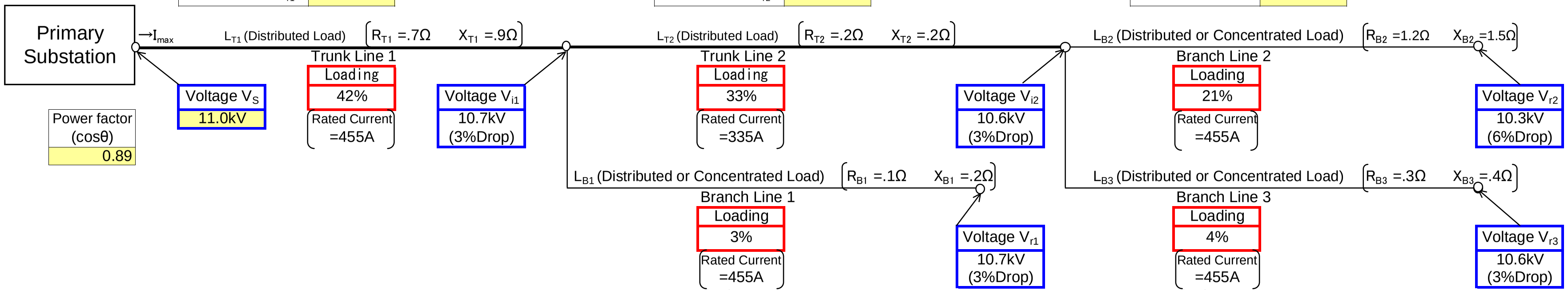
<Trank Line 2>

Load L_{T2}	38A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1500kVA	

<Branch Line 2>

Load L_{B2}	97A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	4.2km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}	3815kVA	

Maximum Current I_{max}
190.0A



<Branch Line 1>

Load L_{B1}	15A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	600kVA	

<Branch Line 3>

Load L_{B3}	16A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	1.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	630kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	MAIN A
Feeder Name	GUINESS 2

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	29A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2.1km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	830kVA	

<Trank Line 2>

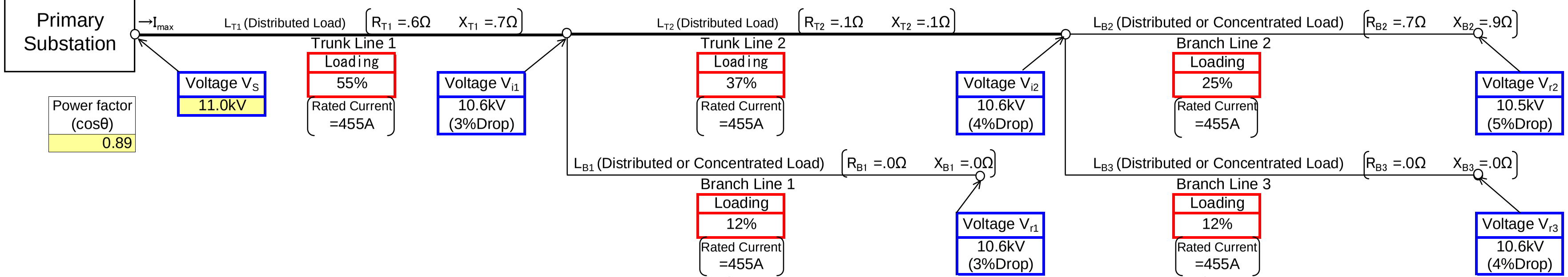
Load L_{T2}	A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	116A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	2.6km	
Type of Distributed Load	Middle Smaller	
Total Transformer Capacity of secondary substations CAP_{B2}	3315kVA	

Maximum Current I_{max}
250.0A

Power factor (cosθ)
0.89



<Branch Line 1>

Load L_{B1}	52A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	.1km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B1}	1500kVA	

<Branch Line 3>

Load L_{B3}	52A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	.1km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B3}	1500kVA	

=====Equation=====

$V_{i1} = V_{s} - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3}$: Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN A
Feeder Name	INDUSTRIAL OHL

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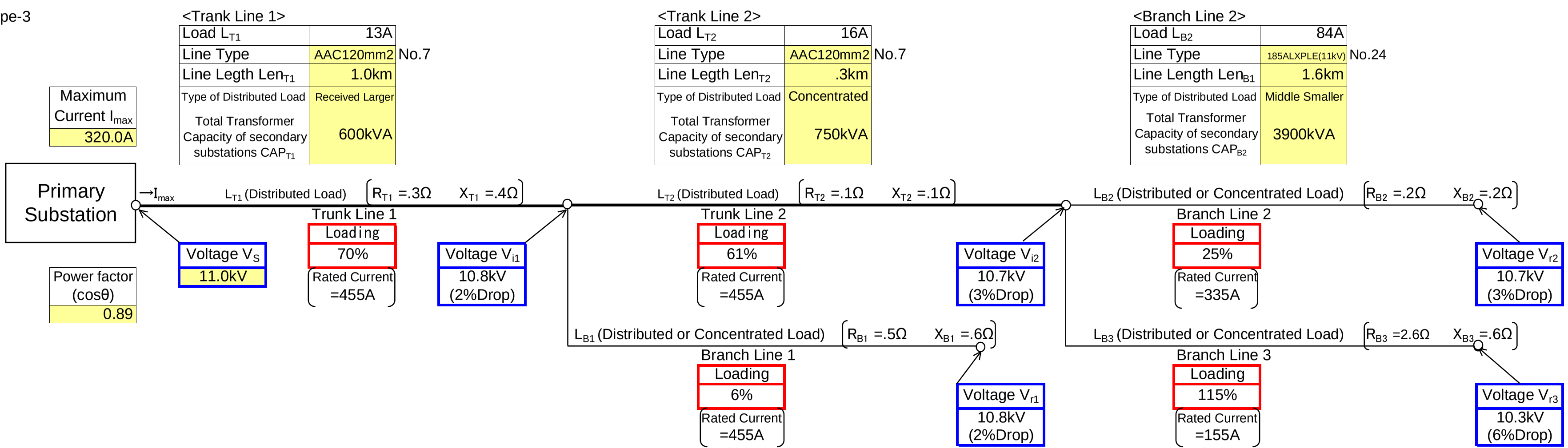
Type-3



Maximum Current I_{max}
320.0A

Power factor (cosθ)
0.89

<Trank Line 1>

Load L_{T1}	13A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	1.0km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	600kVA	

<Trank Line 2>

Load L_{T2}	16A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	84A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	1.6km	
Type of Distributed Load	Middle Smaller	
Total Transformer Capacity of secondary substations CAP_{B2}	3900kVA	

<Branch Line 1>

Load L_{B1}	28A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1300kVA	

<Branch Line 3>

Load L_{B3}	179A	
Line Type	35CuPILC(11kV)	No.17
Line Length Len_{B3}	3.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	8280kVA	

=====Equation=====

$V_{i1} = V_{s} - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	BEKWAI
Feeder Name	KOKOFU

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Type-3

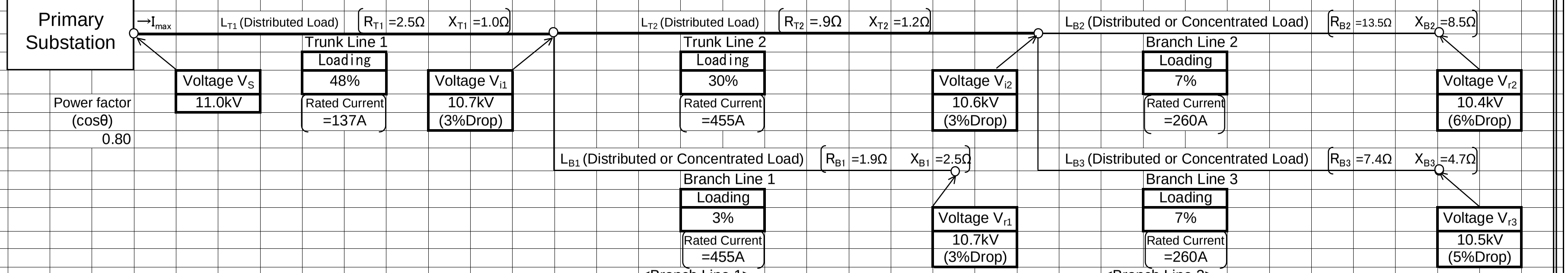
Maximum Current I_{max} 66.0A

<Trank Line 1>		
Load L_{T1}	10A	
Line Type	Cu16mm2	No.16
Line Legth Len_{T1}	1.9km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	300kVA	

<Trank Line 2>		
Load L_{T2}	5A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	3.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	150kVA	

<Branch Line 2>		
Load L_{B2}	18A	
Line Type	AAC50mm2	No.11
Line Length Len_{B1}	22.2km	
Type of Distributed Load	Middle Smaller	
Total Transformer Capacity of secondary substations CAP_{B2}	550kVA	

Power factor (cosθ) 0.80



<Branch Line 1>		
Load L_{B1}	15A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	7.1km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	450kVA	

<Branch Line 3>		
Load L_{B3}	18A	
Line Type	AAC50mm2	No.11
Line Length Len_{B3}	12.2km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	550kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	KONONGO
Feeder Name	KONONGO

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Type-3

<Trank Line 1>

Load L_{T1}	51A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1700kVA	

<Trank Line 2>

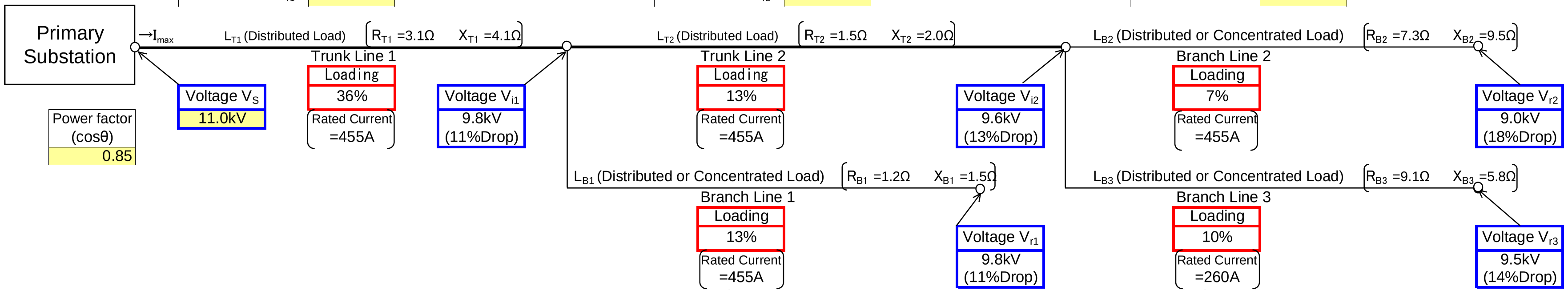
Load L_{T2}	A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	32A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	26.5km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}	1050kVA	

Maximum Current I_{max}
165.0A

Power factor (cosθ)
0.85



<Branch Line 1>

Load L_{B1}	57A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	4.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1890kVA	

<Branch Line 3>

Load L_{B3}	25A	
Line Type	AAC50mm2	No.11
Line Length Len_{B3}	15.0km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	840kVA	

=====Equation=====

$V_{i1} = V_{s} - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

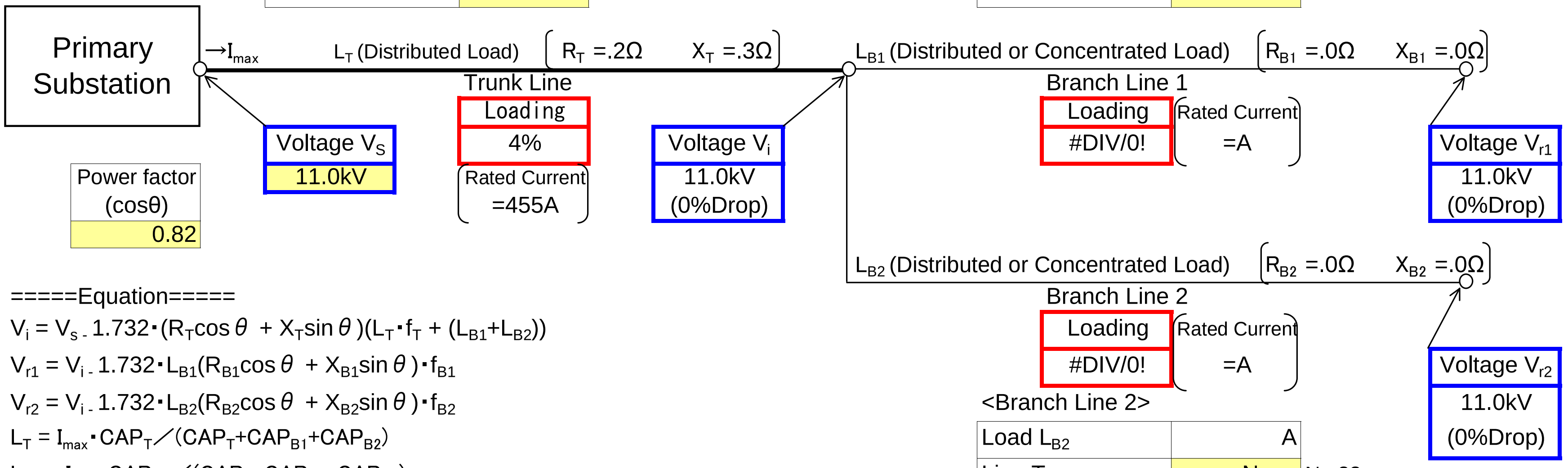
V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	KUMAWU
Feeder Name	KUMAWU 11KV

🟨 : Input data in colored cells

Type-2



Maximum Current I_{max}
16.0A

Power factor (cosθ)
0.82

<Trank Line>

Load L_T	16A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_T	315kVA	

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

=====Equation=====

$V_i = V_{S} - 1.732 \cdot (R_T\cos\theta + X_T\sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_T, R_{B1}, R_{B2}	: Resistance
V_i	: Interim Voltage	L_T	: Load (Trunk line)	X_T, X_{B1}, X_{B2}	: Reactance
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	cosθ	: Power Factor
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	f_T, f_{B1}, f_{B2}	: Dispersal Load Factor

CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	KUMAWU
Feeder Name	KUMAWU 11KV

: Input data in colored cells

Type-3

Maximum Current I_{max}
16.0A

Power factor (cosθ)
0.82

<Trank Line 1>

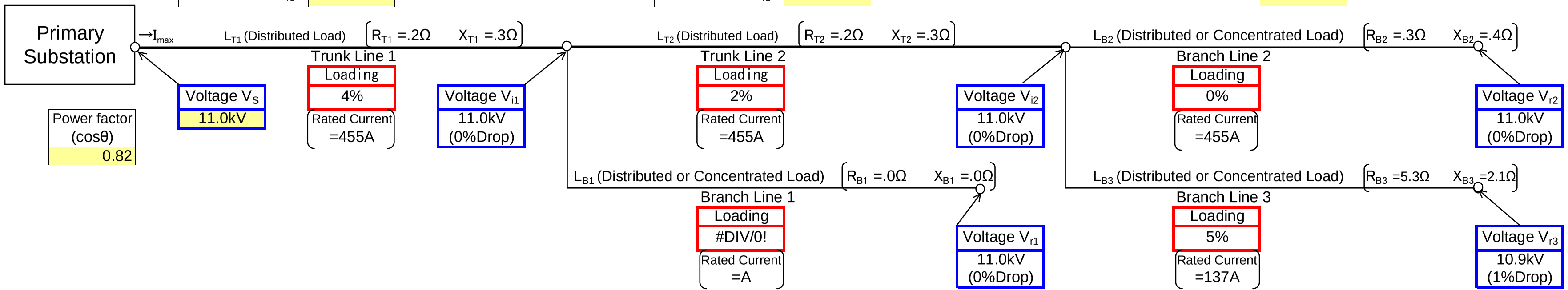
Load L_{T1}	7A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	2A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	1.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	100kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	7A	
Line Type	Cu16mm2	No.16
Line Length Len_{B3}	4.1km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B3}	315kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN A
Feeder Name	L L L

🟨 : Input data in colored cells

Type-2

<Trank Line>

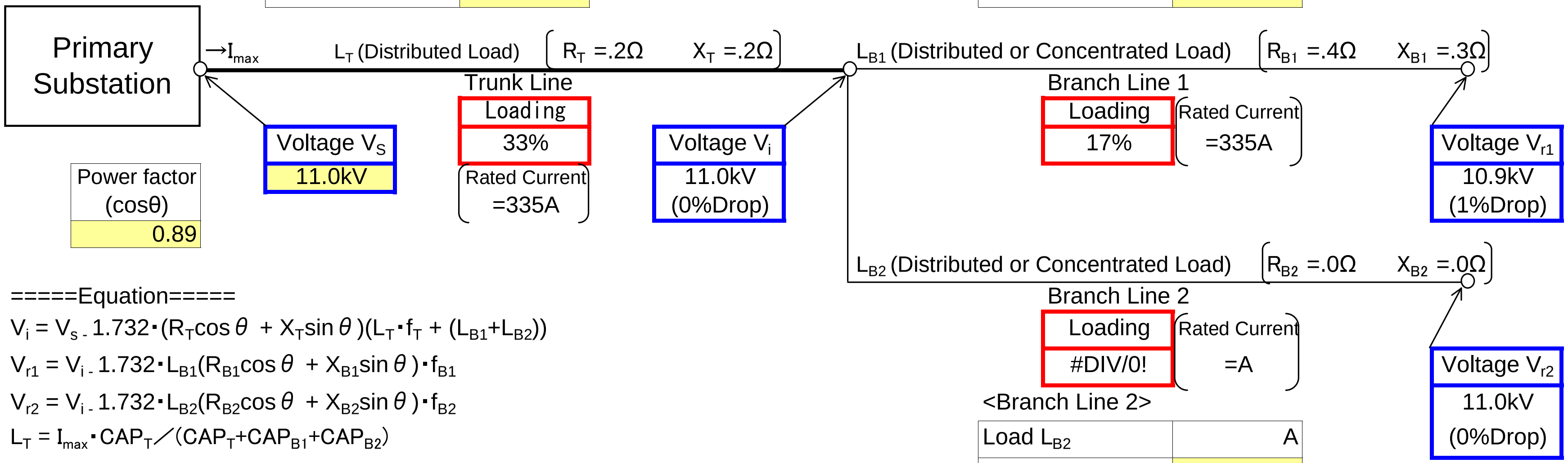
Load L_T	52A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_T	1.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_T	3000kVA	

<Branch Line 1>

Load L_{B1}	58A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	2.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	3400kVA	

Maximum Current I_{max}
110.0A

Power factor (cosθ)
0.89



<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

=====Equation=====

$V_i = V_{S} - 1.732 \cdot (R_T\cos\theta + X_T\sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T + CAP_{B1} + CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_T, R_{B1}, R_{B2}	: Resistance
V_i	: Interim Voltage	L_T	: Load (Trunk line)	X_T, X_{B1}, X_{B2}	: Reactance
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	cosθ	: Power Factor
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	f_T, f_{B1}, f_{B2}	: Dispersal Load Factor

CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN A
Feeder Name	LAKE ROAD

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	187A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4345kVA	

<Trank Line 2>

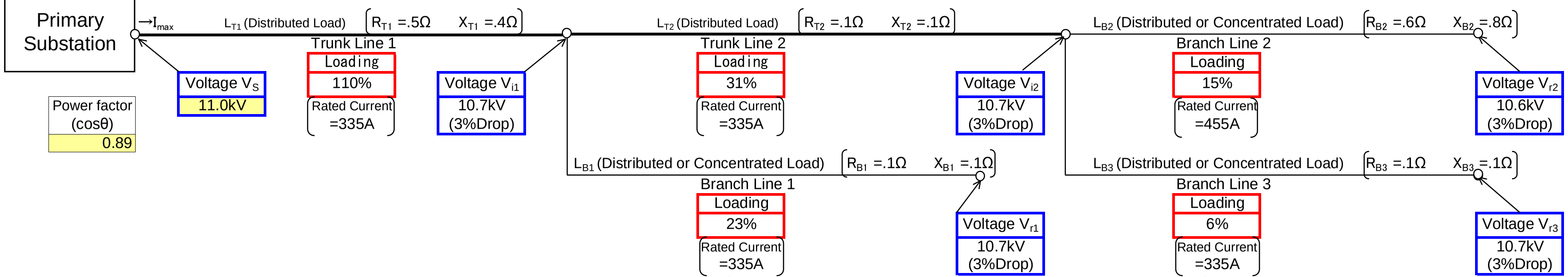
Load L_{T2}	13A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T2}	300kVA	

<Branch Line 2>

Load L_{B2}	70A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	1630kVA	

Maximum Current I_{max}
370.0A

Power factor (cosθ)
0.89



<Branch Line 1>

Load L_{B1}	78A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1815kVA	

<Branch Line 3>

Load L_{B3}	22A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B3}	.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B3}	500kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3}$: Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	EFFIDUASE S/S
Feeder Name	EFFIDUASE

🟨 : Input data in colored cells

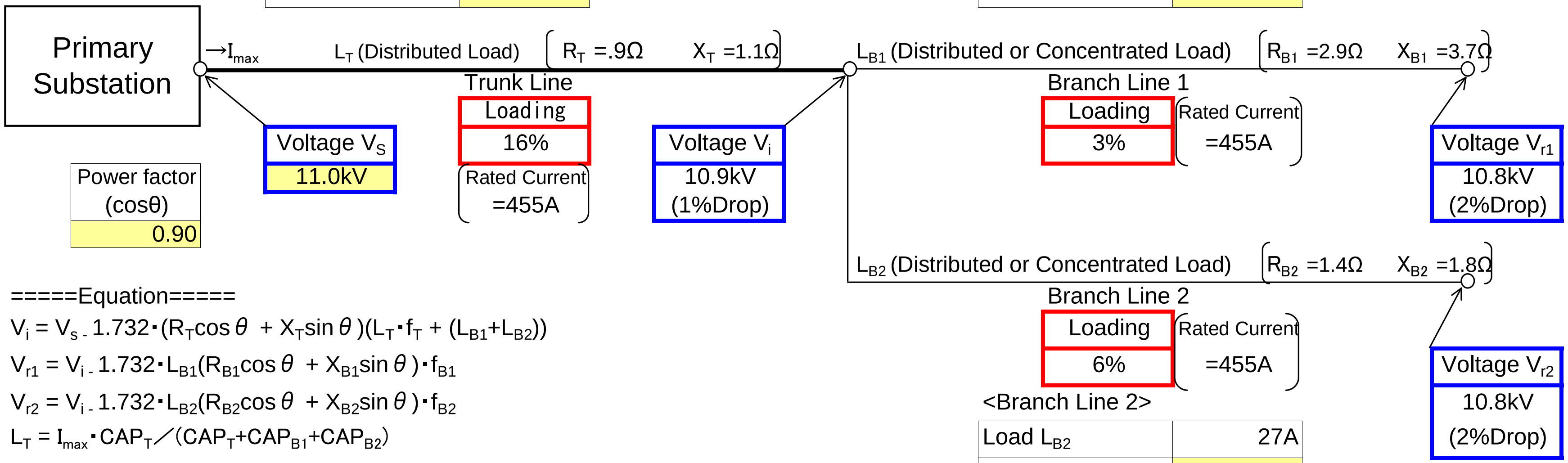
Type-2

<Trank Line>

Load L_T	32A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	3.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1810kVA	

<Branch Line 1>

Load L_{B1}	13A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	10.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	



<Branch Line 2>

Load L_{B2}	27A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	5.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	1510kVA	

=====Equation=====

$V_i = V_{S\,-}\,1.732 \cdot (R_T\cos\theta + X_T\sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_{i\,-}\,1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i\,-}\,1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage

I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)

R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	NSUTA
Feeder Name	MAMPONG

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
126.0A

Power factor (cosθ)
0.97

<Trank Line 1>

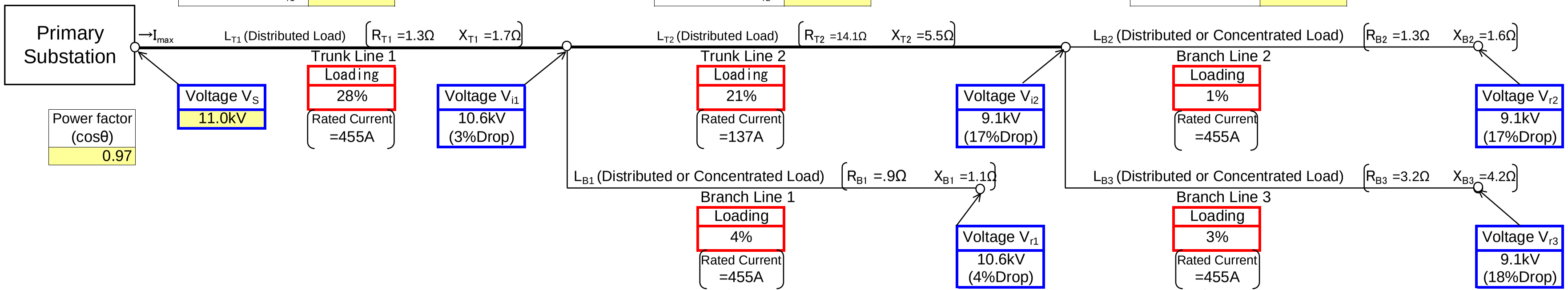
Load L_{T1}	11A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	415kVA	

<Trank Line 2>

Load L_{T2}	79A	
Line Type	Cu16mm2	No.16
Line Legth Len_{T2}	10.9km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	2955kVA	

<Branch Line 2>

Load L_{B2}	7A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	4.6km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	250kVA	



<Branch Line 1>

Load L_{B1}	18A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	3.2km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	665kVA	

<Branch Line 3>

Load L_{B3}	12A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	11.8km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	450kVA	

=====Equation=====

$V_{i1} = V_s - 1.732\cdot(R_{T1}\cos\theta + X_{T1}\sin\theta)\cdot(L_{T1}\cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732\cdot(R_{T2}\cos\theta + X_{T2}\sin\theta)\cdot(L_{T2}\cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732\cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta)\cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732\cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta)\cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732\cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta)\cdot f_{B3}$

$L_{T1} = I_{max}\cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max}\cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max}\cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max}\cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max}\cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3}$: Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN A
Feeder Name	NEW ASAFO

🟨 : Input data in colored cells

Type-2

<Trank Line>

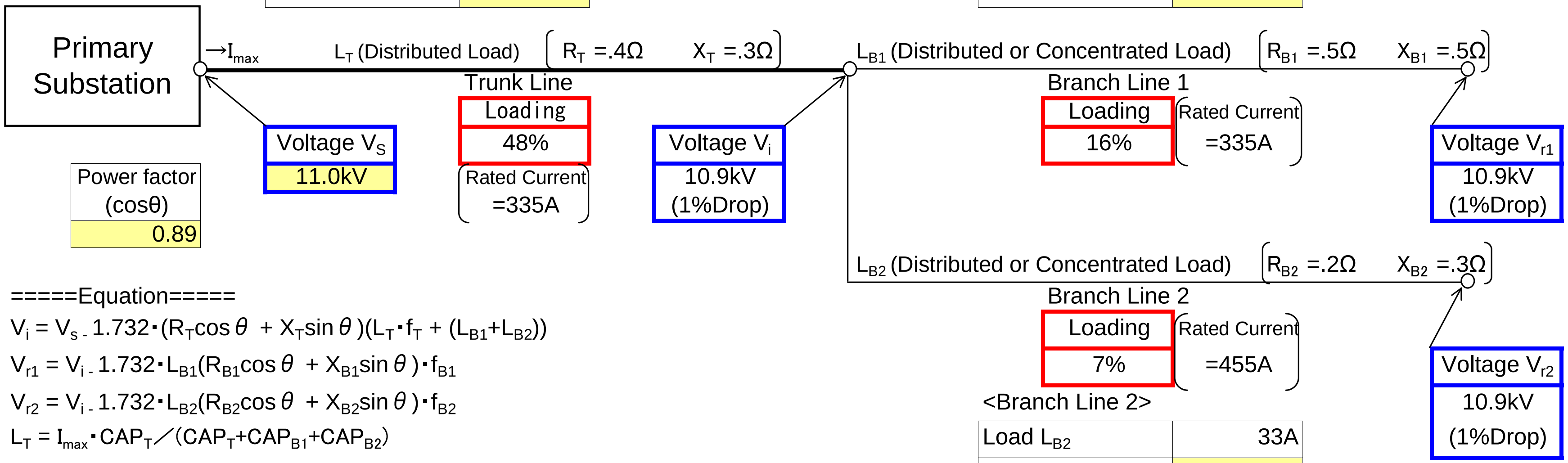
Load L_T	74A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_T	2.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	2245kVA	

<Branch Line 1>

Load L_{B1}	53A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	3.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1600kVA	

Maximum Current I_{max}
160.0A

Power factor (cosθ)
0.89



<Branch Line 2>

Load L_{B2}	33A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	.9km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	1015kVA	

=====Equation=====

$V_i = V_{S} - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T + CAP_{B1} + CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN C
Feeder Name	NSUTA KUMAWU

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}	239.0A

<Trank Line 1>

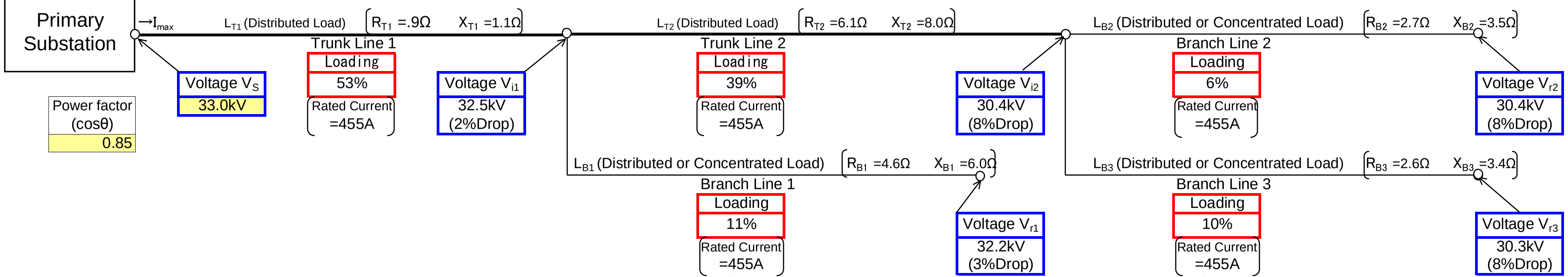
Load L_{T1}	13A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

<Trank Line 2>

Load L_{T2}	106A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	22.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1650kVA	

<Branch Line 2>

Load L_{B2}	26A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	9.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	400kVA	



<Branch Line 1>

Load L_{B1}	50A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	16.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	775kVA	

<Branch Line 3>

Load L_{B3}	45A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	9.5km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	700kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	NSUTA
Feeder Name	NSUTA

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	kVA	

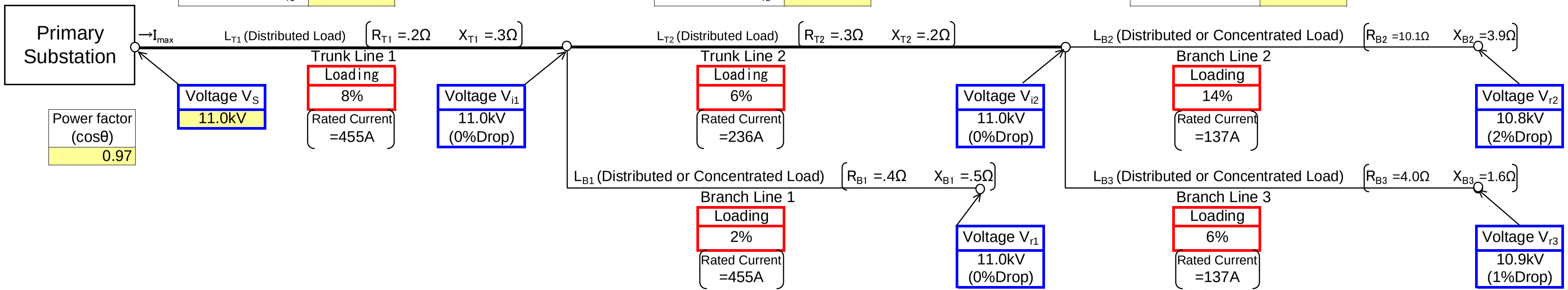
<Trank Line 2>

Load L_{T2}	A	
Line Type	Cu35mm2	No.15
Line Legth Len_{T2}	.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	19A	
Line Type	Cu16mm2	No.16
Line Length Len_{B1}	7.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	550kVA	

Maximum Current I_{max}	37.0A
Power factor (cosθ)	0.97



<Branch Line 1>

Load L_{B1}	10A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	1.4km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	300kVA	

<Branch Line 3>

Load L_{B3}	8A	
Line Type	Cu16mm2	No.16
Line Length Len_{B3}	3.1km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	250kVA	

=====Equation=====

$V_{i1} = V_{s\,-}\,1.732\cdot(R_{T1}\cos\theta + X_{T1}\sin\theta)\cdot(L_{T1}\cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1\,-}\,1.732\cdot(R_{T2}\cos\theta + X_{T2}\sin\theta)\cdot(L_{T2}\cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1\,-}\,1.732\cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta)\cdot f_{B1}$

$V_{r2} = V_{i2\,-}\,1.732\cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta)\cdot f_{B2}$

$V_{r3} = V_{i2\,-}\,1.732\cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta)\cdot f_{B3}$

$L_{T1} = I_{max}\cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max}\cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max}\cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max}\cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max}\cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	MAIN A
Feeder Name	OBR

▨ : Input data in colored cells

Type-3

<Trank Line 1>

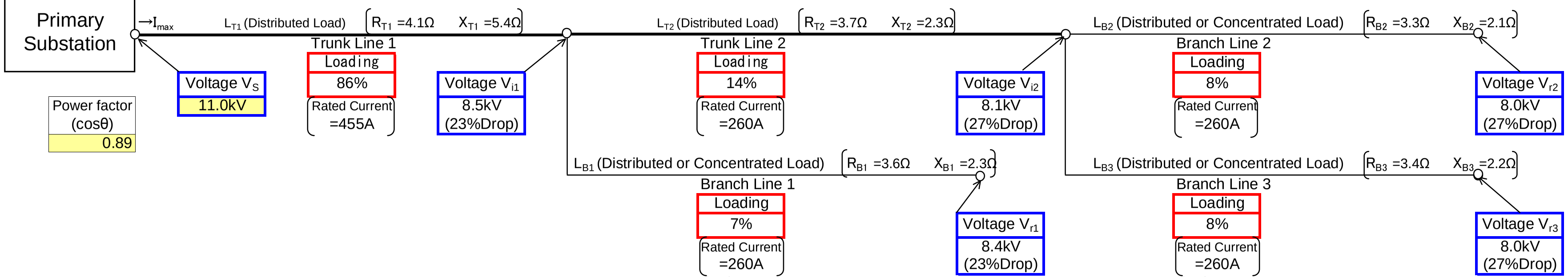
Load L_{T1}	307A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	15.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	9285kVA	

<Trank Line 2>

Load L_{T2}	23A	
Line Type	AAC50mm2	No.11
Line Legth Len_{T2}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	710kVA	

<Branch Line 2>

Load L_{B2}	20A	
Line Type	AAC50mm2	No.11
Line Length Len_{B1}	5.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	600kVA	



<Branch Line 1>

Load L_{B1}	18A	
Line Type	AAC50mm2	No.11
Line Length Len_{B1}	6.0km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	550kVA	

<Branch Line 3>

Load L_{B3}	21A	
Line Type	AAC50mm2	No.11
Line Length Len_{B3}	5.6km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	650kVA	

=====Equation=====

$V_{i1} = V_s - 1.732\cdot(R_{T1}\cos\theta + X_{T1}\sin\theta)\cdot(L_{T1}\cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732\cdot(R_{T2}\cos\theta + X_{T2}\sin\theta)\cdot(L_{T2}\cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732\cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta)\cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732\cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta)\cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732\cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta)\cdot f_{B3}$

$L_{T1} = I_{max}\cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max}\cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max}\cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max}\cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max}\cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	KONONGO
Feeder Name	ODUMASI

: Input data in colored cells

Type-3

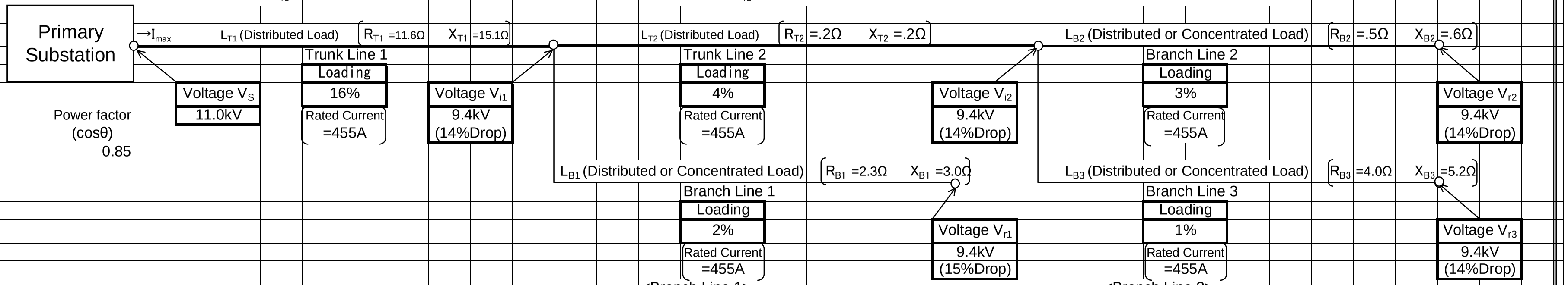
Maximum Current I_{max} 75.0A

Power factor (cosθ) 0.85

<Trank Line 1>		
Load L_{T1}	49A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	42.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2965kVA	

<Trank Line 2>		
Load L_{T2}	A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	.7km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>		
Load L_{B2}	12A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	1.7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	730kVA	



<Branch Line 1>		
Load L_{B1}	8A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	8.5km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B1}	500kVA	

<Branch Line 3>		
Load L_{B3}	5A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	14.5km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	300kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	BAREKESE
Feeder Name	OFFINSO

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
144.0A

Power factor (cosθ)
0.85

<Trank Line 1>

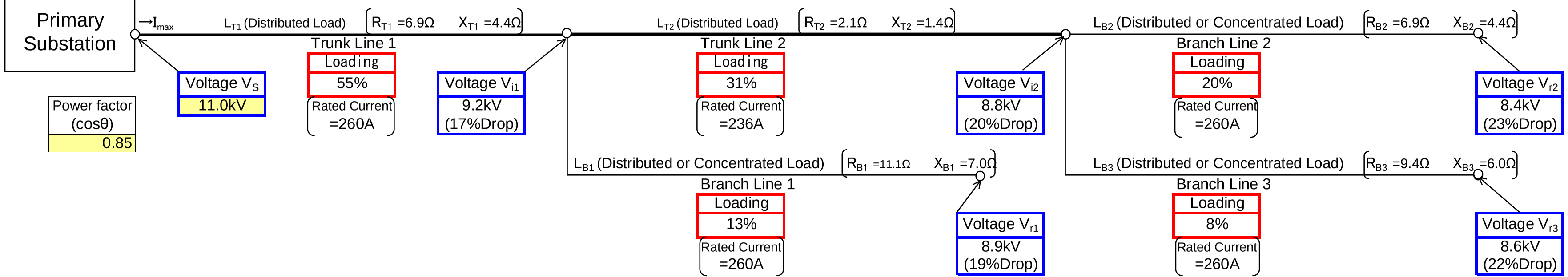
Load L_{T1}	27A	
Line Type	AAC50mm2	No.11
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1145kVA	

<Trank Line 2>

Load L_{T2}	8A	
Line Type	Cu35mm2	No.15
Line Legth Len_{T2}	3.0km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T2}	315kVA	

<Branch Line 2>

Load L_{B2}	53A	
Line Type	AAC50mm2	No.11
Line Length Len_{B1}	11.4km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	2200kVA	



<Branch Line 1>

Load L_{B1}	35A	
Line Type	AAC50mm2	No.11
Line Length Len_{B1}	18.3km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	1465kVA	

<Branch Line 3>

Load L_{B3}	22A	
Line Type	AAC50mm2	No.11
Line Length Len_{B3}	15.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	900kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Step A (Type-1)

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	BEKWAI
Feeder Name	PACKAGE

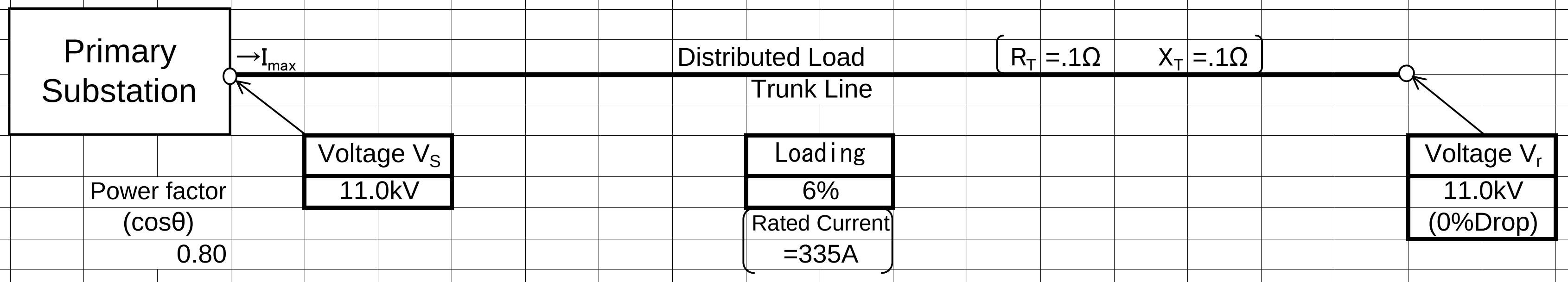
: Input data in colored cells

Type-1

Maximum
Current I_{max}
19.0A

<Trank Line>

Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_T	.5km	
Type of Distributed Load	Concentrated	



Power factor
(cosθ)
0.80

=====Equation=====

$$V_r = Vs - 1.732 \cdot I_{max}(R_T \cos\theta + X_T \sin\theta) \cdot f_T$$

V_s	: Supply Voltage	R_T	: Resistance	f_T	: Dispersal Load Factor
V_r	: Received Voltage	X_T	: Reactance		
I_{max}	: Maximum Current	cosθ	: Power Factor		

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN A
Feeder Name	POWER HOUSE 1

🟨: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	93A
Line Type	185ALXPLE(11kV) No.24
Line Legth Len_{T1}	1.6km
Type of Distributed Load	Middle Smaller
Total Transformer Capacity of secondary substations CAP_{T1}	1600kVA

<Trank Line 2>

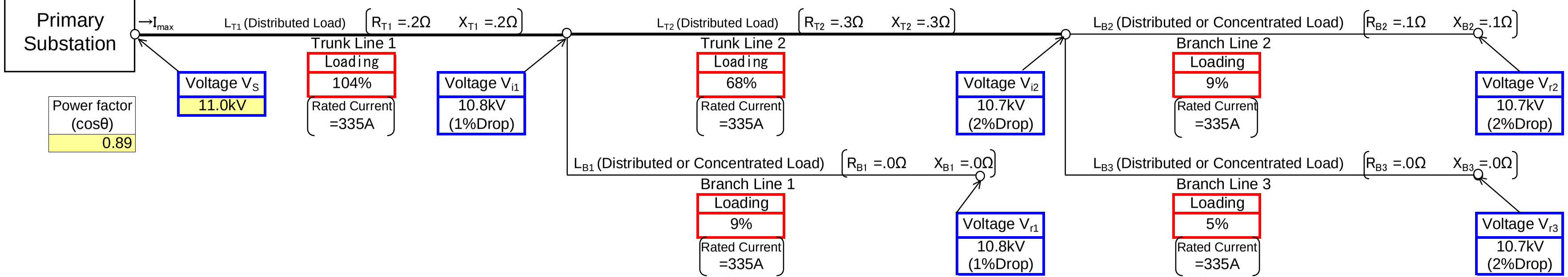
Load L_{T2}	181A
Line Type	185ALXPLE(11kV) No.24
Line Legth Len_{T2}	2.2km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T2}	3115kVA

<Branch Line 2>

Load L_{B2}	29A
Line Type	185ALXPLE(11kV) No.24
Line Length Len_{B1}	.6km
Type of Distributed Load	Concentrated
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA

Maximum Current I_{max}
350.0A

Power factor (cosθ)
0.89



<Branch Line 1>

Load L_{B1}	29A
Line Type	185ALXPLE(11kV) No.24
Line Length Len_{B1}	.3km
Type of Distributed Load	Concentrated
Total Transformer Capacity of secondary substations CAP_{B1}	500kVA

<Branch Line 3>

Load L_{B3}	18A
Line Type	185ALXPLE(11kV) No.24
Line Length Len_{B3}	.1km
Type of Distributed Load	Concentrated
Total Transformer Capacity of secondary substations CAP_{B3}	315kVA

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	MAIN A
Feeder Name	POWER HOUSE 2

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	kVA	

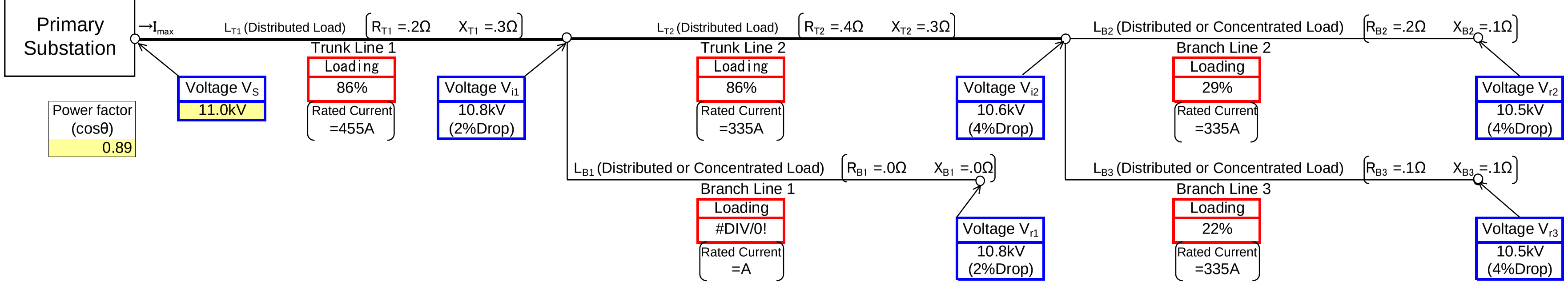
<Trank Line 2>

Load L_{T2}	218A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	2.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2915kVA	

<Branch Line 2>

Load L_{B2}	97A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	1.1km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	1300kVA	

Maximum Current I_{max}	390.0A
Power factor (cosθ)	0.89



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	75A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B3}	.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	1000kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

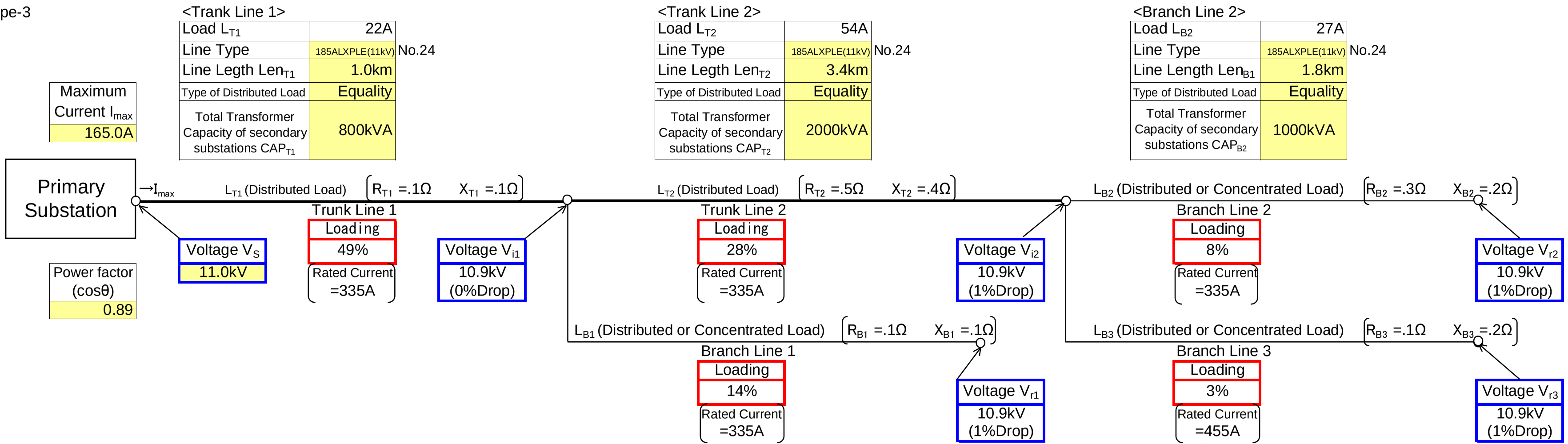
$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3}$: Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN A
Feeder Name	RAIN TREE

🟨 : Input data in colored cells

Type-3



Maximum Current I_{max}
165.0A

Power factor (cosθ)
0.89

<Trank Line 1>

Load L_{T1}	22A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	800kVA	

<Trank Line 2>

Load L_{T2}	54A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2000kVA	

<Branch Line 2>

Load L_{B2}	27A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	1000kVA	

<Branch Line 1>

Load L_{B1}	48A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	.8km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	1760kVA	

<Branch Line 3>

Load L_{B3}	14A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	.5km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B3}	500kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	OBUASI
Feeder Name	STADIUM

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	11A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	500kVA	

<Trank Line 2>

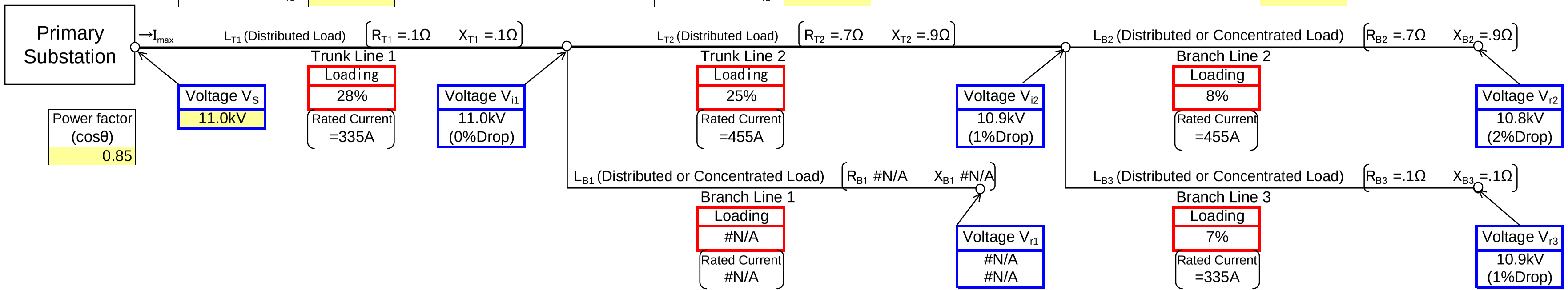
Load L_{T2}	26A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	1150kVA	

<Branch Line 2>

Load L_{B2}	35A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	2.5km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	1550kVA	

Maximum Current I_{max}
94.0A

Power factor (cosθ)
0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type		#N/A
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	22A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B3}	.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B3}	1000kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

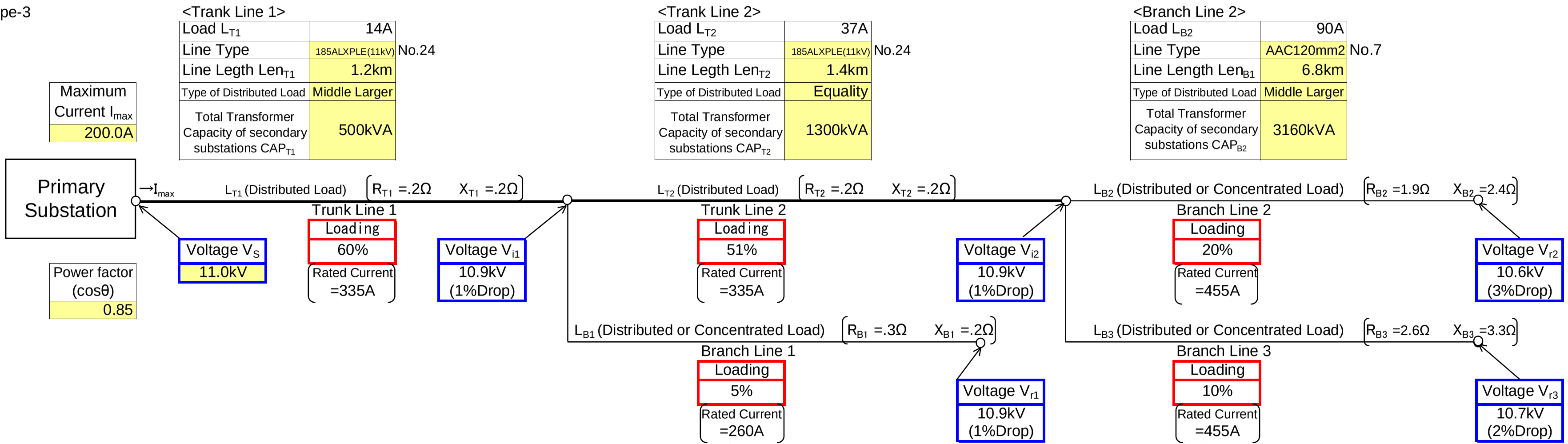
V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	OBUASI
Feeder Name	TUTUKA

▨ : Input data in colored cells

Type-3



<Trank Line 1>

Load L_{T1}	14A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.2km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	500kVA	

<Trank Line 2>

Load L_{T2}	37A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1300kVA	

<Branch Line 2>

Load L_{B2}	90A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	6.8km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	3160kVA	

<Branch Line 1>

Load L_{B1}	14A	
Line Type	AAC50mm2	No.11
Line Length Len_{B1}	.5km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B1}	500kVA	

<Branch Line 3>

Load L_{B3}	45A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	9.3km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B3}	1600kVA	

=====Equation=====

$V_{i1} = V_{s} - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN A
Feeder Name	WAHW

🟨 : Input data in colored cells

Type-2

<Trank Line>

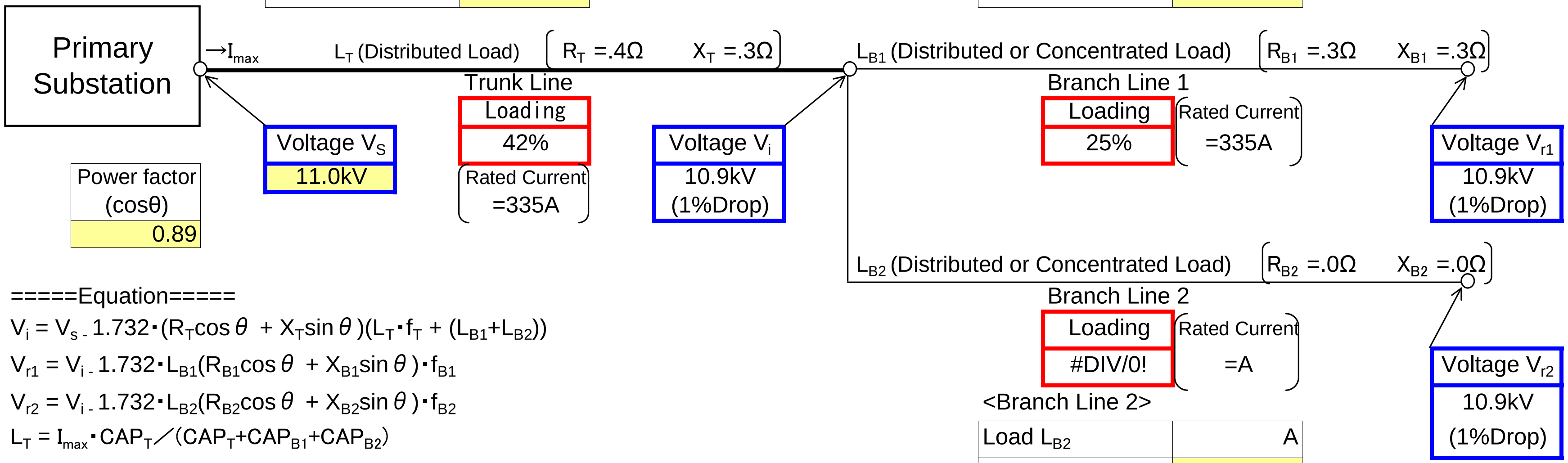
Load L_T	57A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_T	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1600kVA	

<Branch Line 1>

Load L_{B1}	83A	
Line Type	185ALXPLE(11kV)	No.24
Line Length Len_{B1}	2.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	2315kVA	

Maximum Current I_{max}
140.0A

Power factor (cosθ)
0.89



<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

=====Equation=====

$V_i = V_S - 1.732 \cdot (R_T\cos\theta + X_T\sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T + CAP_{B1} + CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Step A (Type-2)

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	BEKWAI
Feeder Name	WATERWORKS

: Input data in colored cells

Type-2

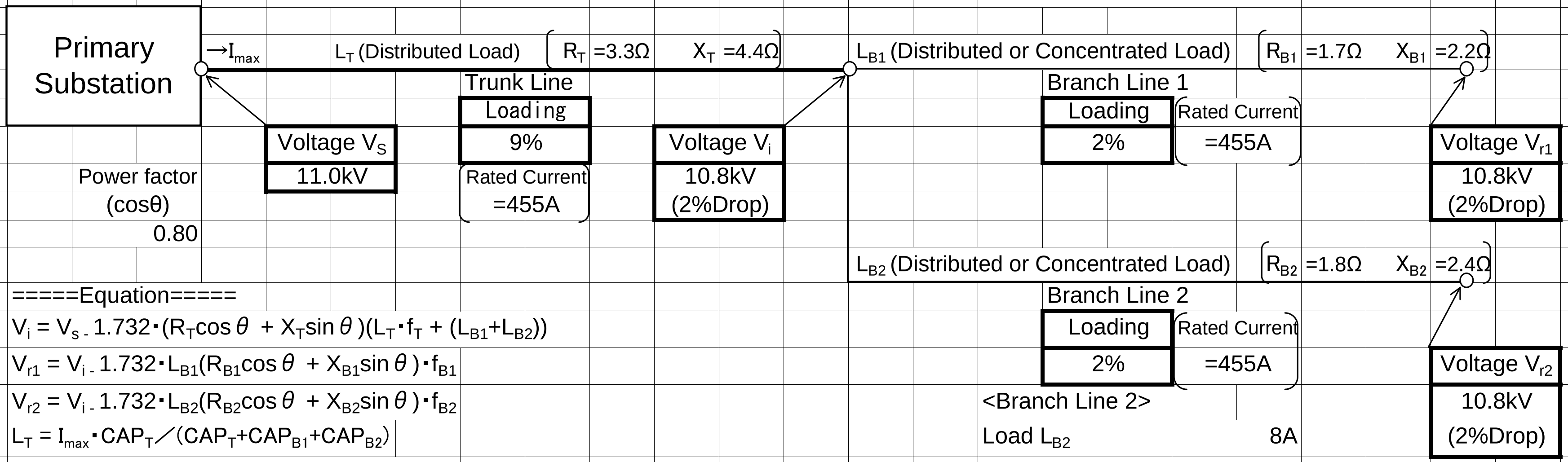
Maximum Current I_{max}	39.0A		
Power factor (cosθ)	0.80		

<Trank Line>

Load L_T	23A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	12.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_T	900kVA	

<Branch Line 1>

Load L_{B1}	8A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	300kVA	



=====Equation=====

$V_i = V_{s} - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_{i} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

<Branch Line 2>

Load L_{B2}	8A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	6.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	300kVA	

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_T, R_{B1}, R_{B2}	: Resistance		
V_i	: Interim Voltage	L_T	: Load (Trunk line)	X_T, X_{B1}, X_{B2}	: Reactance		
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	cosθ	: Power Factor		
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	f_T, f_{B1}, f_{B2}	: Dispersal Load Factor	CAP_T, CAP_{B1}, CAP_{B2}	: Total Transformer Capacity of secondary substations

Power System Analysis

- Ashanti 33kV -

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	MAIN B
Feeder Name	BAREKESE 1

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
70.0A

Power factor (cosθ)
0.97

<Trank Line 1>

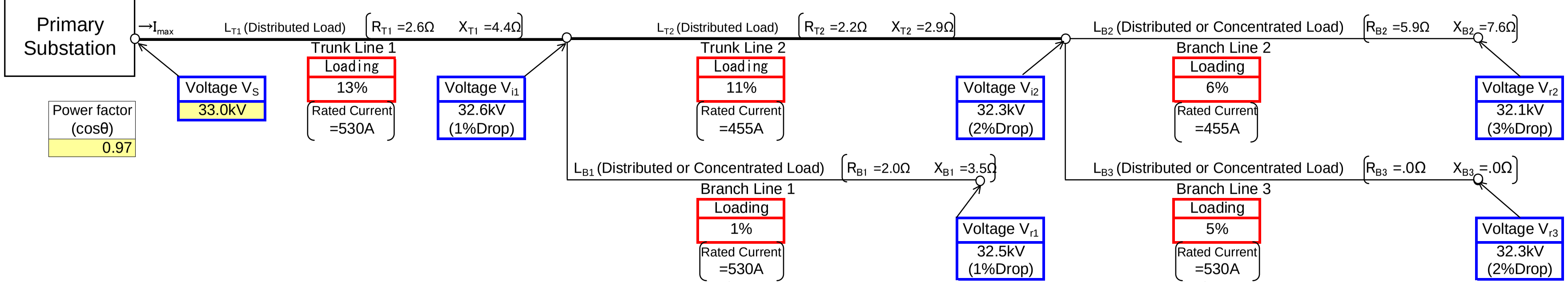
Load L_{T1}	2A	
Line Type	AAC150mm2	No.6
Line Legth Len_{T1}	12.7km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	150kVA	

<Trank Line 2>

Load L_{T2}	4A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	8.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	350kVA	

<Branch Line 2>

Load L_{B2}	28A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	21.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	2465kVA	



<Branch Line 1>

Load L_{B1}	8A	
Line Type	AAC150mm2	No.6
Line Length Len_{B1}	9.9km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	675kVA	

<Branch Line 3>

Load L_{B3}	29A	
Line Type	AAC150mm2	No.6
Line Length Len_{B3}		
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B3}	2500kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

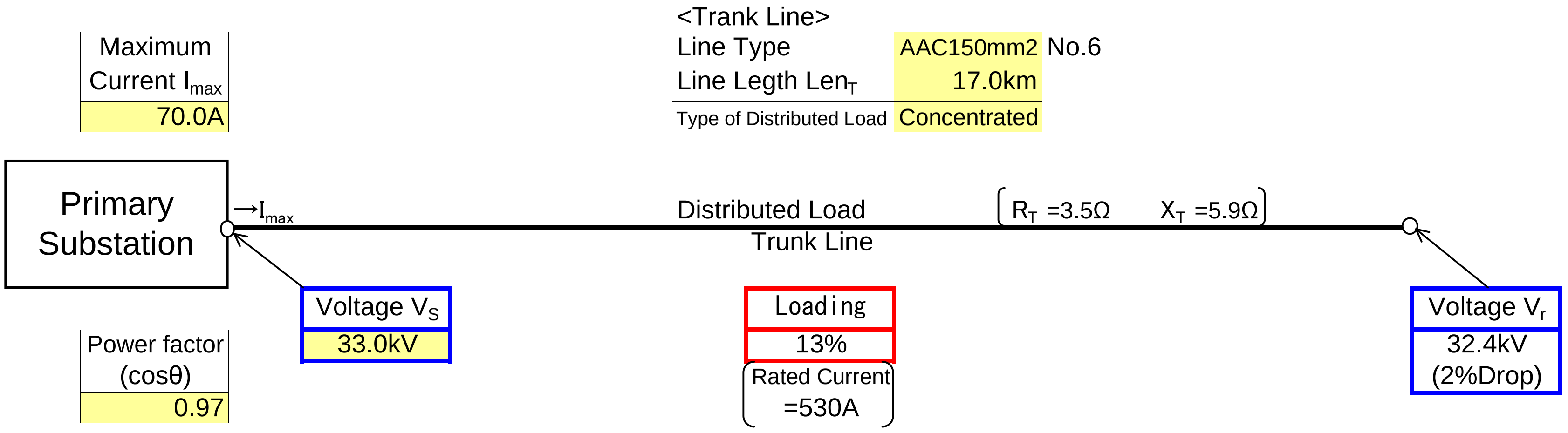
$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3}$: Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN B
Feeder Name	BAREKESE 2

▨ : Input data in colored cells

Type-1



=====Equation=====

$V_r = Vs - 1.732 \cdot I_{max}(R_T \cos\theta + X_T \sin\theta) \cdot f_T$

V_s : Supply Voltage
V_r : Received Voltage
I_{max} : Maximum Current
R_T : Resistance
X_T : Reactance
cosθ : Power Factor
f_T : Dispersal Load Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN B
Feeder Name	BAREKESE 2

▨ : Input data in colored cells

Type-2

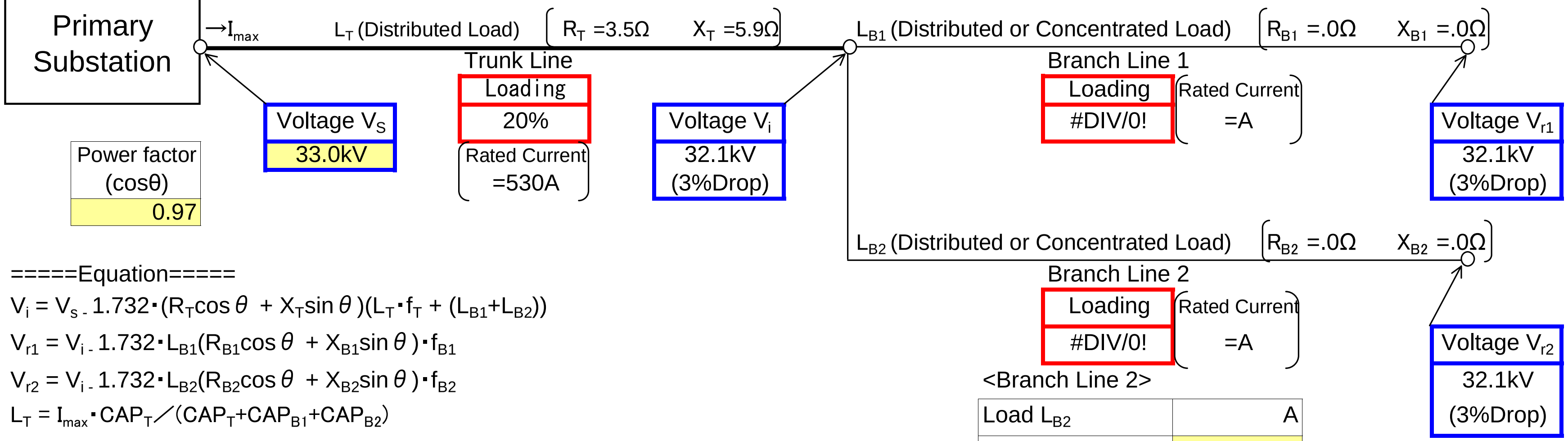
<Trank Line>

Load L_T	104A	
Line Type	AAC150mm2	No.6
Line Legth Len_T	17.0km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_T	7500kVA	

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

Maximum Current I_{max}
104.0A



Power factor (cosθ)
0.97

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

=====Equation=====

$V_i = V_{s\,-}\,1.732 \cdot (R_T\cos\theta + X_T\sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_{i\,-}\,1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i\,-}\,1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage

I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)

R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	STATION D
Feeder Name	BEKWAI 33KV

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
100.0A

Power factor (cosθ)
0.80

<Trank Line 1>

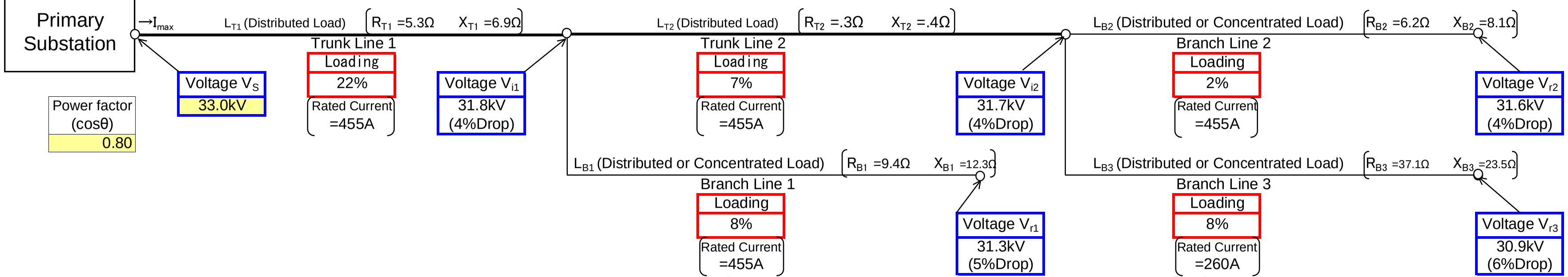
Load L_{T1}	28A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	19.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3100kVA	

<Trank Line 2>

Load L_{T2}	2A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1.1km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	11A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	22.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	1200kVA	



<Branch Line 1>

Load L_{B1}	38A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	34.4km	
Type of Distributed Load	Middle Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	4175kVA	

<Branch Line 3>

Load L_{B3}	21A	
Line Type	AAC50mm2	No.11
Line Length Len_{B3}	61.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	2300kVA	

=====Equation=====

$V_{i1} = V_{s\,-}\,1.732\cdot(R_{T1}\cos\theta + X_{T1}\sin\theta)\cdot(L_{T1}\cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1\,-}\,1.732\cdot(R_{T2}\cos\theta + X_{T2}\sin\theta)\cdot(L_{T2}\cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1\,-}\,1.732\cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta)\cdot f_{B1}$

$V_{r2} = V_{i2\,-}\,1.732\cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta)\cdot f_{B2}$

$V_{r3} = V_{i2\,-}\,1.732\cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta)\cdot f_{B3}$

$L_{T1} = I_{max}\cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max}\cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max}\cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max}\cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max}\cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	AGONA
Feeder Name	KUMAWU

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	3A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	11.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	300kVA	

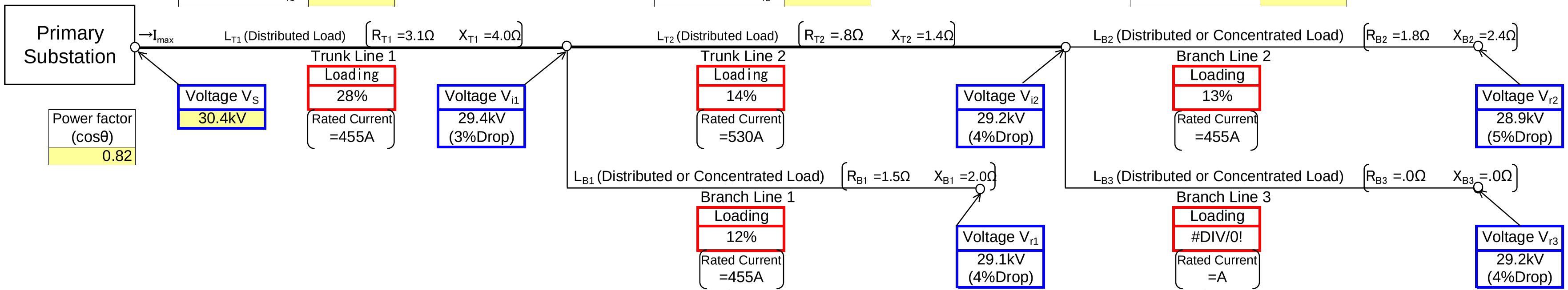
<Trank Line 2>

Load L_{T2}	6A	
Line Type	AAC150mm2	No.6
Line Legth Len_{T2}	3.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	500kVA	

<Branch Line 2>

Load L_{B2}	57A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	6.7km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B2}	5050kVA	

Maximum Current I_{max}
126.0A



<Branch Line 1>

Load L_{B1}	57A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	5.5km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B1}	5000kVA	

<Branch Line 3>

Load L_{B3}	3A	
Line Type	None	No.33
Line Length Len_{B3}	6.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	250kVA	

=====Equation=====

$V_{i1} = V_{s} - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

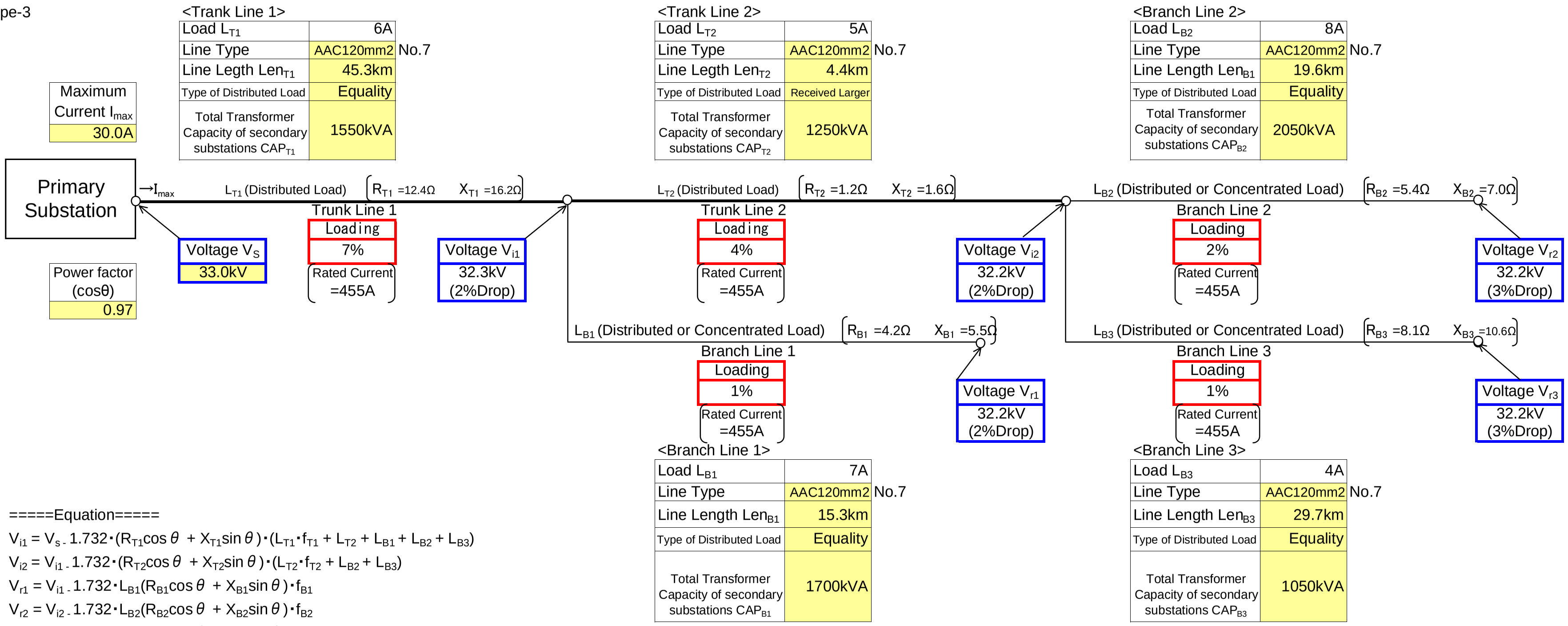
$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$
CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	MAIN B
Feeder Name	MANSO NKWANTA

🟨 : Input data in colored cells

Type-3



Maximum Current I_{max}
30.0A

Power factor (cosθ)
0.97

Voltage V_S
33.0kV

<Trank Line 1>

Load L_{T1}	6A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	45.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1550kVA	

Loading
7%
Rated Current =455A

Voltage V_{i1}
32.3kV (2%Drop)

<Trank Line 2>

Load L_{T2}	5A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4.4km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	1250kVA	

Loading
4%
Rated Current =455A

Voltage V_{i2}
32.2kV (2%Drop)

<Branch Line 2>

Load L_{B2}	8A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	19.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B2}	2050kVA	

Loading
2%
Rated Current =455A

Voltage V_{r2}
32.2kV (3%Drop)

Loading
1%
Rated Current =455A

Voltage V_{r1}
32.2kV (2%Drop)

<Branch Line 1>

Load L_{B1}	7A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	15.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1700kVA	

Loading
1%
Rated Current =455A

Voltage V_{r3}
32.2kV (3%Drop)

<Branch Line 3>

Load L_{B3}	4A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	29.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	OBUASI
Feeder Name	NEW EDUBIASE

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	6A
Line Type	AAC120mm2 No.7
Line Legth Len_{T1}	25.3km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T1}	750kVA

<Trank Line 2>

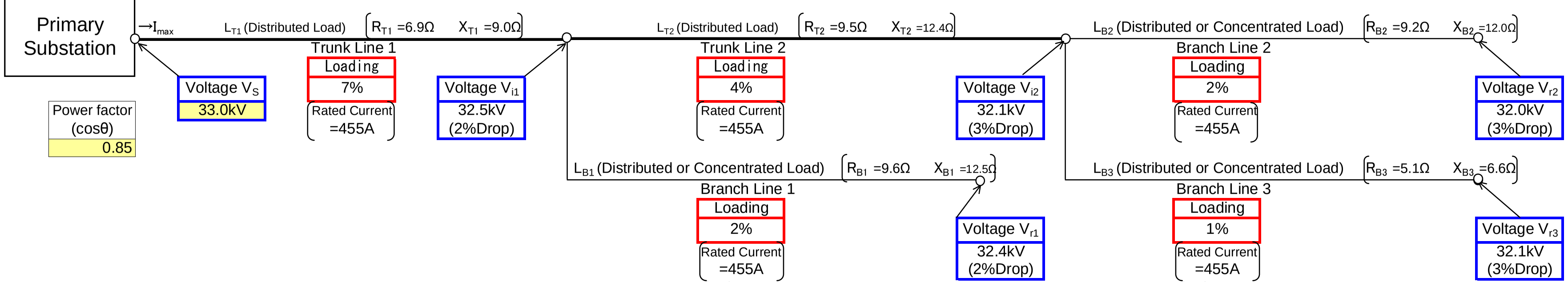
Load L_{T2}	4A
Line Type	AAC120mm2 No.7
Line Legth Len_{T2}	34.8km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T2}	550kVA

<Branch Line 2>

Load L_{B2}	10A
Line Type	AAC120mm2 No.7
Line Length Len_{B1}	33.7km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{B2}	1250kVA

Maximum Current I_{max}
31.0A

Power factor (cosθ)
0.85



<Branch Line 1>

Load L_{B1}	8A
Line Type	AAC120mm2 No.7
Line Length Len_{B1}	35.0km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{B1}	1000kVA

<Branch Line 3>

Load L_{B3}	3A
Line Type	AAC120mm2 No.7
Line Length Len_{B3}	18.5km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{B3}	450kVA

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	AGONA
Feeder Name	NSUTA 33KV

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	6A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	1.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

<Trank Line 2>

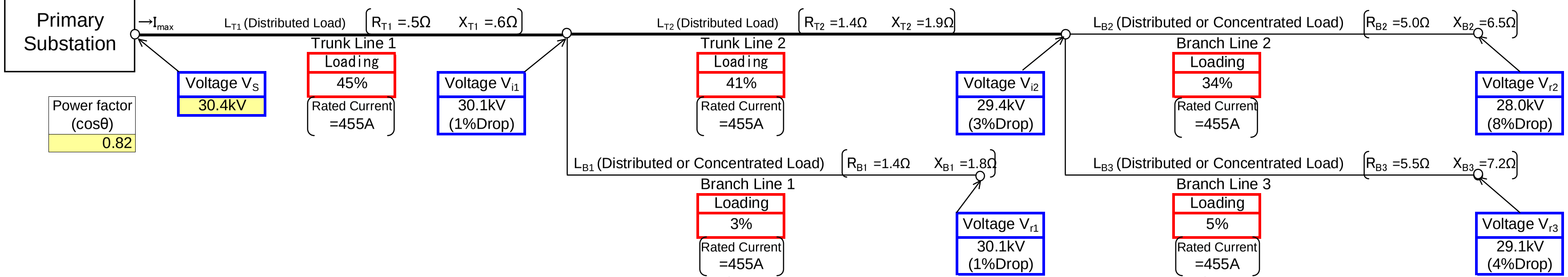
Load L_{T2}	6A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	157A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	18.2km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{B2}	5700kVA	

Maximum Current I_{max}
203.0A

Power factor (cosθ)
0.82



<Branch Line 1>

Load L_{B1}	12A	
Line Type	AAC120mm2	No.7
Line Length Len_{B1}	5.0km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	425kVA	

<Branch Line 3>

Load L_{B3}	23A	
Line Type	AAC120mm2	No.7
Line Length Len_{B3}	20.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{B3}	850kVA	

=====Equation=====

$V_{i1} = V_{s} - 1.732 \cdot (R_{T1} \cos\theta + X_{T1} \sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2} \cos\theta + X_{T2} \sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1} \cos\theta + X_{B1} \sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2} \cos\theta + X_{B2} \sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3} \cos\theta + X_{B3} \sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3}$: Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis

- Central -

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	ANOMABO

: Input data in colored cells

Type-3

Maximum Current I_{max}
38A

Power factor (cosθ)
0.86

<Trank Line 1>

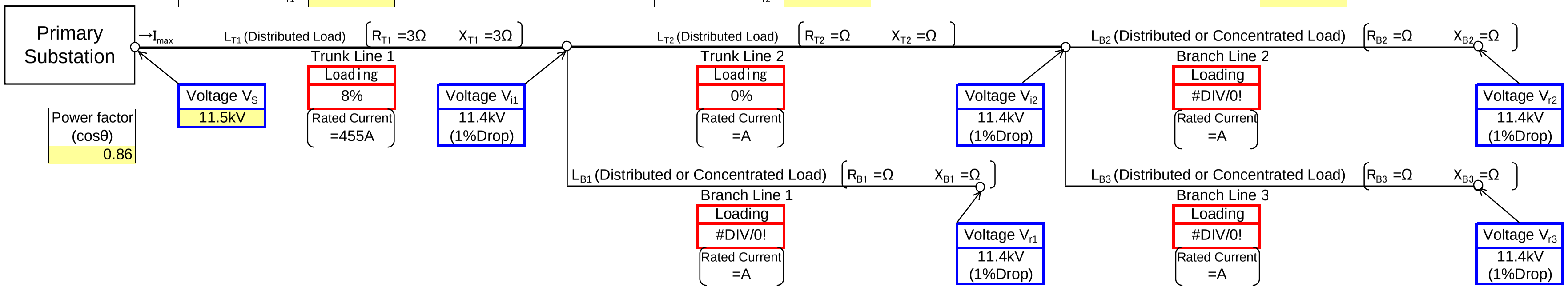
Load L_{T1}	38A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1350kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.33
Line Legth Len_{T2}	km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	ANOMABO

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	40A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1350kVA	

<Trank Line 2>

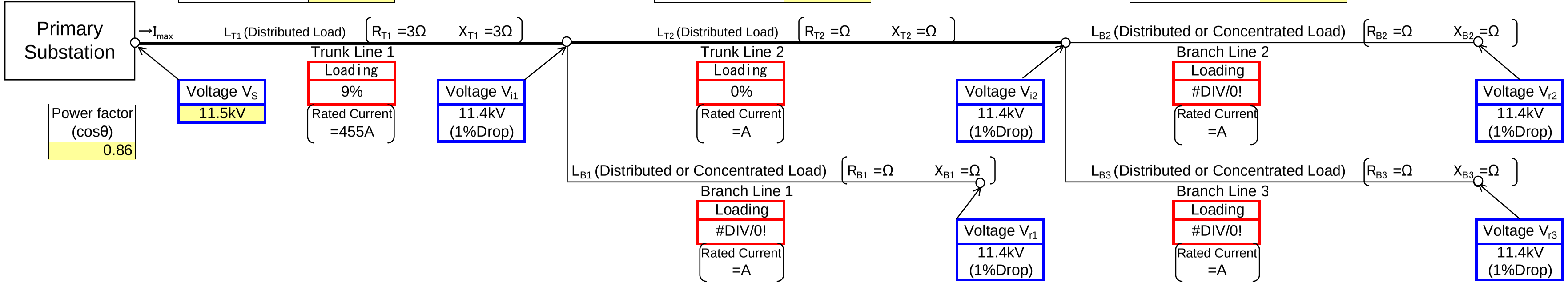
Load L_{T2}	A	
Line Type	None	No.33
Line Legth Len_{T2}	km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
40A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	ANOMABO

: Input data in colored cells

Type-3

Maximum Current I_{max}
43A

Power factor (cosθ)
0.86

<Trank Line 1>

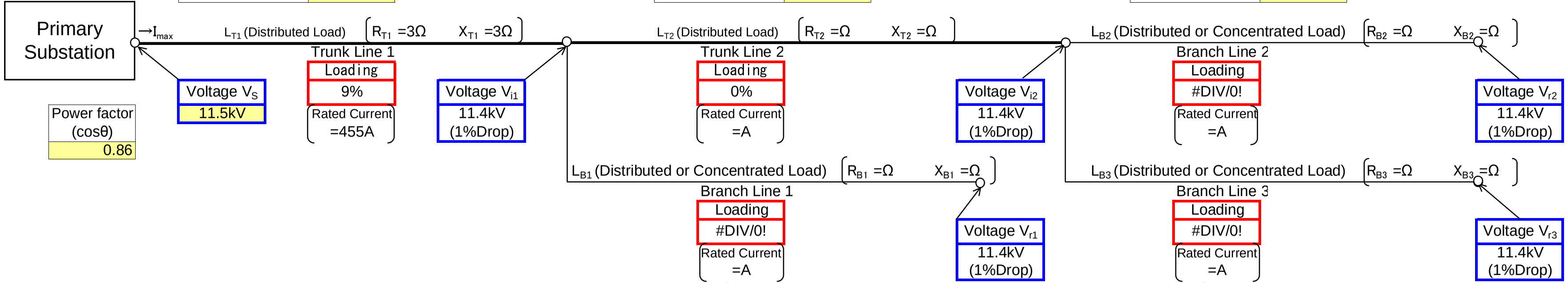
Load L_{T1}	43A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1350kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.33
Line Legth Len_{T2}	km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	ANOMABO

: Input data in colored cells

Type-3

Maximum Current I_{max}
45A

Power factor (cosθ)
0.86

<Trank Line 1>

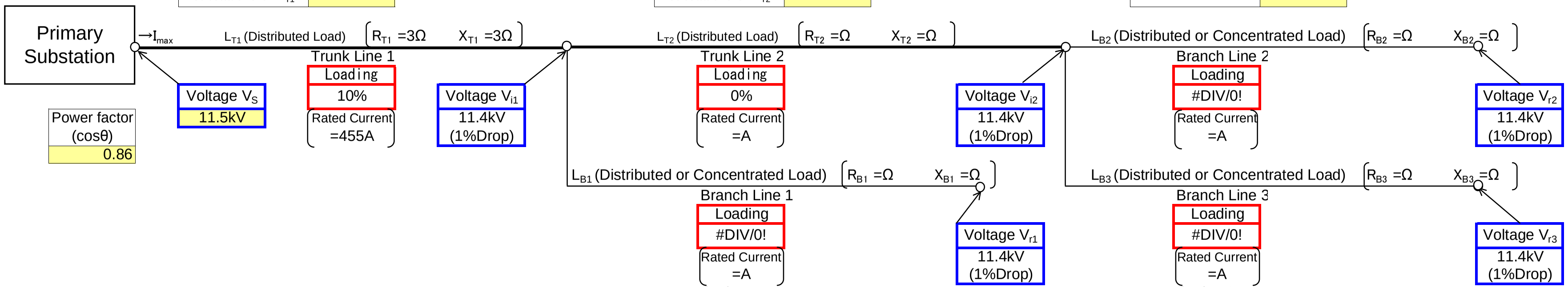
Load L_{T1}	45A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1350kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.33
Line Legth Len_{T2}	km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	ANOMABO

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
48A

Power factor (cosθ)
0.86

<Trank Line 1>

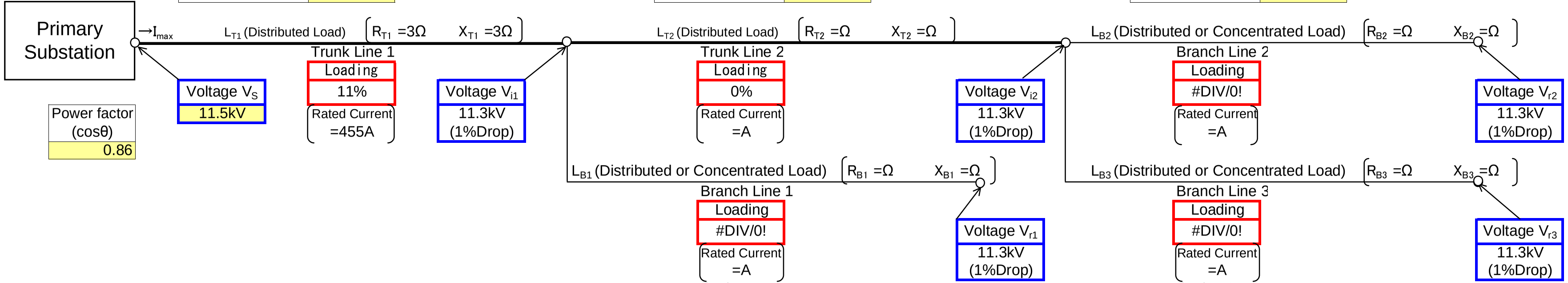
Load L_{T1}	48A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1350kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.33
Line Legth Len_{T2}	km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	ANOMABO

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	50A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1350kVA	

<Trank Line 2>

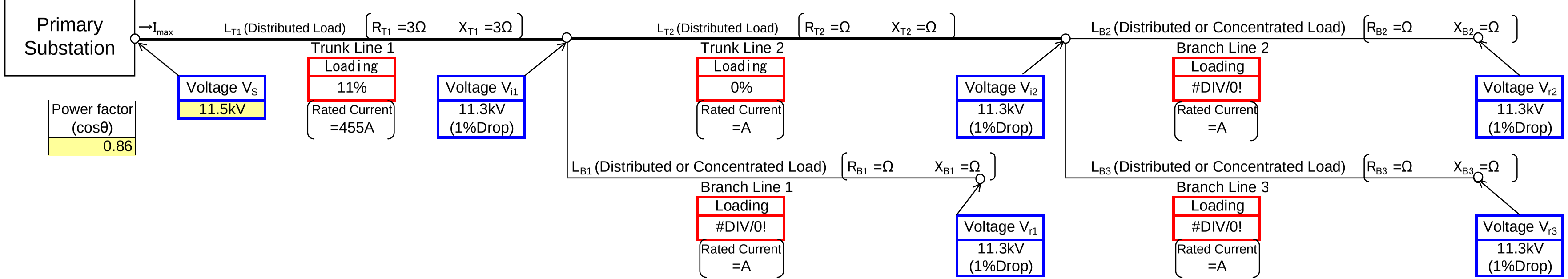
Load L_{T2}	A	
Line Type	None	No.33
Line Legth Len_{T2}	km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
50A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	ANOMABO

: Input data in colored cells

Type-3

Maximum Current I_{max}
53A

Power factor (cosθ)
0.86

<Trank Line 1>

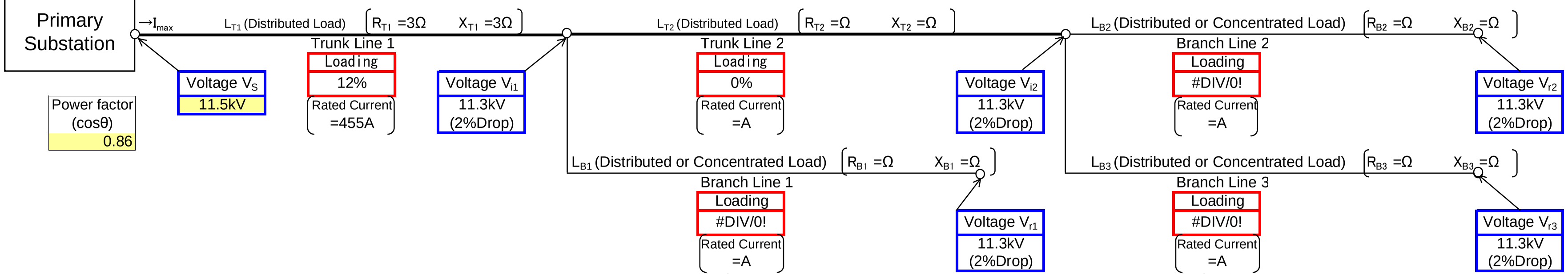
Load L_{T1}	53A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1350kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.33
Line Legth Len_{T2}	km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance		
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance		
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor		
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations		
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}			
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor		

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	ANOMABO

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	56A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1350kVA	

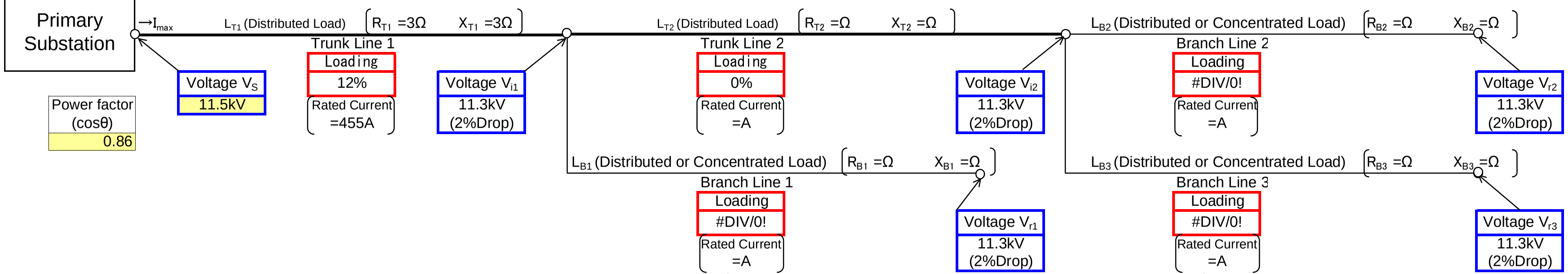
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.33
Line Legth Len_{T2}	km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}	56A
Power factor (cosθ)	0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	ANOMABO

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	60A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1350kVA	

<Trank Line 2>

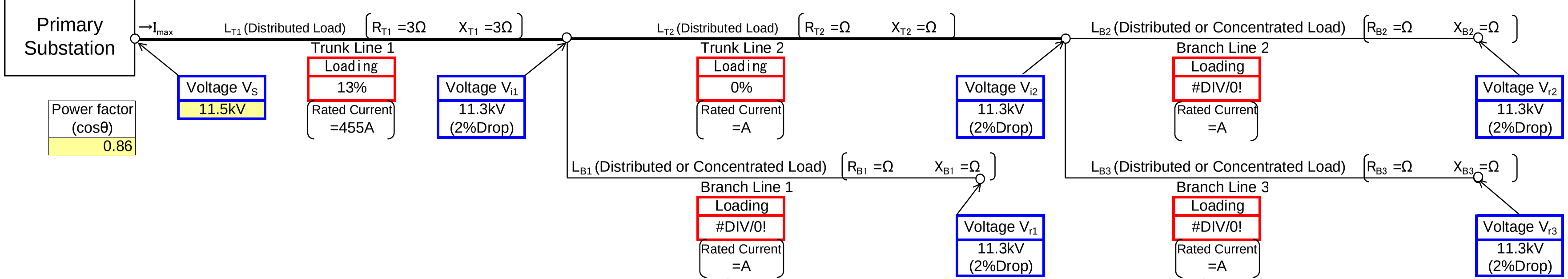
Load L_{T2}	A	
Line Type	None	No.33
Line Legth Len_{T2}	km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
60A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	ANOMABO

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}	63A

Power factor (cosθ)	0.86

<Trank Line 1>

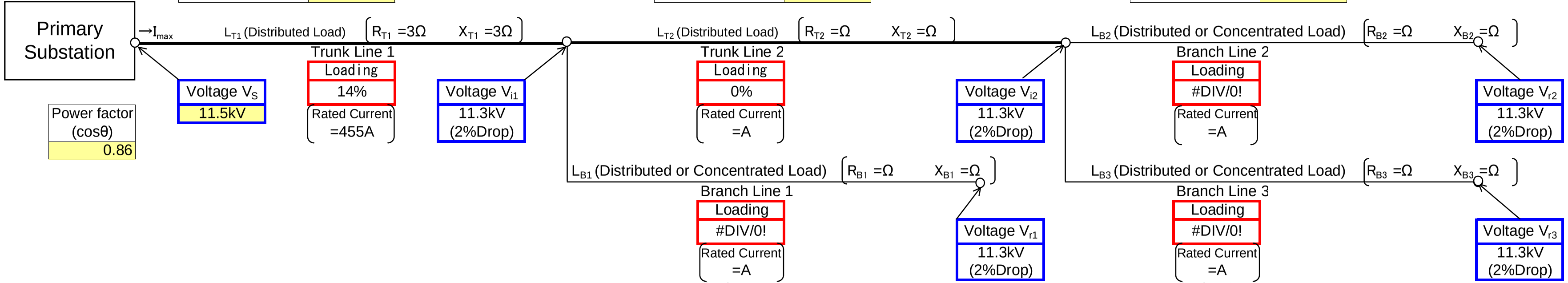
Load L_{T1}	63A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1350kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.33
Line Legth Len_{T2}	km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	ANOMABO

: Input data in colored cells

Type-3

Maximum Current I_{max}
67A

<Trank Line 1>

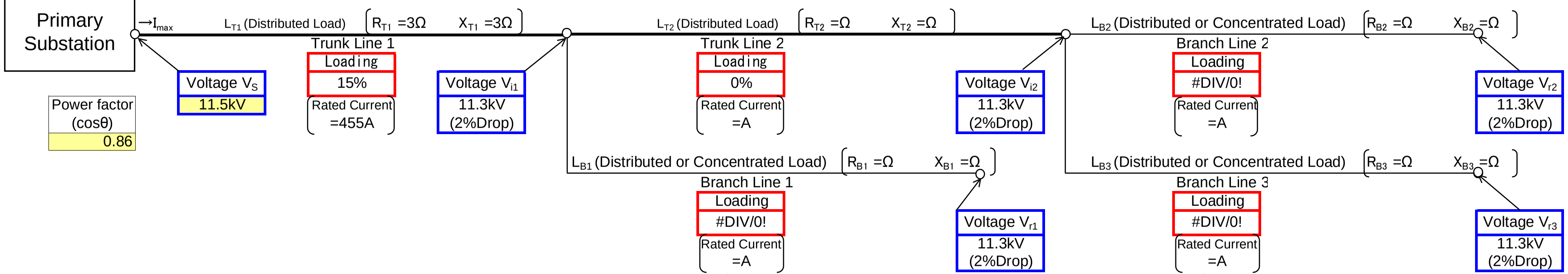
Load L_{T1}	67A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1350kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.33
Line Legth Len_{T2}	km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	ANOMABO

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	71A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1350kVA	

<Trank Line 2>

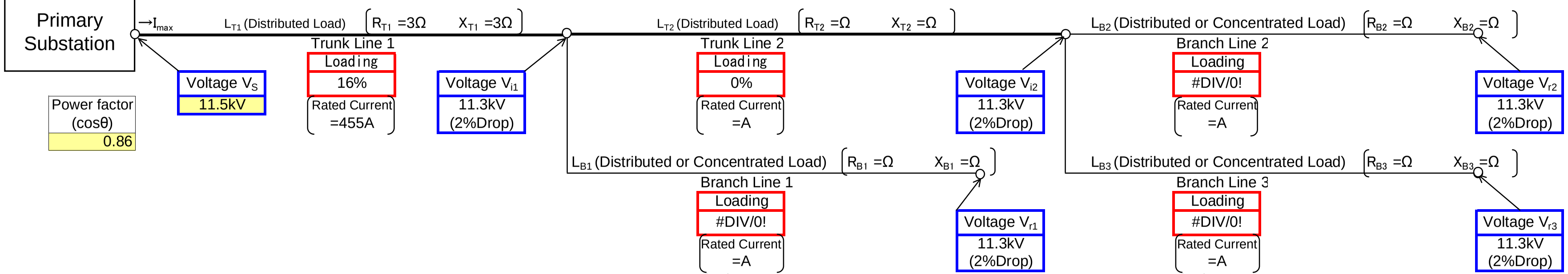
Load L_{T2}	A	
Line Type	None	No.33
Line Legth Len_{T2}	km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
71A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P
Feeder Name	APAM

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	29A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1465kVA	

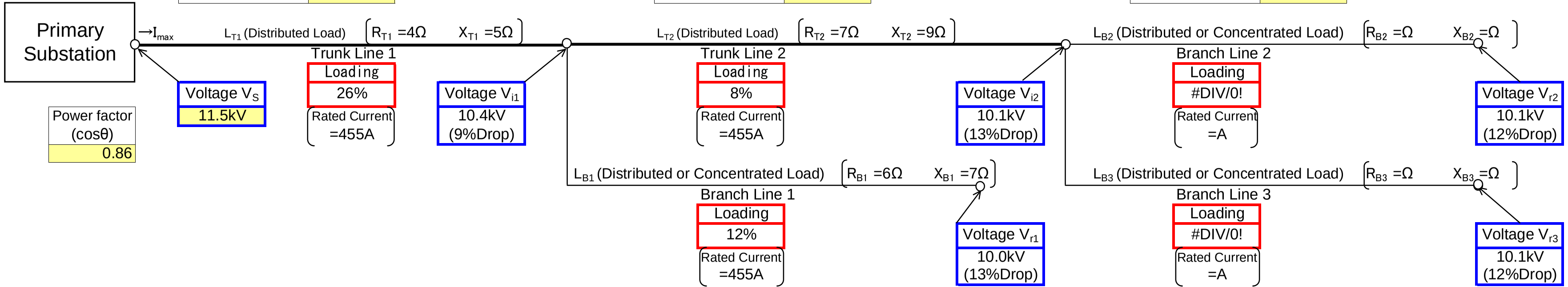
<Trank Line 2>

Load L_{T2}	37A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	24km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
120A



<Branch Line 1>

Load L_{B1}	54A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	2765kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P
Feeder Name	APAM

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
126A

<Trank Line 1>

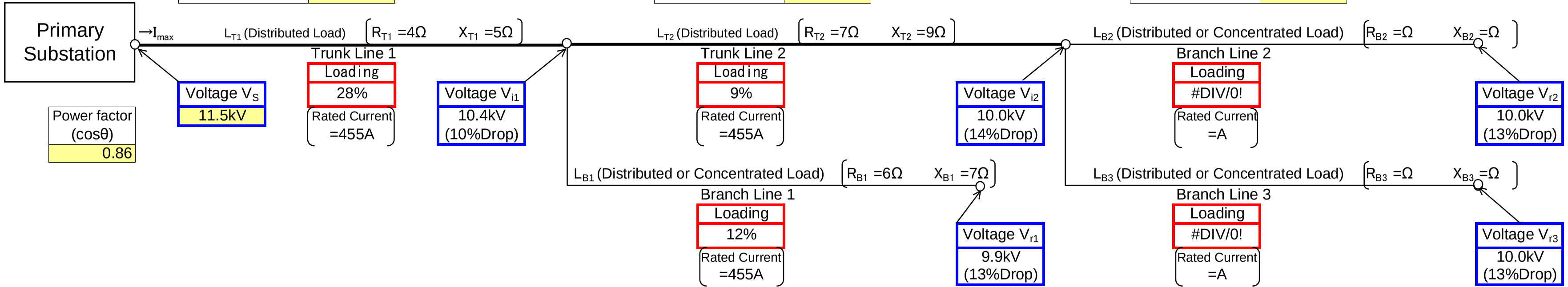
Load L_{T1}	30A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1465kVA	

<Trank Line 2>

Load L_{T2}	39A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	24km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	57A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	2765kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P
Feeder Name	APAM

: Input data in colored cells

Type-3

Maximum Current I_{max}
133A

Power factor (cosθ)
0.86

<Trank Line 1>

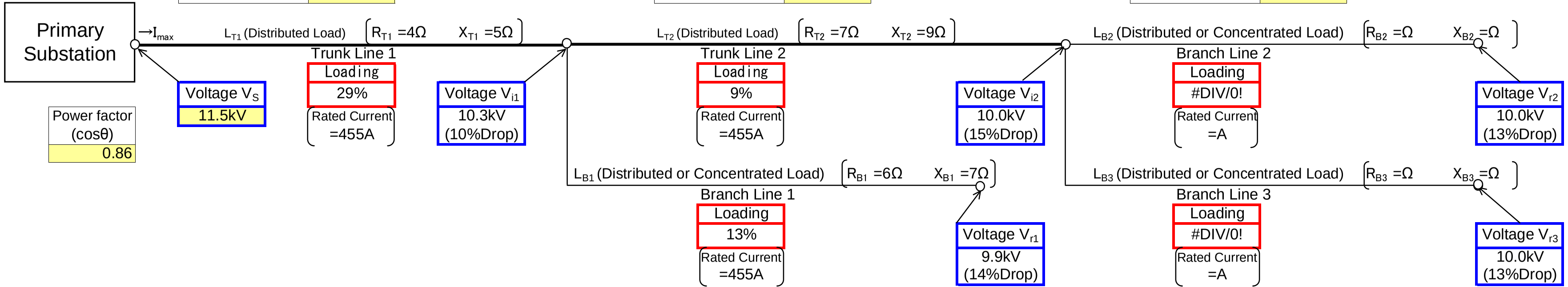
Load L_{T1}	32A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1465kVA	

<Trank Line 2>

Load L_{T2}	41A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	24km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	60A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	2765kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P
Feeder Name	APAM

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
140A

<Trank Line 1>

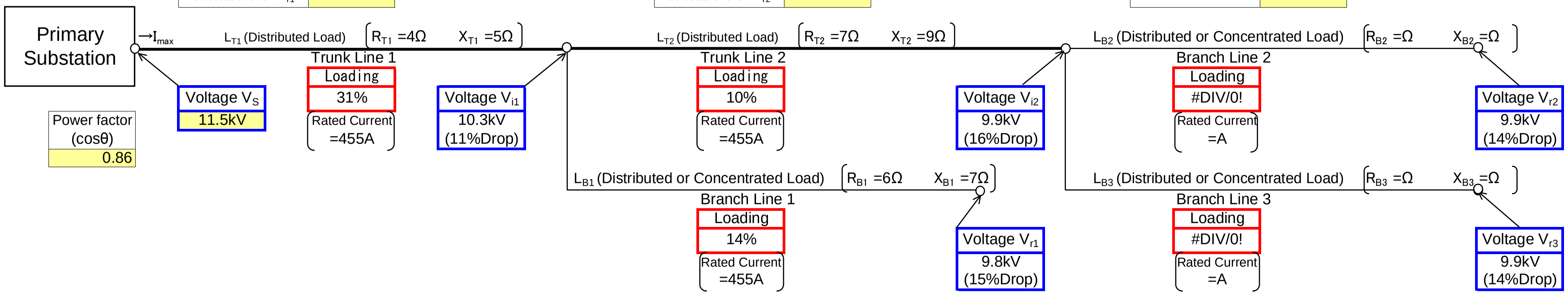
Load L_{T1}	33A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1465kVA	

<Trank Line 2>

Load L_{T2}	43A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	24km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	63A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	2765kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$$

$$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$$

$$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$$

$$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$$

$$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$$

$$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P
Feeder Name	APAM

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Type-3

<Trank Line 1>

Load L_{T1}	35A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1465kVA	

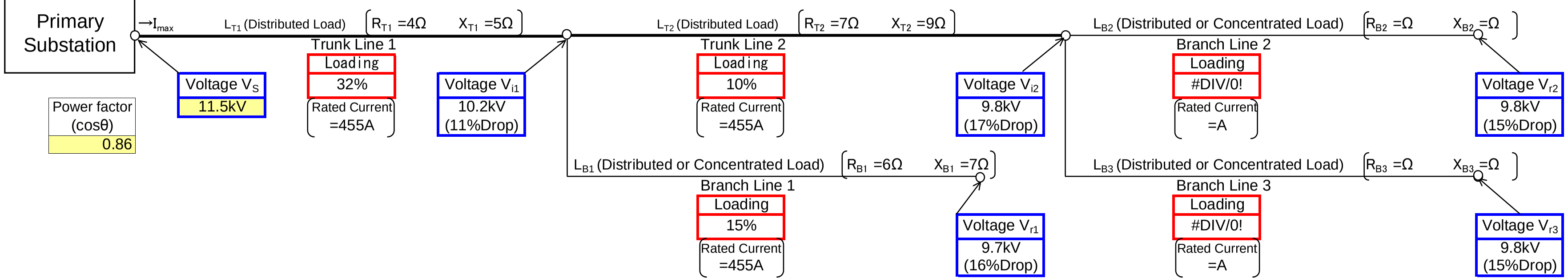
<Trank Line 2>

Load L_{T2}	46A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	24km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
147A



<Branch Line 1>

Load L_{B1}	66A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	2765kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P
Feeder Name	APAM

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	37A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1465kVA	

<Trank Line 2>

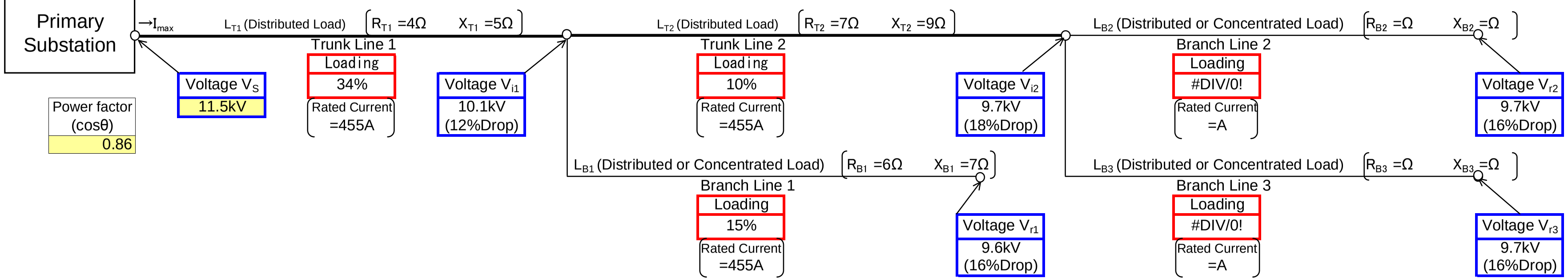
Load L_{T2}	48A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	24km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
154A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	69A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	2765kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P
Feeder Name	APAM

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	39A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1465kVA	

<Trank Line 2>

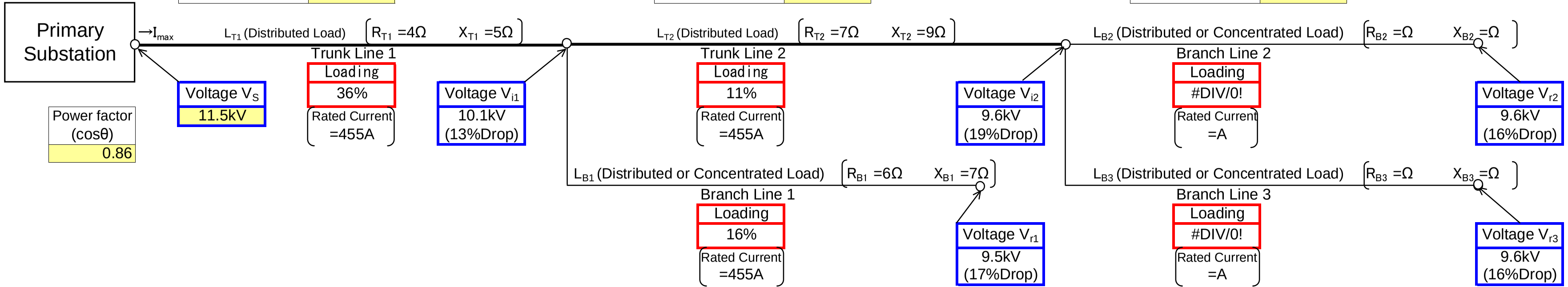
Load L_{T2}	50A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	24km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}	162A

Power factor (cosθ)	0.86



<Branch Line 1>

Load L_{B1}	73A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	2765kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P
Feeder Name	APAM

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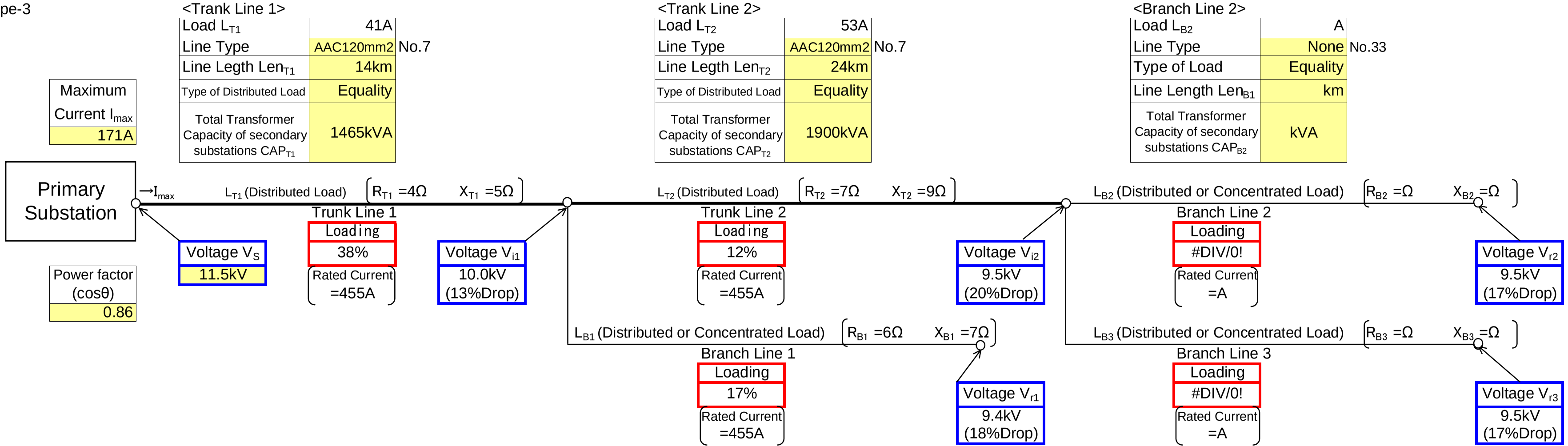
Type-3



Maximum Current I_{max}	171A

Power factor (cosθ)	0.86

<Trank Line 1>

Load L_{T1}	41A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1465kVA	

<Trank Line 2>

Load L_{T2}	53A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	24km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	77A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	2765kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P
Feeder Name	APAM

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
180A

Power factor (cosθ)
0.86

<Trank Line 1>

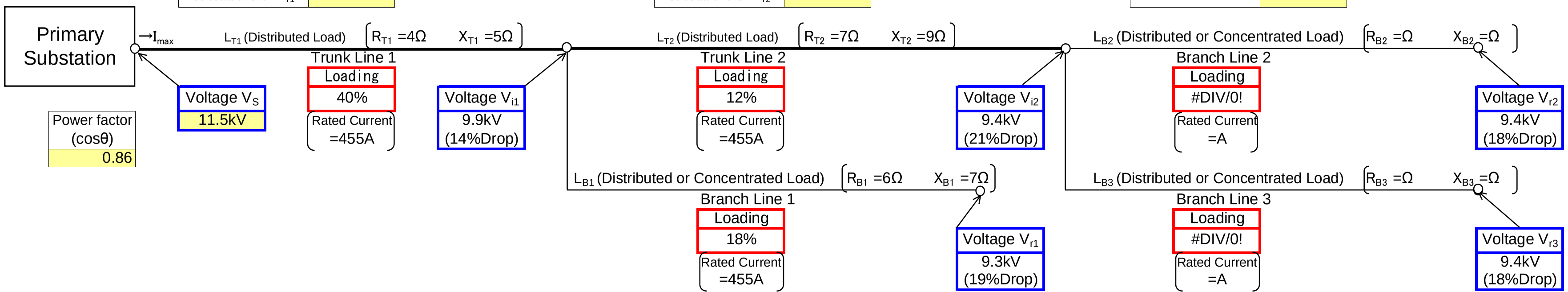
Load L_{T1}	43A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1465kVA	

<Trank Line 2>

Load L_{T2}	56A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	24km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	81A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	2765kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$$

$$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$$

$$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$$

$$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$$

$$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$$

$$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P
Feeder Name	APAM

: Input data in colored cells

Type-3

Maximum Current I_{max}
189A

<Trank Line 1>

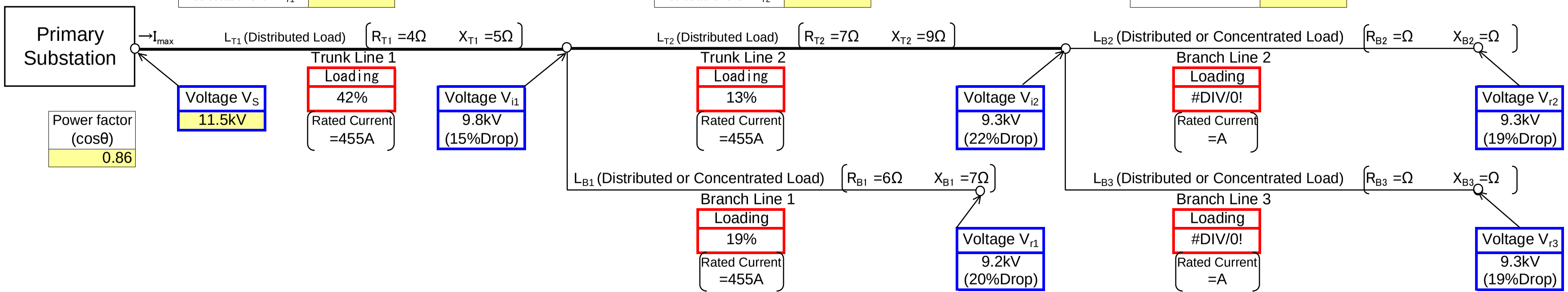
Load L_{T1}	45A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1465kVA	

<Trank Line 2>

Load L_{T2}	59A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	24km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	85A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	2765kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P
Feeder Name	APAM

: Input data in colored cells

Type-3

Maximum Current I_{max}	199A

<Trank Line 1>

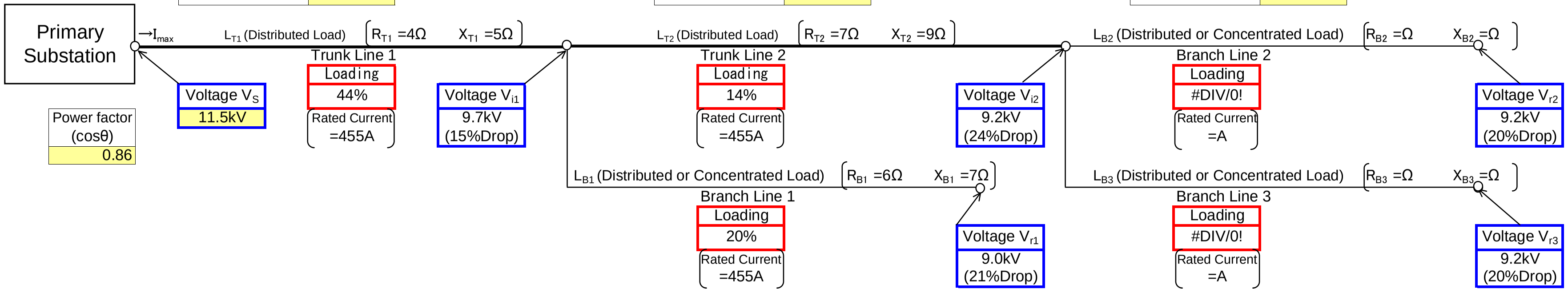
Load L_{T1}	48A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1465kVA	

<Trank Line 2>

Load L_{T2}	62A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	24km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	90A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	2765kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P
Feeder Name	APAM

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
209A

<Trank Line 1>

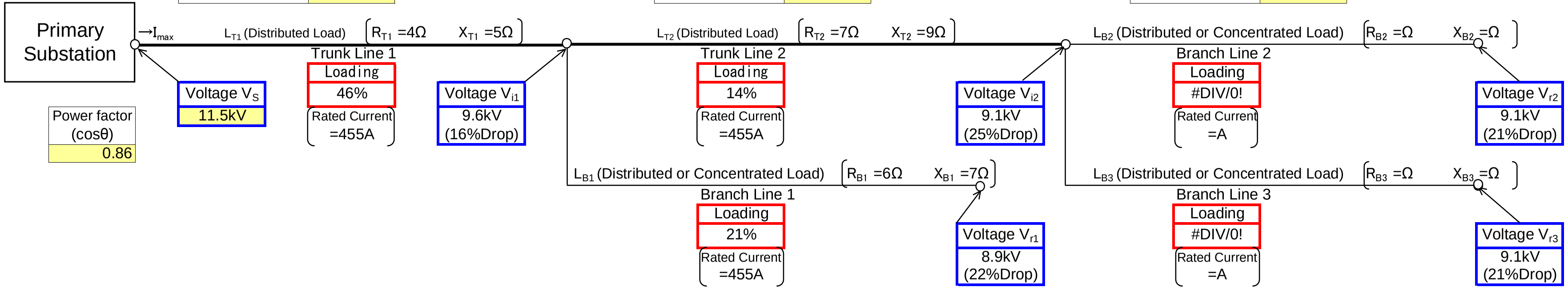
Load L_{T1}	50A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1465kVA	

<Trank Line 2>

Load L_{T2}	65A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	24km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	94A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	2765kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	ODA
Feeder Name	SIKUMA (ACHIASI

🟨 : Input data in colored cells

Type-2

Maximum Current I_{max}
116A

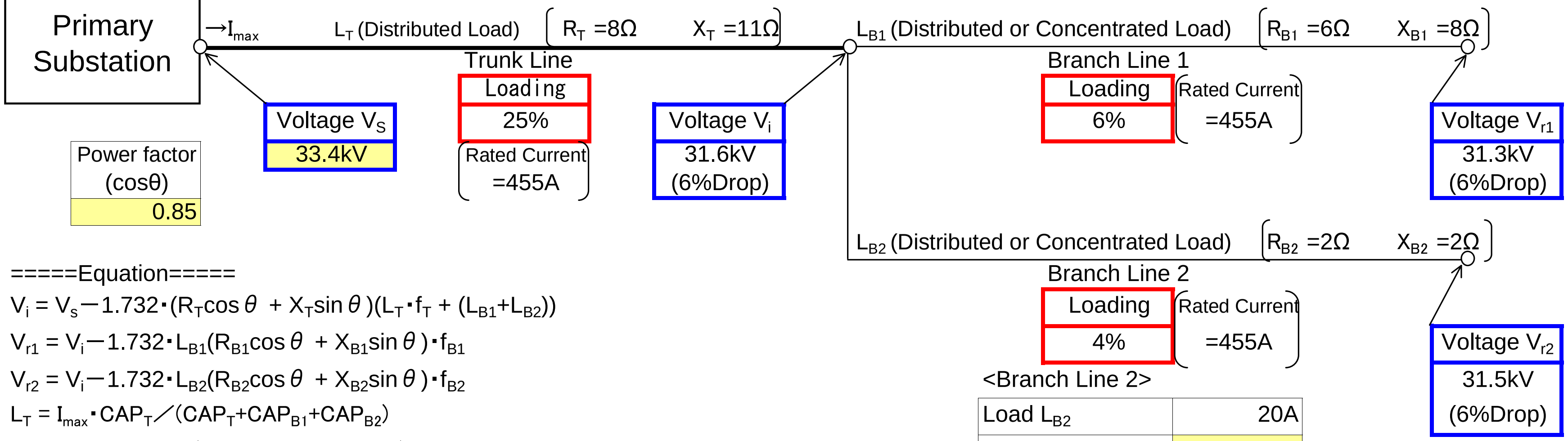
Power factor (cosθ)
0.85

<Trank Line>

Load L_T	68A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	31km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1700kVA	

<Branch Line 1>

Load L_{B1}	28A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	700kVA	



<Branch Line 2>

Load L_{B2}	20A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	7km	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	

=====Equation=====

$V_i = V_s - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1} + L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T + CAP_{B1} + CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_T, R_{B1}, R_{B2}	: Resistance
V_i	: Interim Voltage	L_T	: Load (Trunk line)	X_T, X_{B1}, X_{B2}	: Reactance
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	cosθ	: Power Factor
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	f_T, f_{B1}, f_{B2}	: Dispersal Load Factor

CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	ODA
Feeder Name	SIKUMA (ACHIASI

: Input data in colored cells

Type-2

<Trank Line>

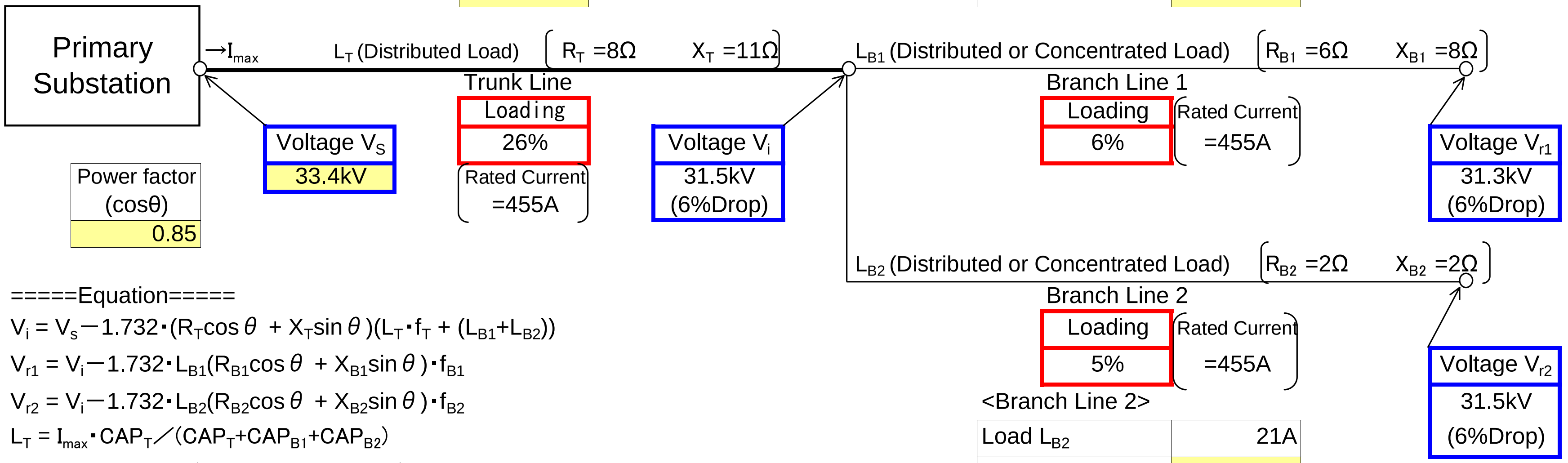
Load L_T	70A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	31km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1700kVA	

<Branch Line 1>

Load L_{B1}	29A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	700kVA	

Maximum Current I_{max}
119A

Power factor (cosθ)
0.85



=====Equation=====

$V_i = V_s - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1} + L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1} \cos\theta + X_{B1} \sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2} \cos\theta + X_{B2} \sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T + CAP_{B1} + CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

<Branch Line 2>

Load L_{B2}	21A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	7km	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage

I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)

R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor

CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	ODA
Feeder Name	SIKUMA (ACHIASI

🟨 : Input data in colored cells

Type-2

<Trank Line>

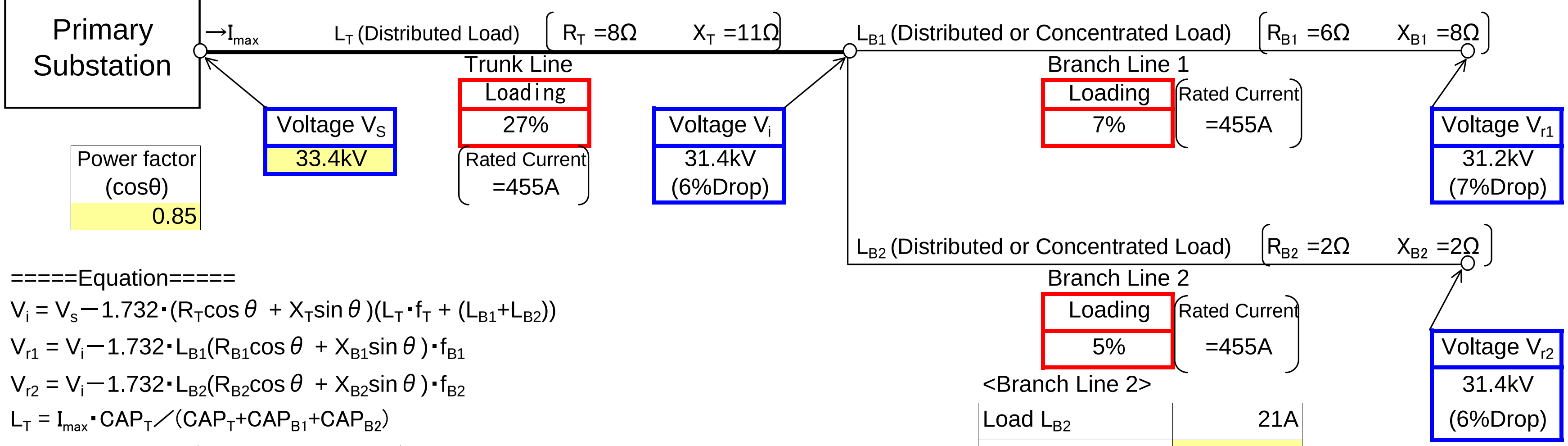
Load L_T	72A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	31km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1700kVA	

<Branch Line 1>

Load L_{B1}	30A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	700kVA	

Maximum Current I_{max}
123A

Power factor (cosθ)
0.85



<Branch Line 2>

Load L_{B2}	21A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	7km	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	

=====Equation=====

$V_i = V_s - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	ODA
Feeder Name	SIKUMA (ACHIASI

🟨 : Input data in colored cells

Type-2

<Trank Line>

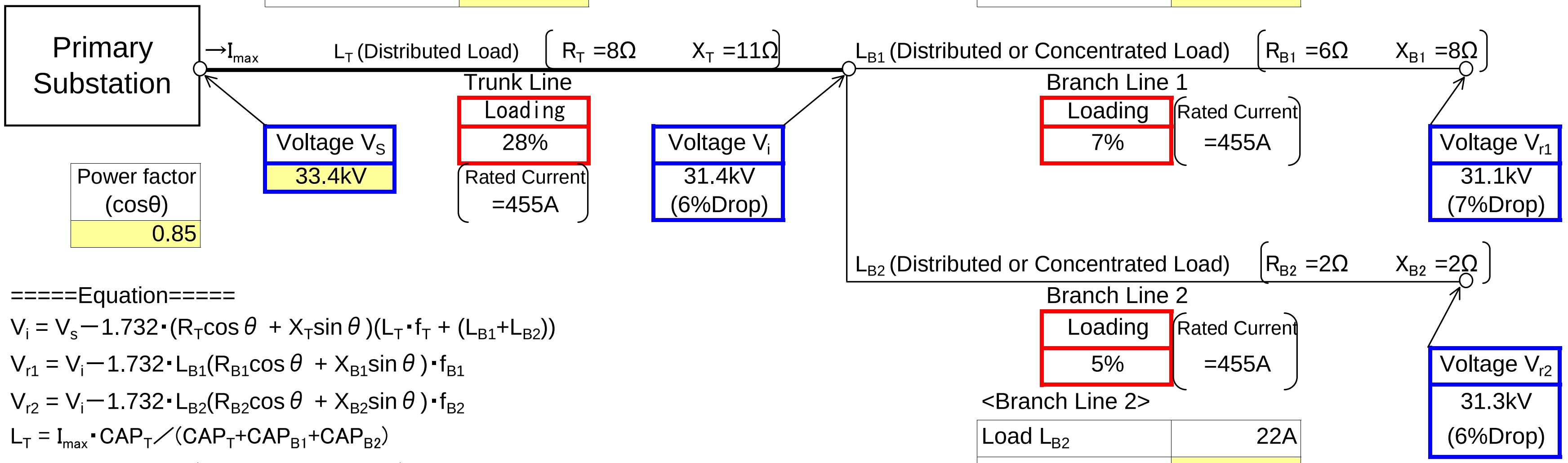
Load L_T	74A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	31km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1700kVA	

<Branch Line 1>

Load L_{B1}	31A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	700kVA	

Maximum Current I_{max}
127A

Power factor (cosθ)
0.85



<Branch Line 2>

Load L_{B2}	22A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	7km	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	

=====Equation=====

$V_i = V_s - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T + CAP_{B1} + CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

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Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	ODA
Feeder Name	SIKUMA (ACHIASI

🟨 : Input data in colored cells

Type-2

Maximum Current I_{max}
130A

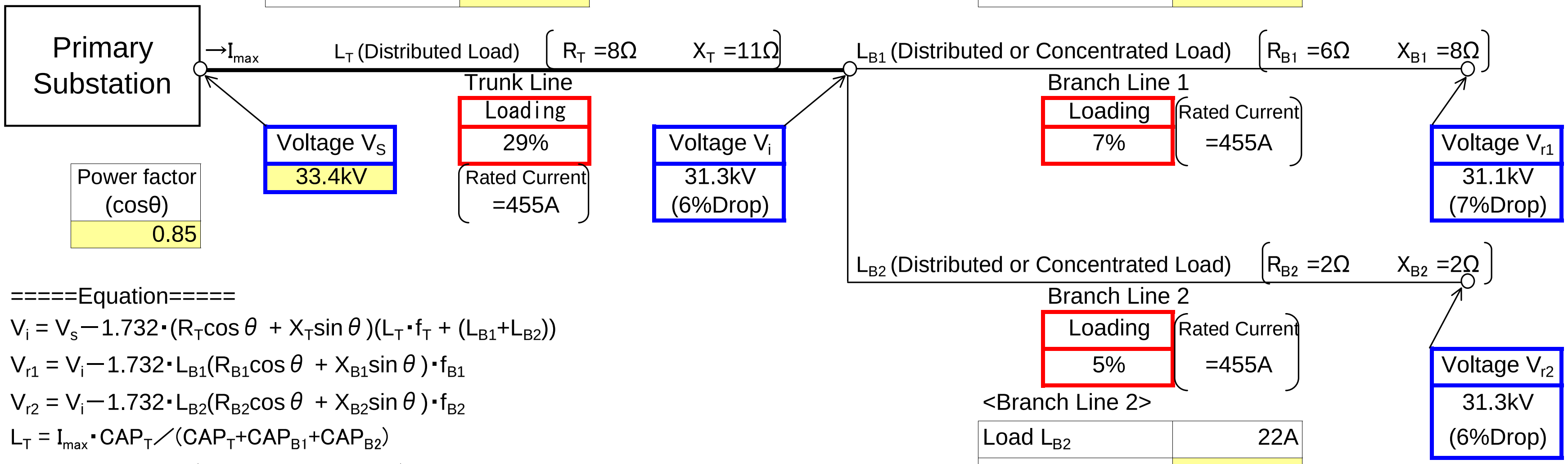
Power factor (cosθ)
0.85

<Trank Line>

Load L_T	76A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	31km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1700kVA	

<Branch Line 1>

Load L_{B1}	31A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	700kVA	



<Branch Line 2>

Load L_{B2}	22A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	7km	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	

=====Equation=====

$V_i = V_s - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_T, R_{B1}, R_{B2}	: Resistance
V_i	: Interim Voltage	L_T	: Load (Trunk line)	X_T, X_{B1}, X_{B2}	: Reactance
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	cosθ	: Power Factor
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	f_T, f_{B1}, f_{B2}	: Dispersal Load Factor CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	ODA
Feeder Name	SIKUMA (ACHIASI

🟨 : Input data in colored cells

Type-2

<Trank Line>

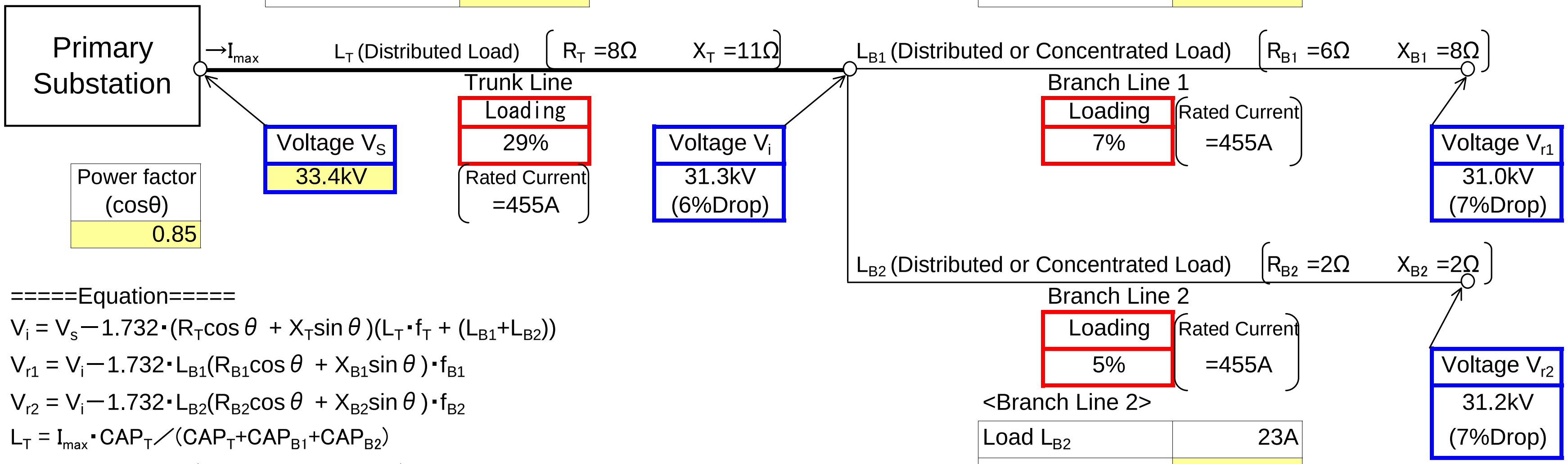
Load L_T	79A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	31km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1700kVA	

<Branch Line 1>

Load L_{B1}	32A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	700kVA	

Maximum Current I_{max}
134A

Power factor (cosθ)
0.85



<Branch Line 2>

Load L_{B2}	23A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	7km	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	

=====Equation=====

$V_i = V_s - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1} + L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1} \cos\theta + X_{B1} \sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2} \cos\theta + X_{B2} \sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T + CAP_{B1} + CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	ODA
Feeder Name	SIKUMA (ACHIASI

🟨 : Input data in colored cells

Type-2

<Trank Line>

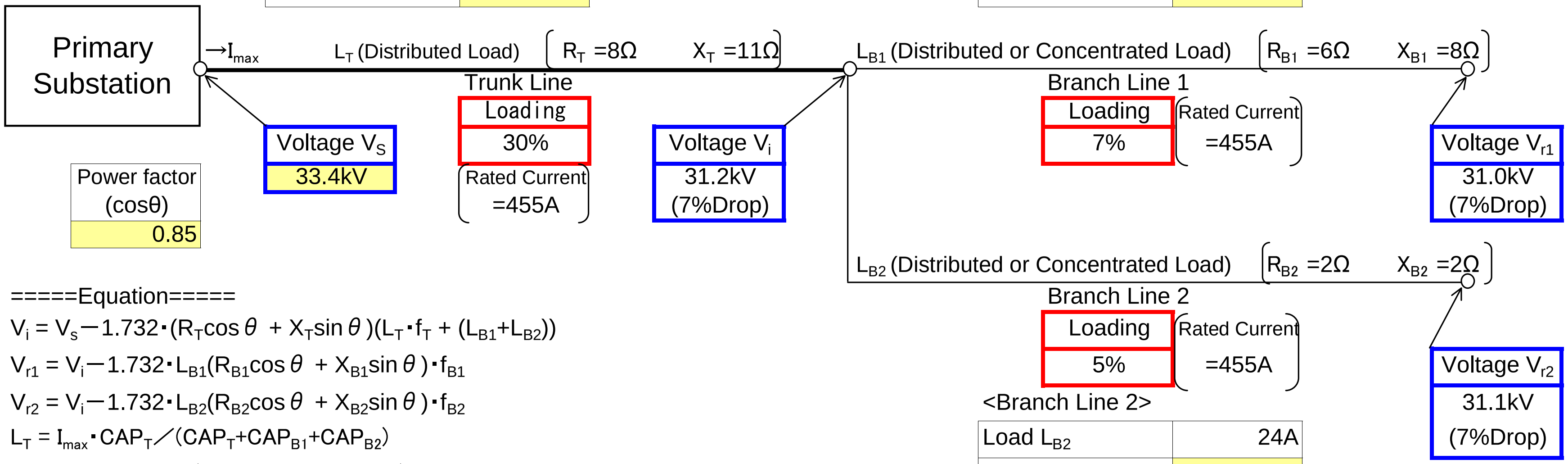
Load L_T	81A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	31km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1700kVA	

<Branch Line 1>

Load L_{B1}	33A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	700kVA	

Maximum Current I_{max}
138A

Power factor (cosθ)
0.85



<Branch Line 2>

Load L_{B2}	24A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	7km	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	

=====Equation=====

$V_i = V_s - 1.732 \cdot (R_T\cos\theta + X_T\sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T + CAP_{B1} + CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_T, R_{B1}, R_{B2}	: Resistance
V_i	: Interim Voltage	L_T	: Load (Trunk line)	X_T, X_{B1}, X_{B2}	: Reactance
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	cosθ	: Power Factor
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	f_T, f_{B1}, f_{B2}	: Dispersal Load Factor

CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	ODA
Feeder Name	SIKUMA (ACHIASI

▨ : Input data in colored cells

Type-2

<Trank Line>

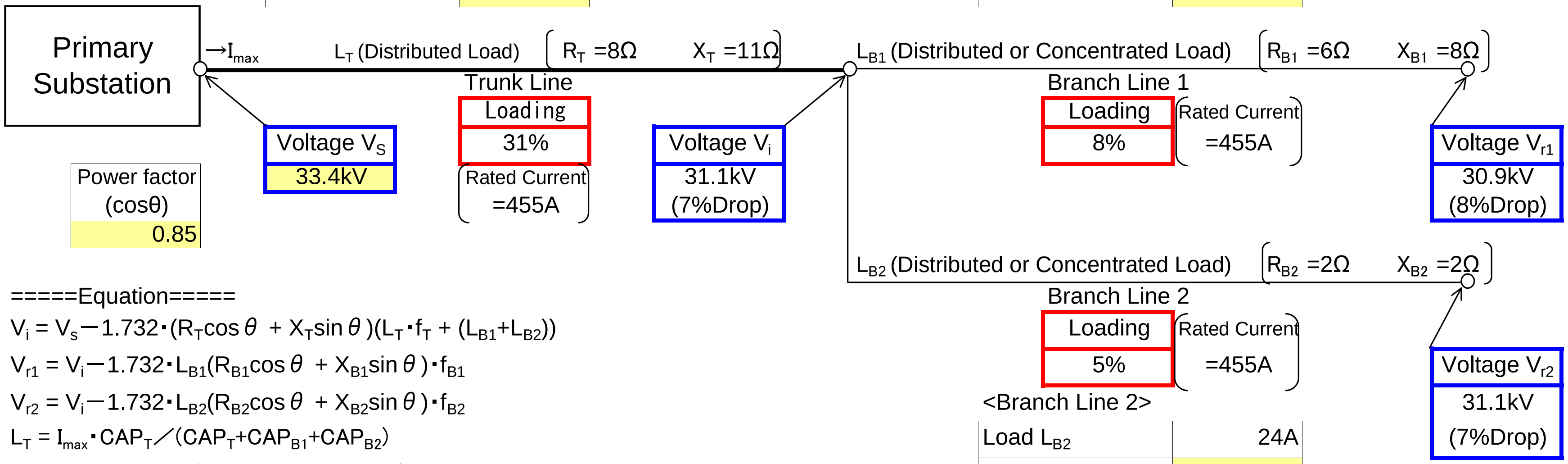
Load L_T	83A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	31km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1700kVA	

<Branch Line 1>

Load L_{B1}	34A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	700kVA	

Maximum Current I_{max}
142A

Power factor (cosθ)
0.85



<Branch Line 2>

Load L_{B2}	24A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	7km	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	

=====Equation=====

$V_i = V_s - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	ODA
Feeder Name	SIKUMA (ACHIASI

▨ : Input data in colored cells

Type-2

<Trank Line>

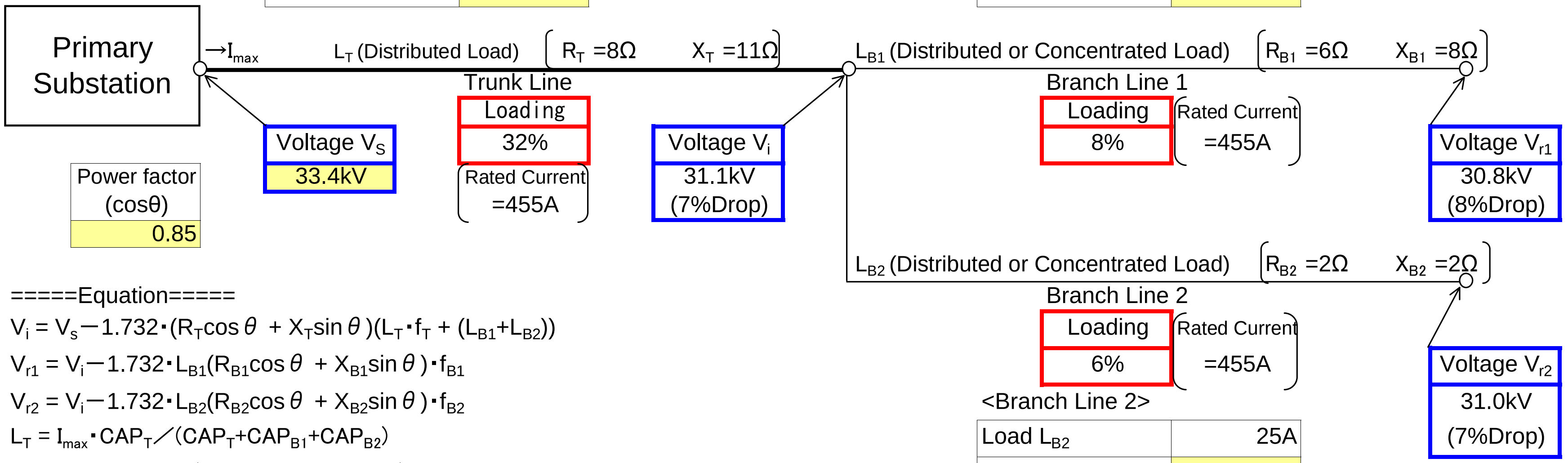
Load L_T	86A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	31km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1700kVA	

<Branch Line 1>

Load L_{B1}	35A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	700kVA	

Maximum Current I_{max}
146A

Power factor (cosθ)
0.85



<Branch Line 2>

Load L_{B2}	25A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	7km	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	

=====Equation=====

$V_i = V_s - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1} + L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T + CAP_{B1} + CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	ODA
Feeder Name	SIKUMA (ACHIASI

🟨 : Input data in colored cells

Type-2

<Trank Line>

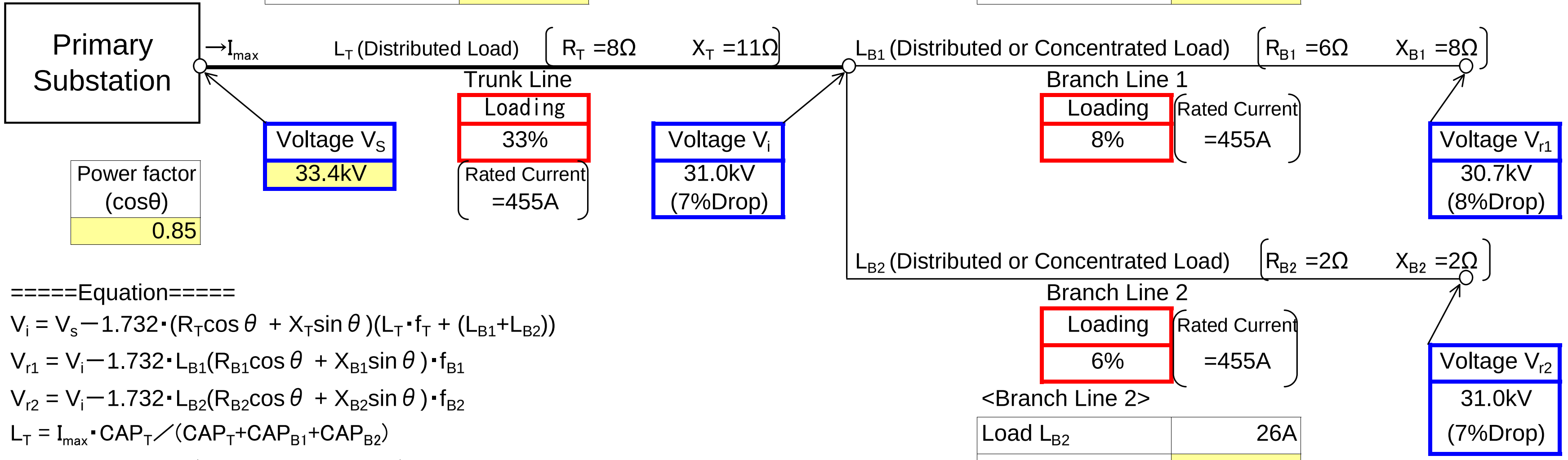
Load L_T	88A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	31km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1700kVA	

<Branch Line 1>

Load L_{B1}	36A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	700kVA	

Maximum Current I_{max}
150A

Power factor (cosθ)
0.85



=====Equation=====

$V_i = V_s - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

<Branch Line 2>

Load L_{B2}	26A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	7km	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_T, R_{B1}, R_{B2}	: Resistance
V_i	: Interim Voltage	L_T	: Load (Trunk line)	X_T, X_{B1}, X_{B2}	: Reactance
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	cosθ	: Power Factor
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	f_T, f_{B1}, f_{B2}	: Dispersal Load Factor

CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	ODA
Feeder Name	SIKUMA (ACHIASI

🟨 : Input data in colored cells

Type-2

<Trank Line>

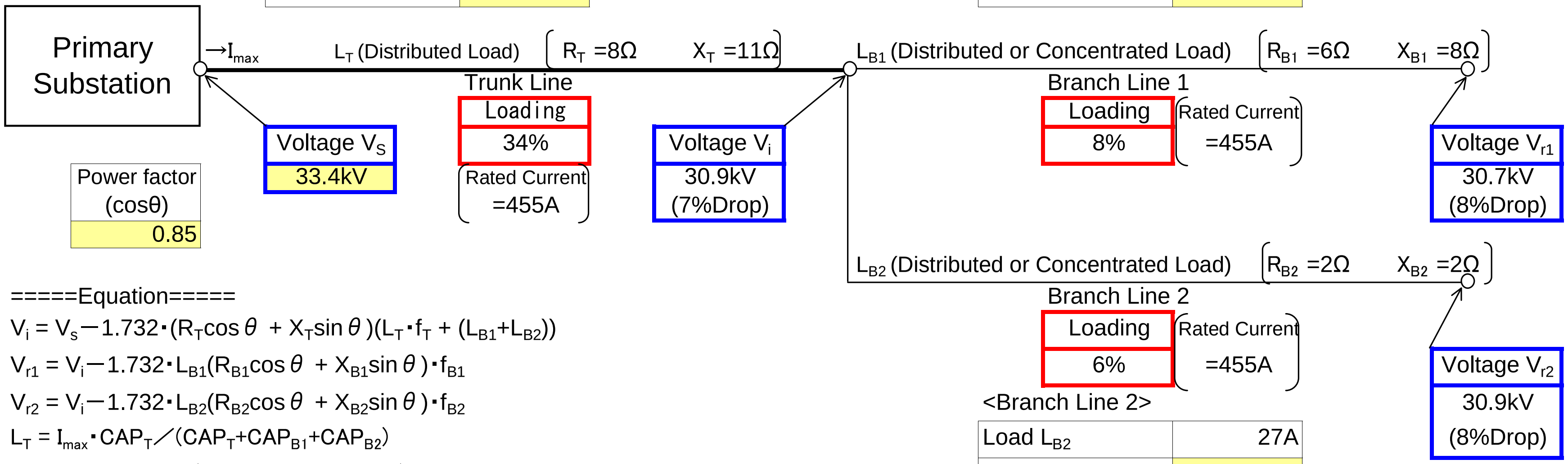
Load L_T	91A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	31km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1700kVA	

<Branch Line 1>

Load L_{B1}	37A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	700kVA	

Maximum Current I_{max}
155A

Power factor (cosθ)
0.85



<Branch Line 2>

Load L_{B2}	27A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	7km	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	

=====Equation=====

$V_i = V_s - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$

$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$L_T = I_{max} \cdot CAP_T / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T + CAP_{B1} + CAP_{B2})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T + CAP_{B1} + CAP_{B2})$

$I_{max} = L_T + L_{B1} + L_{B2}$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	ODA
Feeder Name	SIKUMA (ACHIASI

🟨 : Input data in colored cells

Type-2

<Trank Line>

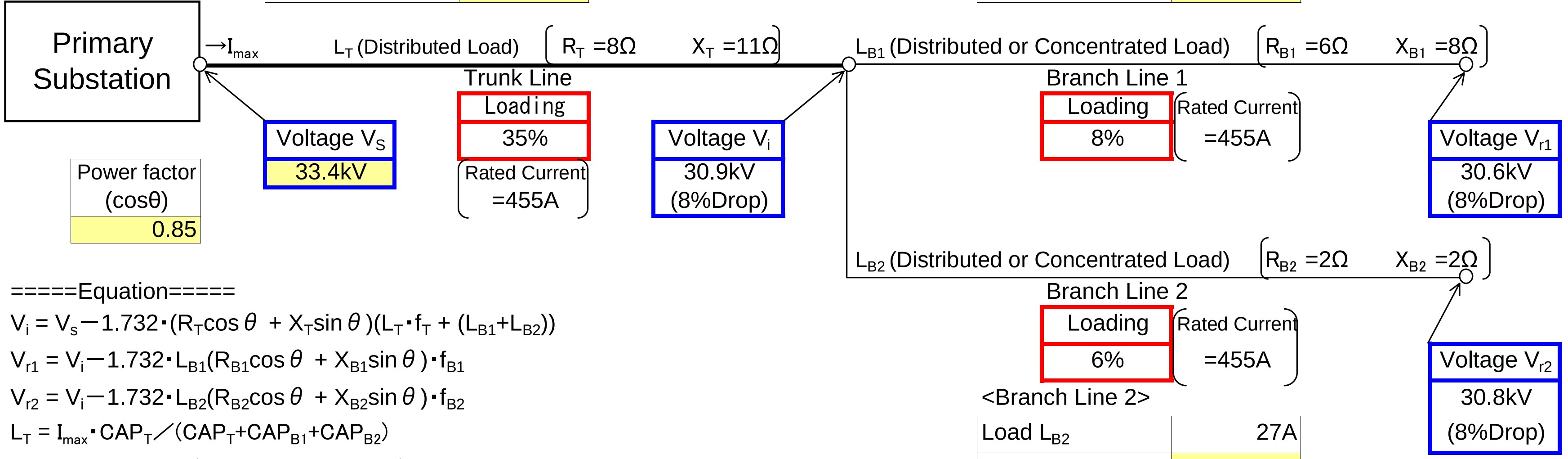
Load L_T	93A	
Line Type	AAC120mm2	No.7
Line Legth Len_T	31km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_T	1700kVA	

<Branch Line 1>

Load L_{B1}	38A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	700kVA	

Maximum Current I_{max}
159A

Power factor (cosθ)
0.85



<Branch Line 2>

Load L_{B2}	27A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	7km	
Total Transformer Capacity of secondary substations CAP_{B2}	500kVA	

=====Equation=====

$$V_i = V_s - 1.732 \cdot (R_T \cos\theta + X_T \sin\theta)(L_T \cdot f_T + (L_{B1}+L_{B2}))$$

$$V_{r1} = V_i - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$$

$$V_{r2} = V_i - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$$

$$L_T = I_{max} \cdot CAP_T / (CAP_T+CAP_{B1}+CAP_{B2})$$

$$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_T+CAP_{B1}+CAP_{B2})$$

$$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_T+CAP_{B1}+CAP_{B2})$$

$$I_{max} = L_T + L_{B1} + L_{B2}$$

V_s : Supply Voltage
V_i : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
I_{max} : Maximum Current
L_T : Load (Trunk line)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
R_T, R_{B1}, R_{B2} : Resistance
X_T, X_{B1}, X_{B2} : Reactance
cosθ : Power Factor
f_T, f_{B1}, f_{B2} : Dispersal Load Factor
CAP_T, CAP_{B1}, CAP_{B2} : Total Transformer Capacity of secondary substations

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

: Input data in colored cells

Type-3

Maximum Current I_{max}
280A

<Trank Line 1>

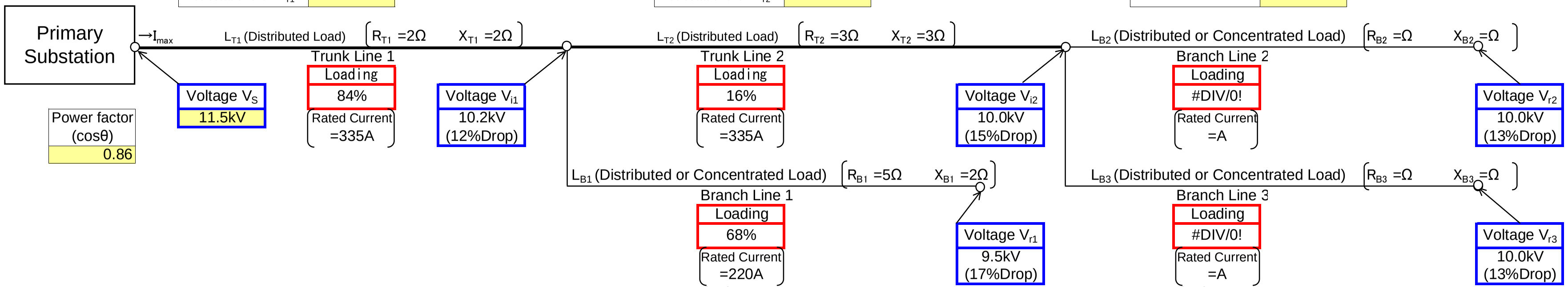
Load L_{T1}	76A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

<Trank Line 2>

Load L_{T2}	54A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	150A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	ELMINA

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}	
320A	

Power factor (cosθ)	
0.86	

<Trank Line 1>

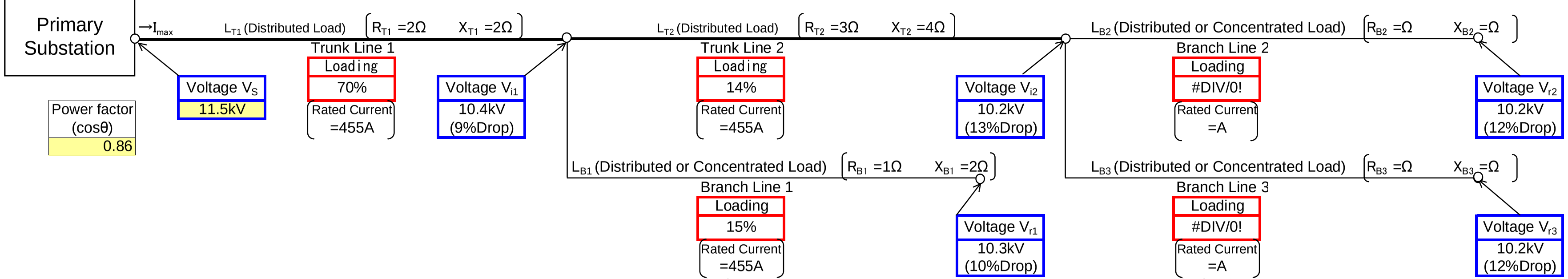
Load L_{T1}	188A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7525kVA	

<Trank Line 2>

Load L_{T2}	63A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2500kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	69A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	4km	
Total Transformer Capacity of secondary substations CAP_{B1}	2750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	ELMINA

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
340A

<Trank Line 1>

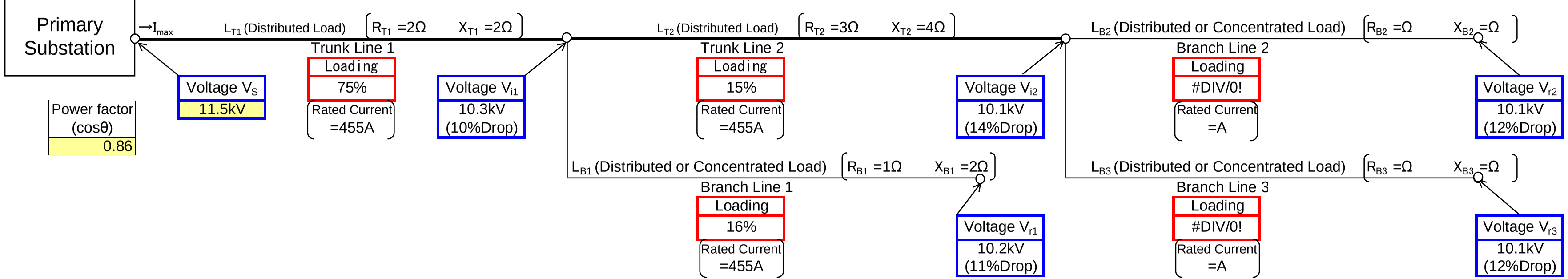
Load L_{T1}	200A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7525kVA	

<Trank Line 2>

Load L_{T2}	67A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2500kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	73A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	4km	
Total Transformer Capacity of secondary substations CAP_{B1}	2750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3}$: Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	ELMINA

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
361A

<Trank Line 1>

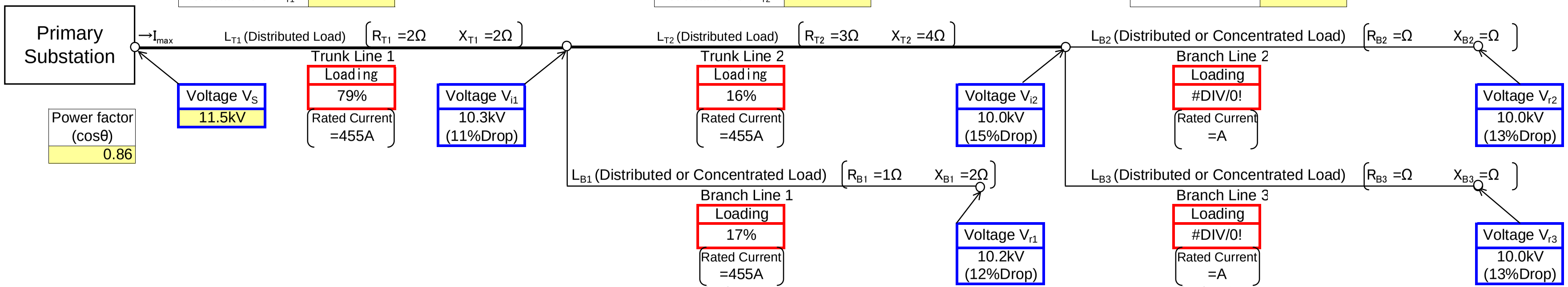
Load L_{T1}	213A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7525kVA	

<Trank Line 2>

Load L_{T2}	71A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2500kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	78A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	4km	
Total Transformer Capacity of secondary substations CAP_{B1}	2750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	ELMINA

: Input data in colored cells

Type-3

Maximum Current I_{max}
384A

Power factor (cosθ)
0.86

<Trank Line 1>

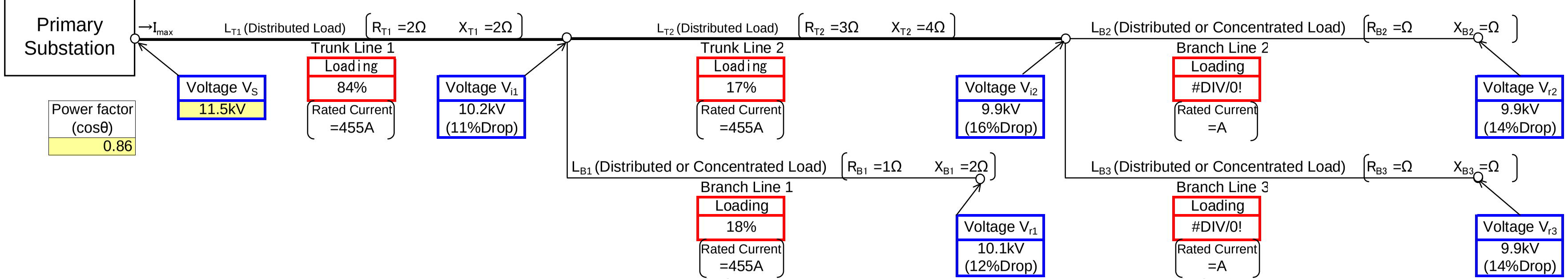
Load L_{T1}	226A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7525kVA	

<Trank Line 2>

Load L_{T2}	75A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2500kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	83A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	4km	
Total Transformer Capacity of secondary substations CAP_{B1}	2750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	ELMINA

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
408A

Power factor (cosθ)
0.86

<Trank Line 1>

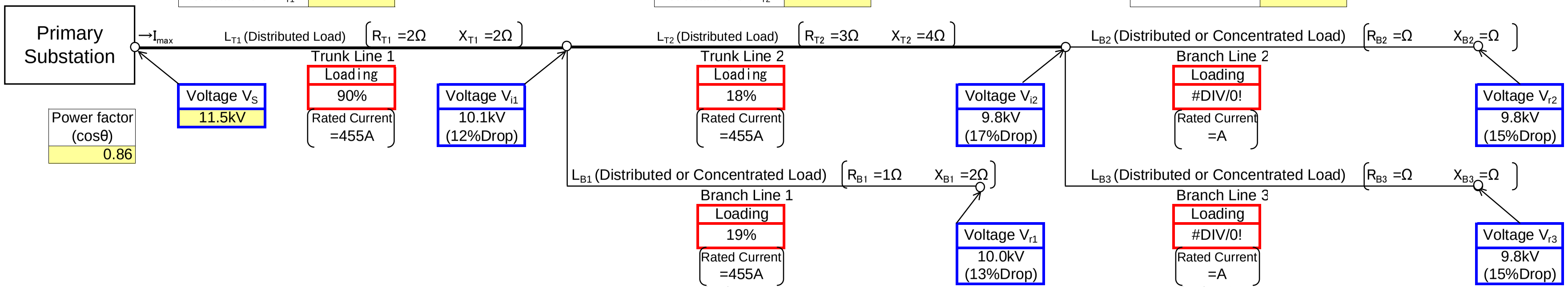
Load L_{T1}	240A
Line Type	AAC120mm2 No.7
Line Legth Len_{T1}	7km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T1}	7525kVA

<Trank Line 2>

Load L_{T2}	80A
Line Type	AAC120mm2 No.7
Line Legth Len_{T2}	11km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T2}	2500kVA

<Branch Line 2>

Load L_{B2}	A
Line Type	None No.33
Type of Load	Equality
Line Length Len_{B1}	km
Total Transformer Capacity of secondary substations CAP_{B2}	kVA



<Branch Line 1>

Load L_{B1}	88A
Line Type	AAC120mm2 No.7
Type of Load	Equality
Line Length Len_{B1}	4km
Total Transformer Capacity of secondary substations CAP_{B1}	2750kVA

<Branch Line 3>

Load L_{B3}	A
Line Type	None No.33
Type of Load	Equality
Line Length Len_{B3}	km
Total Transformer Capacity of secondary substations CAP_{B3}	kVA

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	ELMINA

: Input data in colored cells

Type-3

Maximum Current I_{max}
433A

Power factor (cosθ)
0.86

<Trank Line 1>

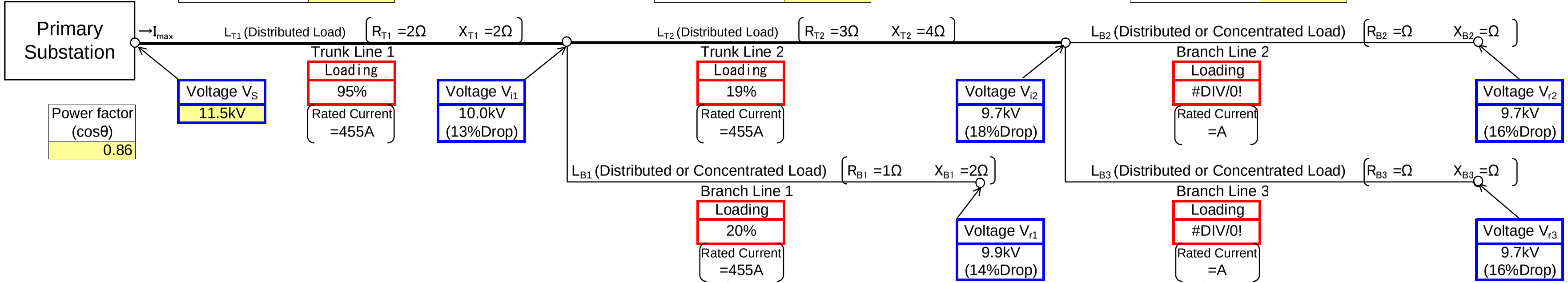
Load L_{T1}	255A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7525kVA	

<Trank Line 2>

Load L_{T2}	85A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2500kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	93A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	4km	
Total Transformer Capacity of secondary substations CAP_{B1}	2750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	ELMINA

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	271A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7525kVA	

<Trank Line 2>

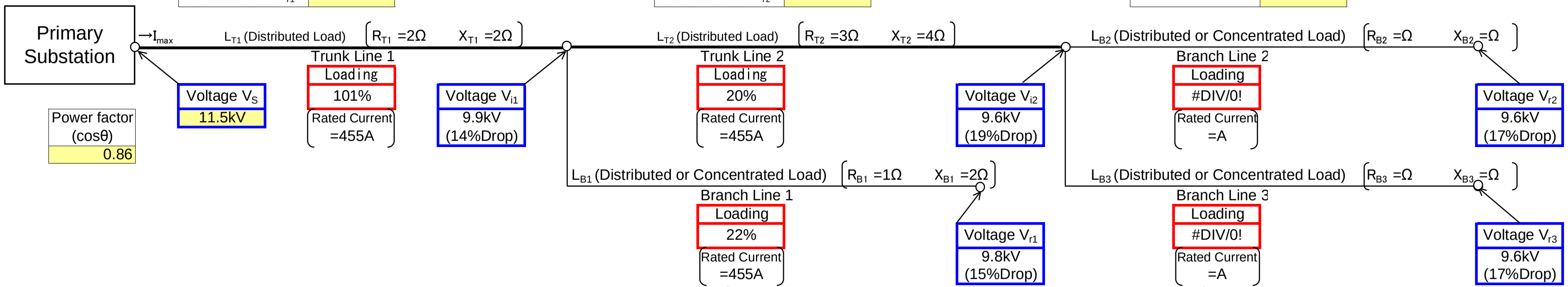
Load L_{T2}	90A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2500kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
460A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	99A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	4km	
Total Transformer Capacity of secondary substations CAP_{B1}	2750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	ELMINA

: Input data in colored cells

Type-3

Maximum Current I_{max}	489A

<Trank Line 1>

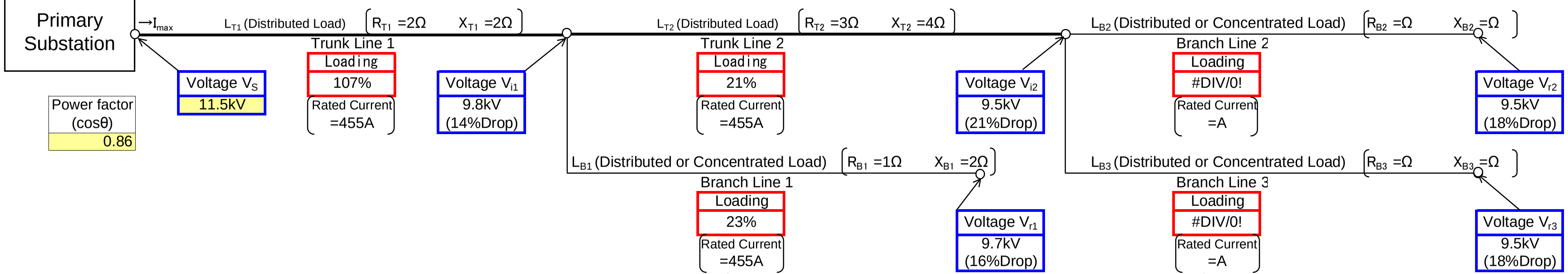
Load L_{T1}	288A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7525kVA	

<Trank Line 2>

Load L_{T2}	96A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2500kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	105A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	4km	
Total Transformer Capacity of secondary substations CAP_{B1}	2750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}
CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	ELMINA

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
519A

<Trank Line 1>

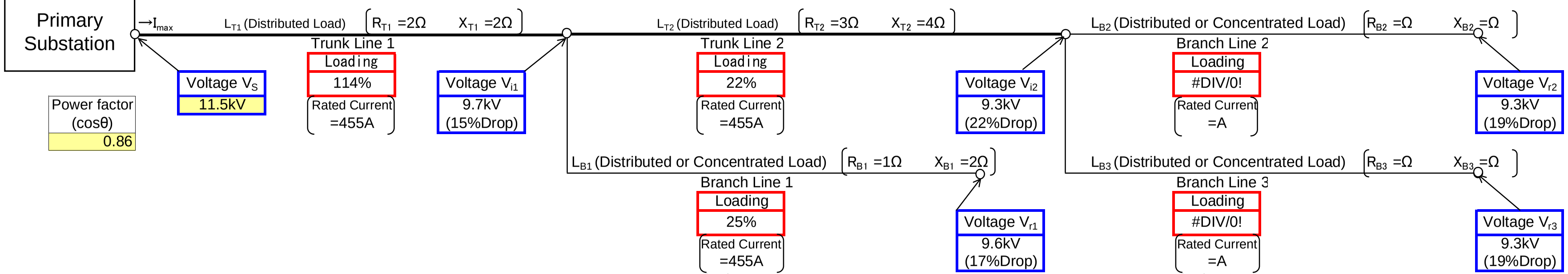
Load L_{T1}	306A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7525kVA	

<Trank Line 2>

Load L_{T2}	102A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2500kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	112A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	4km	
Total Transformer Capacity of secondary substations CAP_{B1}	2750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	ELMINA

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
552A

Power factor (cosθ)
0.86

<Trank Line 1>

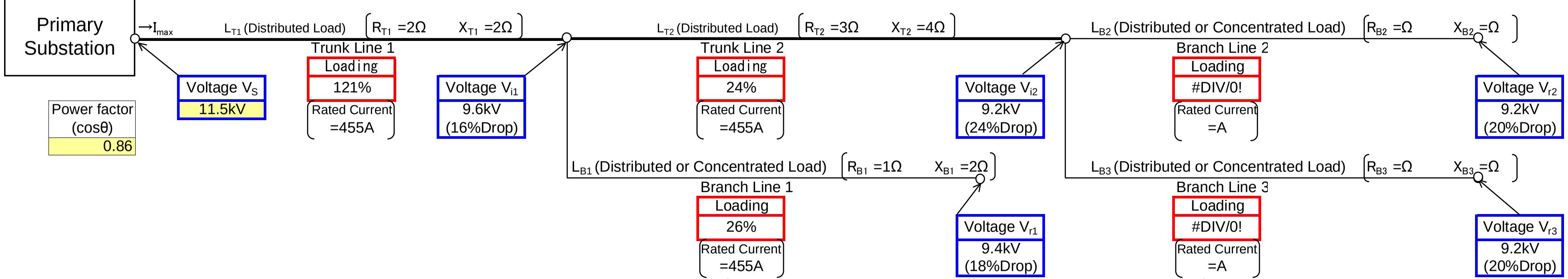
Load L_{T1}	325A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7525kVA	

<Trank Line 2>

Load L_{T2}	108A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2500kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	119A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	4km	
Total Transformer Capacity of secondary substations CAP_{B1}	2750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	ELMINA

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}	
586A	

Power factor (cosθ)	
0.86	

<Trank Line 1>

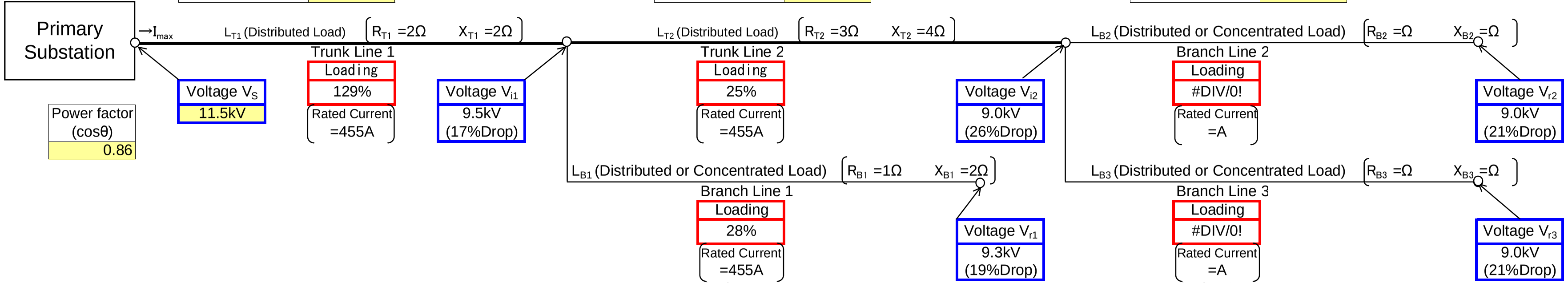
Load L_{T1}	345A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7525kVA	

<Trank Line 2>

Load L_{T2}	115A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2500kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	126A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	4km	
Total Transformer Capacity of secondary substations CAP_{B1}	2750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	ELMINA

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
623A

Power factor (cosθ)
0.86

<Trank Line 1>

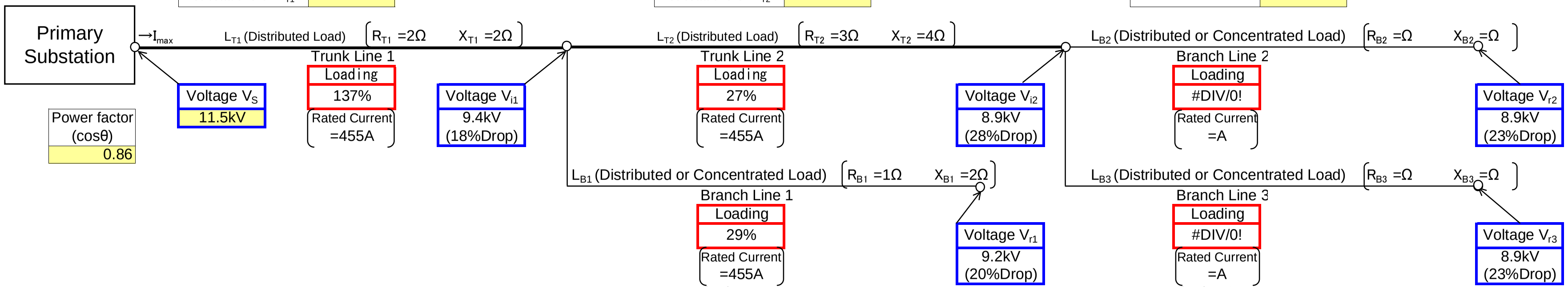
Load L_{T1}	367A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7525kVA	

<Trank Line 2>

Load L_{T2}	122A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2500kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	134A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	4km	
Total Transformer Capacity of secondary substations CAP_{B1}	2750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

2006

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	FOSU

: Input data in colored cells

Type-3

Maximum Current I_{max}	
112A	

<Trank Line 1>

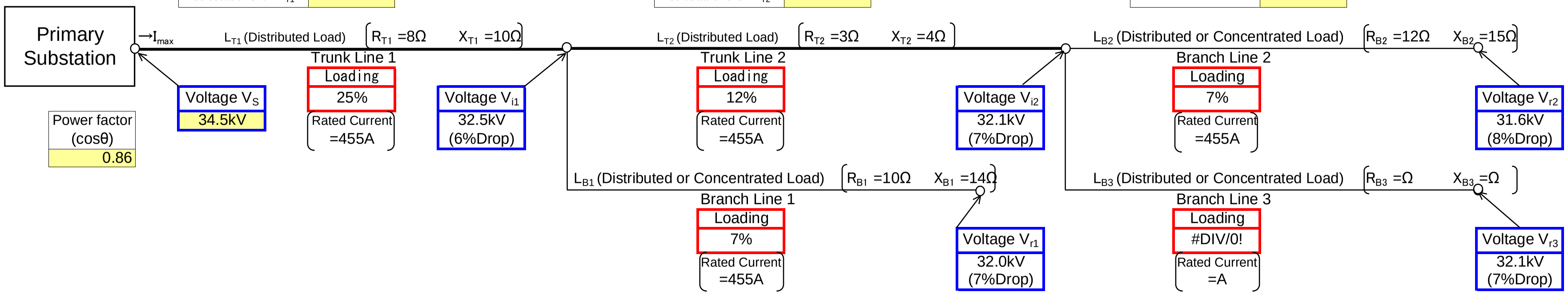
Load L_{T1}	23A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	28km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3125kVA	

<Trank Line 2>

Load L_{T2}	22A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2950kVA	

<Branch Line 2>

Load L_{B2}	34A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	43km	
Total Transformer Capacity of secondary substations CAP_{B2}	4605kVA	



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	34A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B1}	4605kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$$

$$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$$

$$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$$

$$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$$

$$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$$

$$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$$

$$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$$

$$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$$

$$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$$

$$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$$

$$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	FOSU

🟨: Input data in colored cells

Type-3

Maximum Current I_{max}
118A

Power factor (cosθ)
0.86

<Trank Line 1>

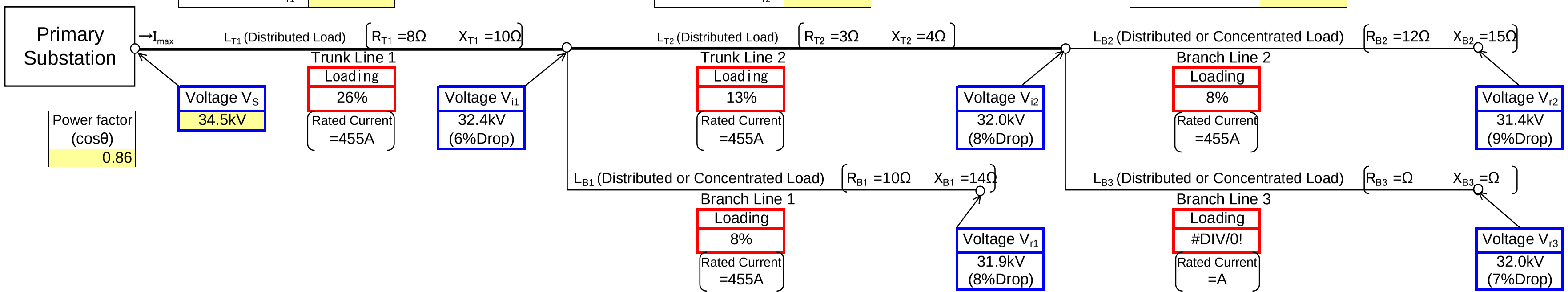
Load L_{T1}	24A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	28km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3125kVA	

<Trank Line 2>

Load L_{T2}	23A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2950kVA	

<Branch Line 2>

Load L_{B2}	36A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	43km	
Total Transformer Capacity of secondary substations CAP_{B2}	4605kVA	



<Branch Line 1>

Load L_{B1}	36A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B1}	4605kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	FOSU

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	25A
Line Type	AAC120mm2 No.7
Line Legth Len_{T1}	28km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T1}	3125kVA

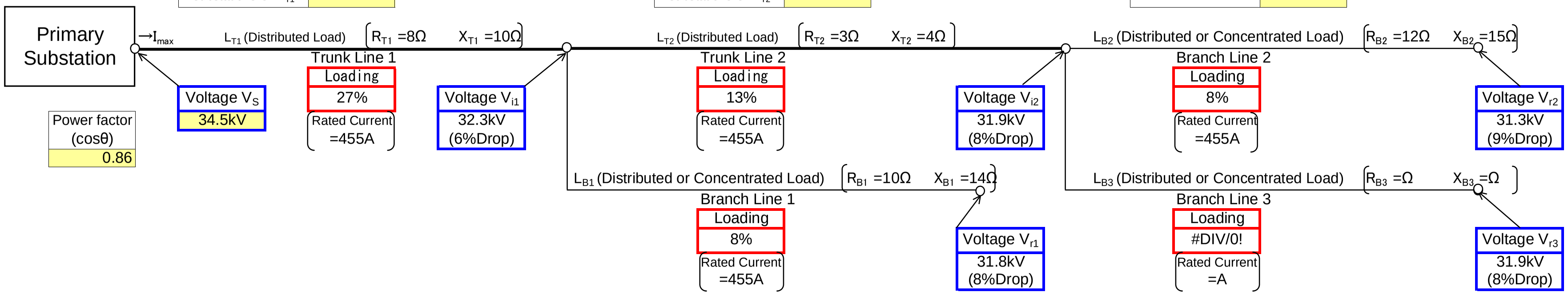
<Trank Line 2>

Load L_{T2}	24A
Line Type	AAC120mm2 No.7
Line Legth Len_{T2}	11km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T2}	2950kVA

<Branch Line 2>

Load L_{B2}	37A
Line Type	AAC120mm2 No.7
Type of Load	Equality
Line Length Len_{B1}	43km
Total Transformer Capacity of secondary substations CAP_{B2}	4605kVA

Maximum Current I_{max}
123A



<Branch Line 1>

Load L_{B1}	37A
Line Type	AAC120mm2 No.7
Type of Load	Equality
Line Length Len_{B1}	38km
Total Transformer Capacity of secondary substations CAP_{B1}	4605kVA

<Branch Line 3>

Load L_{B3}	A
Line Type	None No.33
Type of Load	Equality
Line Length Len_{B3}	km
Total Transformer Capacity of secondary substations CAP_{B3}	kVA

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

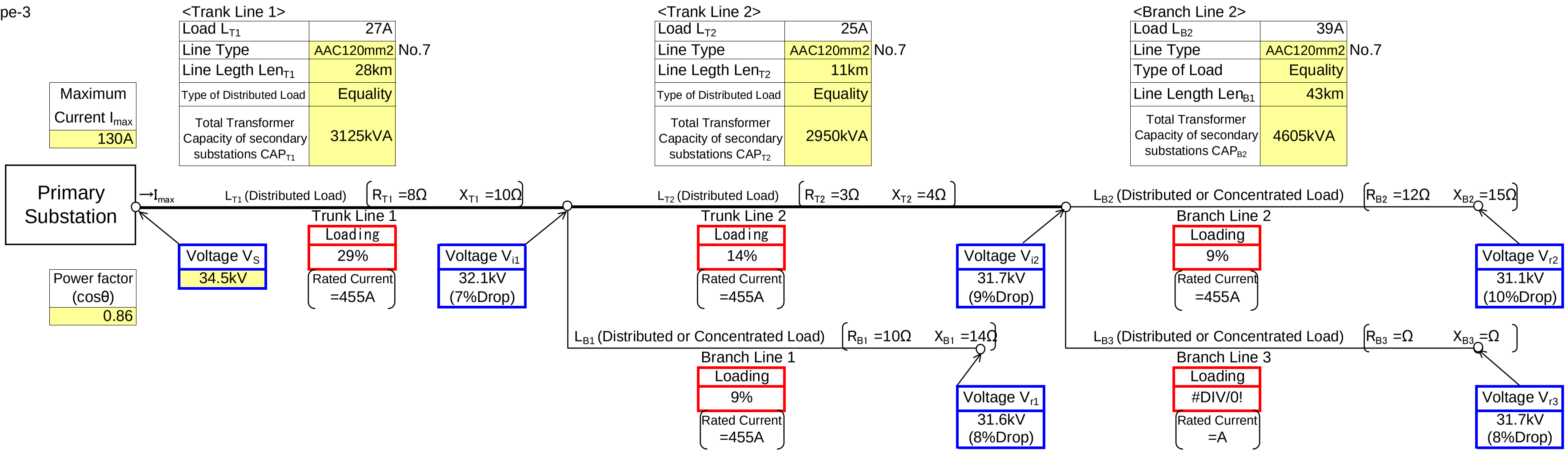
V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	FOSU

: Input data in colored cells

Type-3



<Trank Line 1>

Load L_{T1}	27A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	28km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3125kVA	

<Trank Line 2>

Load L_{T2}	25A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2950kVA	

<Branch Line 2>

Load L_{B2}	39A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	43km	
Total Transformer Capacity of secondary substations CAP_{B2}	4605kVA	

<Branch Line 1>

Load L_{B1}	39A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B1}	4605kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	FOSU

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	28A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	28km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3125kVA	

<Trank Line 2>

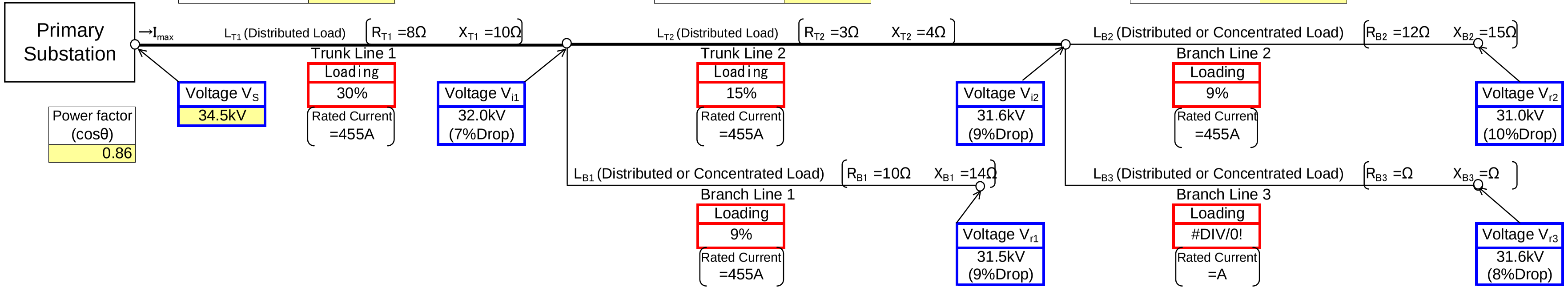
Load L_{T2}	26A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2950kVA	

<Branch Line 2>

Load L_{B2}	41A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	43km	
Total Transformer Capacity of secondary substations CAP_{B2}	4605kVA	

Maximum Current I_{max}
136A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	41A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B1}	4605kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	FOSU

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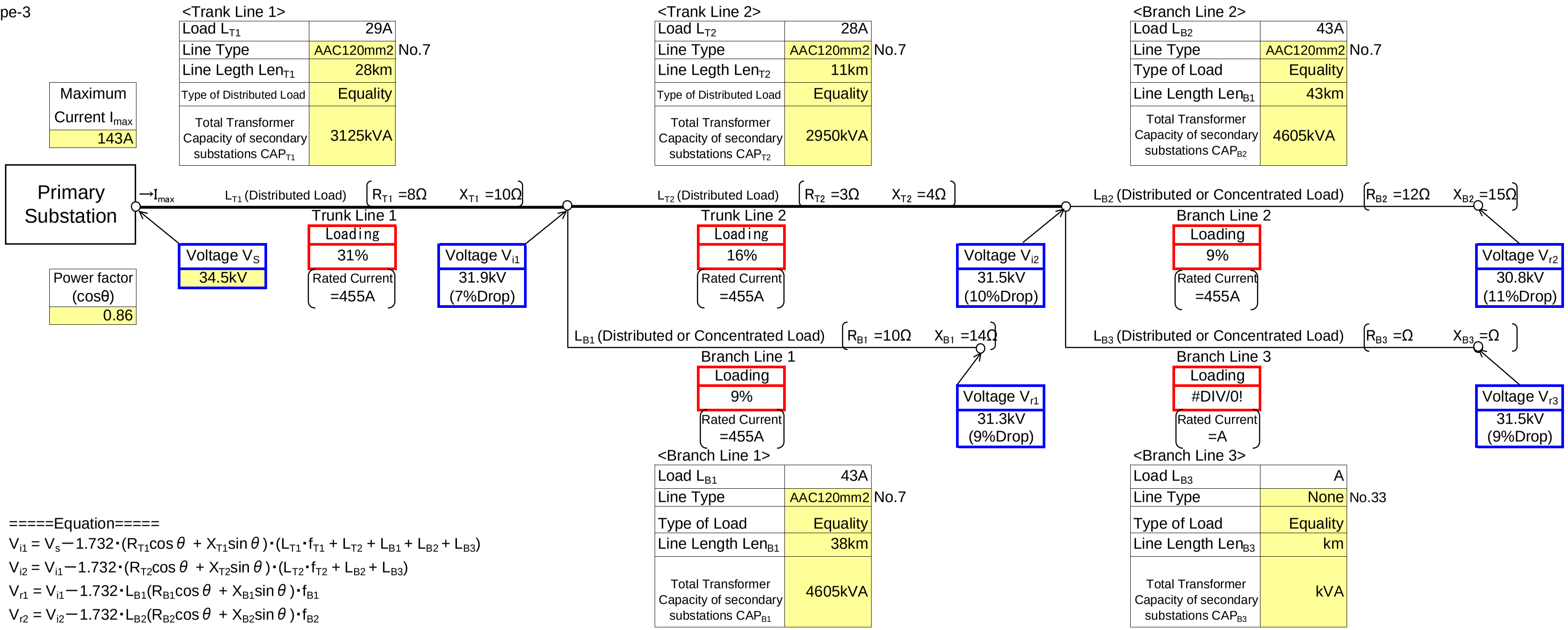
Type-3



<Trank Line 1>

Load L_{T1}	29A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	28km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3125kVA	

<Trank Line 2>

Load L_{T2}	28A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2950kVA	

<Branch Line 2>

Load L_{B2}	43A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	43km	
Total Transformer Capacity of secondary substations CAP_{B2}	4605kVA	

<Branch Line 1>

Load L_{B1}	43A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B1}	4605kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} ／ (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} ／ (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} ／ (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} ／ (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} ／ (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	FOSU

🟨: Input data in colored cells

Type-3

<Trank Line 1>

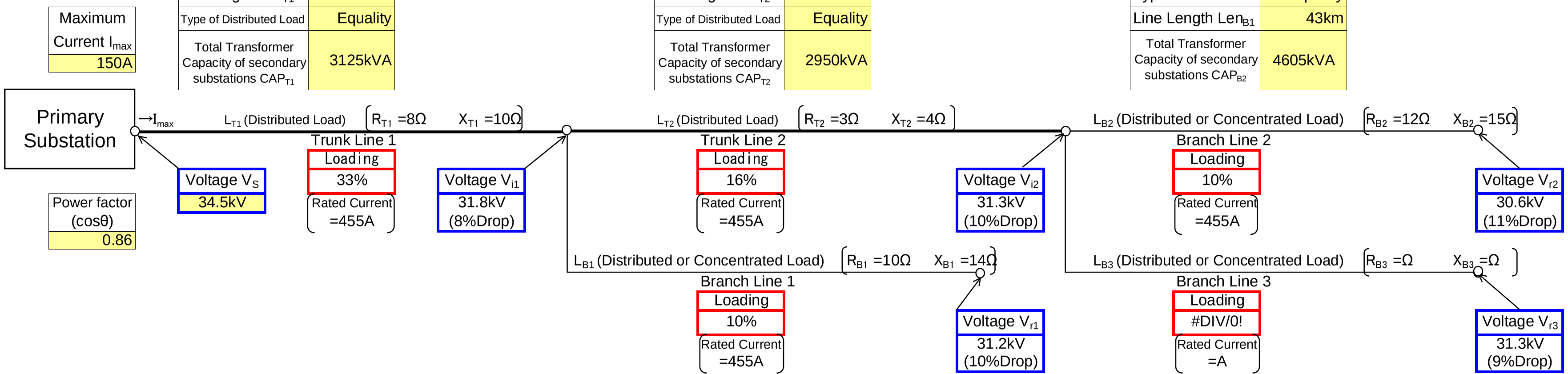
Load L_{T1}	31A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	28km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3125kVA	

<Trank Line 2>

Load L_{T2}	29A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2950kVA	

<Branch Line 2>

Load L_{B2}	45A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	43km	
Total Transformer Capacity of secondary substations CAP_{B2}	4605kVA	



<Branch Line 1>

Load L_{B1}	45A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B1}	4605kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	FOSU

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	32A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	28km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3125kVA	

<Trank Line 2>

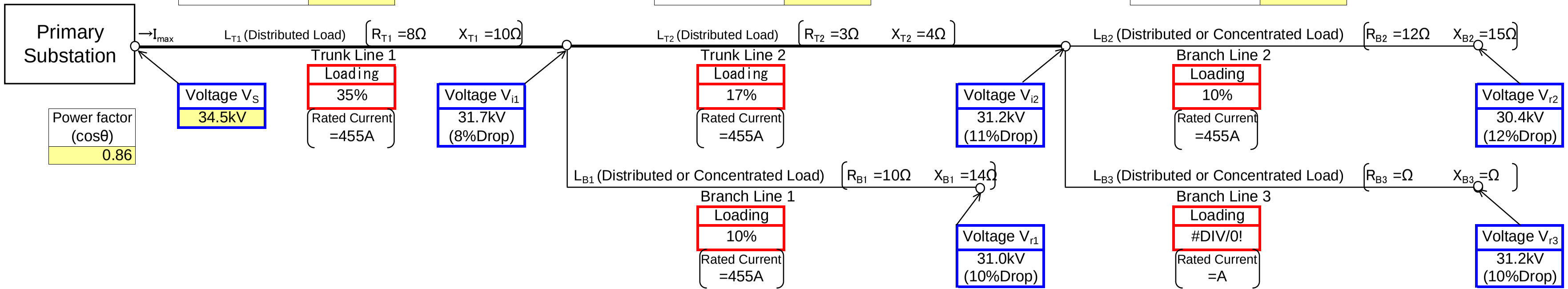
Load L_{T2}	30A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2950kVA	

<Branch Line 2>

Load L_{B2}	47A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	43km	
Total Transformer Capacity of secondary substations CAP_{B2}	4605kVA	

Maximum Current I_{max}
157A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	47A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B1}	4605kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	FOSU

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
165A

<Trank Line 1>

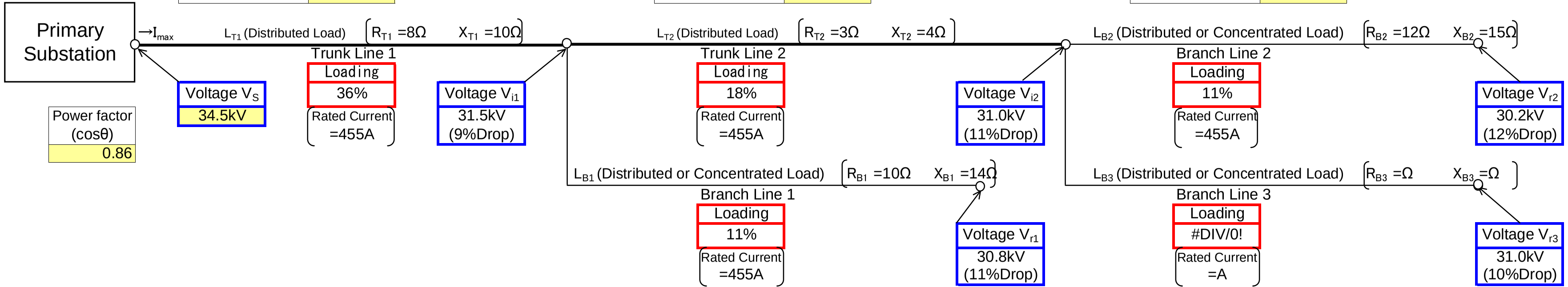
Load L_{T1}	34A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	28km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3125kVA	

<Trank Line 2>

Load L_{T2}	32A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2950kVA	

<Branch Line 2>

Load L_{B2}	50A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	43km	
Total Transformer Capacity of secondary substations CAP_{B2}	4605kVA	



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	50A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B1}	4605kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	FOSU

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	35A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	28km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3125kVA	

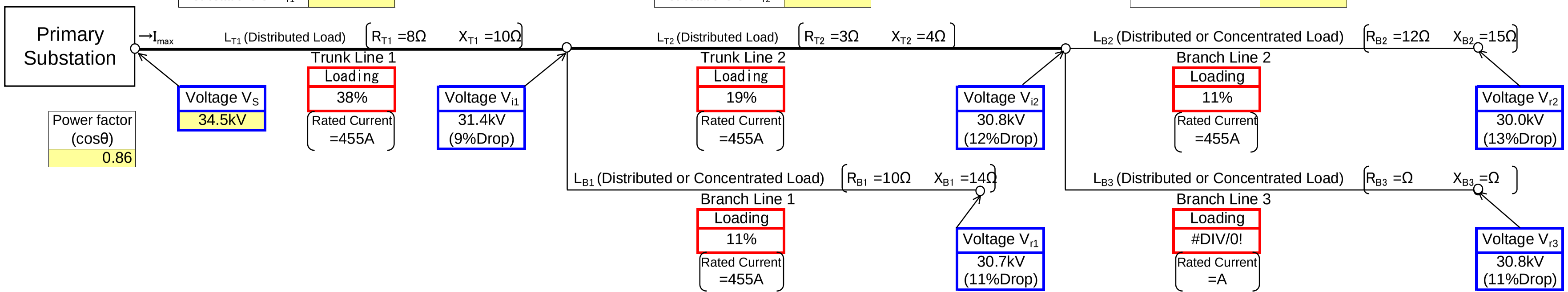
<Trank Line 2>

Load L_{T2}	33A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2950kVA	

<Branch Line 2>

Load L_{B2}	52A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	43km	
Total Transformer Capacity of secondary substations CAP_{B2}	4605kVA	

Maximum Current I_{max}
173A



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	52A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B1}	4605kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	FOSU

🟨: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	37A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	28km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3125kVA	

<Trank Line 2>

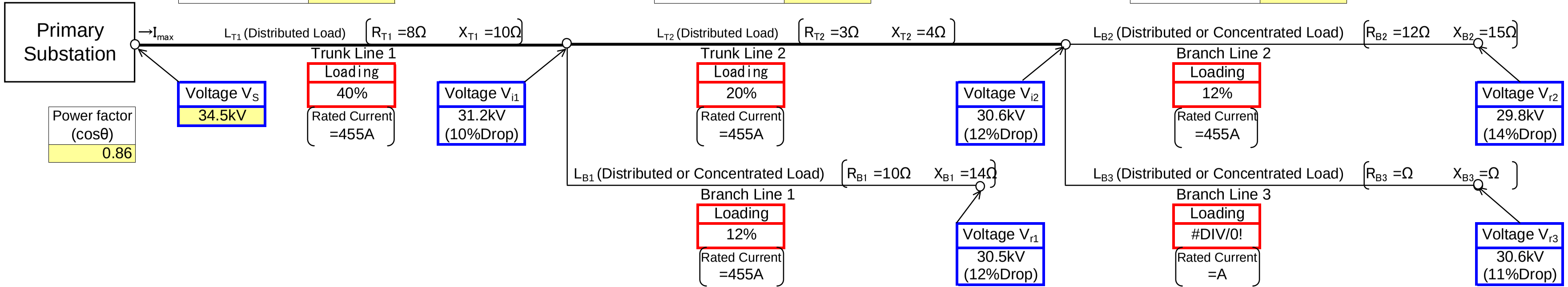
Load L_{T2}	35A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2950kVA	

<Branch Line 2>

Load L_{B2}	55A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	43km	
Total Transformer Capacity of secondary substations CAP_{B2}	4605kVA	

Maximum Current I_{max}
182A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	55A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B1}	4605kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	FOSU

🟨: Input data in colored cells

Type-3

Maximum Current I_{max}
191A

Power factor (cosθ)
0.86

<Trank Line 1>

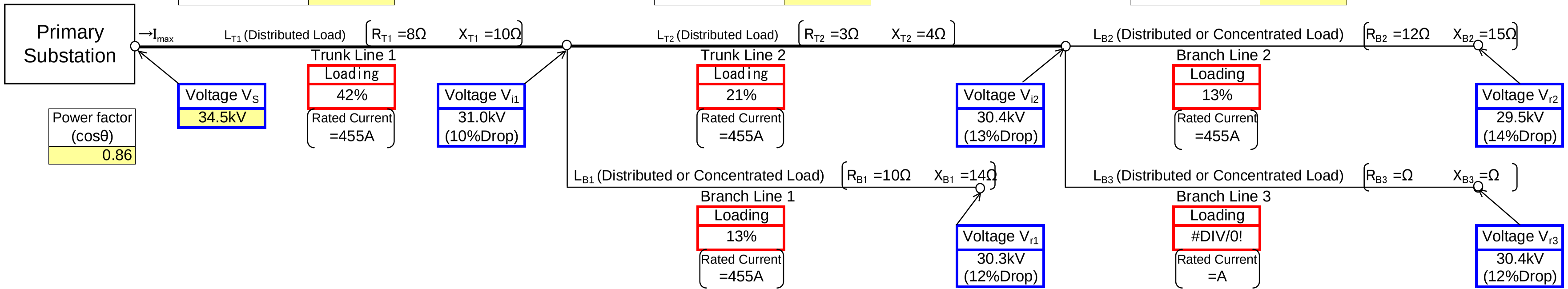
Load L_{T1}	39A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	28km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3125kVA	

<Trank Line 2>

Load L_{T2}	37A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2950kVA	

<Branch Line 2>

Load L_{B2}	58A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	43km	
Total Transformer Capacity of secondary substations CAP_{B2}	4605kVA	



<Branch Line 1>

Load L_{B1}	58A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B1}	4605kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$$

$$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$$

$$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$$

$$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$$

$$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$$

$$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	TOKUSE
Feeder Name	KASOA

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
227A

Power factor (cosθ)
0.86

<Trank Line 1>

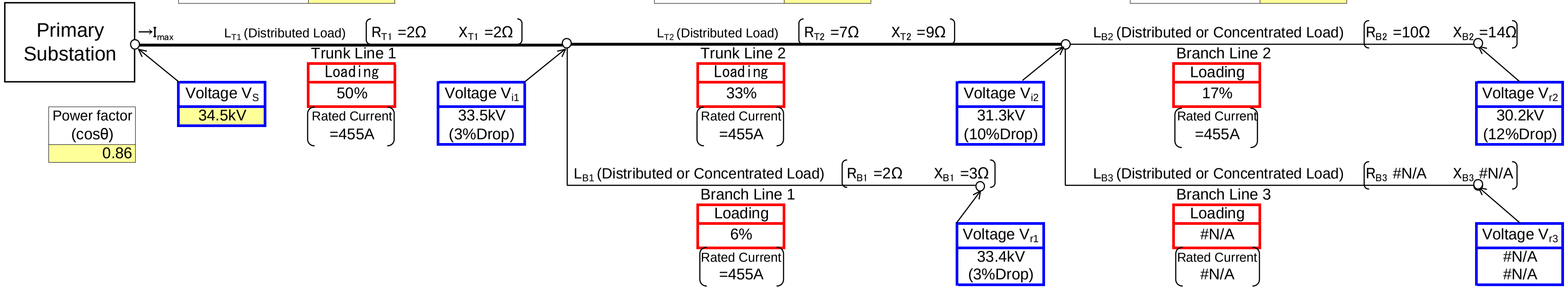
Load L_{T1}	48A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	8765kVA	

<Trank Line 2>

Load L_{T2}	73A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	26km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	13315kVA	

<Branch Line 2>

Load L_{B2}	78A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B2}	14210kVA	



<Branch Line 1>

Load L_{B1}	27A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4900kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type		#N/A
Type of Load	Equality	
Line Length Len_{B3}		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	TOKUSE
Feeder Name	KASOA

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	51A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	8765kVA	

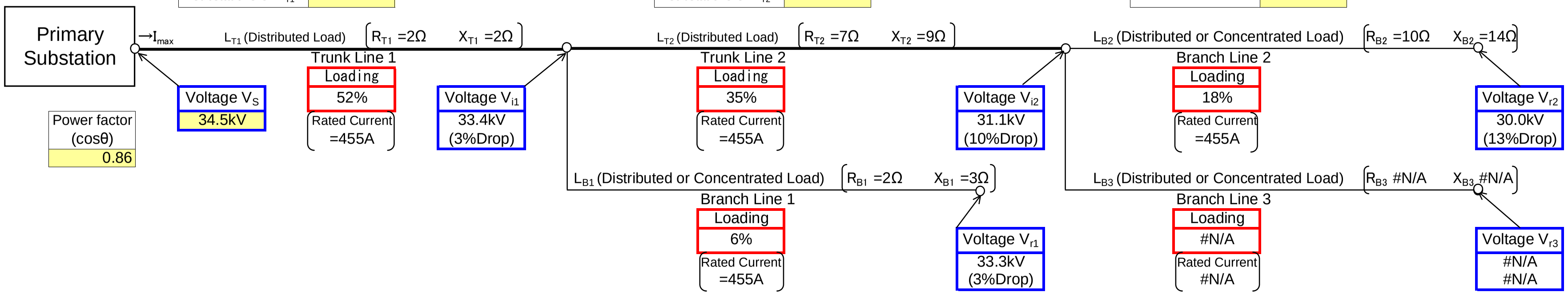
<Trank Line 2>

Load L_{T2}	77A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	26km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	13315kVA	

<Branch Line 2>

Load L_{B2}	82A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B2}	14210kVA	

Maximum Current I_{max}
238A



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	28A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4900kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type		#N/A
Type of Load	Equality	
Line Length Len_{B3}		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	TOKUSE
Feeder Name	KASOA

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	53A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	8765kVA	

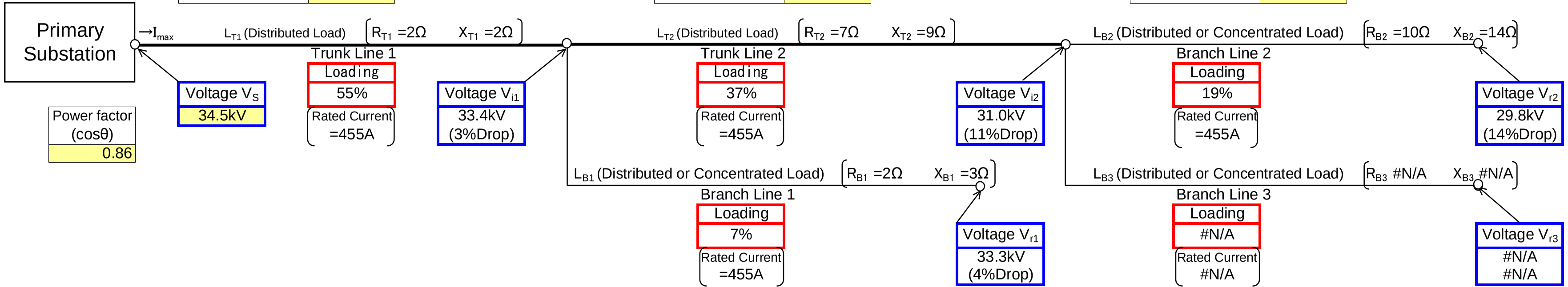
<Trank Line 2>

Load L_{T2}	80A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	26km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	13315kVA	

<Branch Line 2>

Load L_{B2}	86A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B2}	14210kVA	

Maximum Current I_{max}
249A



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	30A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4900kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type		#N/A
Type of Load	Equality	
Line Length Len_{B3}		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

$V_{i1} = V_s - 1.732\cdot(R_{T1}\cos\theta + X_{T1}\sin\theta)\cdot(L_{T1}\cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732\cdot(R_{T2}\cos\theta + X_{T2}\sin\theta)\cdot(L_{T2}\cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732\cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta)\cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732\cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta)\cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732\cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta)\cdot f_{B3}$

$L_{T1} = I_{max}\cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max}\cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max}\cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max}\cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max}\cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	TOKUSE
Feeder Name	KASOA

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
262A

<Trank Line 1>

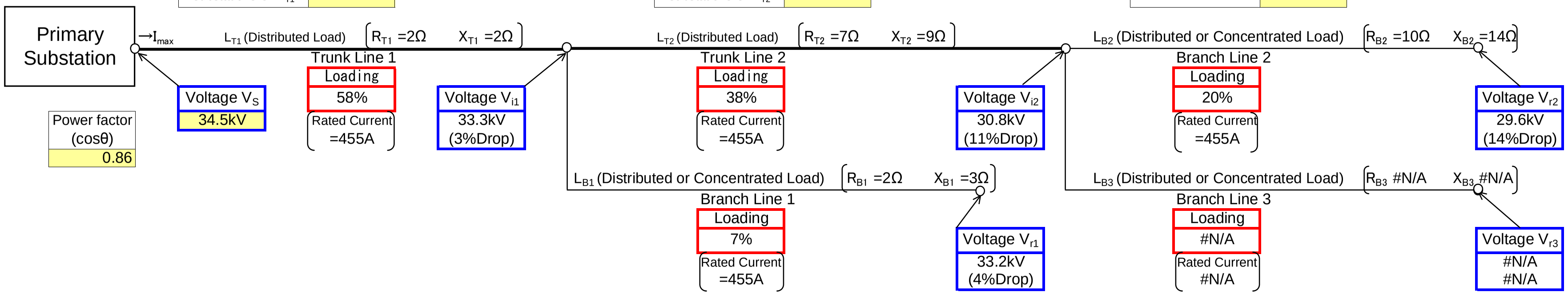
Load L_{T1}	56A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	8765kVA	

<Trank Line 2>

Load L_{T2}	85A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	26km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	13315kVA	

<Branch Line 2>

Load L_{B2}	90A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B2}	14210kVA	



<Branch Line 1>

Load L_{B1}	31A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4900kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type		#N/A
Type of Load	Equality	
Line Length Len_{B3}		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	TOKUSE
Feeder Name	KASOA

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	58A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	8765kVA	

<Trank Line 2>

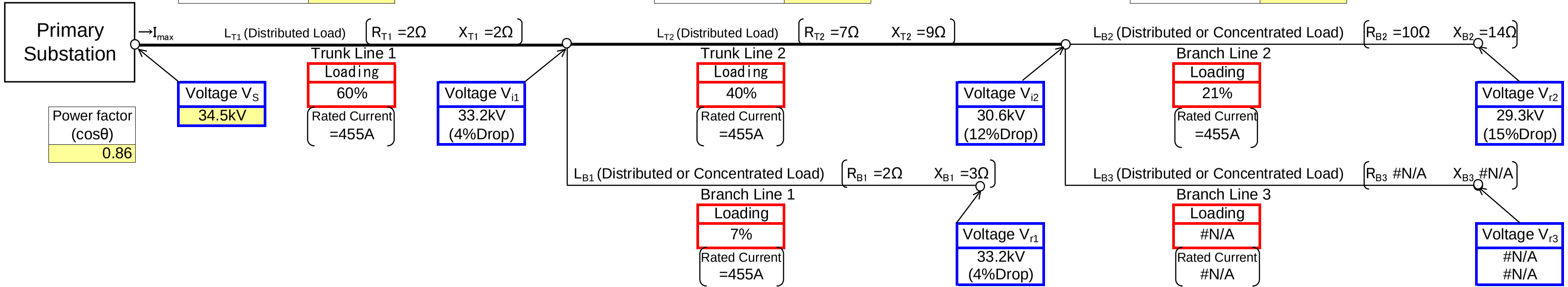
Load L_{T2}	89A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	26km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	13315kVA	

<Branch Line 2>

Load L_{B2}	95A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B2}	14210kVA	

Maximum Current I_{max}
274A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	33A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4900kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type		#N/A
Type of Load	Equality	
Line Length Len_{B3}		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	TOKUSE
Feeder Name	KASOA

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
288A

<Trank Line 1>

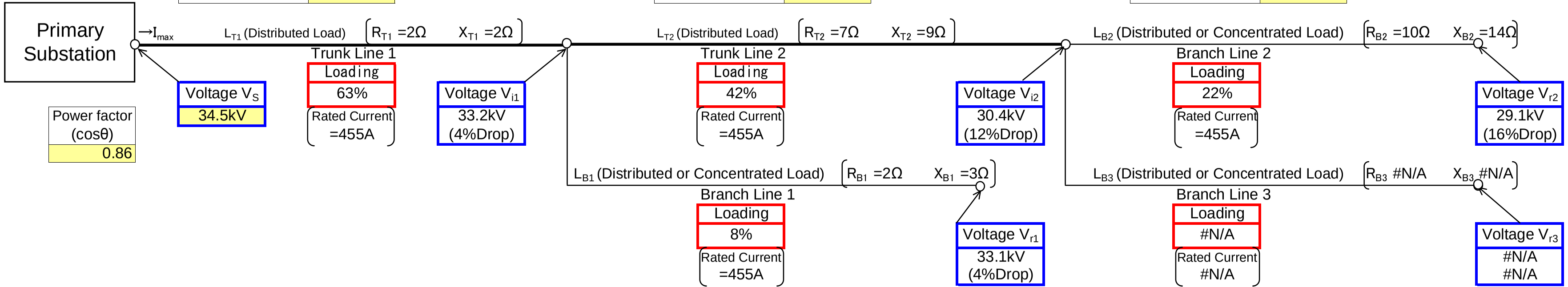
Load L_{T1}	61A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	8765kVA	

<Trank Line 2>

Load L_{T2}	93A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	26km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	13315kVA	

<Branch Line 2>

Load L_{B2}	99A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B2}	14210kVA	



<Branch Line 1>

Load L_{B1}	34A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4900kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type		#N/A
Type of Load	Equality	
Line Length Len_{B3}		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	TOKUSE
Feeder Name	KASOA

🟨: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	64A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	8765kVA	

<Trank Line 2>

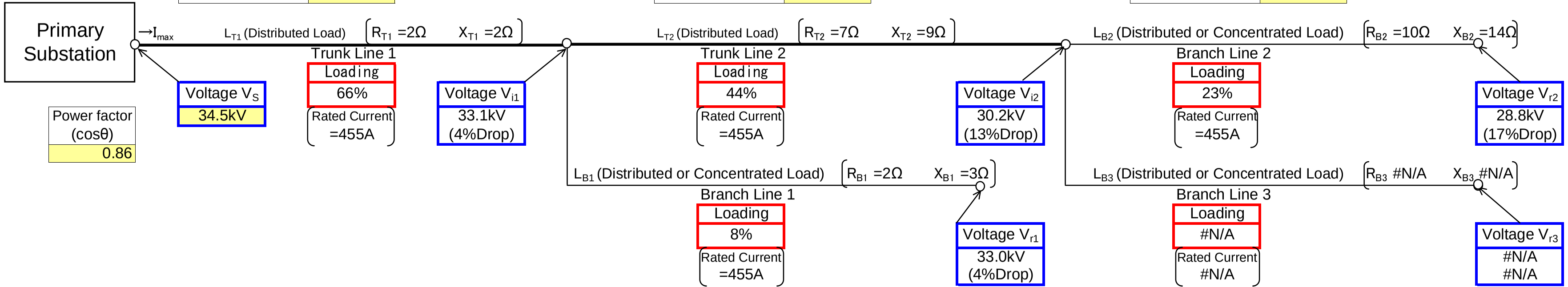
Load L_{T2}	98A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	26km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	13315kVA	

<Branch Line 2>

Load L_{B2}	104A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B2}	14210kVA	

Maximum Current I_{max}
302A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	36A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4900kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type		#N/A
Type of Load	Equality	
Line Length Len_{B3}		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	TOKUSE
Feeder Name	KASOA

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
317A

Power factor (cosθ)
0.86

<Trank Line 1>

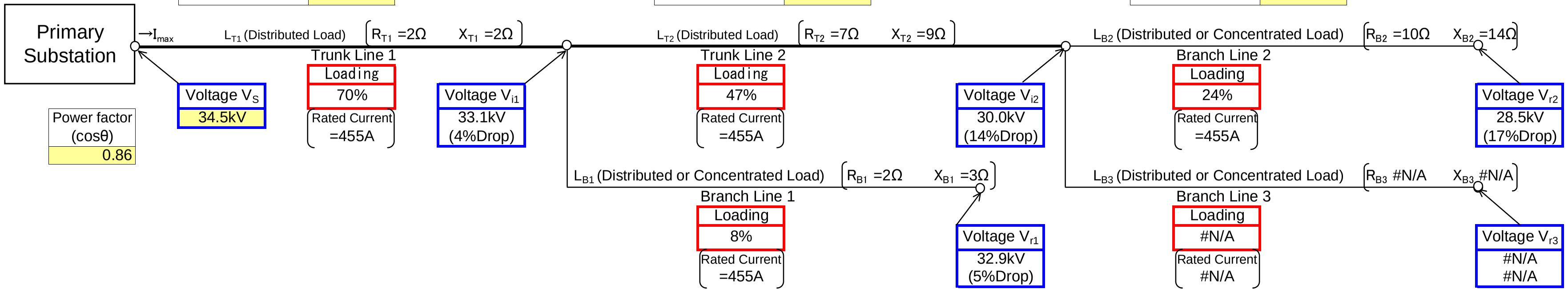
Load L_{T1}	67A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	8765kVA	

<Trank Line 2>

Load L_{T2}	102A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	26km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	13315kVA	

<Branch Line 2>

Load L_{B2}	109A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B2}	14210kVA	



<Branch Line 1>

Load L_{B1}	38A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4900kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type		#N/A
Type of Load	Equality	
Line Length Len_{B3}		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	TOKUSE
Feeder Name	KASOA

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	71A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	8765kVA	

<Trank Line 2>

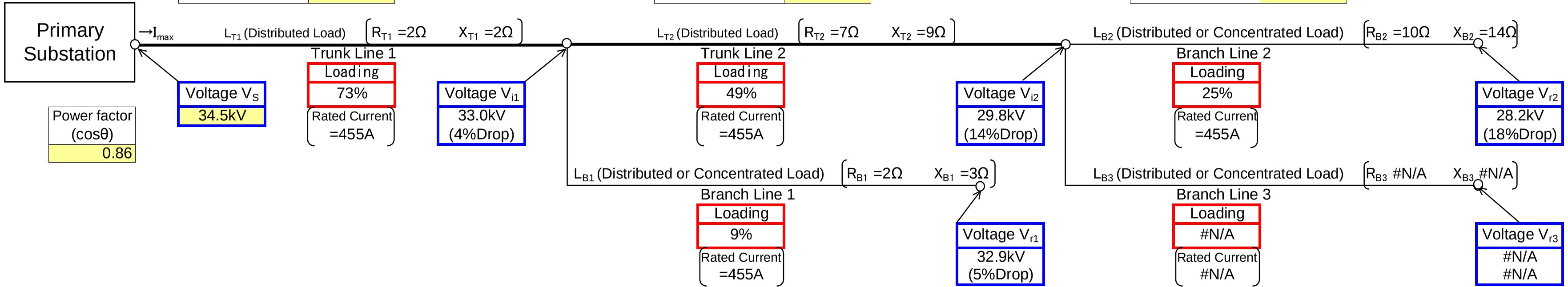
Load L_{T2}	107A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	26km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	13315kVA	

<Branch Line 2>

Load L_{B2}	115A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B2}	14210kVA	

Maximum Current I_{max}
332A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	39A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4900kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type		#N/A
Type of Load	Equality	
Line Length Len_{B3}		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	TOKUSE
Feeder Name	KASOA

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
349A

Power factor (cosθ)
0.86

<Trank Line 1>

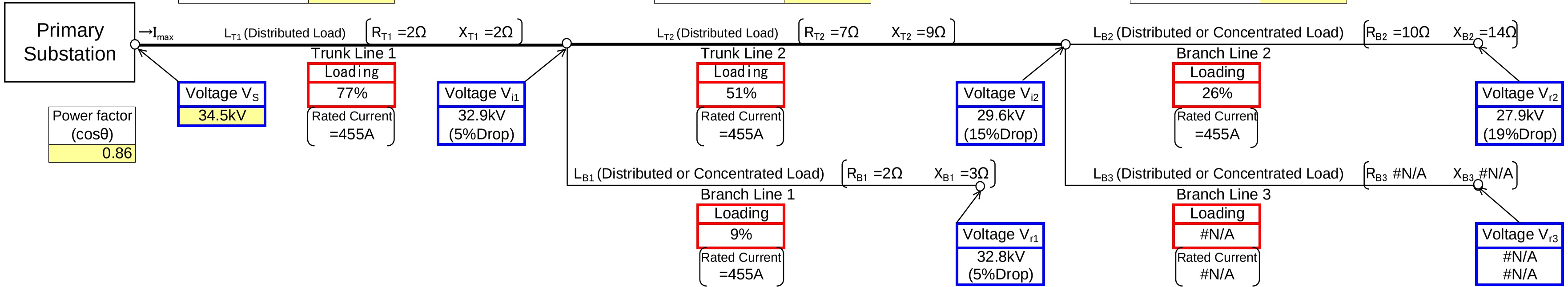
Load L_{T1}	74A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	8765kVA	

<Trank Line 2>

Load L_{T2}	113A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	26km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	13315kVA	

<Branch Line 2>

Load L_{B2}	120A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B2}	14210kVA	



<Branch Line 1>

Load L_{B1}	42A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4900kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type		#N/A
Type of Load	Equality	
Line Length Len_{B3}		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	TOKUSE
Feeder Name	KASOA

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	78A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	8765kVA	

<Trank Line 2>

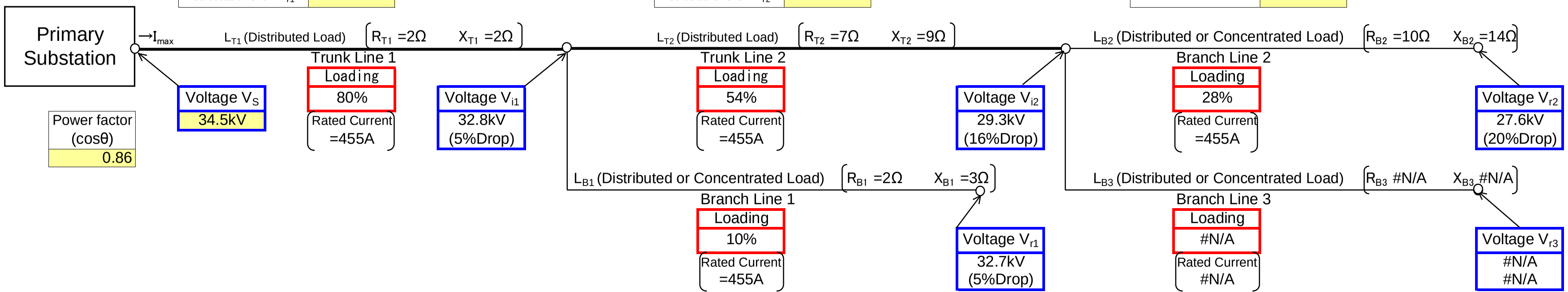
Load L_{T2}	118A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	26km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	13315kVA	

<Branch Line 2>

Load L_{B2}	126A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B2}	14210kVA	

Maximum Current I_{max}
366A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	44A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4900kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type		#N/A
Type of Load	Equality	
Line Length Len_{B3}		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	TOKUSE
Feeder Name	KASOA

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	82A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Received Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	8765kVA	

<Trank Line 2>

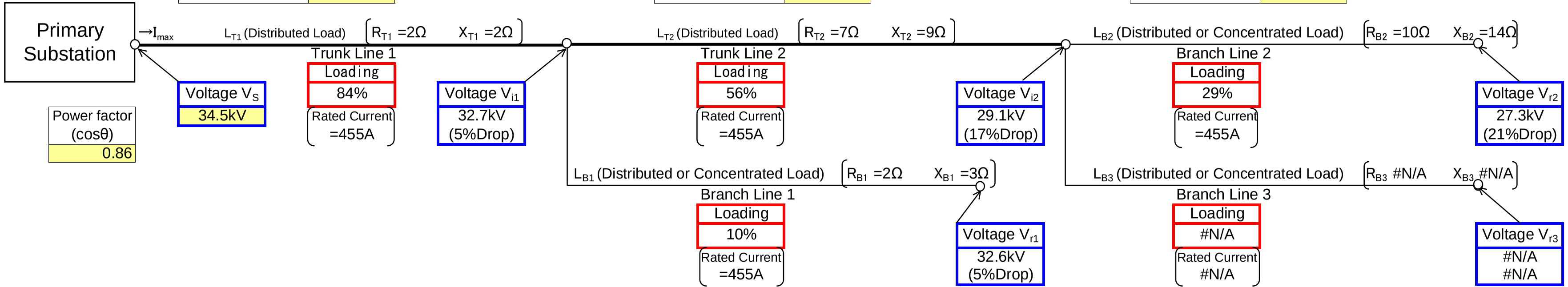
Load L_{T2}	124A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	26km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	13315kVA	

<Branch Line 2>

Load L_{B2}	132A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B2}	14210kVA	

Maximum Current I_{max}
384A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	46A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4900kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type		#N/A
Type of Load	Equality	
Line Length Len_{B3}		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

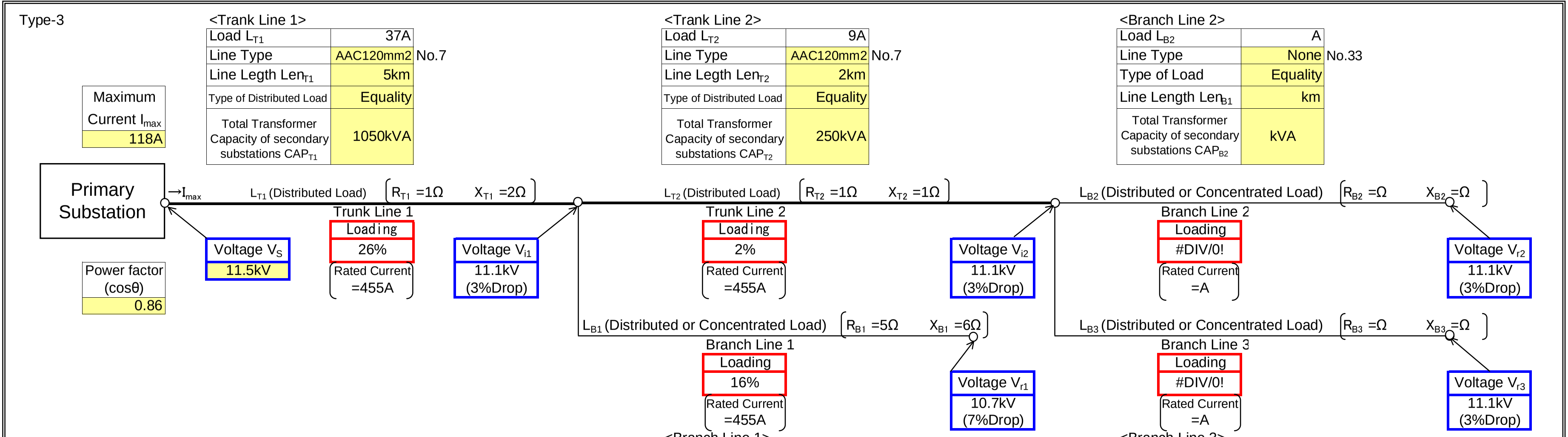
$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	MANKESSIM

▨ : Input data in colored cells



<Trank Line 1>

Load L_{T1}	37A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1050kVA	

<Trank Line 2>

Load L_{T2}	9A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	250kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	72A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	17km	
Total Transformer Capacity of secondary substations CAP_{B1}	2050kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	MANKESSIM

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
124A

Power factor (cosθ)
0.86

<Trank Line 1>

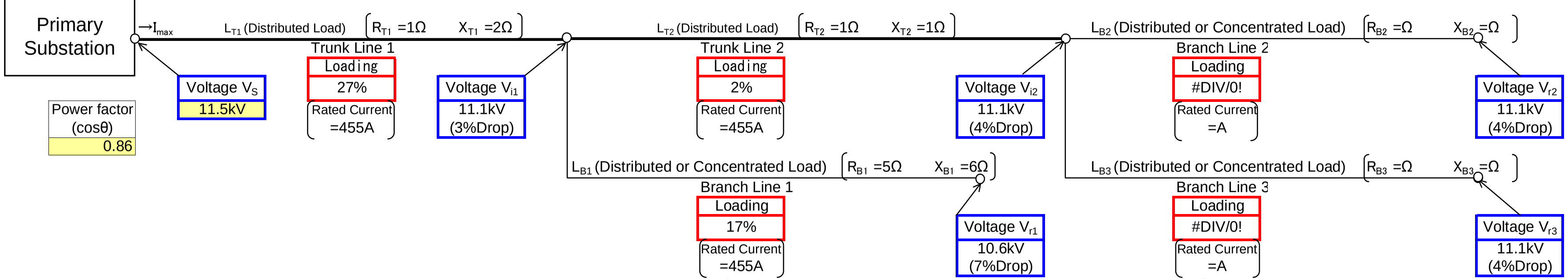
Load L_{T1}	39A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1050kVA	

<Trank Line 2>

Load L_{T2}	9A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	250kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	76A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	17km	
Total Transformer Capacity of secondary substations CAP_{B1}	2050kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage	I_{max} : Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1} : Received Voltage	L_{B1} : Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3} : Received Voltage	L_{B3} : Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	MANKESSIM

: Input data in colored cells

Type-3

Maximum Current I_{max}
131A

<Trank Line 1>

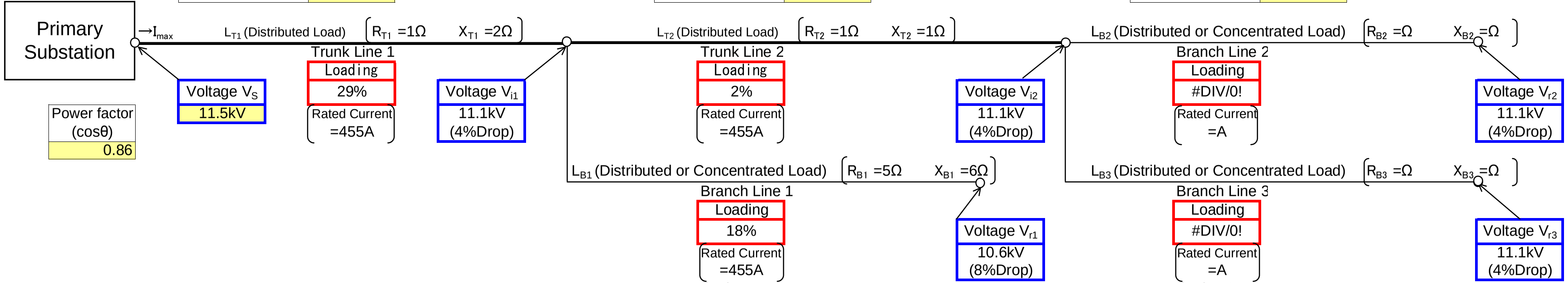
Load L_{T1}	41A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1050kVA	

<Trank Line 2>

Load L_{T2}	10A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	250kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	80A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	17km	
Total Transformer Capacity of secondary substations CAP_{B1}	2050kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	MANKESSIM

: Input data in colored cells

Type-3

Maximum Current I_{max}
138A

Power factor (cosθ)
0.86

<Trank Line 1>

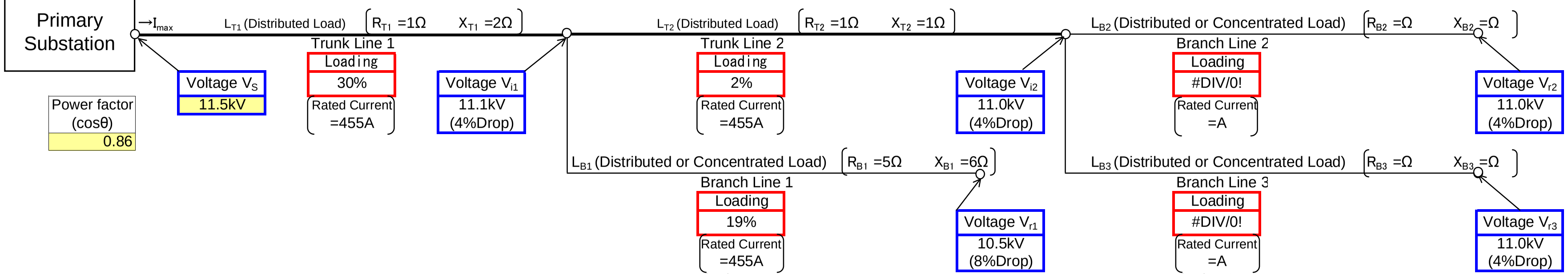
Load L_{T1}	43A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1050kVA	

<Trank Line 2>

Load L_{T2}	10A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	250kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	84A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	17km	
Total Transformer Capacity of secondary substations CAP_{B1}	2050kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	MANKESSIM

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}	145A

Power factor (cosθ)	0.86

<Trank Line 1>

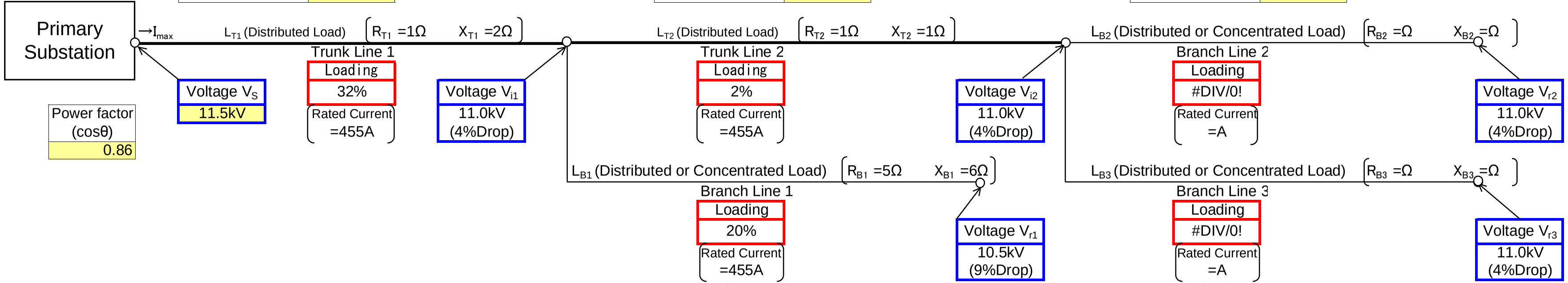
Load L_{T1}	45A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1050kVA	

<Trank Line 2>

Load L_{T2}	11A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	250kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	89A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	17km	
Total Transformer Capacity of secondary substations CAP_{B1}	2050kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	MANKESSIM

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}	153A

Power factor (cosθ)	0.86

<Trank Line 1>

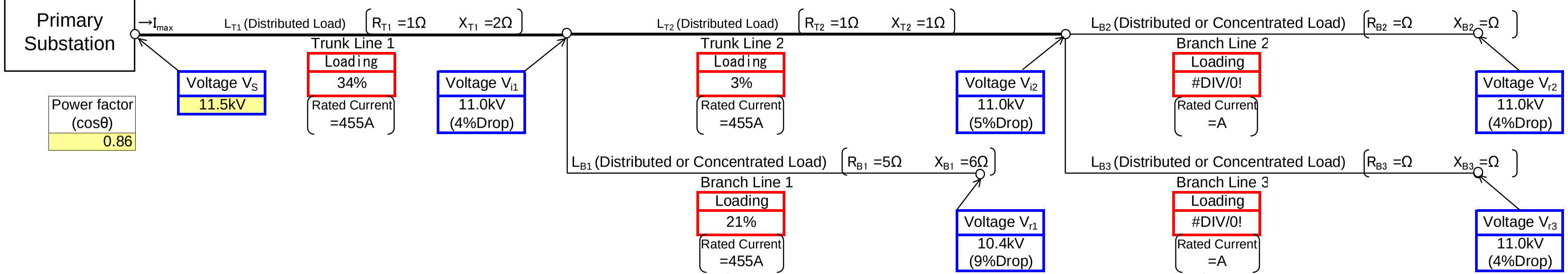
Load L_{T1}	48A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1050kVA	

<Trank Line 2>

Load L_{T2}	11A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	250kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	94A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	17km	
Total Transformer Capacity of secondary substations CAP_{B1}	2050kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	MANKESSIM

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	50A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1050kVA	

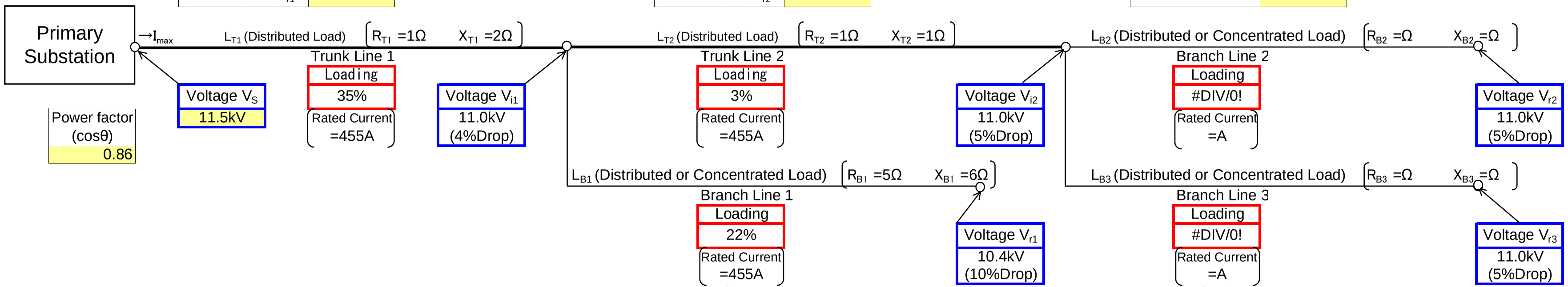
<Trank Line 2>

Load L_{T2}	12A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	250kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
161A



<Branch Line 1>

Load L_{B1}	99A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	17km	
Total Transformer Capacity of secondary substations CAP_{B1}	2050kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	MANKESSIM

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	53A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1050kVA	

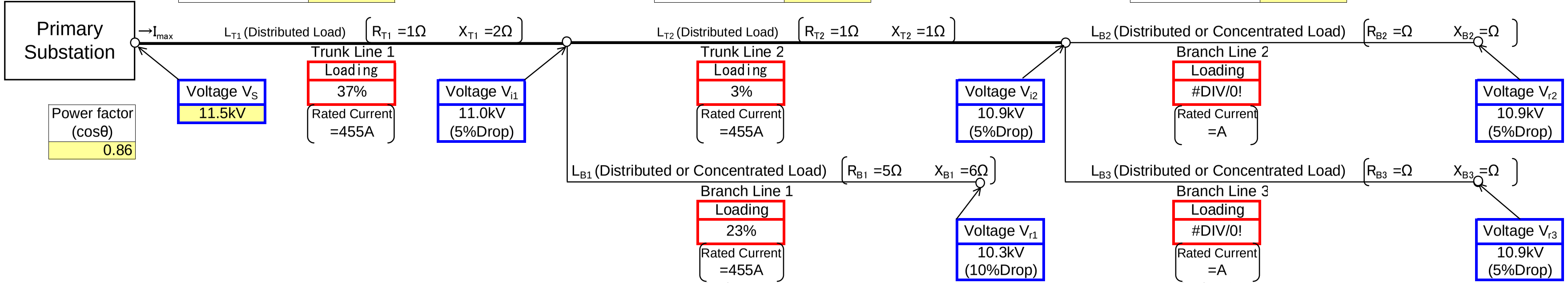
<Trank Line 2>

Load L_{T2}	13A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	250kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
169A



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	103A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	17km	
Total Transformer Capacity of secondary substations CAP_{B1}	2050kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3}$: Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	MANKESSIM

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
178A

Power factor (cosθ)
0.86

<Trank Line 1>

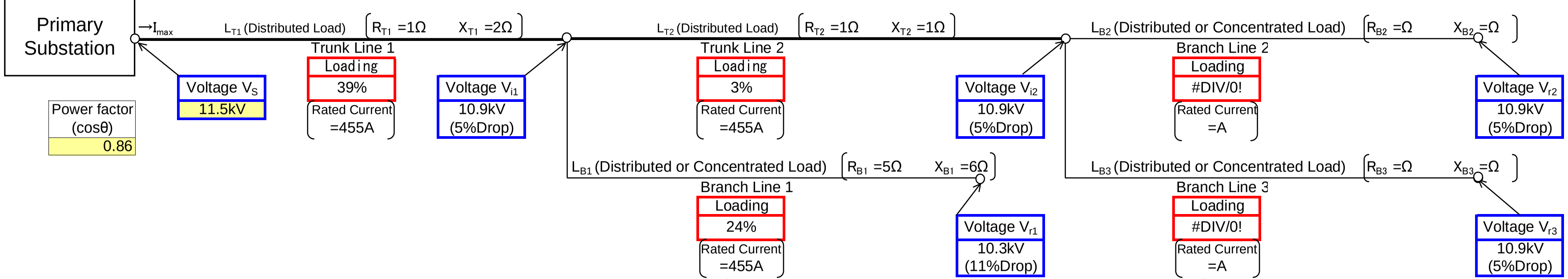
Load L_{T1}	56A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1050kVA	

<Trank Line 2>

Load L_{T2}	13A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	250kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	109A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	17km	
Total Transformer Capacity of secondary substations CAP_{B1}	2050kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance		
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance		
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor		
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations		
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)				
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor		

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	MANKESSIM

: Input data in colored cells

Type-3

Maximum Current I_{max}
187A

<Trank Line 1>

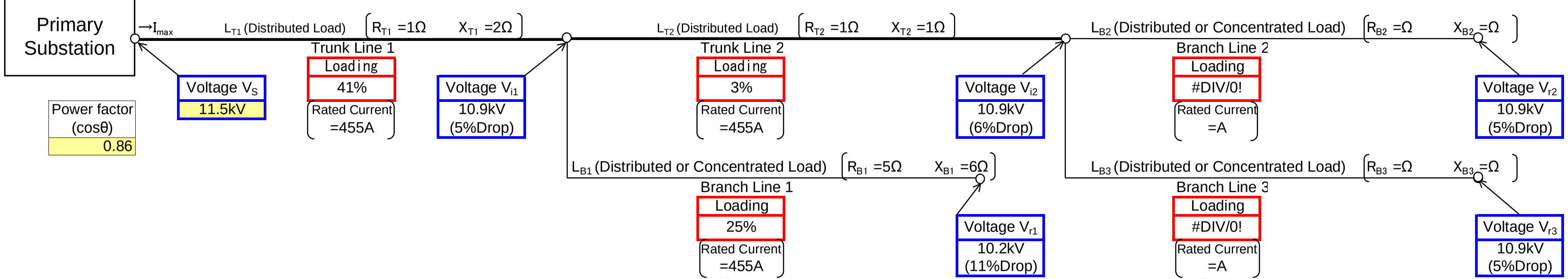
Load L_{T1}	59A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1050kVA	

<Trank Line 2>

Load L_{T2}	14A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	250kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	114A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	17km	
Total Transformer Capacity of secondary substations CAP_{B1}	2050kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	MANKESSIM

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
197A

<Trank Line 1>

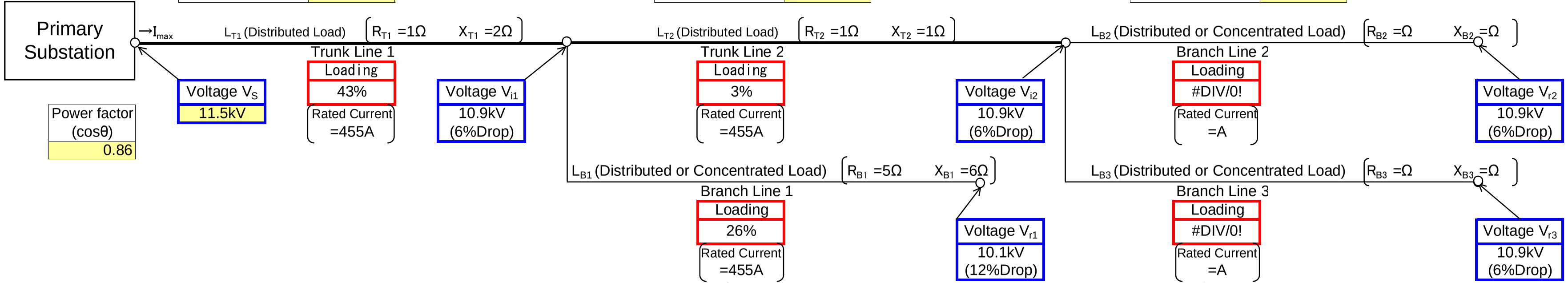
Load L_{T1}	62A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1050kVA	

<Trank Line 2>

Load L_{T2}	15A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	250kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	121A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	17km	
Total Transformer Capacity of secondary substations CAP_{B1}	2050kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	MANKESSIM

: Input data in colored cells

Type-3

Maximum Current I_{max}
208A

Power factor (cosθ)
0.86

<Trank Line 1>

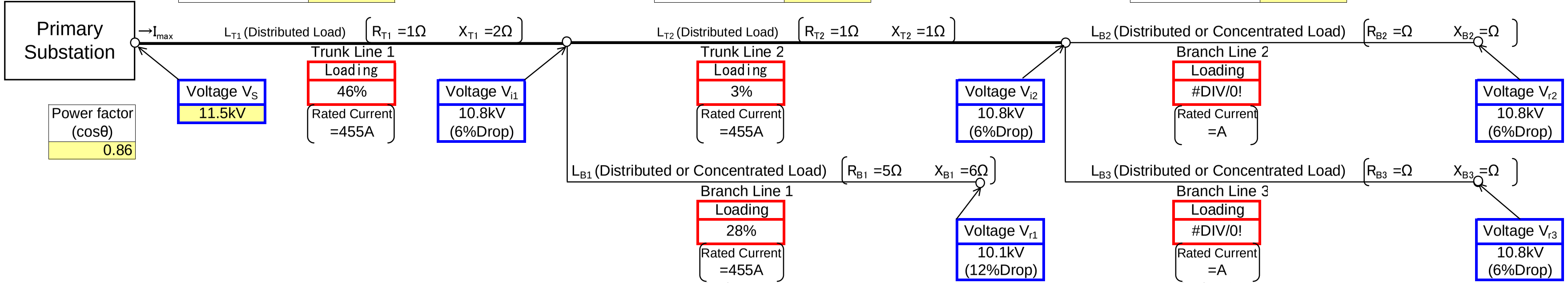
Load L_{T1}	65A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1050kVA	

<Trank Line 2>

Load L_{T2}	16A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	250kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	127A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	17km	
Total Transformer Capacity of secondary substations CAP_{B1}	2050kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

: Input data in colored cells

Type-3

Maximum Current I_{max}
280A

<Trank Line 1>

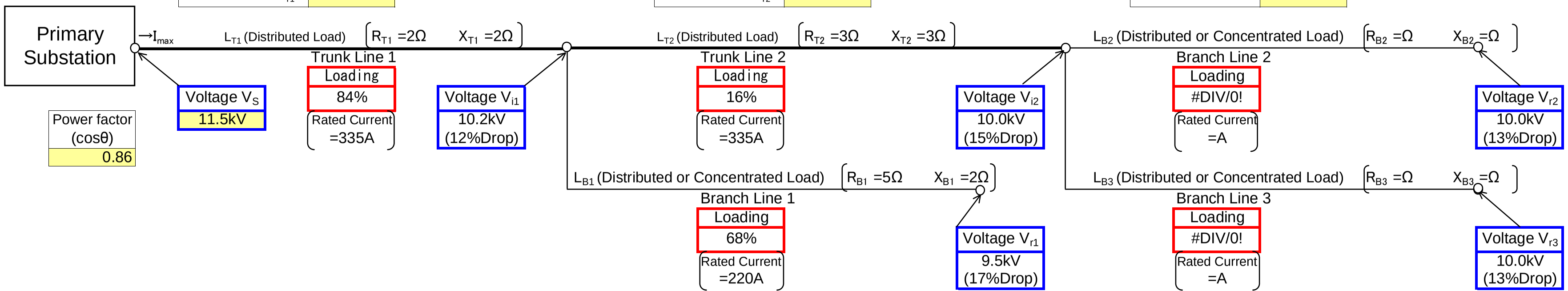
Load L_{T1}	76A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

<Trank Line 2>

Load L_{T2}	54A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	150A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

SWEDRU 1

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 1

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	65A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1225kVA	

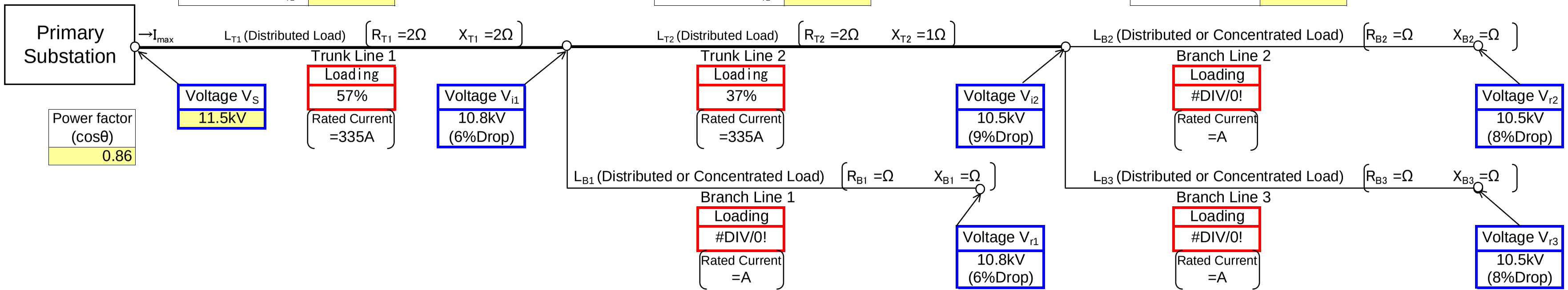
<Trank Line 2>

Load L_{T2}	125A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2345kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
190A



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

Substation Name	SALTPOND
Feeder Name	ANOMABO

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	38A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1350kVA	

<Trank Line 2>

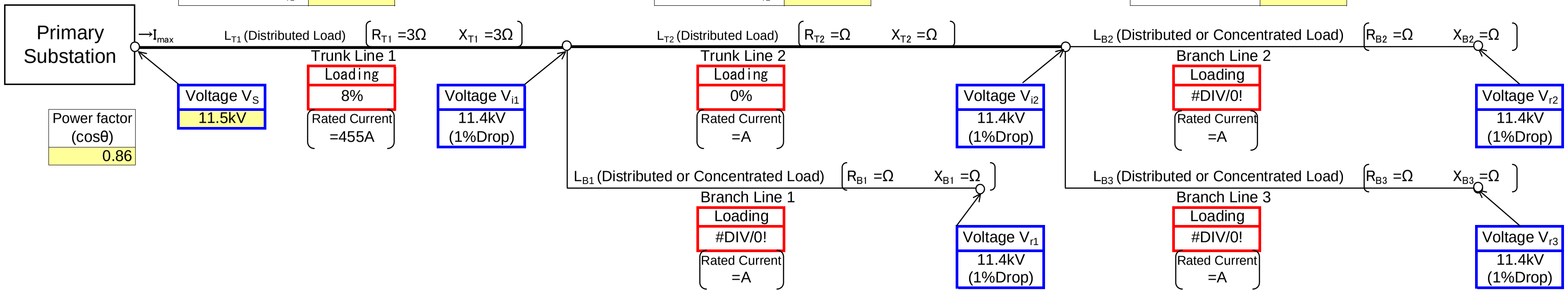
Load L_{T2}	A	
Line Type	None	No.33
Line Legth Len_{T2}	km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}	38A

Power factor (cosθ)	0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

Substation Name	SALTPOND
Feeder Name	MANKESSIM

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	40A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1050kVA	

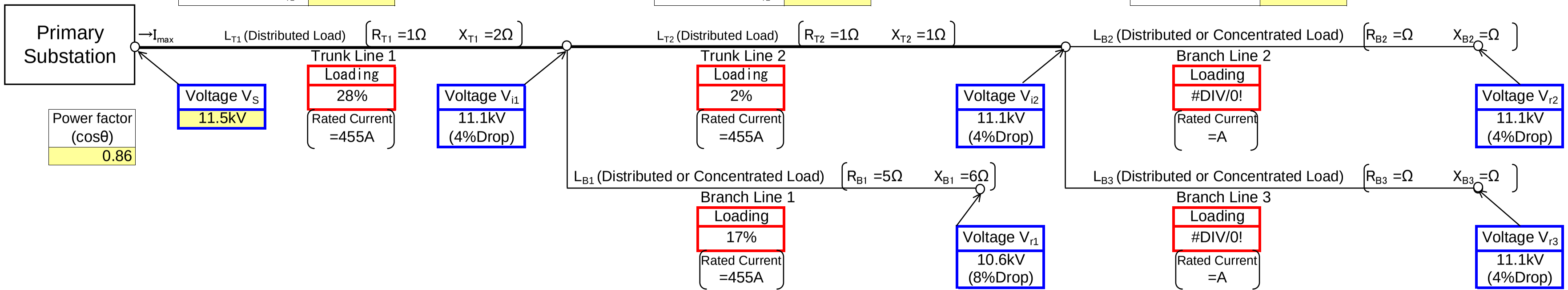
<Trank Line 2>

Load L_{T2}	10A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	250kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}	128A
Power factor (cosθ)	0.86



<Branch Line 1>

Load L_{B1}	78A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	17km	
Total Transformer Capacity of secondary substations CAP_{B1}	2050kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	SALTPOND

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
47A

<Trank Line 1>

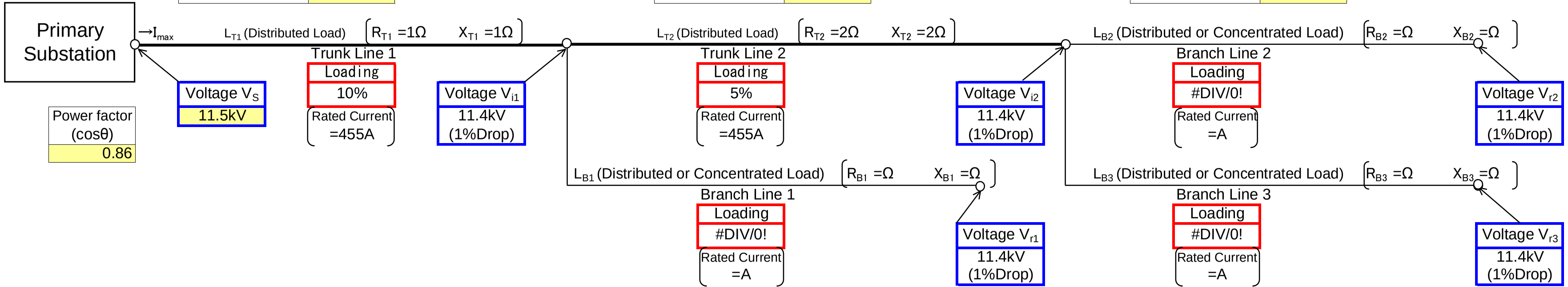
Load L_{T1}	24A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	980kVA	

<Trank Line 2>

Load L_{T2}	23A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	950kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P
Feeder Name	APAM

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}	120A

Power factor (cosθ)	0.86

<Trank Line 1>

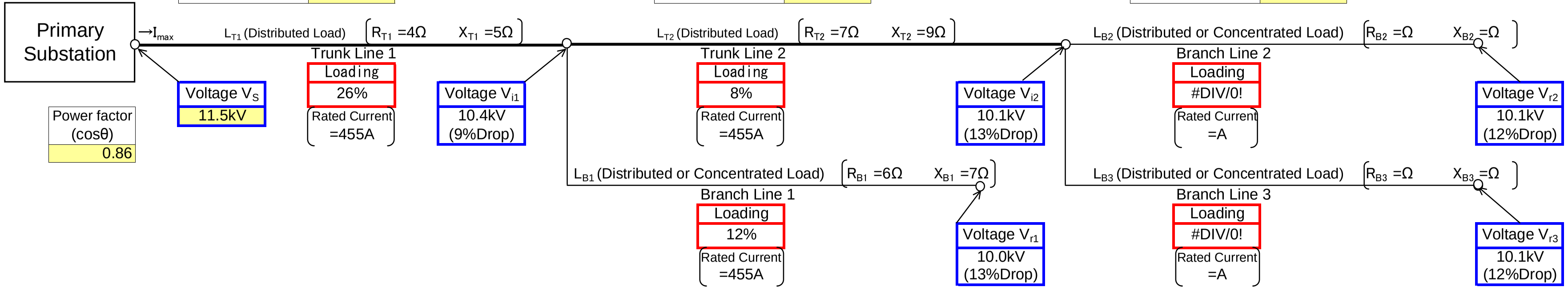
Load L_{T1}	29A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1465kVA	

<Trank Line 2>

Load L_{T2}	37A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	24km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	54A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	21km	
Total Transformer Capacity of secondary substations CAP_{B1}	2765kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	WINNEBA

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
380A

<Trank Line 1>

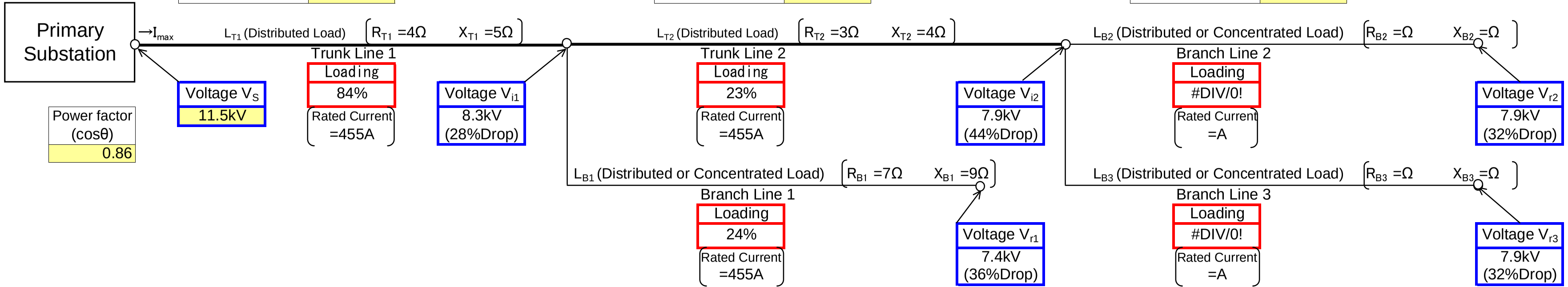
Load L_{T1}	166A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	15km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4345kVA	

<Trank Line 2>

Load L_{T2}	105A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2765kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	109A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	24km	
Total Transformer Capacity of secondary substations CAP_{B1}	2865kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	ASIKUMA

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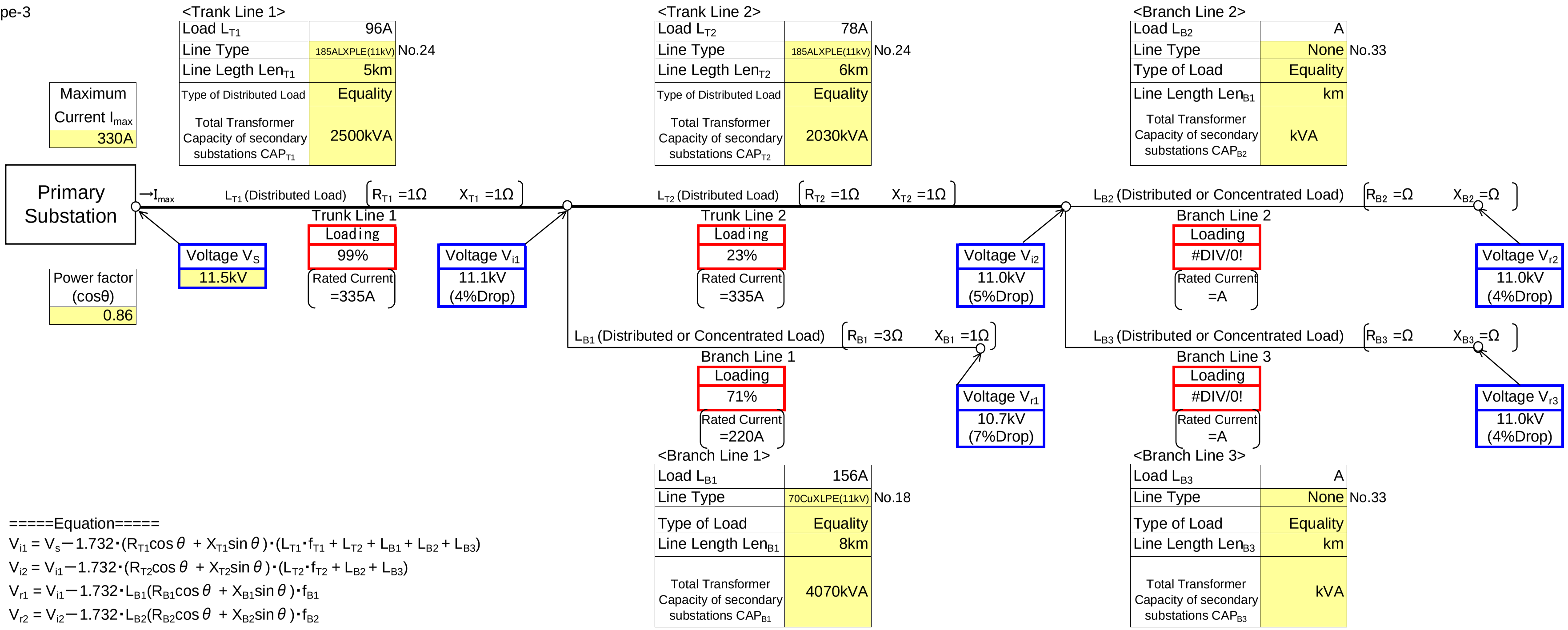
Type-3



<Trank Line 1>

Load L_{T1}	96A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	78A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	156A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	PRASO

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
54A

<Trank Line 1>

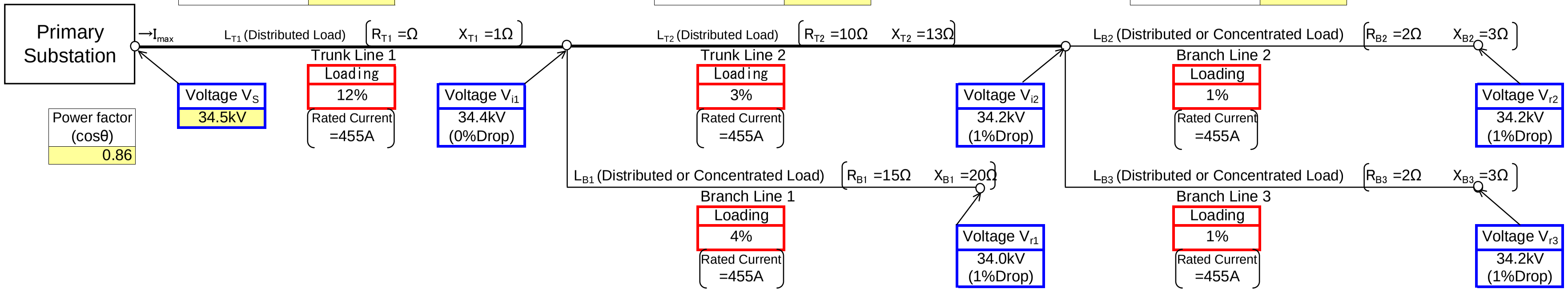
Load L_{T1}	20A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5200kVA	

<Trank Line 2>

Load L_{T2}	7A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	37km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	3A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B2}	750kVA	



<Branch Line 1>

Load L_{B1}	20A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	56km	
Total Transformer Capacity of secondary substations CAP_{B1}	5350kVA	

<Branch Line 3>

Load L_{B3}	4A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	7km	
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	SALTPOND

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	17A
Line Type	AAC120mm2 No.7
Line Legth Len_{T1}	35km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T1}	1300kVA

<Trank Line 2>

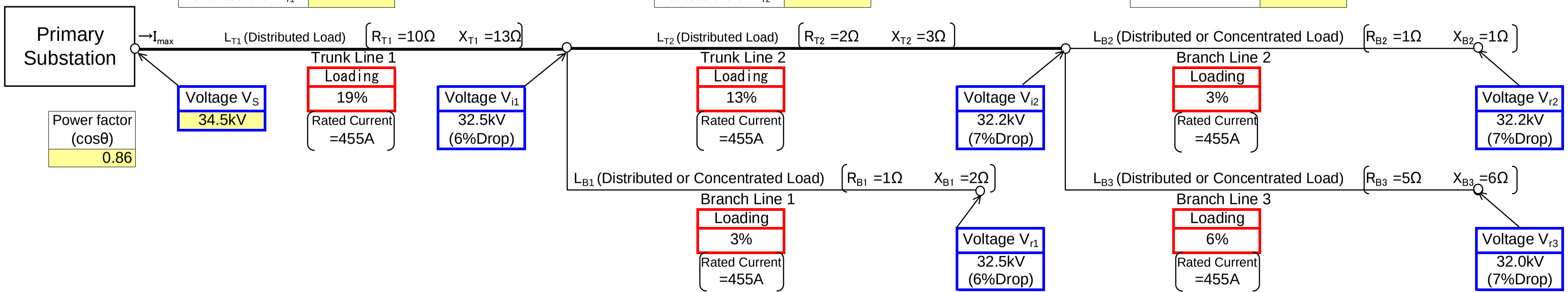
Load L_{T2}	18A
Line Type	AAC120mm2 No.7
Line Legth Len_{T2}	9km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T2}	1400kVA

<Branch Line 2>

Load L_{B2}	13A
Line Type	AAC120mm2 No.7
Type of Load	Equality
Line Length Len_{B1}	3km
Total Transformer Capacity of secondary substations CAP_{B2}	980kVA

Maximum Current I_{max}
86A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	12A
Line Type	AAC120mm2 No.7
Type of Load	Equality
Line Length Len_{B1}	5km
Total Transformer Capacity of secondary substations CAP_{B1}	950kVA

<Branch Line 3>

Load L_{B3}	26A
Line Type	AAC120mm2 No.7
Type of Load	Equality
Line Length Len_{B3}	18km
Total Transformer Capacity of secondary substations CAP_{B3}	2050kVA

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	FOSU

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	23A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	28km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3125kVA	

<Trank Line 2>

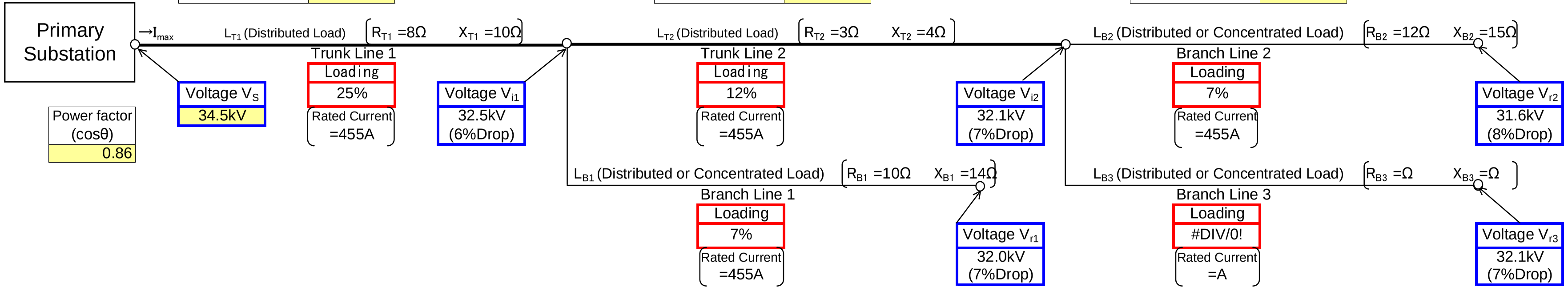
Load L_{T2}	22A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2950kVA	

<Branch Line 2>

Load L_{B2}	34A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	43km	
Total Transformer Capacity of secondary substations CAP_{B2}	4605kVA	

Maximum Current I_{max}
112A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	34A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	38km	
Total Transformer Capacity of secondary substations CAP_{B1}	4605kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	RIDGES

: Input data in colored cells

Type-3

Maximum Current I_{max}	120A
Power factor (cosθ)	0.86

<Trank Line 1>

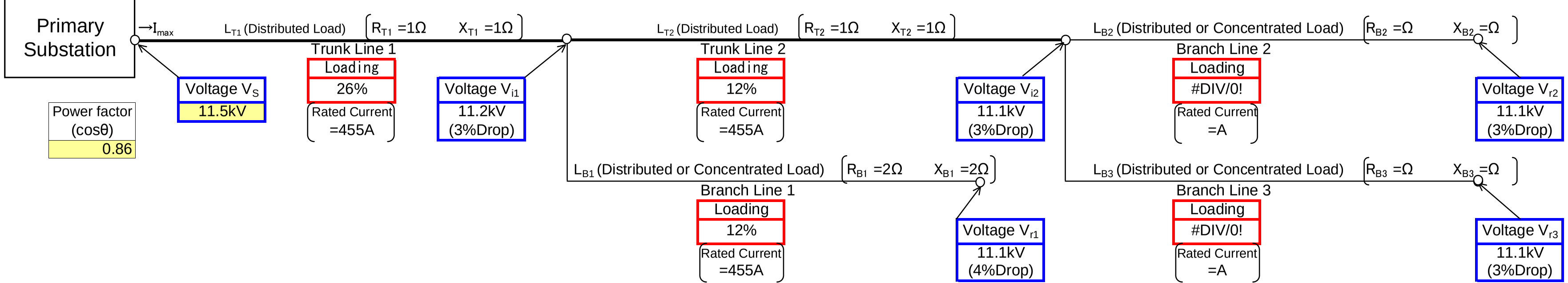
Load L_{T1}	14A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

<Trank Line 2>

Load L_{T2}	53A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	53A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	6km	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	ELMINA

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}	320A
Power factor (cosθ)	0.86

<Trank Line 1>

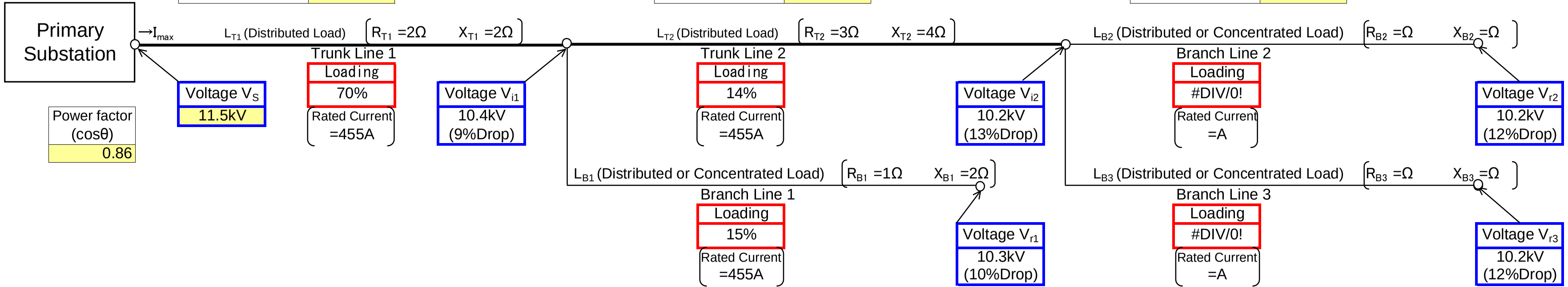
Load L_{T1}	188A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7525kVA	

<Trank Line 2>

Load L_{T2}	63A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	11km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2500kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	69A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	4km	
Total Transformer Capacity of secondary substations CAP_{B1}	2750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

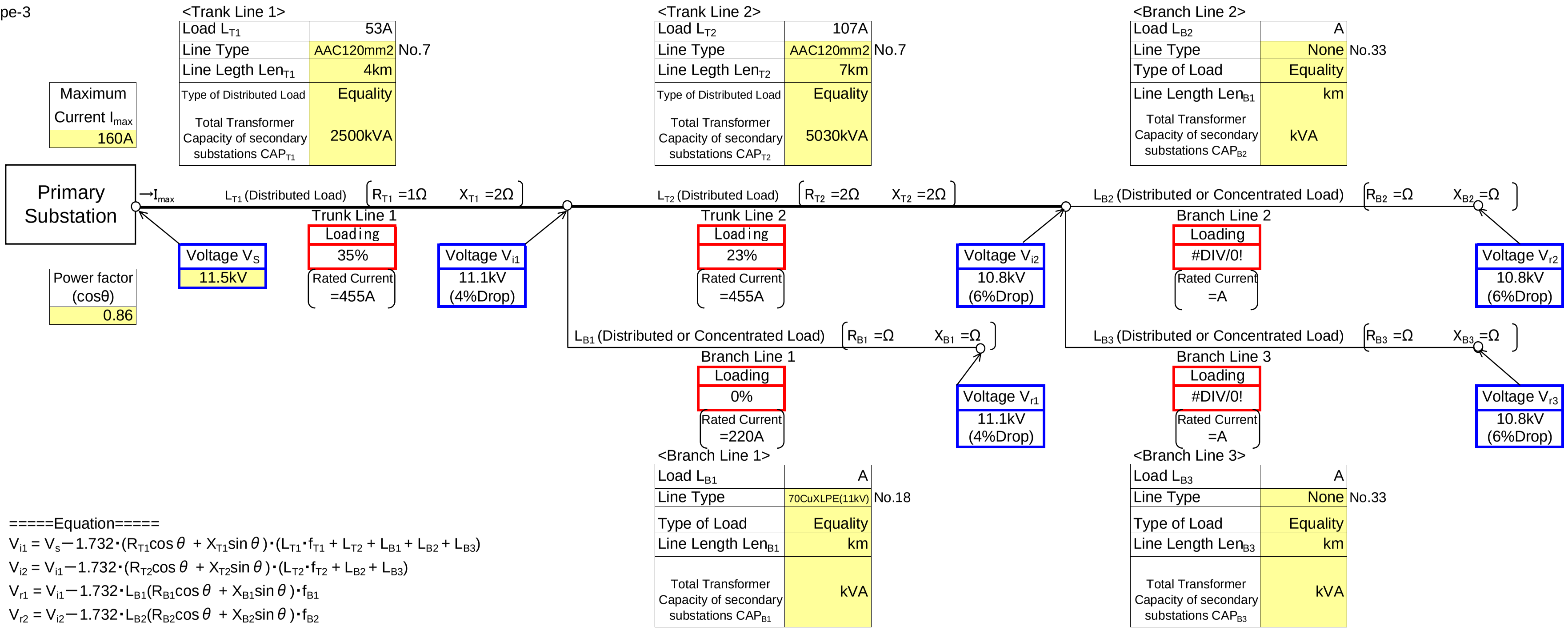
V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 3

: Input data in colored cells

Type-3



Maximum Current I_{max}
160A

Power factor (cosθ)
0.86

<Trank Line 1>

Load L_{T1}	53A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	107A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 1

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
120A

<Trank Line 1>

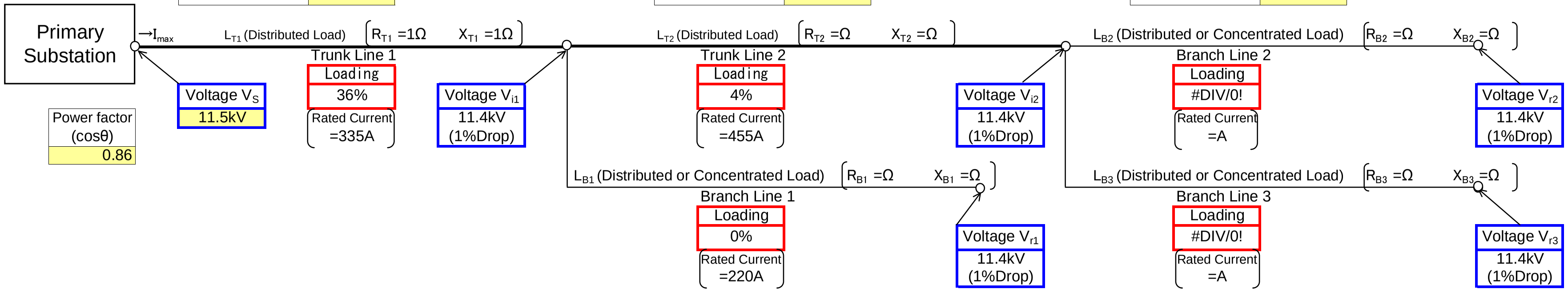
Load L_{T1}	108A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1845kVA	

<Trank Line 2>

Load L_{T2}	12A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 2

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
330A

Power factor (cosθ)
0.86

<Trank Line 1>

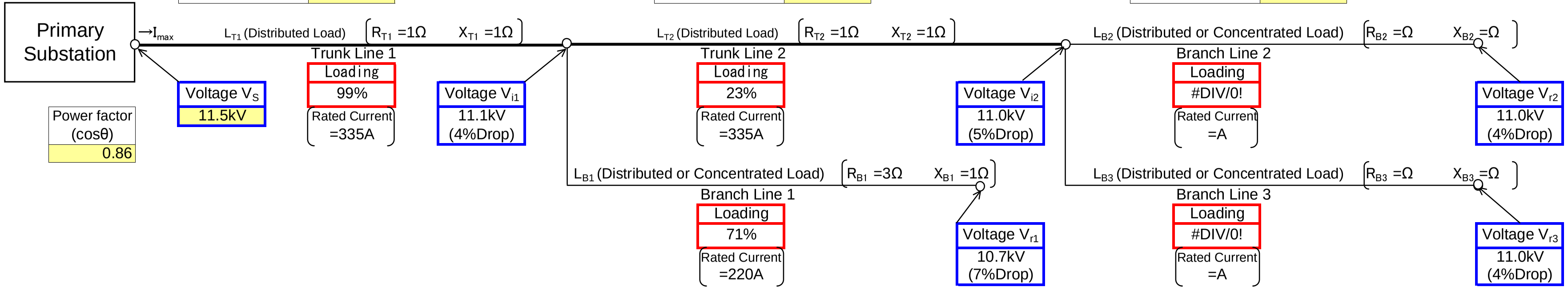
Load L_{T1}	96A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	78A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	156A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	PRASO

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
54A

<Trank Line 1>

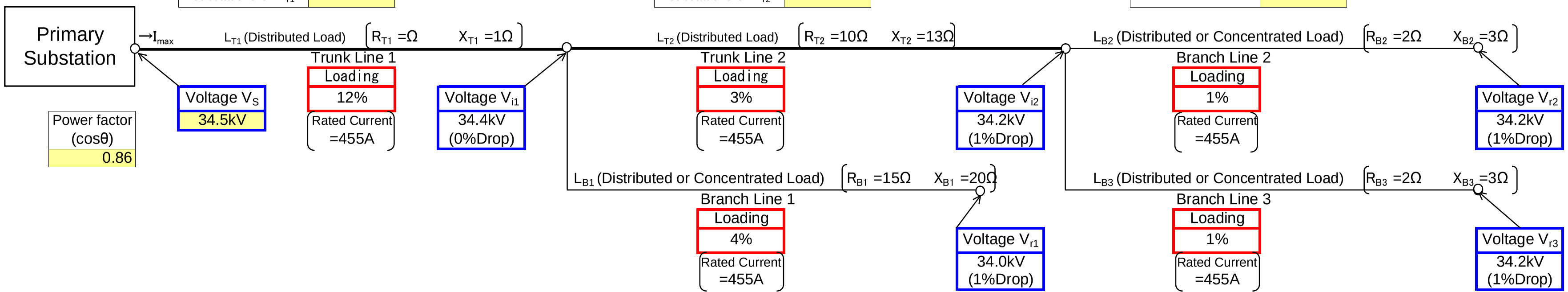
Load L_{T1}	20A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5200kVA	

<Trank Line 2>

Load L_{T2}	7A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	37km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	3A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B2}	750kVA	



<Branch Line 1>

Load L_{B1}	20A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	56km	
Total Transformer Capacity of secondary substations CAP_{B1}	5350kVA	

<Branch Line 3>

Load L_{B3}	4A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	7km	
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	PRASO

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
57A

<Trank Line 1>

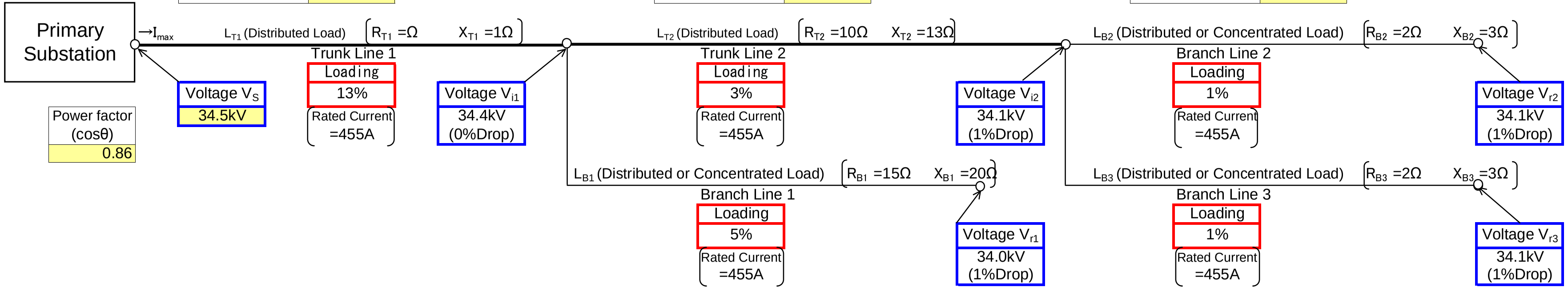
Load L_{T1}	21A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5200kVA	

<Trank Line 2>

Load L_{T2}	8A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	37km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	3A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B2}	750kVA	



<Branch Line 1>

Load L_{B1}	21A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	56km	
Total Transformer Capacity of secondary substations CAP_{B1}	5350kVA	

<Branch Line 3>

Load L_{B3}	4A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	7km	
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	PRASO

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	22A
Line Type	AAC120mm2 No.7
Line Legth Len_{T1}	2km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T1}	5200kVA

<Trank Line 2>

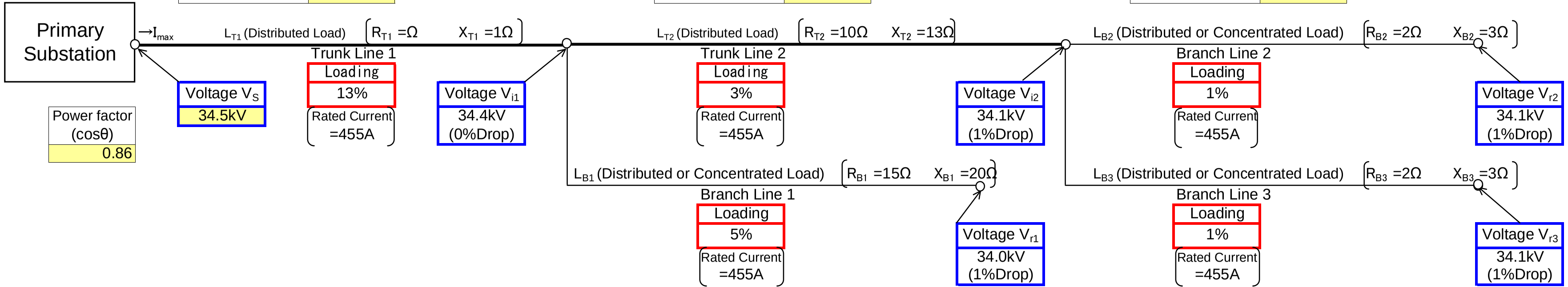
Load L_{T2}	8A
Line Type	AAC120mm2 No.7
Line Legth Len_{T2}	37km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA

<Branch Line 2>

Load L_{B2}	3A
Line Type	AAC120mm2 No.7
Type of Load	Equality
Line Length Len_{B1}	8km
Total Transformer Capacity of secondary substations CAP_{B2}	750kVA

Maximum Current I_{max}
60A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	23A
Line Type	AAC120mm2 No.7
Type of Load	Equality
Line Length Len_{B1}	56km
Total Transformer Capacity of secondary substations CAP_{B1}	5350kVA

<Branch Line 3>

Load L_{B3}	4A
Line Type	AAC120mm2 No.7
Type of Load	Equality
Line Length Len_{B3}	7km
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	PRASO

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	23A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5200kVA	

<Trank Line 2>

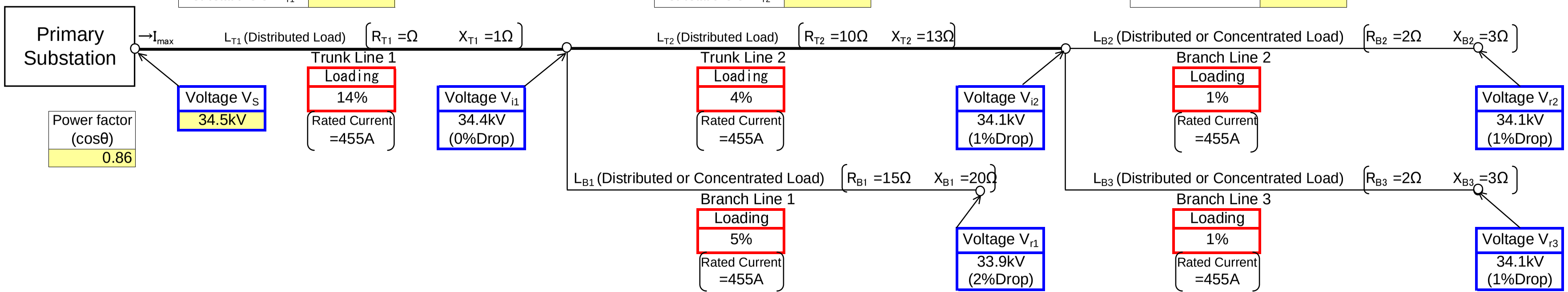
Load L_{T2}	9A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	37km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	3A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B2}	750kVA	

Maximum Current I_{max}
64A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	24A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	56km	
Total Transformer Capacity of secondary substations CAP_{B1}	5350kVA	

<Branch Line 3>

Load L_{B3}	5A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	7km	
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA	

=====Equation=====

$$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$$

$$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$$

$$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$$

$$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$$

$$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$$

$$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}
CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	PRASO

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	25A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5200kVA	

<Trank Line 2>

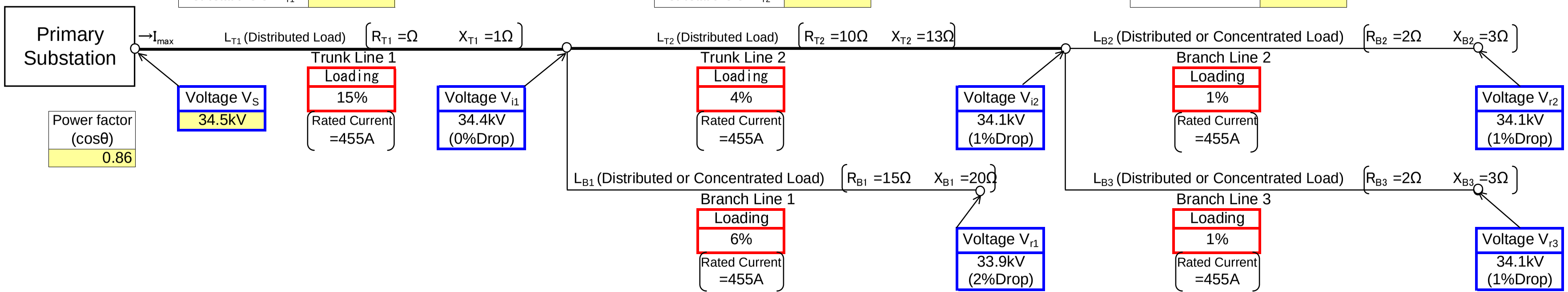
Load L_{T2}	9A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	37km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	4A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B2}	750kVA	

Maximum Current I_{max}
68A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	26A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	56km	
Total Transformer Capacity of secondary substations CAP_{B1}	5350kVA	

<Branch Line 3>

Load L_{B3}	5A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	7km	
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

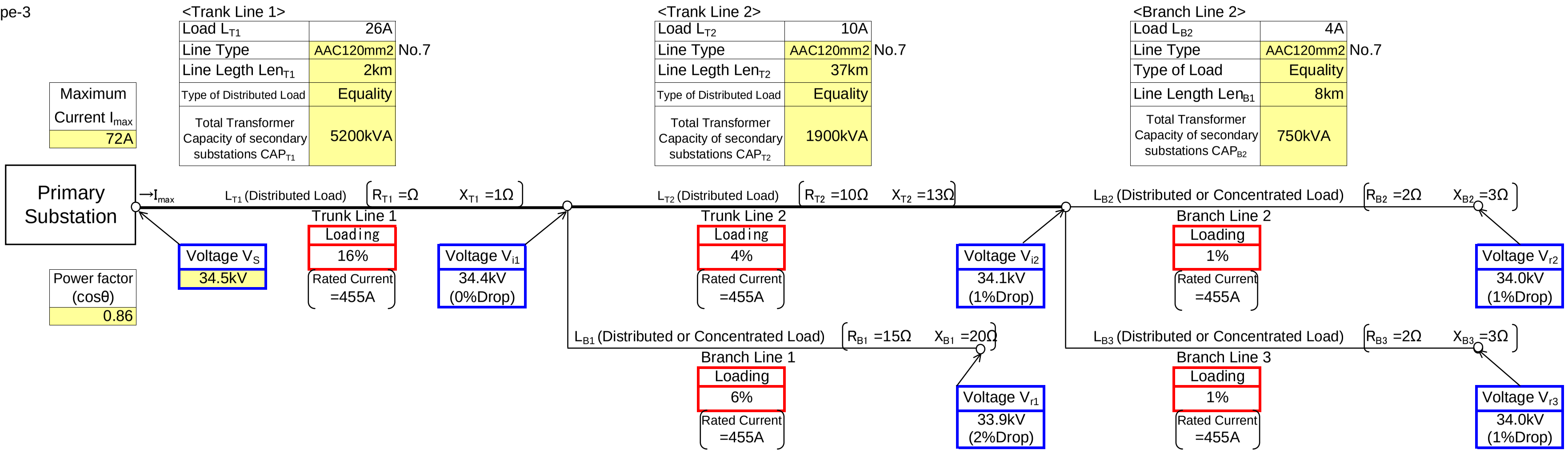
V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	PRASO

▨ : Input data in colored cells

Type-3



<Trank Line 1>

Load L_{T1}	26A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5200kVA	

<Trank Line 2>

Load L_{T2}	10A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	37km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	4A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B2}	750kVA	

<Branch Line 1>

Load L_{B1}	27A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	56km	
Total Transformer Capacity of secondary substations CAP_{B1}	5350kVA	

<Branch Line 3>

Load L_{B3}	5A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	7km	
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	PRASO

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
76A

Power factor (cosθ)
0.86

<Trank Line 1>

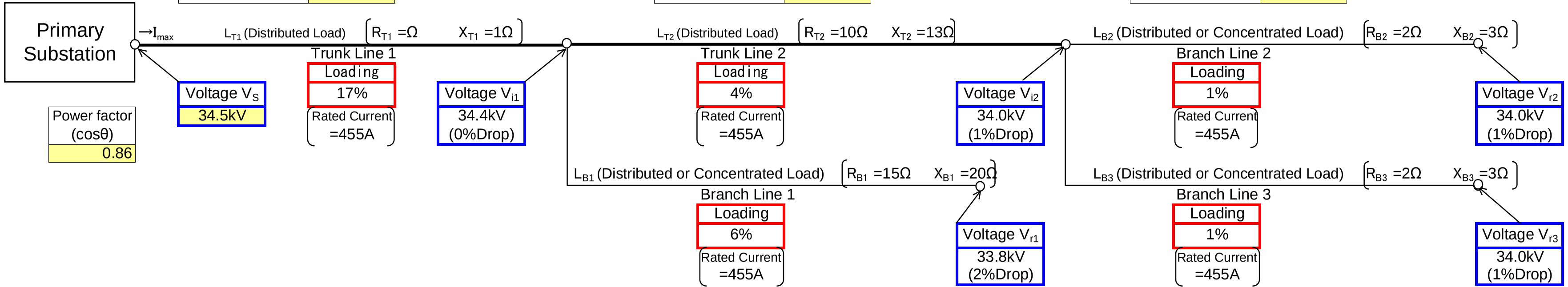
Load L_{T1}	28A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5200kVA	

<Trank Line 2>

Load L_{T2}	10A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	37km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	4A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B2}	750kVA	



<Branch Line 1>

Load L_{B1}	29A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	56km	
Total Transformer Capacity of secondary substations CAP_{B1}	5350kVA	

<Branch Line 3>

Load L_{B3}	6A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	7km	
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	PRASO

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
80A

Power factor (cosθ)
0.86

<Trank Line 1>

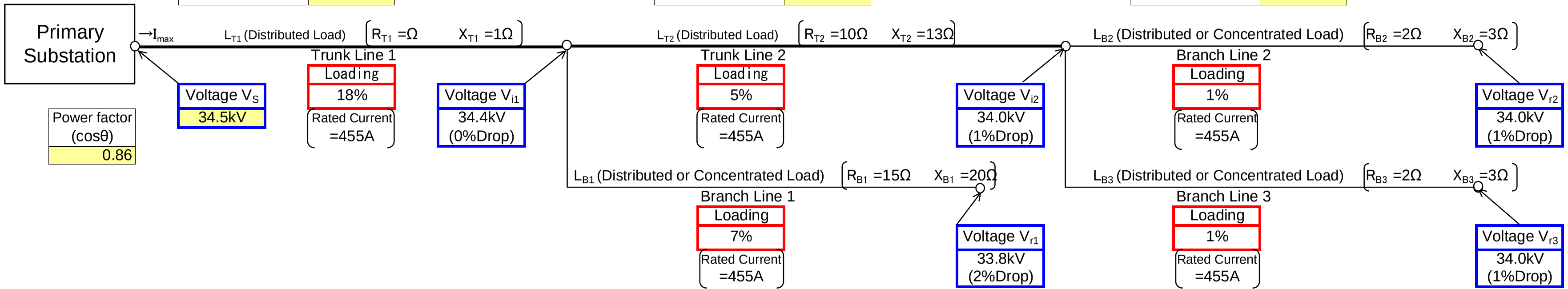
Load L_{T1}	29A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5200kVA	

<Trank Line 2>

Load L_{T2}	11A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	37km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	4A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B2}	750kVA	



<Branch Line 1>

Load L_{B1}	30A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	56km	
Total Transformer Capacity of secondary substations CAP_{B1}	5350kVA	

<Branch Line 3>

Load L_{B3}	6A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	7km	
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	PRASO

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	31A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5200kVA	

<Trank Line 2>

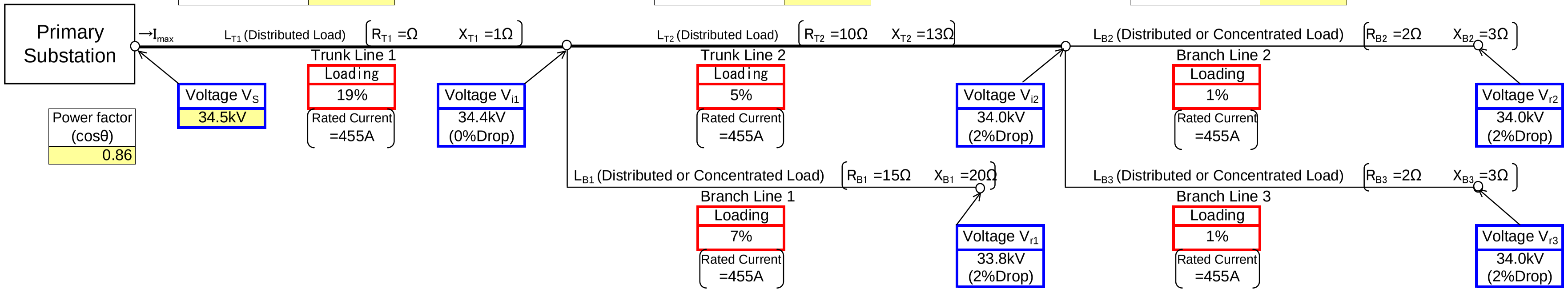
Load L_{T2}	11A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	37km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	4A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B2}	750kVA	

Maximum Current I_{max}
85A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	32A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	56km	
Total Transformer Capacity of secondary substations CAP_{B1}	5350kVA	

<Branch Line 3>

Load L_{B3}	6A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	7km	
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	PRASO

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

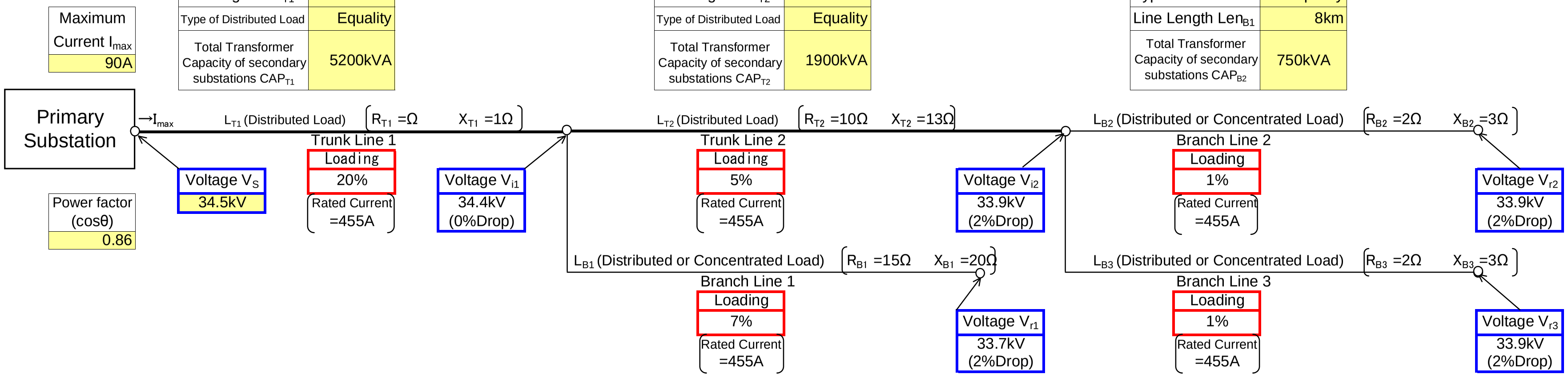
Load L_{T1}	33A
Line Type	AAC120mm2 No.7
Line Legth Len_{T1}	2km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T1}	5200kVA

<Trank Line 2>

Load L_{T2}	12A
Line Type	AAC120mm2 No.7
Line Legth Len_{T2}	37km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA

<Branch Line 2>

Load L_{B2}	5A
Line Type	AAC120mm2 No.7
Type of Load	Equality
Line Length Len_{B1}	8km
Total Transformer Capacity of secondary substations CAP_{B2}	750kVA



<Branch Line 1>

Load L_{B1}	34A
Line Type	AAC120mm2 No.7
Type of Load	Equality
Line Length Len_{B1}	56km
Total Transformer Capacity of secondary substations CAP_{B1}	5350kVA

<Branch Line 3>

Load L_{B3}	7A
Line Type	AAC120mm2 No.7
Type of Load	Equality
Line Length Len_{B3}	7km
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} ∕ (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} ∕ (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} ∕ (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} ∕ (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} ∕ (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

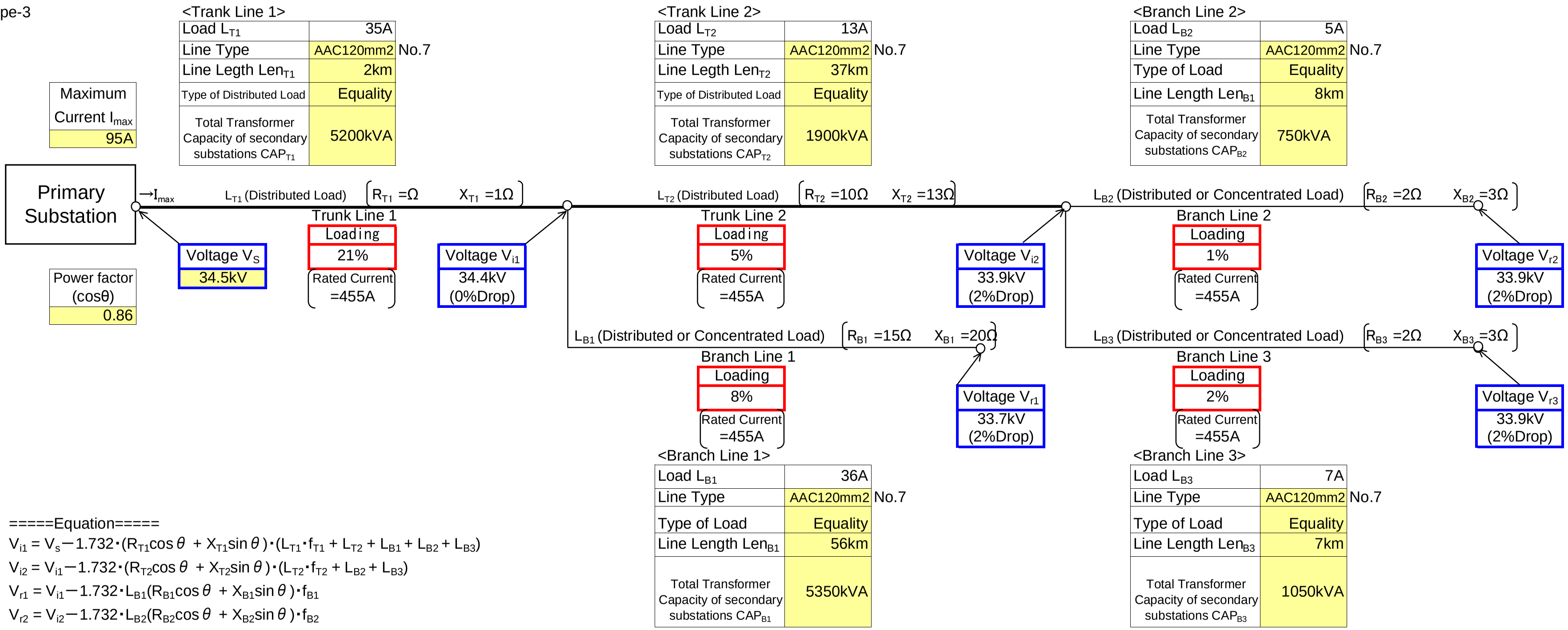
R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	PRASO

: Input data in colored cells

Type-3



Maximum Current I_{max}
95A

Power factor (cosθ)
0.86

<Trank Line 1>

Load L_{T1}	35A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5200kVA	

<Trank Line 2>

Load L_{T2}	13A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	37km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	5A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B2}	750kVA	

<Branch Line 1>

Load L_{B1}	36A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	56km	
Total Transformer Capacity of secondary substations CAP_{B1}	5350kVA	

<Branch Line 3>

Load L_{B3}	7A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	7km	
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	PRASO

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
100A

<Trank Line 1>

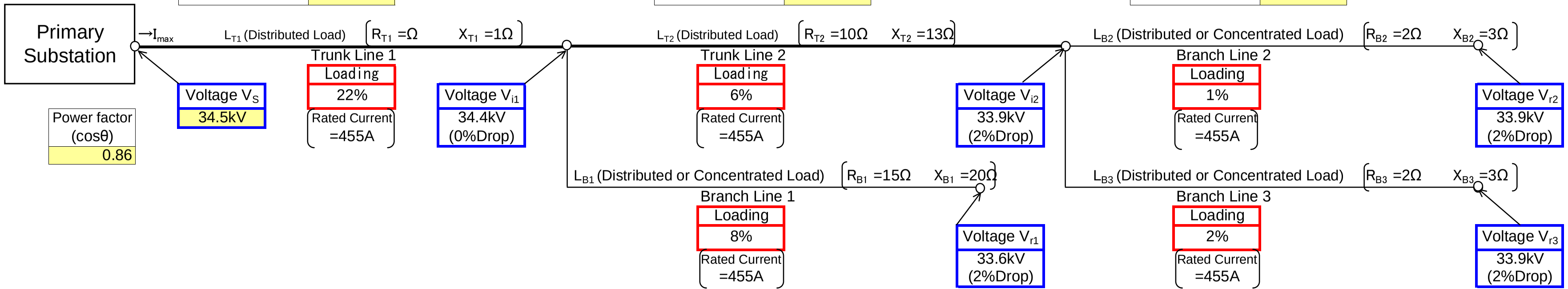
Load L_{T1}	36A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5200kVA	

<Trank Line 2>

Load L_{T2}	13A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	37km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1900kVA	

<Branch Line 2>

Load L_{B2}	5A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B2}	750kVA	



<Branch Line 1>

Load L_{B1}	38A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	56km	
Total Transformer Capacity of secondary substations CAP_{B1}	5350kVA	

<Branch Line 3>

Load L_{B3}	7A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	7km	
Total Transformer Capacity of secondary substations CAP_{B3}	1050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	RIDGES

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	14A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

<Trank Line 2>

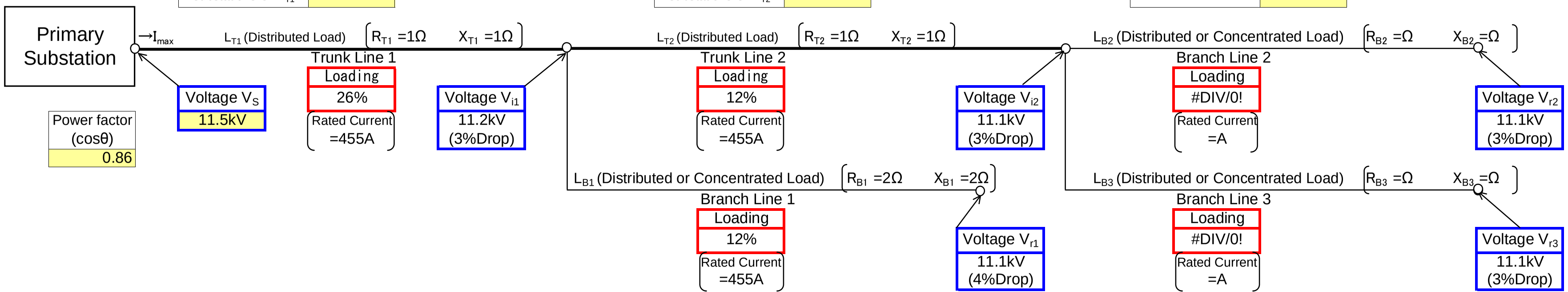
Load L_{T2}	53A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
120A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	53A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	6km	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	RIDGES

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
127A

Power factor (cosθ)
0.86

<Trank Line 1>

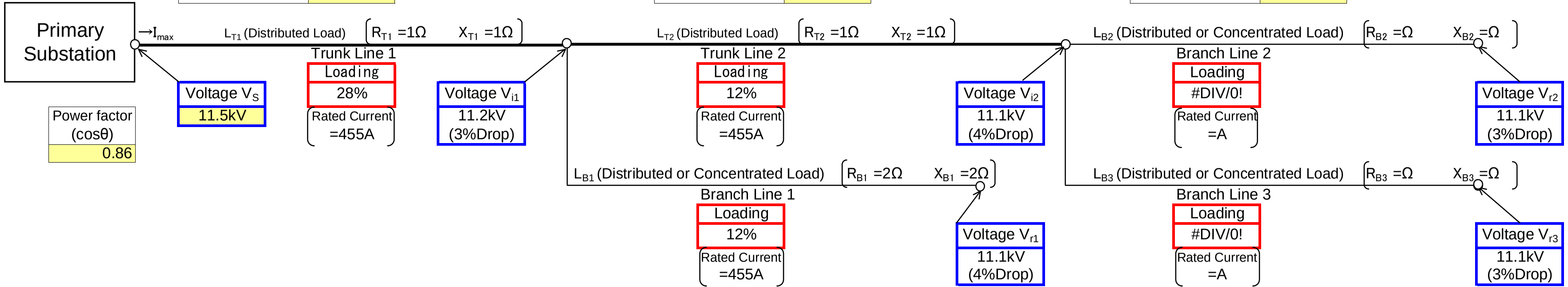
Load L_{T1}	15A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

<Trank Line 2>

Load L_{T2}	56A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	56A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	6km	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	RIDGES

: Input data in colored cells

Type-3

Maximum Current I_{max}
134A

Power factor (cosθ)
0.86

<Trank Line 1>

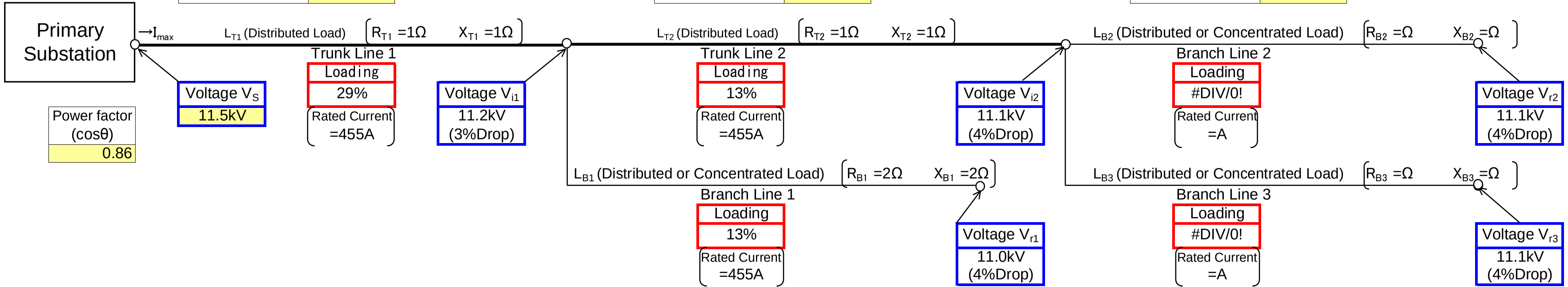
Load L_{T1}	16A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

<Trank Line 2>

Load L_{T2}	59A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	59A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	6km	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	RIDGES

: Input data in colored cells

Type-3

Maximum Current I_{max}
142A

<Trank Line 1>

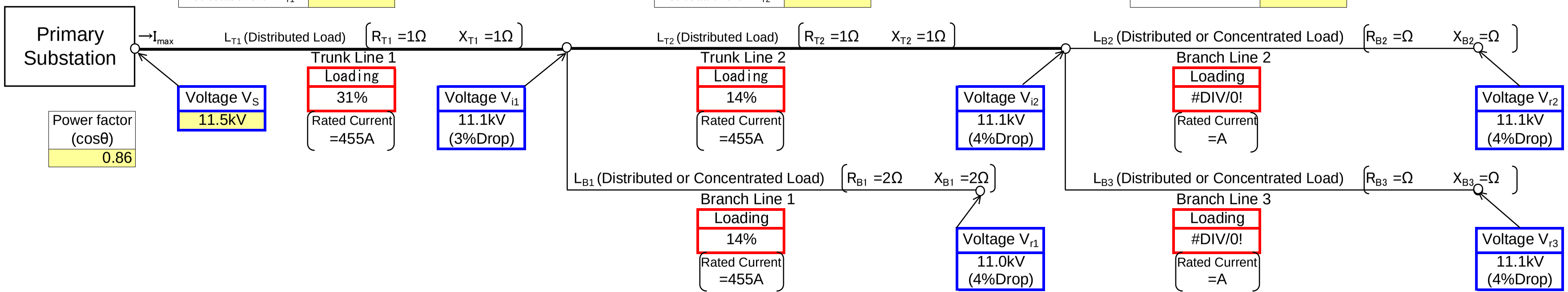
Load L_{T1}	17A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

<Trank Line 2>

Load L_{T2}	63A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	63A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	6km	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	RIDGES

▭ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	18A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

<Trank Line 2>

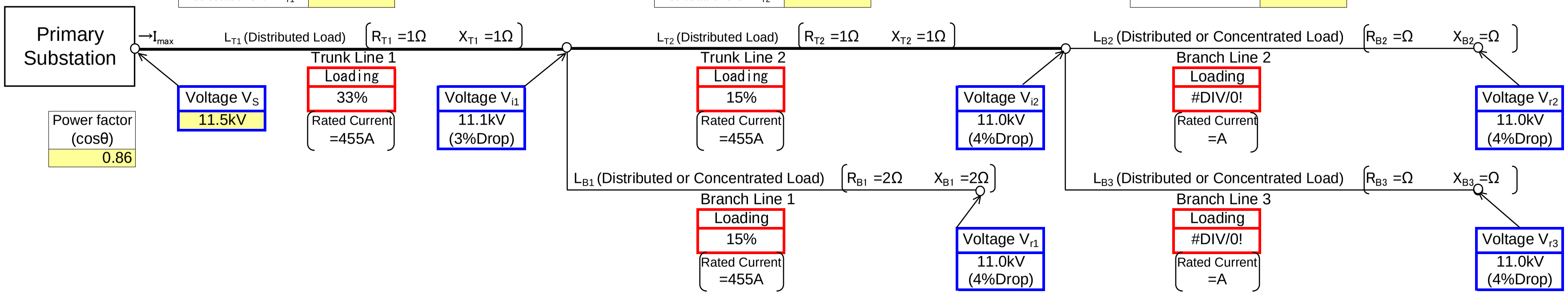
Load L_{T2}	66A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
150A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	66A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	6km	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	RIDGES

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
159A

<Trank Line 1>

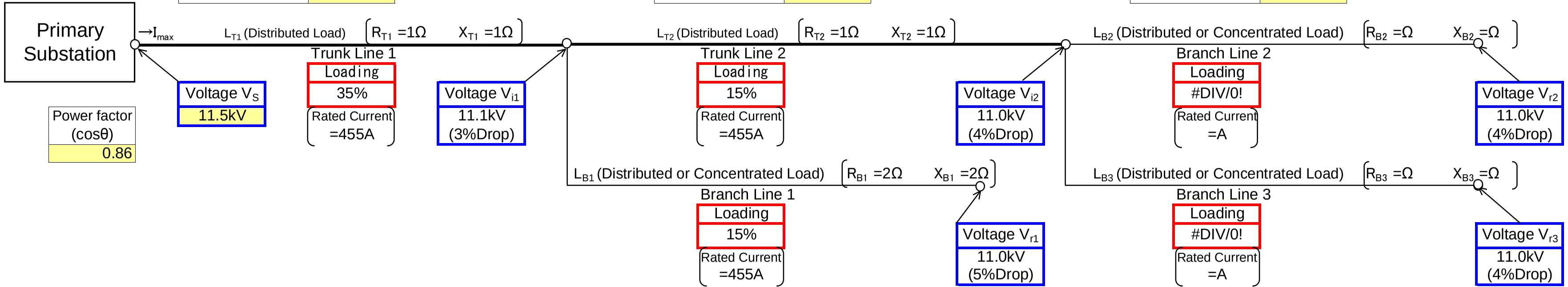
Load L_{T1}	19A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

<Trank Line 2>

Load L_{T2}	70A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	70A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	6km	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	RIDGES

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	20A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

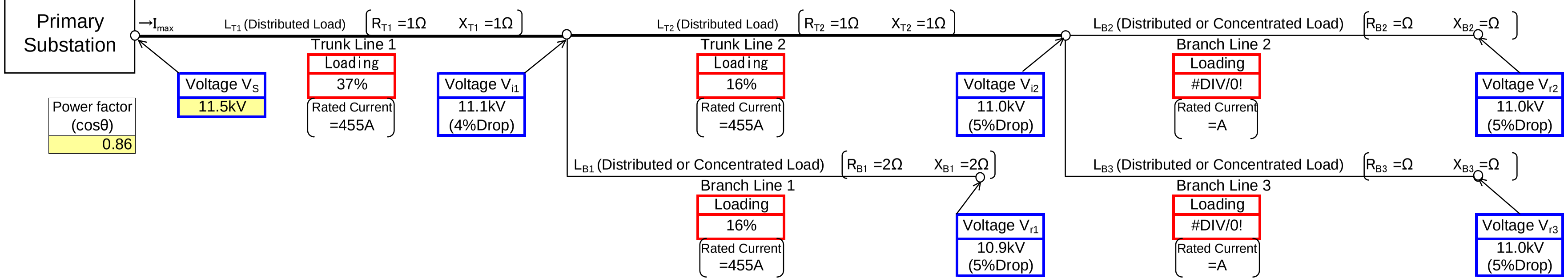
<Trank Line 2>

Load L_{T2}	74A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
168A



<Branch Line 1>

Load L_{B1}	74A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	6km	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	RIDGES

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	21A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

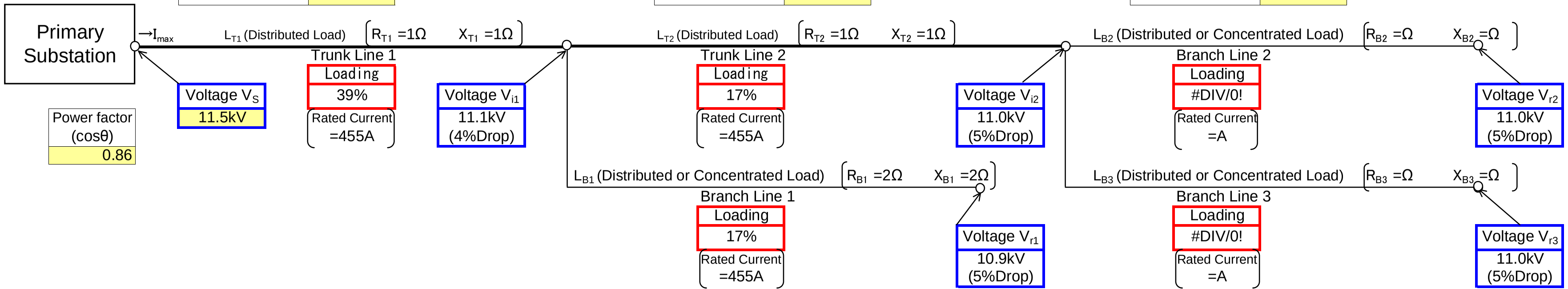
<Trank Line 2>

Load L_{T2}	79A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
178A



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	79A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	6km	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	RIDGES

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
188A

<Trank Line 1>

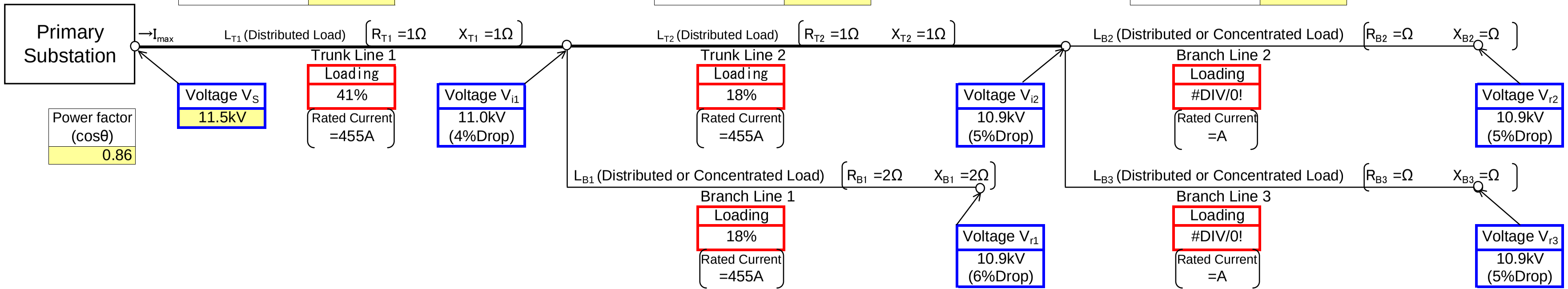
Load L_{T1}	22A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

<Trank Line 2>

Load L_{T2}	83A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	83A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	6km	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	RIDGES

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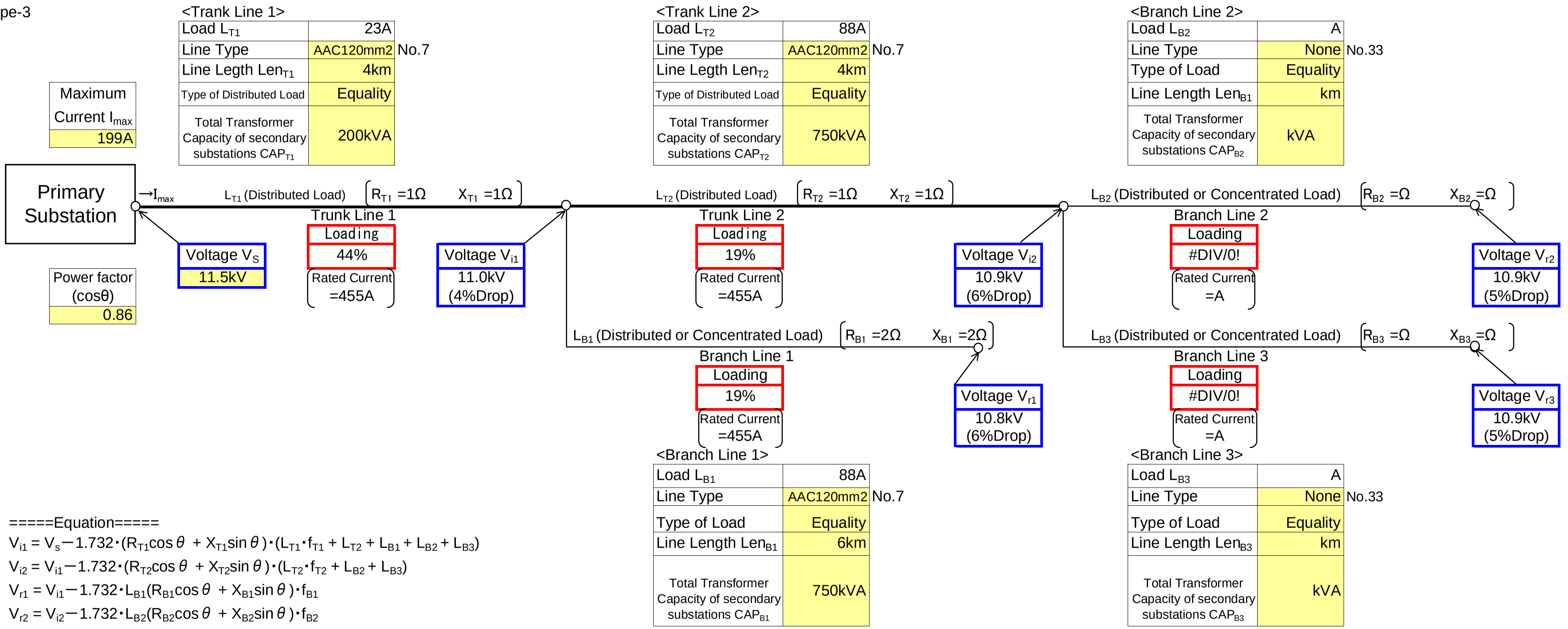
Type-3



Maximum Current I_{max}	199A

Power factor (cosθ)	0.86

<Trank Line 1>

Load L_{T1}	23A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

<Trank Line 2>

Load L_{T2}	88A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	88A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	6km	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	RIDGES

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Type-3

<Trank Line 1>

Load L_{T1}	25A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

<Trank Line 2>

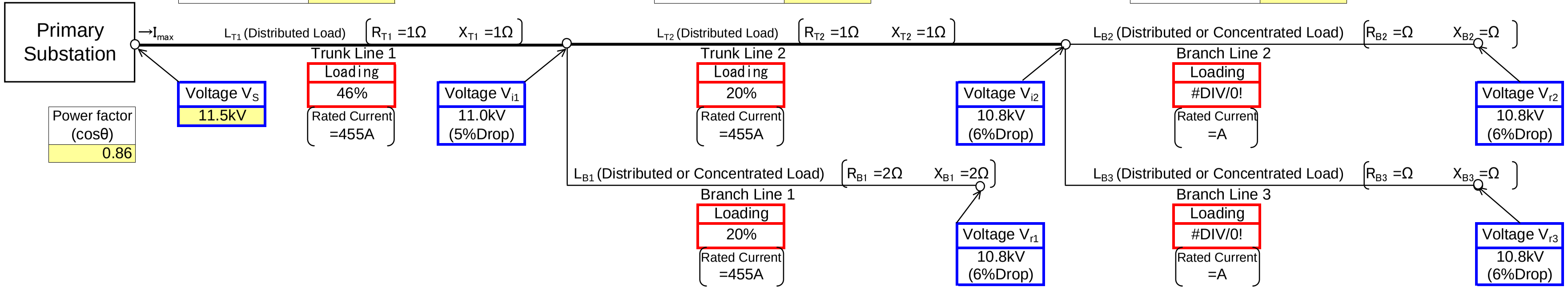
Load L_{T2}	93A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
211A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	93A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	6km	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	RIDGES

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
223A

<Trank Line 1>

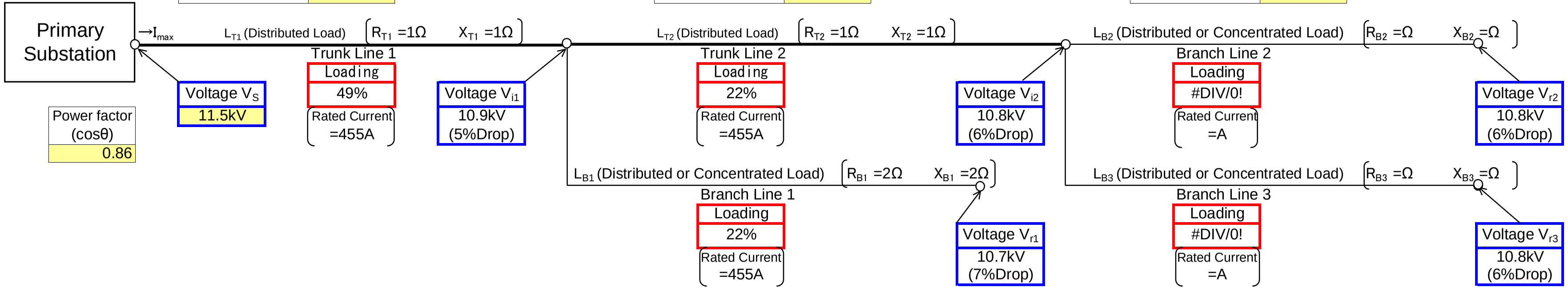
Load L_{T1}	26A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	200kVA	

<Trank Line 2>

Load L_{T2}	98A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	750kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	98A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	6km	
Total Transformer Capacity of secondary substations CAP_{B1}	750kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	SALTPOND

🟨: Input data in colored cells

Type-3

Maximum Current I_{max}
47A

<Trank Line 1>

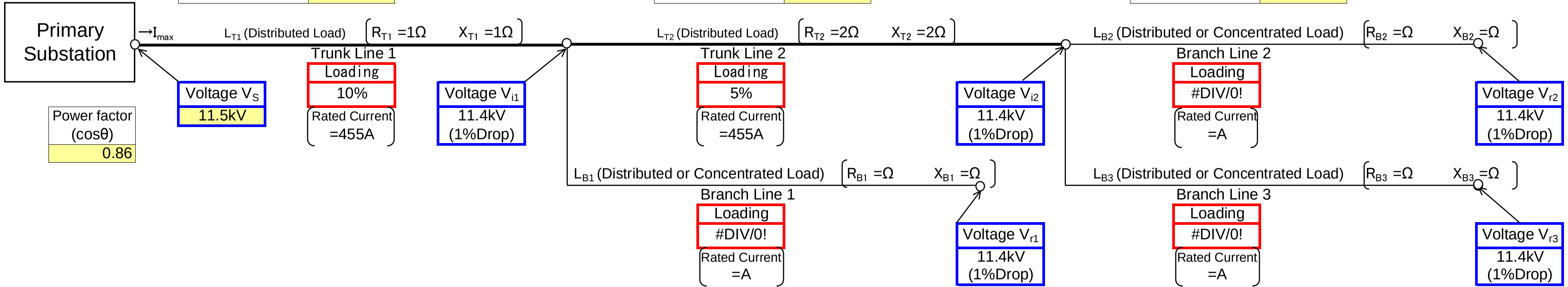
Load L_{T1}	24A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	980kVA	

<Trank Line 2>

Load L_{T2}	23A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	950kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	SALTPOND

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
50A

Power factor (cosθ)
0.86

<Trank Line 1>

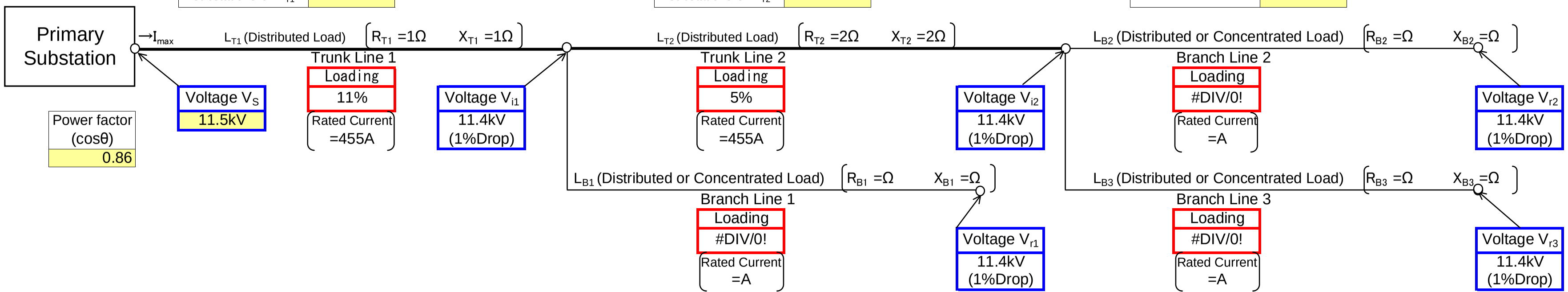
Load L_{T1}	25A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	980kVA	

<Trank Line 2>

Load L_{T2}	25A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	950kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

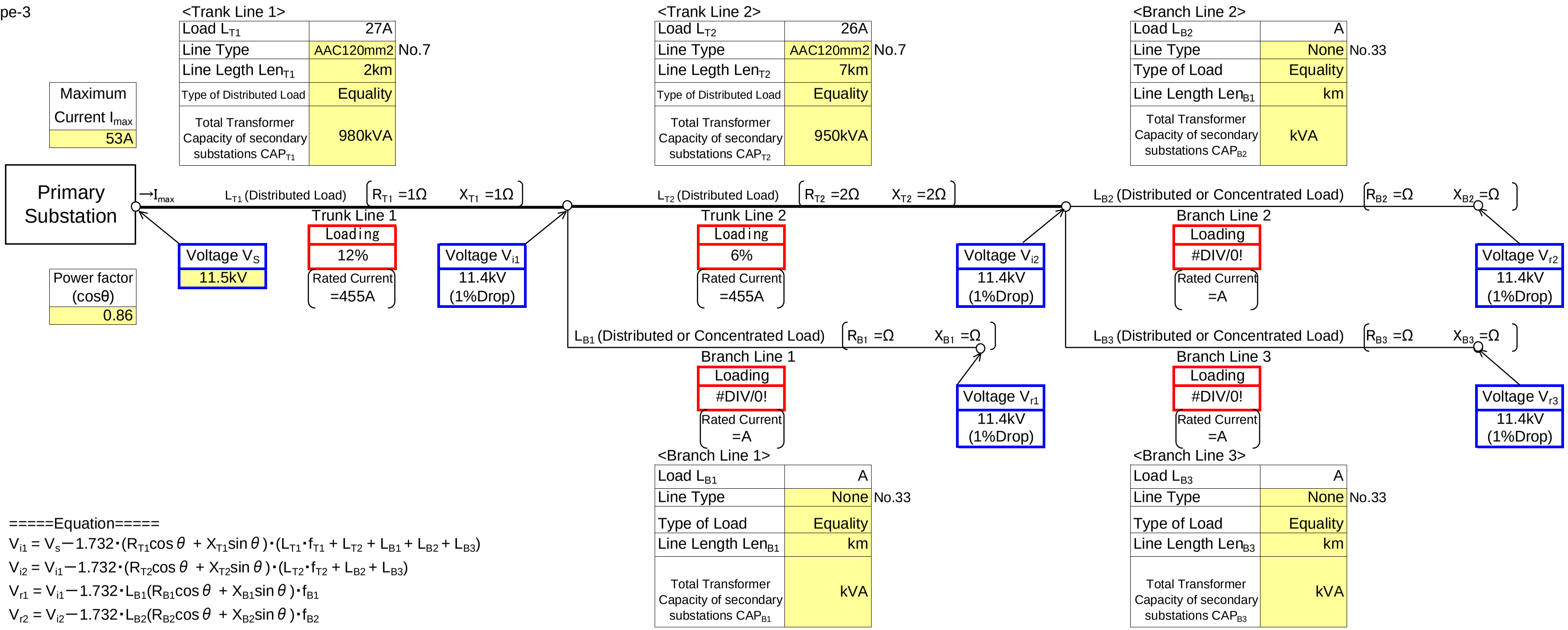
V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	SALTPOND

🟨 : Input data in colored cells

Type-3



<Trank Line 1>

Load L_{T1}	27A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	980kVA	

<Trank Line 2>

Load L_{T2}	26A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	950kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	SALTPOND

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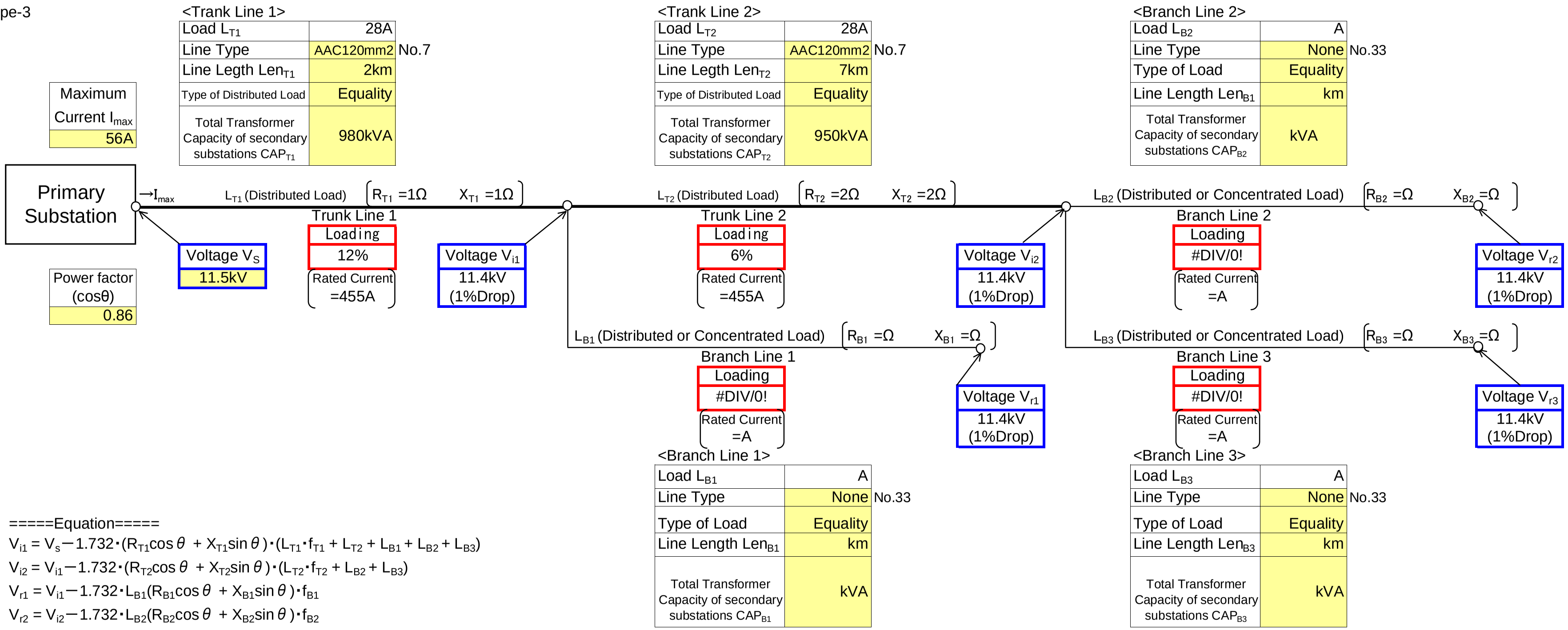
Type-3



Maximum Current I_{max}
56A

Power factor (cosθ)
0.86

<Trank Line 1>

Load L_{T1}	28A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	980kVA	

<Trank Line 2>

Load L_{T2}	28A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	950kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	SALTPOND

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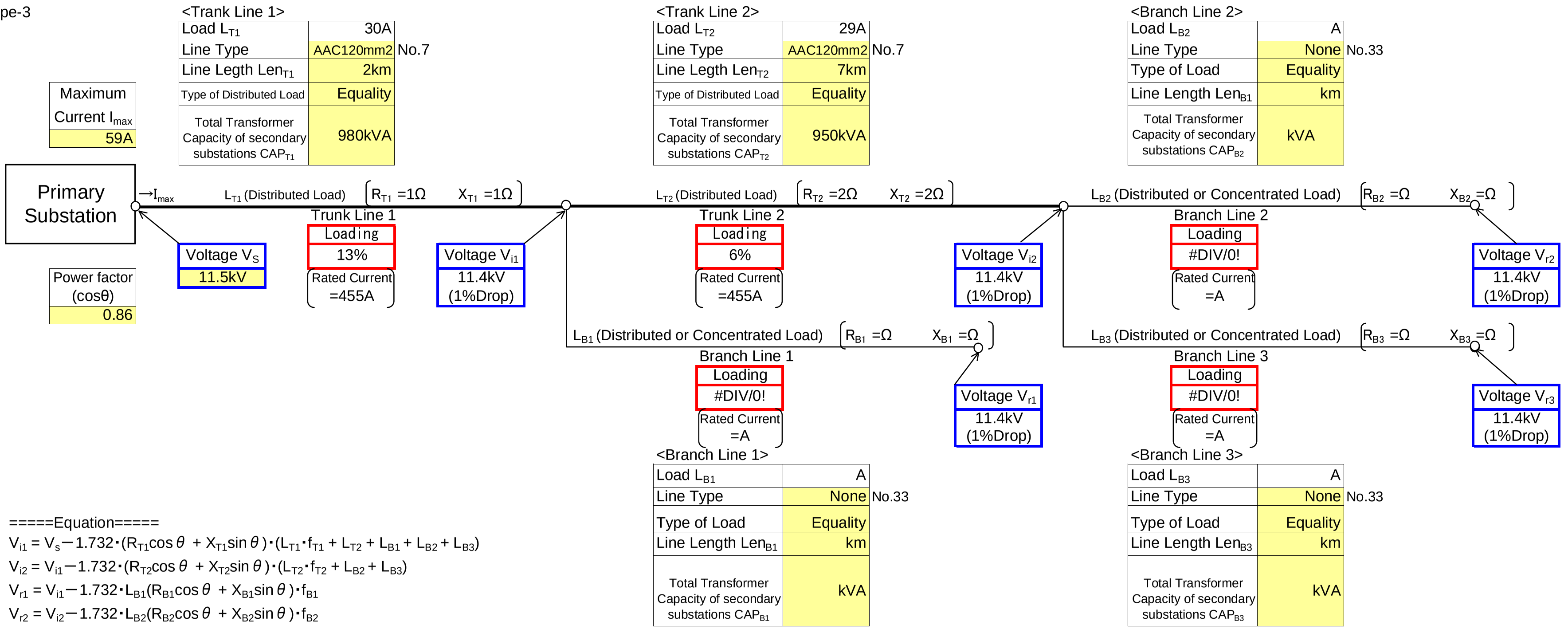
Type-3



Maximum Current I_{max}
59A

Power factor (cosθ)
0.86

<Trank Line 1>

Load L_{T1}	30A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	980kVA	

<Trank Line 2>

Load L_{T2}	29A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	950kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1} \cos\theta + X_{T1} \sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2} \cos\theta + X_{T2} \sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1} (R_{B1} \cos\theta + X_{B1} \sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2} (R_{B2} \cos\theta + X_{B2} \sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3} (R_{B3} \cos\theta + X_{B3} \sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	SALTPOND

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Type-3

<Trank Line 1>

Load L_{T1}	31A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	980kVA	

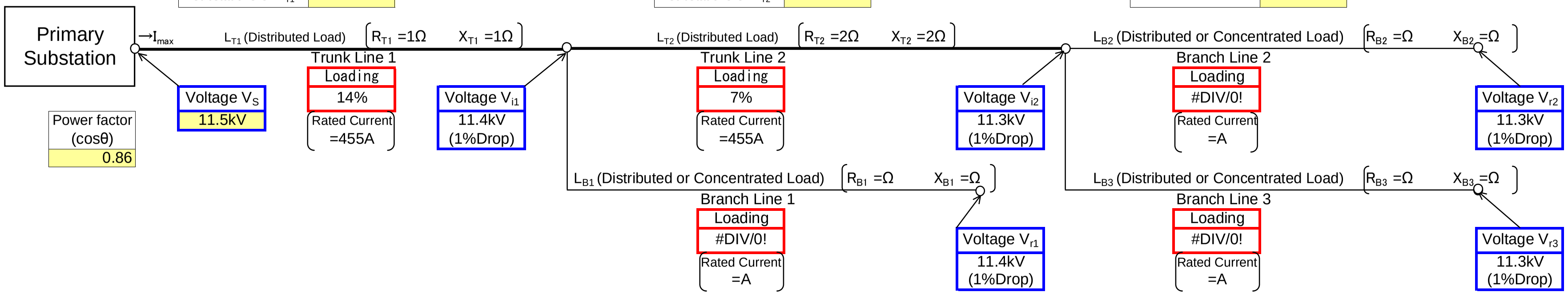
<Trank Line 2>

Load L_{T2}	31A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	950kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
62A



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	SALTPOND

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	34A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	980kVA	

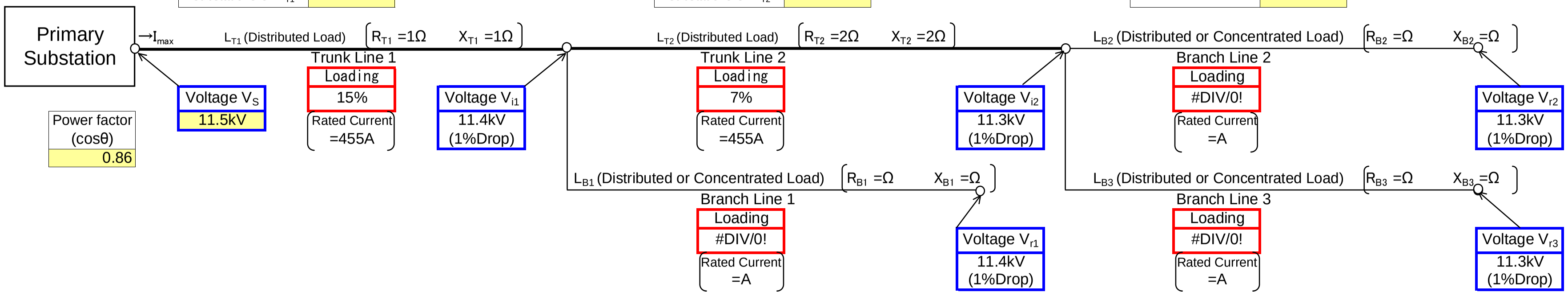
<Trank Line 2>

Load L_{T2}	32A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	950kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}	66A
Power factor (cosθ)	0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	SALTPOND

▭ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	36A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	980kVA	

<Trank Line 2>

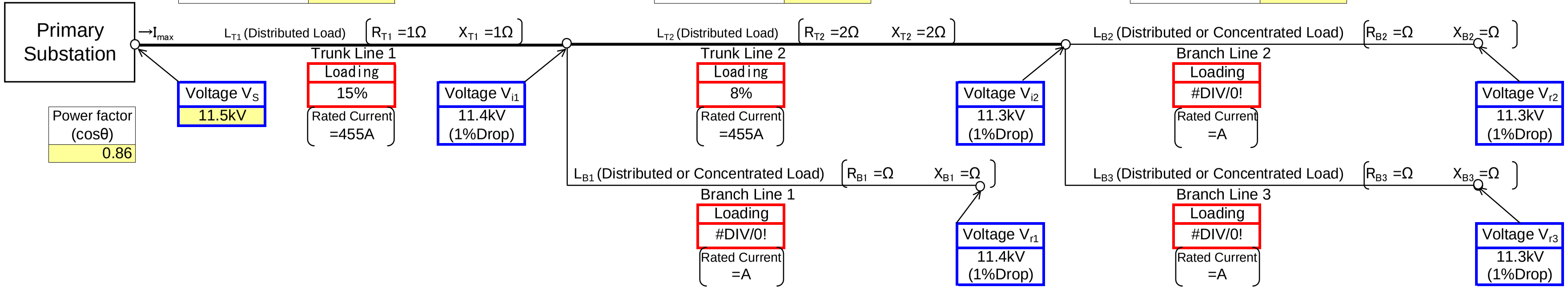
Load L_{T2}	34A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	950kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
70A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	SALTPOND

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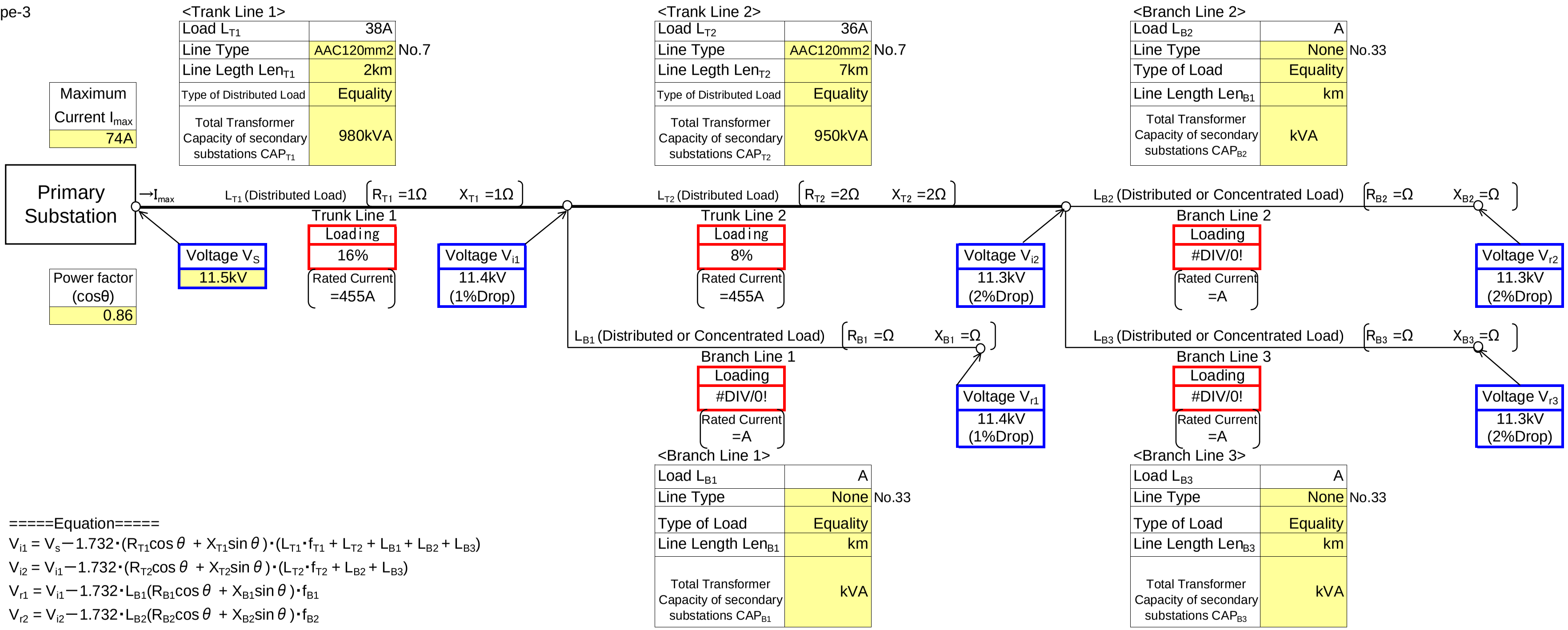
Type-3



<Trank Line 1>

Load L_{T1}	38A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	980kVA	

<Trank Line 2>

Load L_{T2}	36A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	950kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	SALTPOND
Feeder Name	SALTPOND

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	40A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	980kVA	

<Trank Line 2>

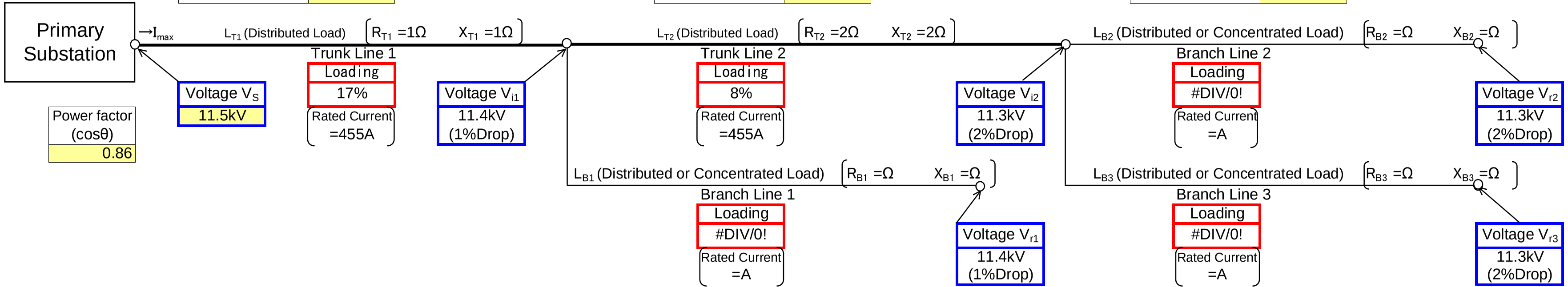
Load L_{T2}	38A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	950kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
78A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	SALTPOND

▭ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	42A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	980kVA	

<Trank Line 2>

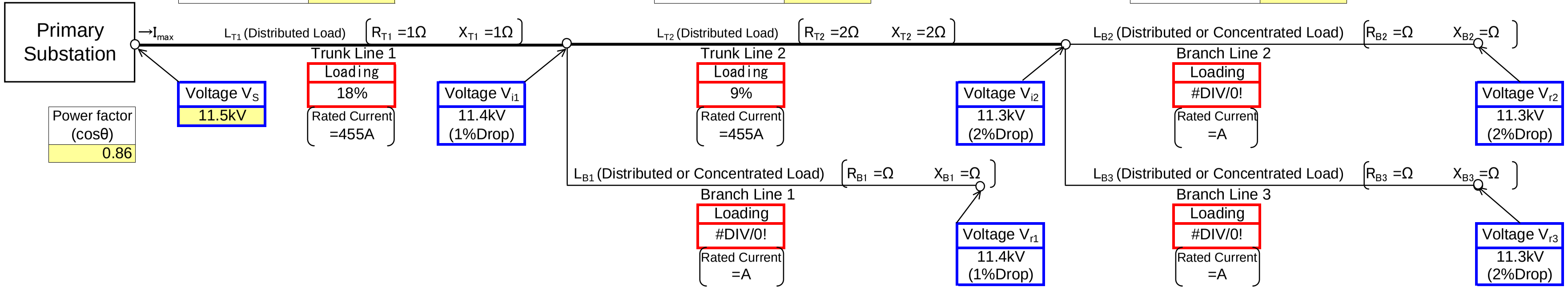
Load L_{T2}	41A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	950kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
83A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	SALTPOND
Feeder Name	SALTPOND

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
87A

Power factor (cosθ)
0.86

<Trank Line 1>

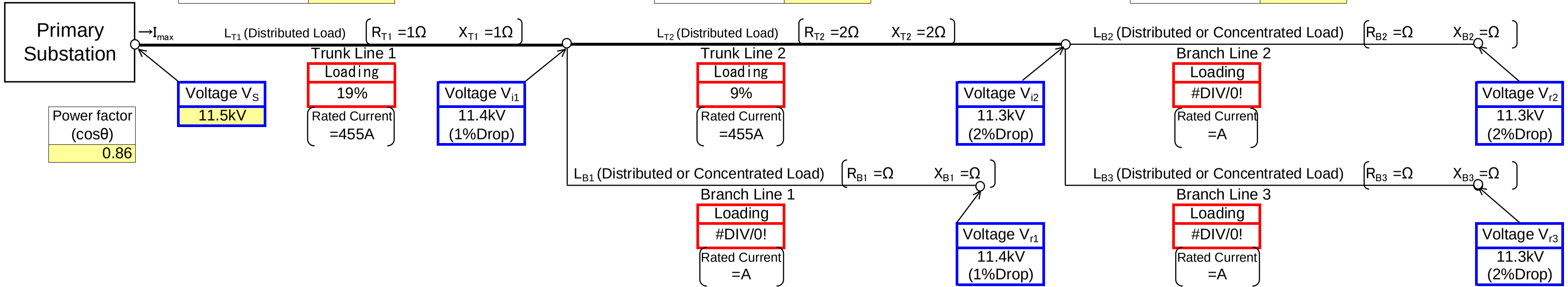
Load L_{T1}	44A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	980kVA	

<Trank Line 2>

Load L_{T2}	43A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	950kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1} \cos\theta + X_{T1} \sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2} \cos\theta + X_{T2} \sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1} (R_{B1} \cos\theta + X_{B1} \sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2} (R_{B2} \cos\theta + X_{B2} \sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3} (R_{B3} \cos\theta + X_{B3} \sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	SALTPOND

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	17A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	35km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1300kVA	

<Trank Line 2>

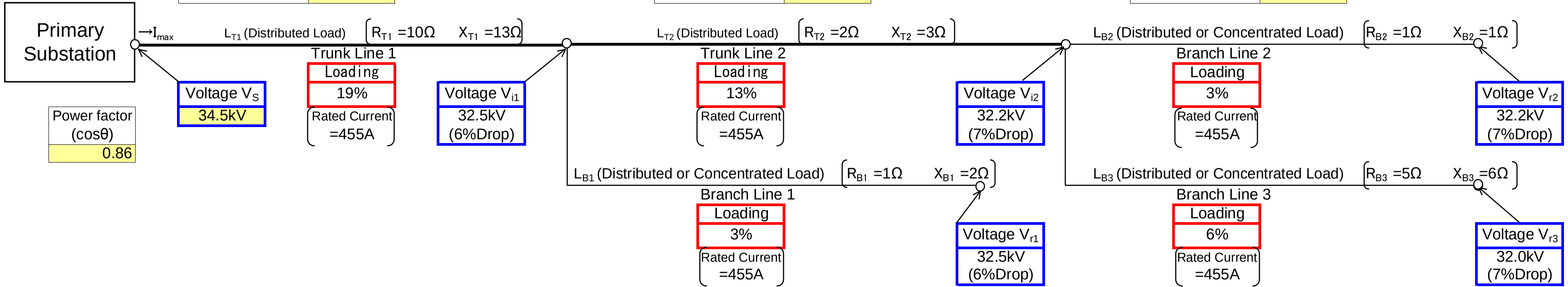
Load L_{T2}	18A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1400kVA	

<Branch Line 2>

Load L_{B2}	13A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	3km	
Total Transformer Capacity of secondary substations CAP_{B2}	980kVA	

Maximum Current I_{max}
86A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	12A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	5km	
Total Transformer Capacity of secondary substations CAP_{B1}	950kVA	

<Branch Line 3>

Load L_{B3}	26A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	18km	
Total Transformer Capacity of secondary substations CAP_{B3}	2050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	SALTPOND

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}	91A

Power factor (cosθ)	0.86

<Trank Line 1>

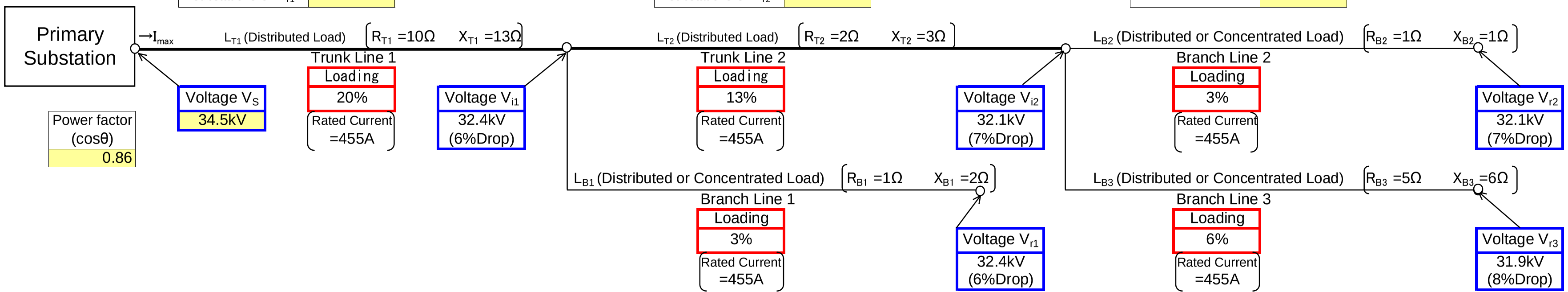
Load L_{T1}	18A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	35km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1300kVA	

<Trank Line 2>

Load L_{T2}	19A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1400kVA	

<Branch Line 2>

Load L_{B2}	13A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	3km	
Total Transformer Capacity of secondary substations CAP_{B2}	980kVA	



<Branch Line 1>

Load L_{B1}	13A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	5km	
Total Transformer Capacity of secondary substations CAP_{B1}	950kVA	

<Branch Line 3>

Load L_{B3}	28A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	18km	
Total Transformer Capacity of secondary substations CAP_{B3}	2050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	SALTPOND

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}	
96A	

Power factor (cosθ)	
0.86	

<Trank Line 1>

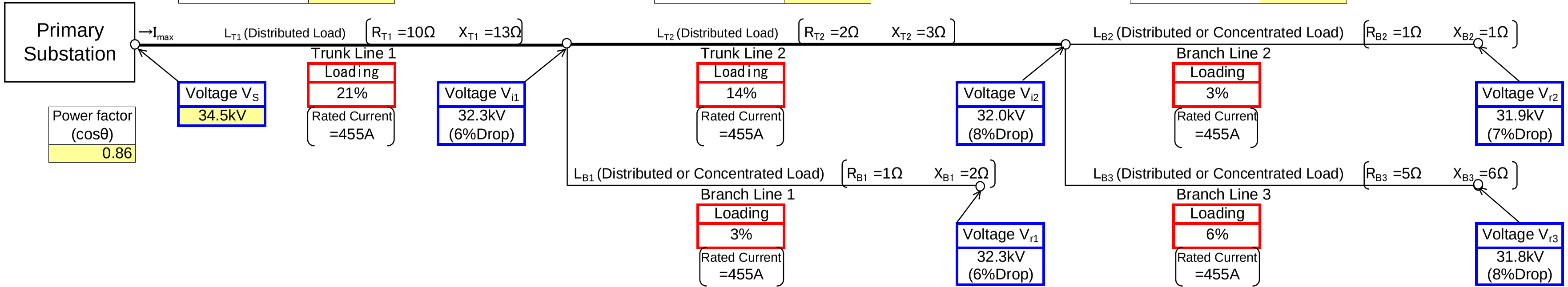
Load L_{T1}	19A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	35km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1300kVA	

<Trank Line 2>

Load L_{T2}	20A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1400kVA	

<Branch Line 2>

Load L_{B2}	14A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	3km	
Total Transformer Capacity of secondary substations CAP_{B2}	980kVA	



<Branch Line 1>

Load L_{B1}	14A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	5km	
Total Transformer Capacity of secondary substations CAP_{B1}	950kVA	

<Branch Line 3>

Load L_{B3}	29A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	18km	
Total Transformer Capacity of secondary substations CAP_{B3}	2050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	SALTPOND

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
102A

Power factor (cosθ)
0.86

<Trank Line 1>

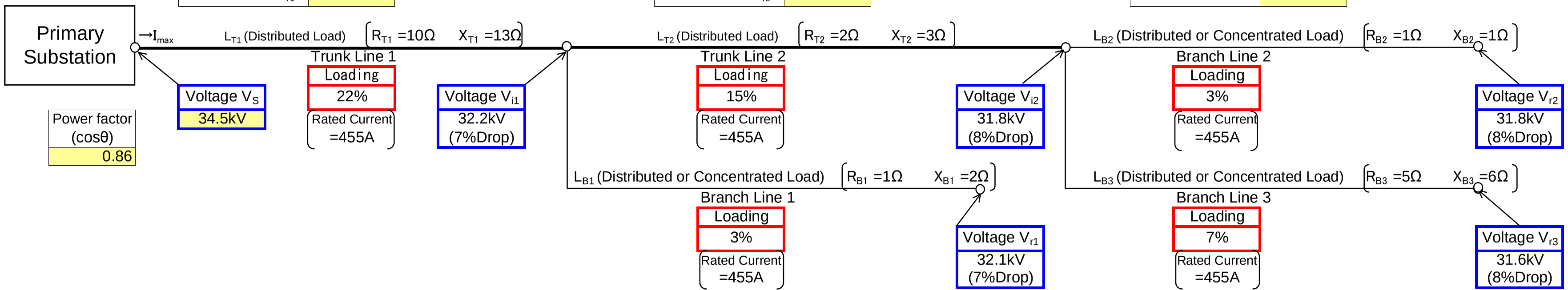
Load L_{T1}	20A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	35km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1300kVA	

<Trank Line 2>

Load L_{T2}	21A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1400kVA	

<Branch Line 2>

Load L_{B2}	15A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	3km	
Total Transformer Capacity of secondary substations CAP_{B2}	980kVA	



<Branch Line 1>

Load L_{B1}	15A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	5km	
Total Transformer Capacity of secondary substations CAP_{B1}	950kVA	

<Branch Line 3>

Load L_{B3}	31A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	18km	
Total Transformer Capacity of secondary substations CAP_{B3}	2050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3}$: Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	SALTPOND

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
108A

<Trank Line 1>

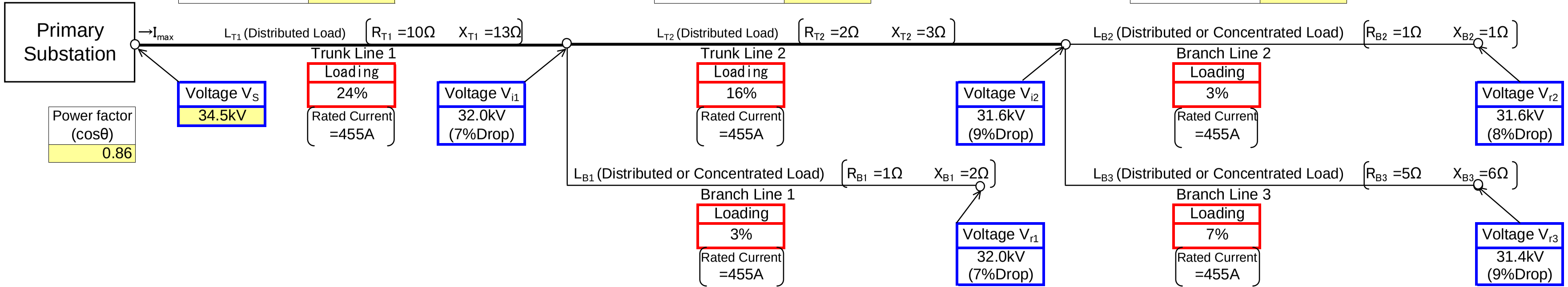
Load L_{T1}	21A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	35km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1300kVA	

<Trank Line 2>

Load L_{T2}	23A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1400kVA	

<Branch Line 2>

Load L_{B2}	16A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	3km	
Total Transformer Capacity of secondary substations CAP_{B2}	980kVA	



<Branch Line 1>

Load L_{B1}	15A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	5km	
Total Transformer Capacity of secondary substations CAP_{B1}	950kVA	

<Branch Line 3>

Load L_{B3}	33A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	18km	
Total Transformer Capacity of secondary substations CAP_{B3}	2050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	SALTPOND

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	22A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	35km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1300kVA	

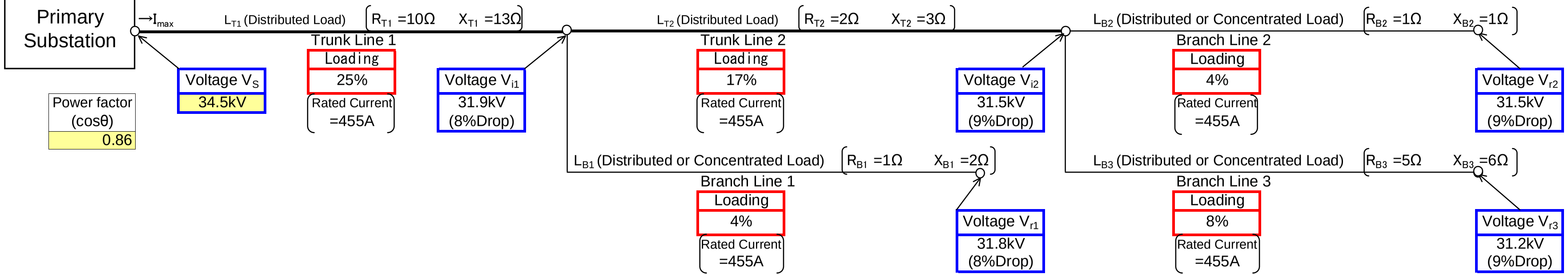
<Trank Line 2>

Load L_{T2}	24A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1400kVA	

<Branch Line 2>

Load L_{B2}	17A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	3km	
Total Transformer Capacity of secondary substations CAP_{B2}	980kVA	

Maximum Current I_{max}
114A



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	16A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	5km	
Total Transformer Capacity of secondary substations CAP_{B1}	950kVA	

<Branch Line 3>

Load L_{B3}	35A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	18km	
Total Transformer Capacity of secondary substations CAP_{B3}	2050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	SALTPOND

🟨: Input data in colored cells

Type-3

Maximum Current I_{max}
121A

<Trank Line 1>

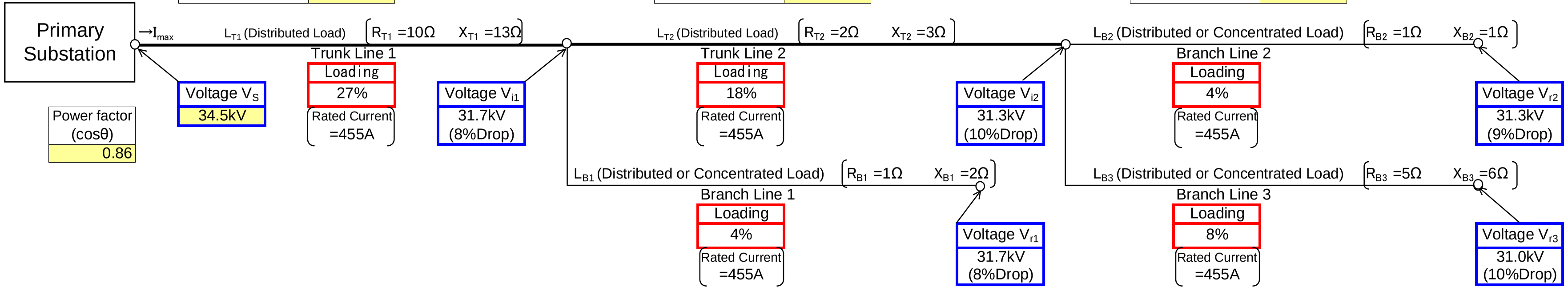
Load L_{T1}	24A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	35km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1300kVA	

<Trank Line 2>

Load L_{T2}	25A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1400kVA	

<Branch Line 2>

Load L_{B2}	18A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	3km	
Total Transformer Capacity of secondary substations CAP_{B2}	980kVA	



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	17A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	5km	
Total Transformer Capacity of secondary substations CAP_{B1}	950kVA	

<Branch Line 3>

Load L_{B3}	37A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	18km	
Total Transformer Capacity of secondary substations CAP_{B3}	2050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	SALTPOND

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	25A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	35km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1300kVA	

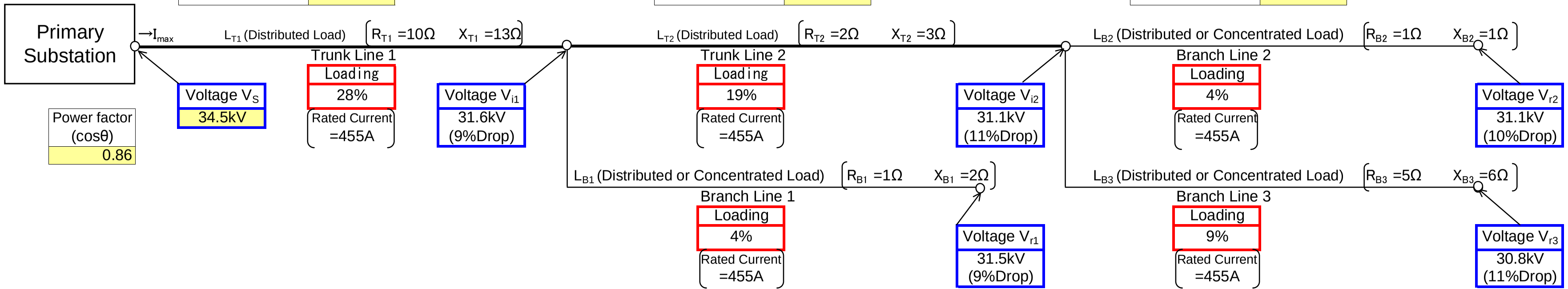
<Trank Line 2>

Load L_{T2}	27A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1400kVA	

<Branch Line 2>

Load L_{B2}	19A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	3km	
Total Transformer Capacity of secondary substations CAP_{B2}	980kVA	

Maximum Current I_{max}
128A



<Branch Line 1>

Load L_{B1}	18A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	5km	
Total Transformer Capacity of secondary substations CAP_{B1}	950kVA	

<Branch Line 3>

Load L_{B3}	39A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	18km	
Total Transformer Capacity of secondary substations CAP_{B3}	2050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	SALTPOND

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
135A

<Trank Line 1>

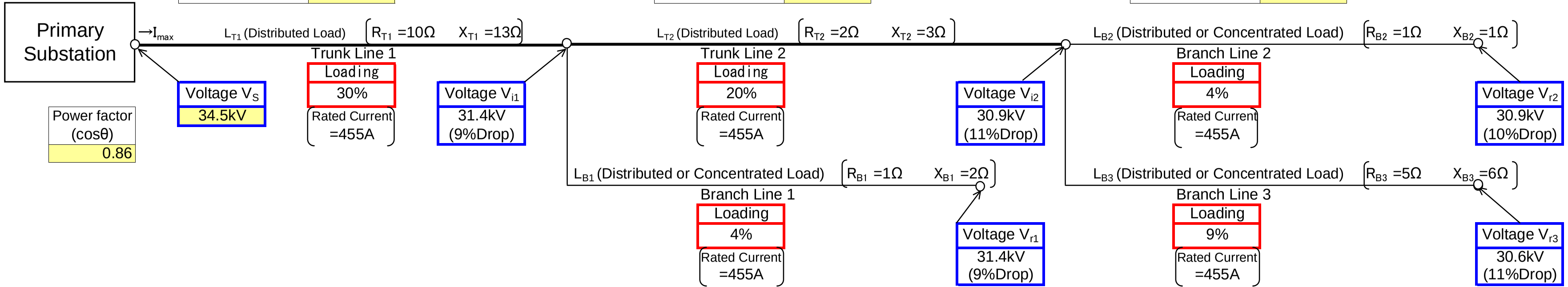
Load L_{T1}	26A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	35km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1300kVA	

<Trank Line 2>

Load L_{T2}	28A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1400kVA	

<Branch Line 2>

Load L_{B2}	20A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	3km	
Total Transformer Capacity of secondary substations CAP_{B2}	980kVA	



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	19A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	5km	
Total Transformer Capacity of secondary substations CAP_{B1}	950kVA	

<Branch Line 3>

Load L_{B3}	41A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	18km	
Total Transformer Capacity of secondary substations CAP_{B3}	2050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	SALTPOND

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	28A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	35km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1300kVA	

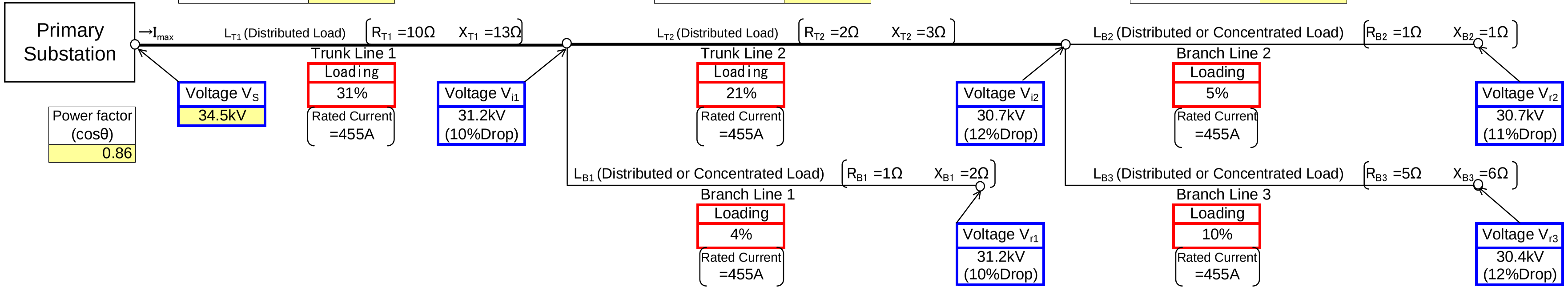
<Trank Line 2>

Load L_{T2}	30A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1400kVA	

<Branch Line 2>

Load L_{B2}	21A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	3km	
Total Transformer Capacity of secondary substations CAP_{B2}	980kVA	

Maximum Current I_{max}
143A



<Branch Line 1>

Load L_{B1}	20A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	5km	
Total Transformer Capacity of secondary substations CAP_{B1}	950kVA	

<Branch Line 3>

Load L_{B3}	44A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	18km	
Total Transformer Capacity of secondary substations CAP_{B3}	2050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	SALTPOND

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
151A

Power factor (cosθ)
0.86

<Trank Line 1>

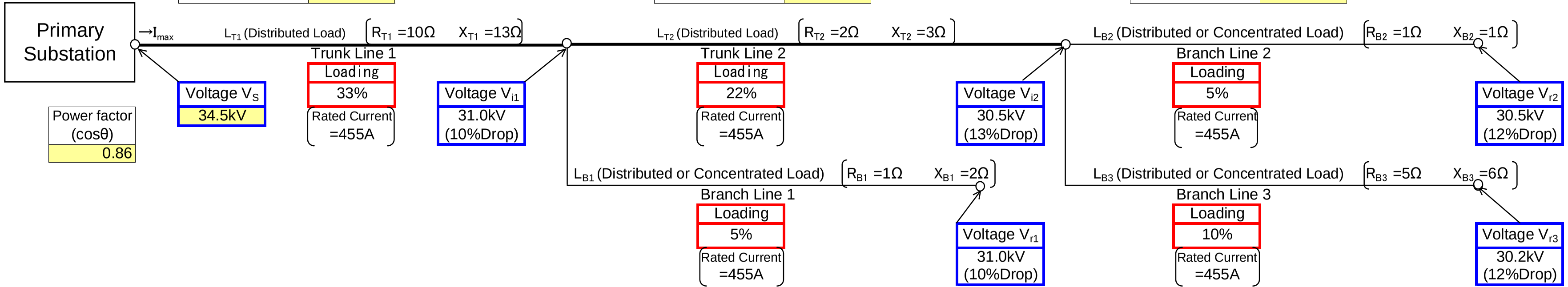
Load L_{T1}	29A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	35km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1300kVA	

<Trank Line 2>

Load L_{T2}	32A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1400kVA	

<Branch Line 2>

Load L_{B2}	22A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	3km	
Total Transformer Capacity of secondary substations CAP_{B2}	980kVA	



<Branch Line 1>

Load L_{B1}	21A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	5km	
Total Transformer Capacity of secondary substations CAP_{B1}	950kVA	

<Branch Line 3>

Load L_{B3}	46A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	18km	
Total Transformer Capacity of secondary substations CAP_{B3}	2050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	SALTPOND

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
160A

<Trank Line 1>

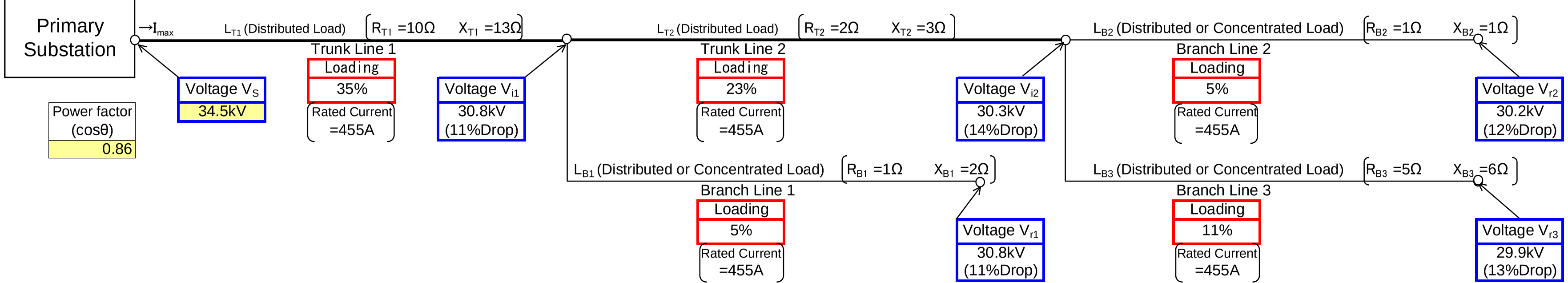
Load L_{T1}	31A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	35km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1300kVA	

<Trank Line 2>

Load L_{T2}	34A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1400kVA	

<Branch Line 2>

Load L_{B2}	23A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	3km	
Total Transformer Capacity of secondary substations CAP_{B2}	980kVA	



<Branch Line 1>

Load L_{B1}	23A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	5km	
Total Transformer Capacity of secondary substations CAP_{B1}	950kVA	

<Branch Line 3>

Load L_{B3}	49A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B3}	18km	
Total Transformer Capacity of secondary substations CAP_{B3}	2050kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 1

: Input data in colored cells

Type-3

Maximum Current I_{max}
185A

Power factor (cosθ)
0.86

<Trank Line 1>

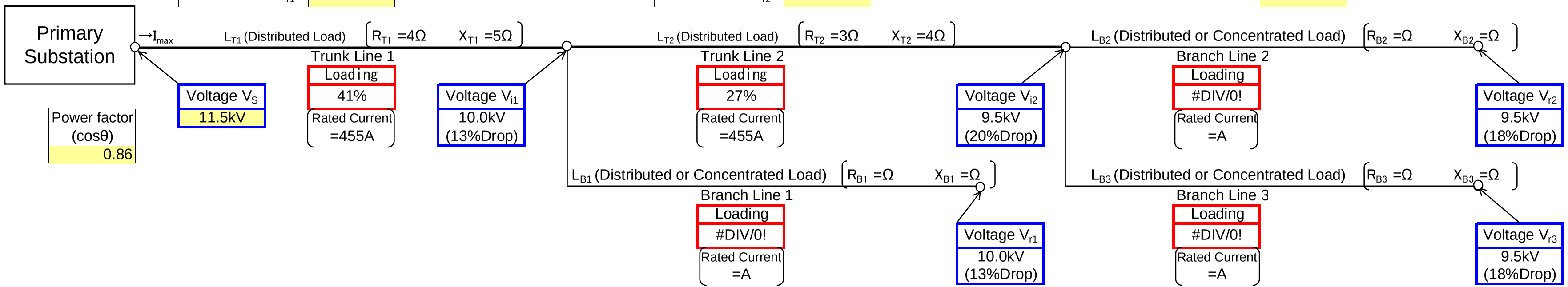
Load L_{T1}	63A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1225kVA	

<Trank Line 2>

Load L_{T2}	122A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2345kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 1

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
191A

<Trank Line 1>

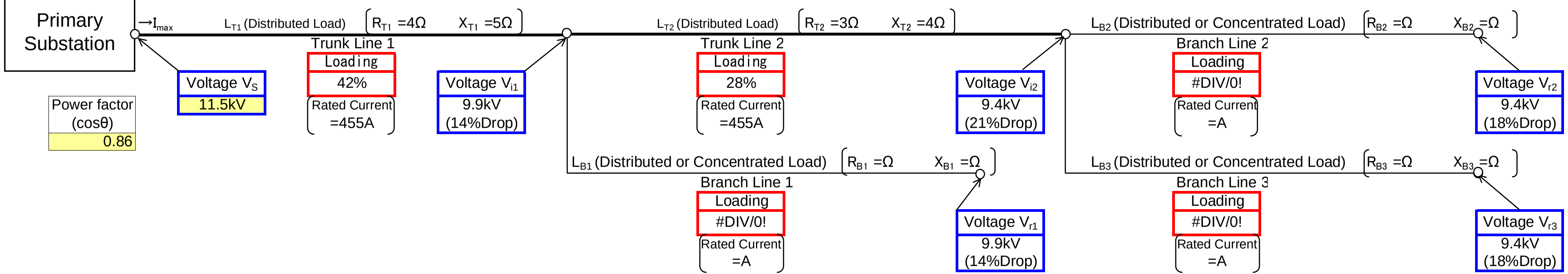
Load L_{T1}	66A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1225kVA	

<Trank Line 2>

Load L_{T2}	125A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2345kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 1

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
196A

Power factor (cosθ)
0.86

<Trank Line 1>

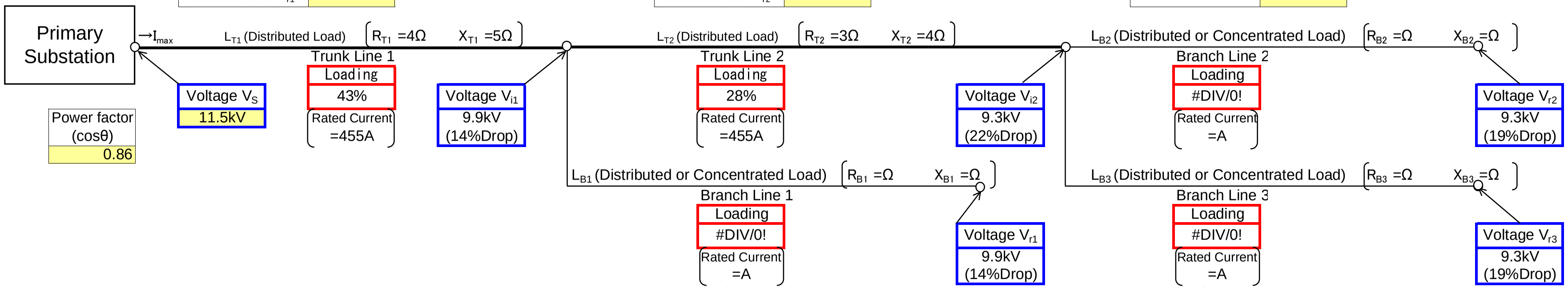
Load L_{T1}	67A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1225kVA	

<Trank Line 2>

Load L_{T2}	129A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2345kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 1

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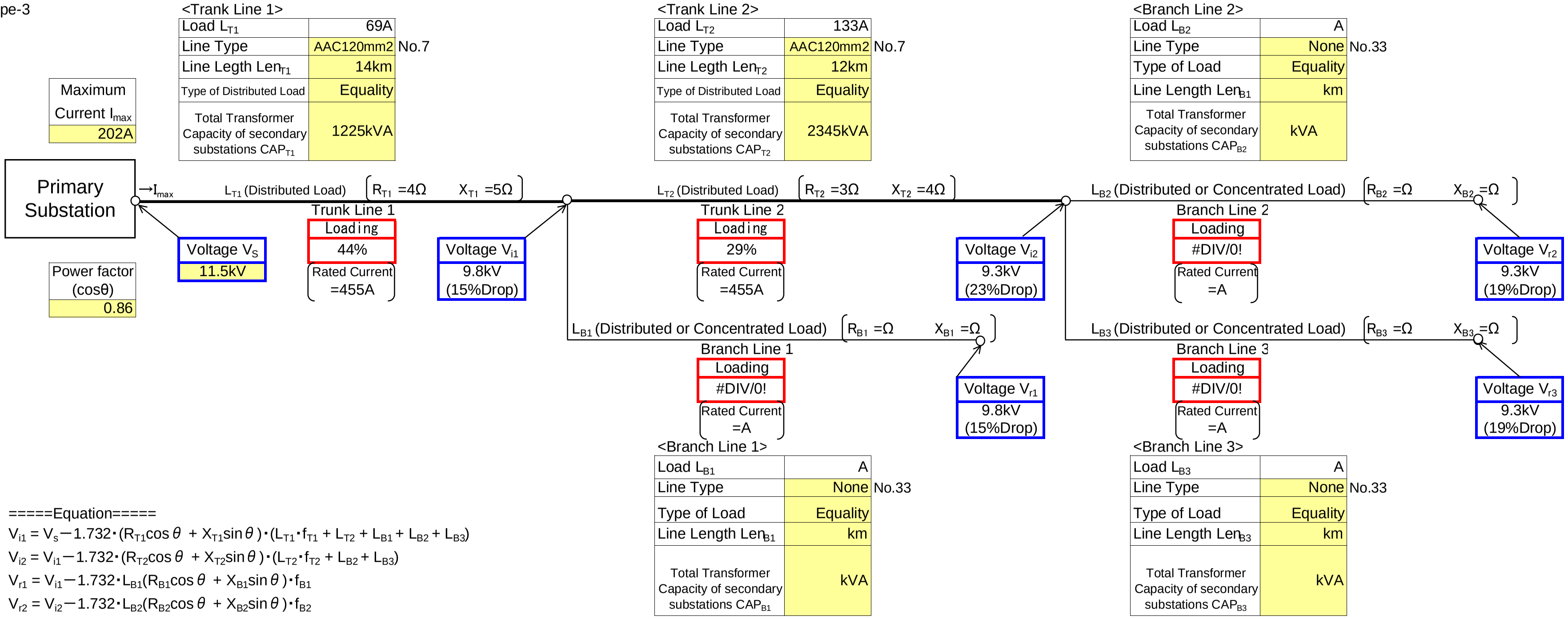
Type-3



Maximum Current I_{max}
202A

Power factor (cosθ)
0.86

<Trank Line 1>

Load L_{T1}	69A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1225kVA	

<Trank Line 2>

Load L_{T2}	133A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2345kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 1

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
208A

Power factor (cosθ)
0.86

<Trank Line 1>

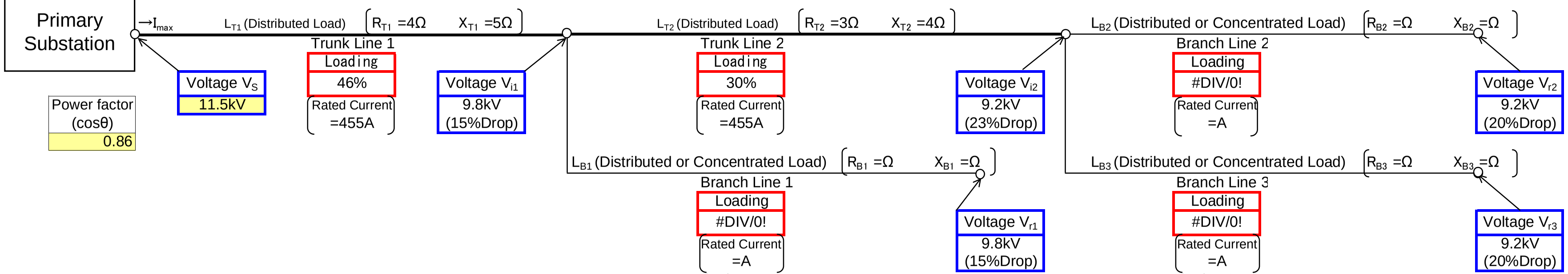
Load L_{T1}	71A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1225kVA	

<Trank Line 2>

Load L_{T2}	137A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2345kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 1

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}	215A

Power factor (cosθ)	0.86

<Trank Line 1>

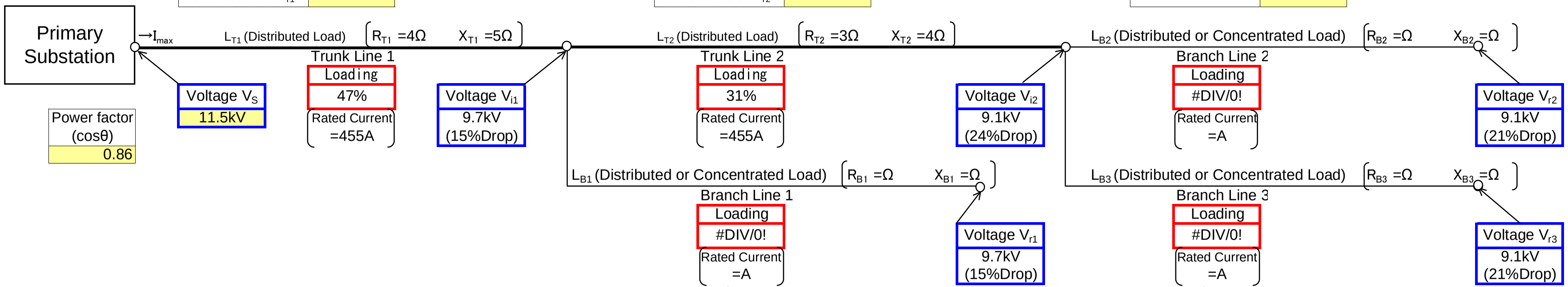
Load L_{T1}	74A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1225kVA	

<Trank Line 2>

Load L_{T2}	141A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2345kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 1

: Input data in colored cells

Type-3

Maximum Current I_{max}
221A

<Trank Line 1>

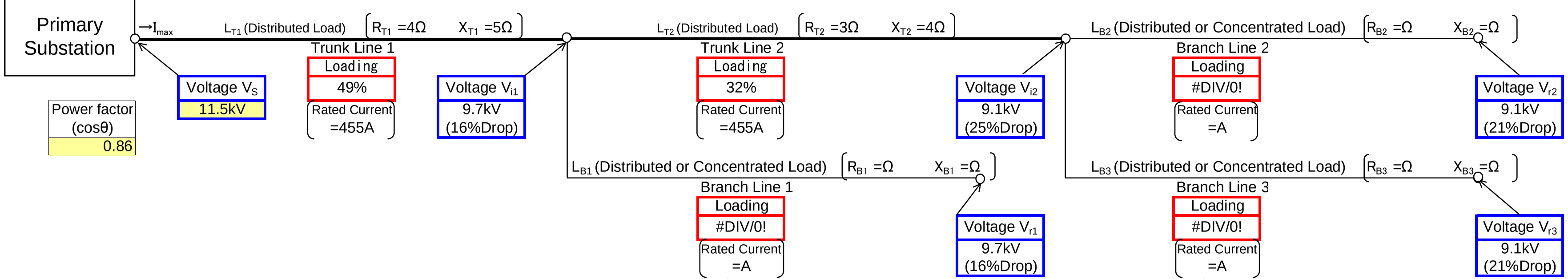
Load L_{T1}	76A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1225kVA	

<Trank Line 2>

Load L_{T2}	145A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2345kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 1

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	78A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1225kVA	

<Trank Line 2>

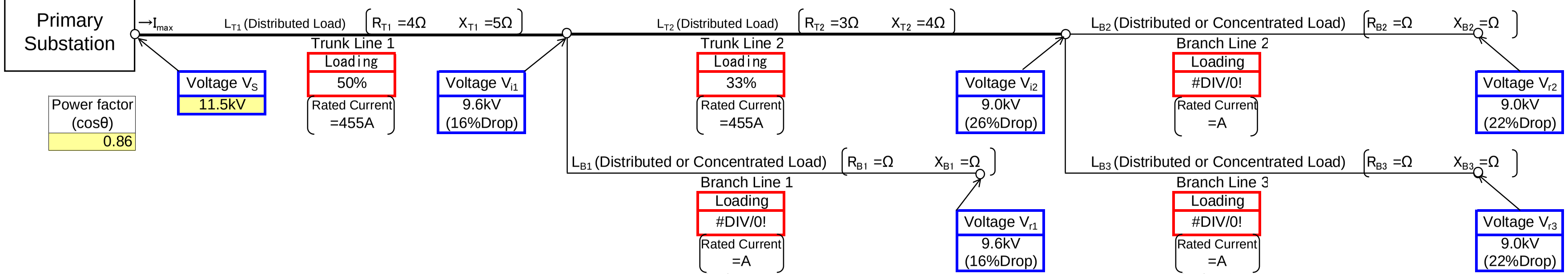
Load L_{T2}	150A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2345kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
228A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 1

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Type-3

<Trank Line 1>

Load L_{T1}	80A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1225kVA	

<Trank Line 2>

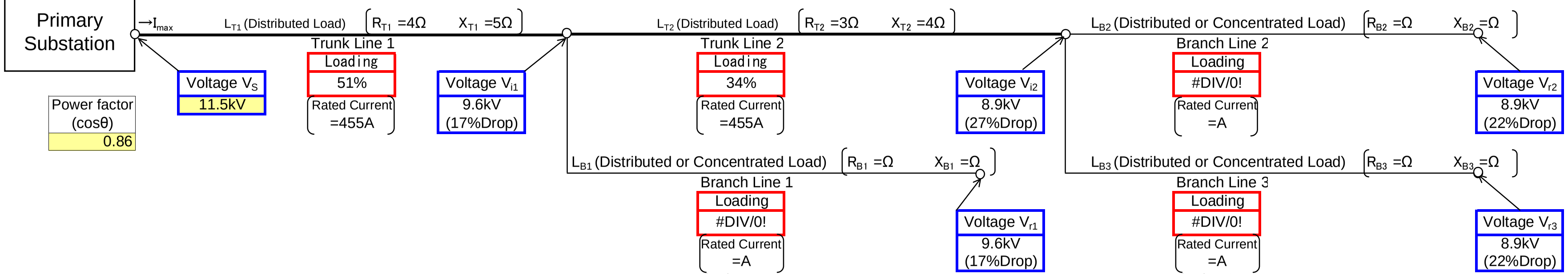
Load L_{T2}	154A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2345kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
234A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 1

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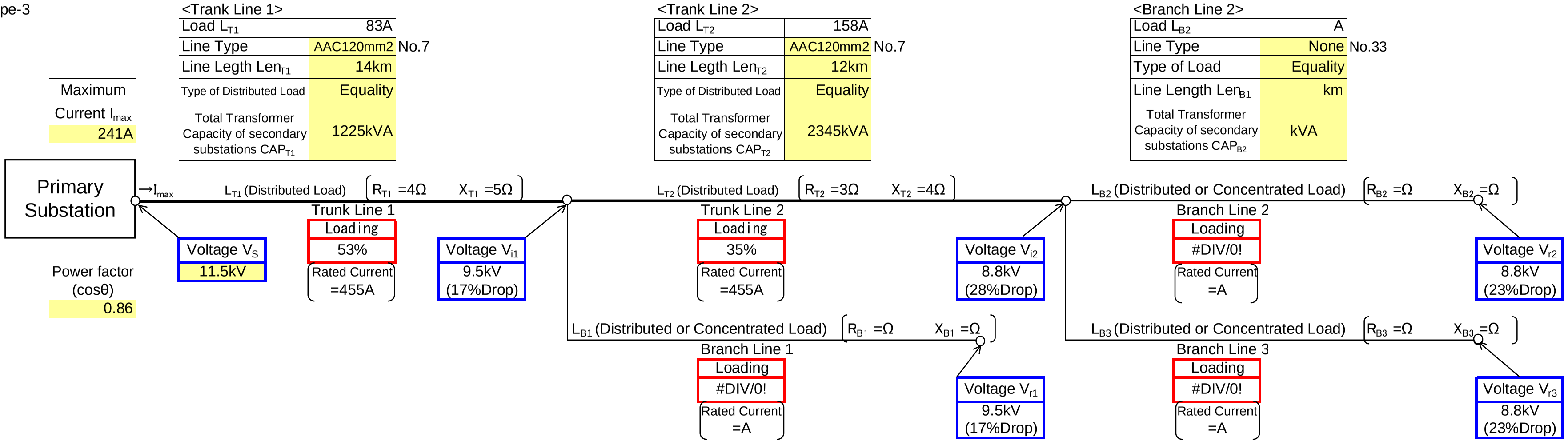
Type-3



Maximum Current I_{max}
241A

Power factor (cosθ)
0.86

<Trank Line 1>

Load L_{T1}	83A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1225kVA	

<Trank Line 2>

Load L_{T2}	158A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2345kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 1

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Type-3

Maximum Current I_{max}
249A

<Trank Line 1>

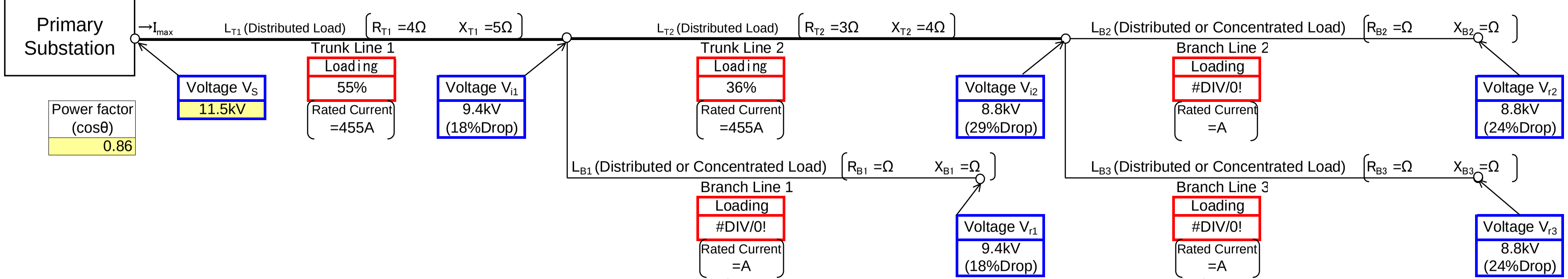
Load L_{T1}	85A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1225kVA	

<Trank Line 2>

Load L_{T2}	164A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2345kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 1

: Input data in colored cells

Type-3

Maximum Current I_{max}
256A

Power factor (cosθ)
0.86

<Trank Line 1>

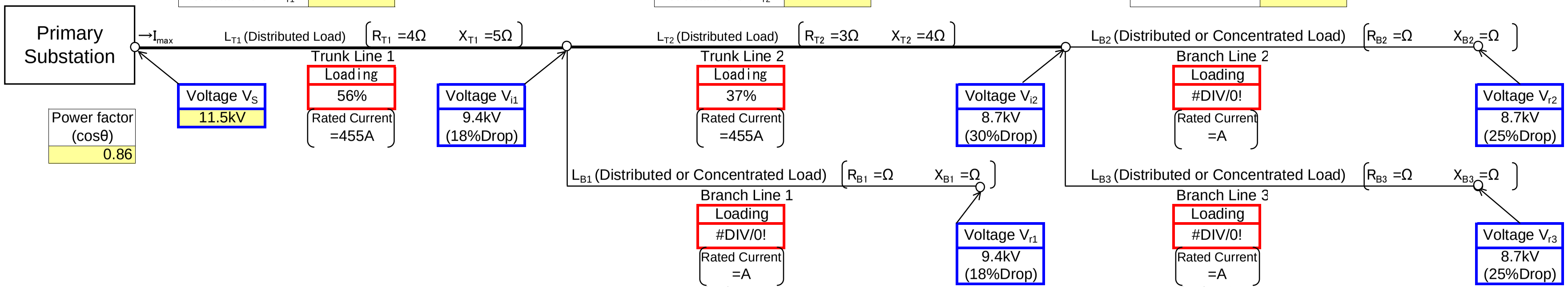
Load L_{T1}	88A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	14km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1225kVA	

<Trank Line 2>

Load L_{T2}	168A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	12km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2345kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	76A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

<Trank Line 2>

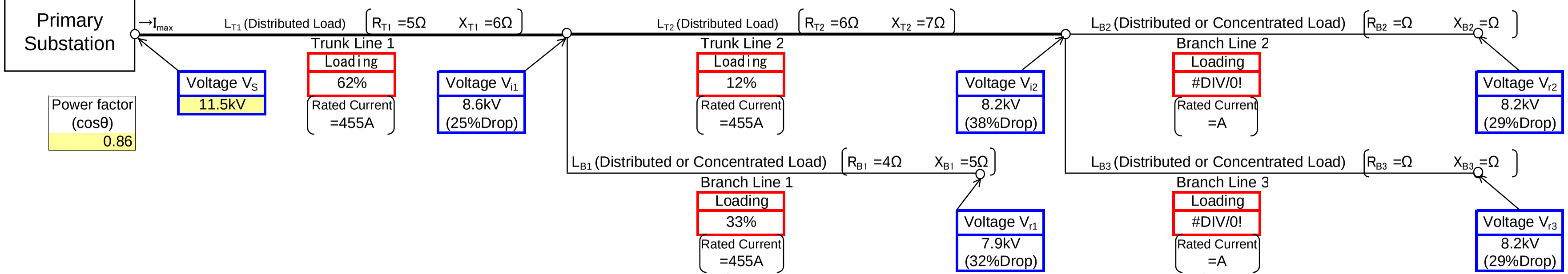
Load L_{T2}	54A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
280A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	150A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

2007

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

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Type-3

Maximum Current I_{max}
289A

<Trank Line 1>

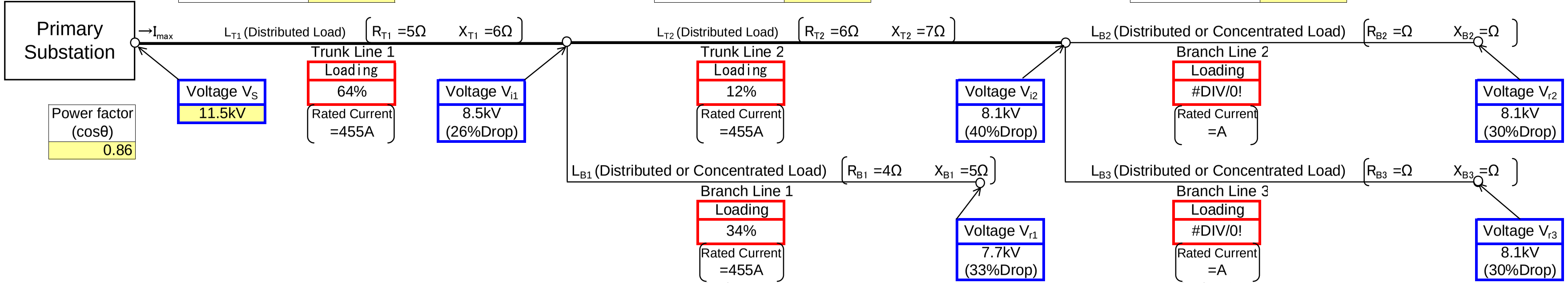
Load L_{T1}	79A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

<Trank Line 2>

Load L_{T2}	55A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	155A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
298A

Power factor (cosθ)
0.86

<Trank Line 1>

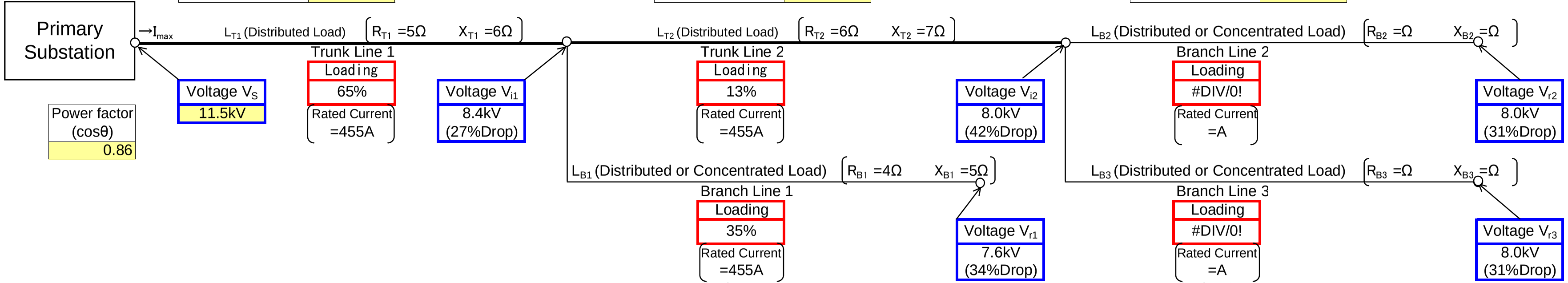
Load L_{T1}	81A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

<Trank Line 2>

Load L_{T2}	57A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	160A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	84A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

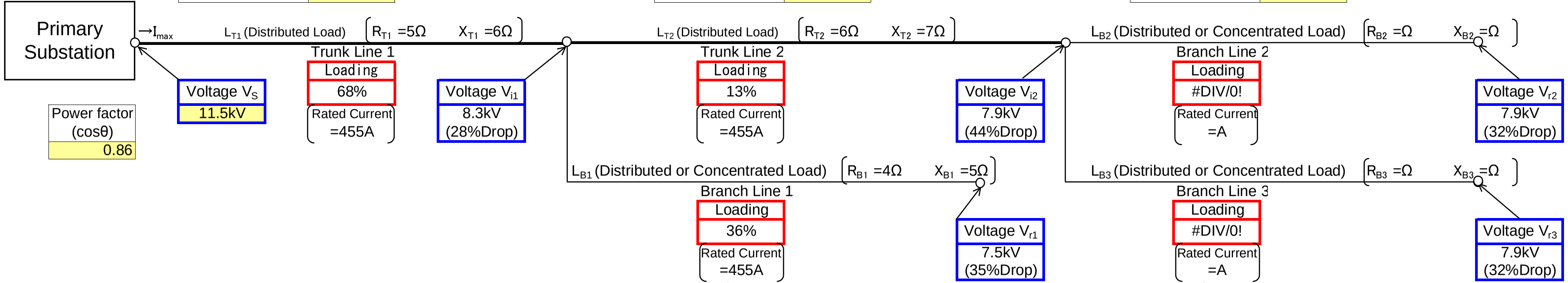
<Trank Line 2>

Load L_{T2}	59A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
308A



<Branch Line 1>

Load L_{B1}	165A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

: Input data in colored cells

Type-3

Maximum Current I_{max}	318A
Power factor (cosθ)	0.86

<Trank Line 1>

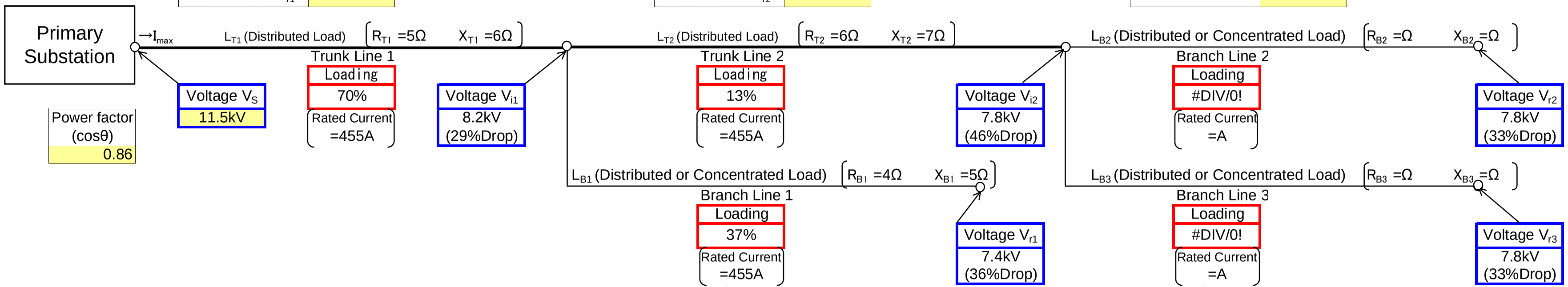
Load L_{T1}	87A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

<Trank Line 2>

Load L_{T2}	61A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	170A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
328A

<Trank Line 1>

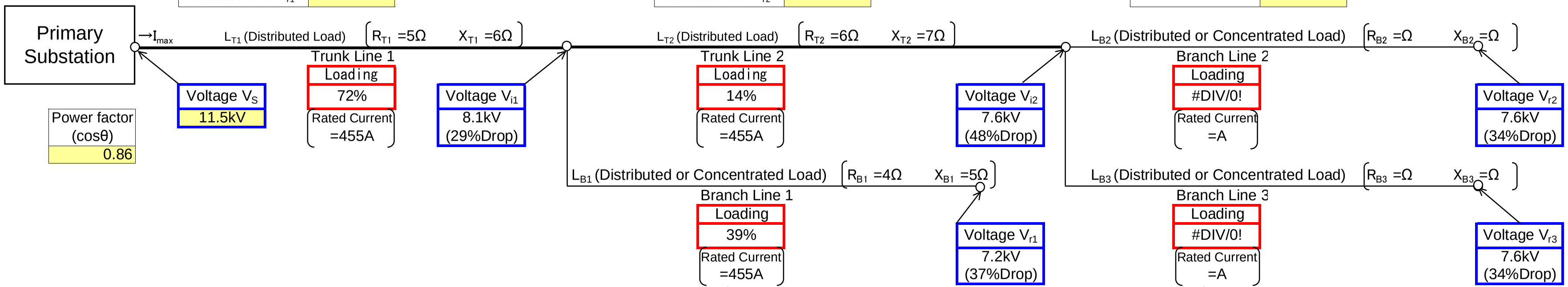
Load L_{T1}	89A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

<Trank Line 2>

Load L_{T2}	63A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	176A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

: Input data in colored cells

Type-3

Maximum Current I_{max}	339A

Power factor (cosθ)	0.86

<Trank Line 1>

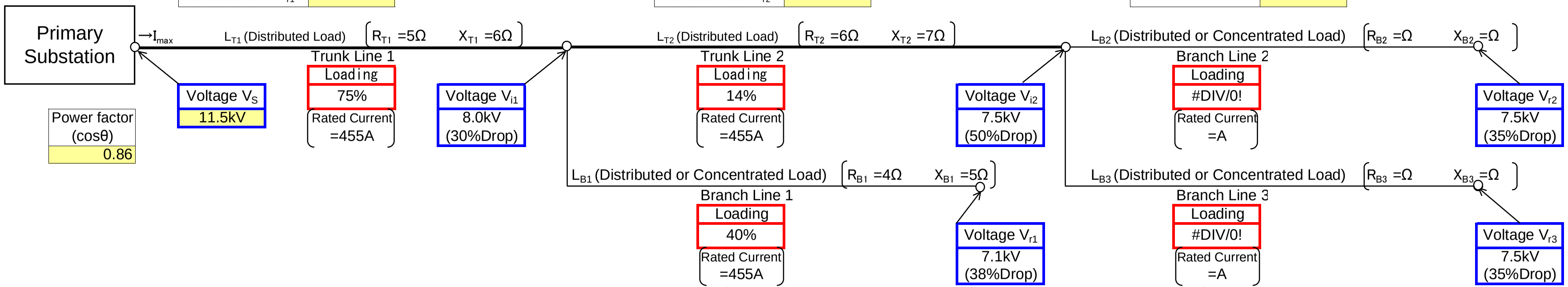
Load L_{T1}	92A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

<Trank Line 2>

Load L_{T2}	65A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	182A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

: Input data in colored cells

Type-3

Maximum Current I_{max}
350A

<Trank Line 1>

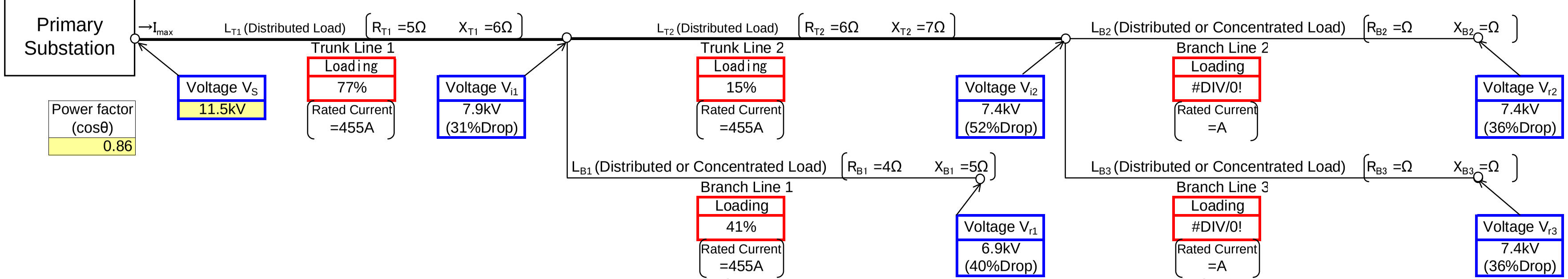
Load L_{T1}	95A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

<Trank Line 2>

Load L_{T2}	67A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	187A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	98A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

<Trank Line 2>

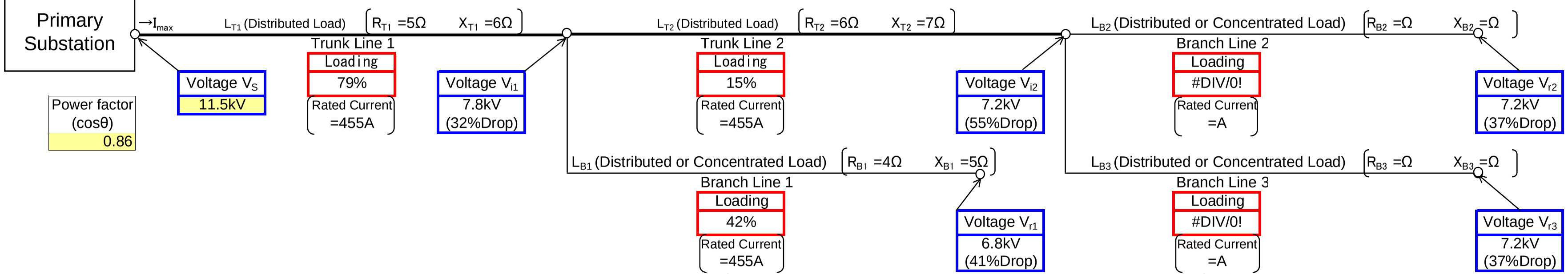
Load L_{T2}	69A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
361A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	193A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	102A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

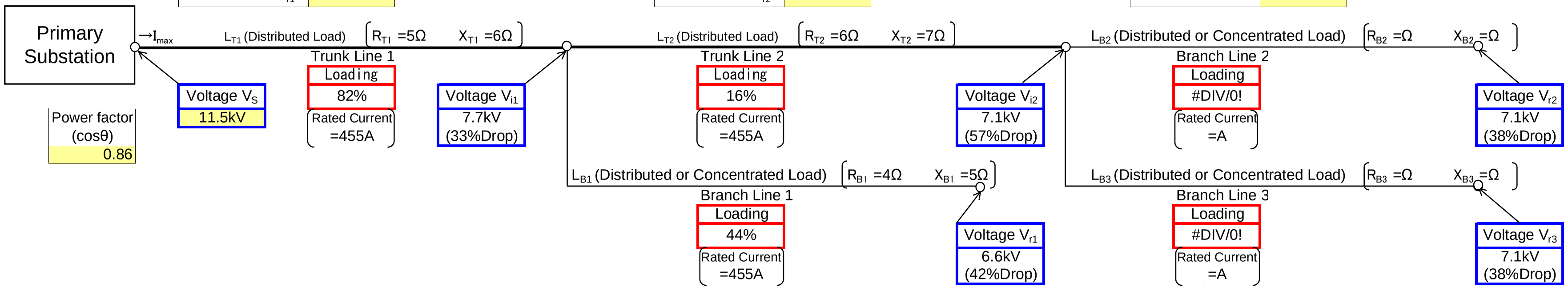
<Trank Line 2>

Load L_{T2}	72A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
373A



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	200A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}$, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
385A

<Trank Line 1>

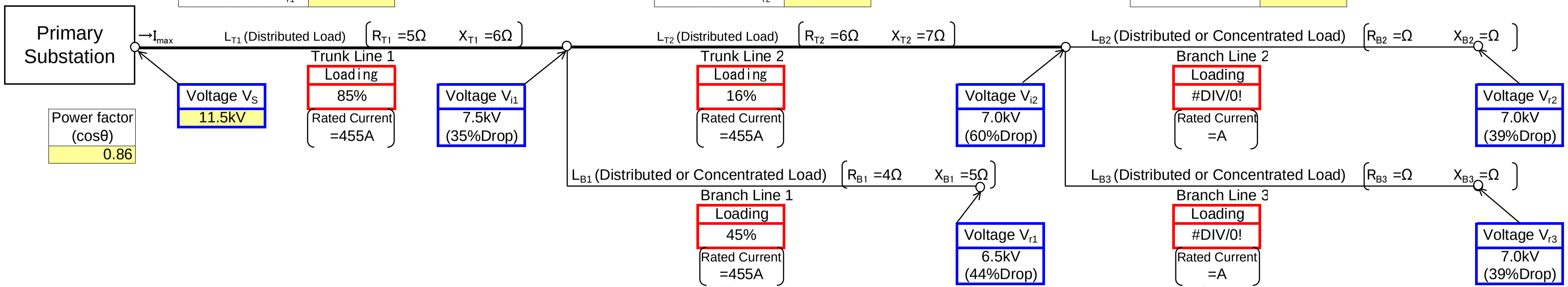
Load L_{T1}	105A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

<Trank Line 2>

Load L_{T2}	74A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	206A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	SWEDRU 2

: Input data in colored cells

Type-3

Maximum Current I_{max}
397A

<Trank Line 1>

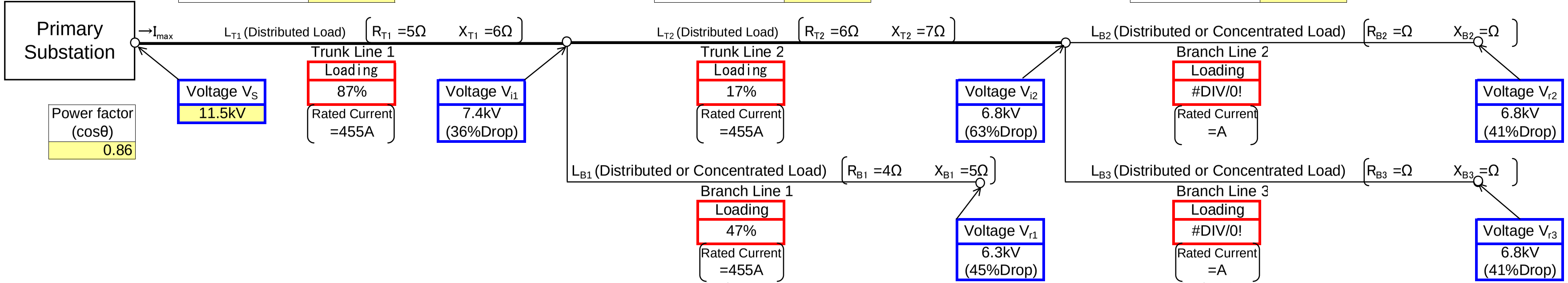
Load L_{T1}	108A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	17km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2950kVA	

<Trank Line 2>

Load L_{T2}	76A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	21km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2075kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	213A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	5795kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 2

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	96A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

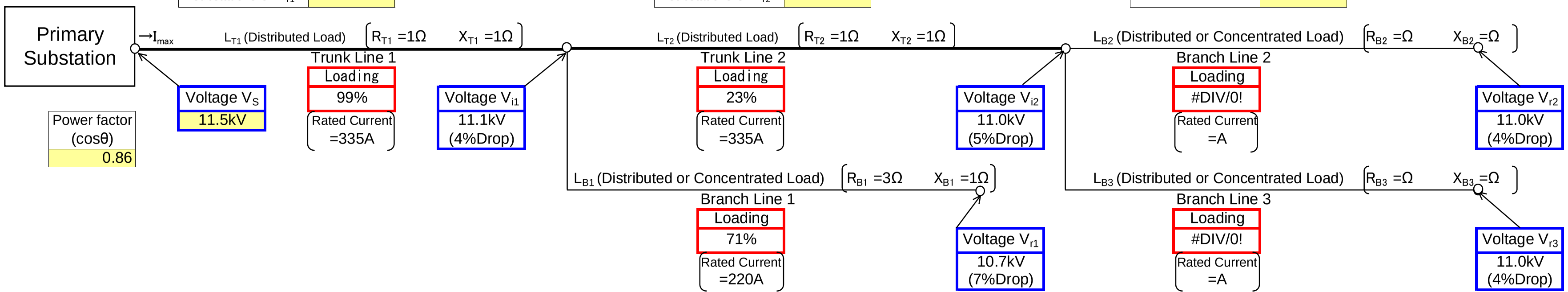
Load L_{T2}	78A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
330A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	156A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 2

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Type-3

<Trank Line 1>

Load L_{T1}	99A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

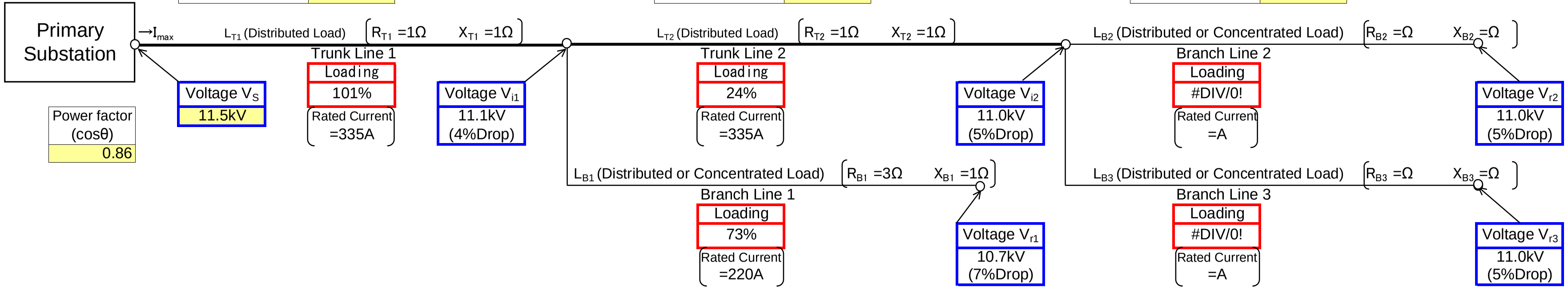
Load L_{T2}	80A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
339A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	160A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 2

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Type-3

<Trank Line 1>

Load L_{T1}	101A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

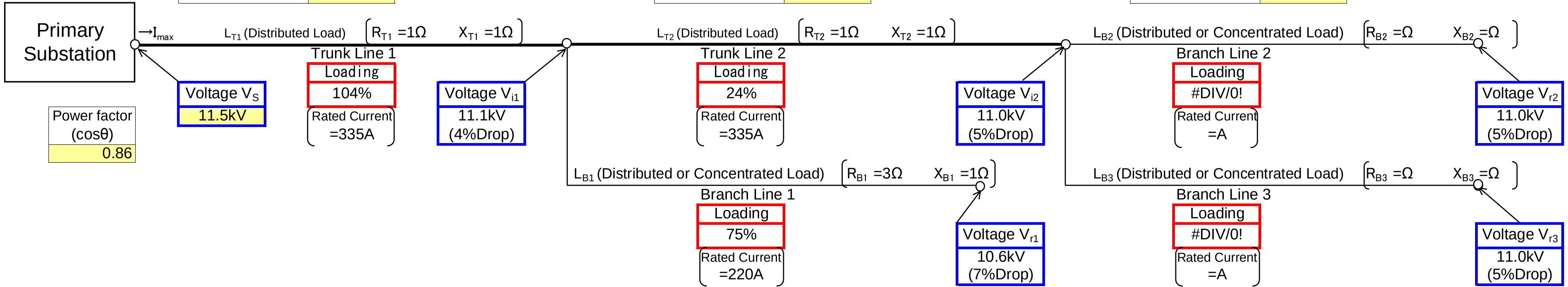
Load L_{T2}	82A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
347A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	164A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$$

$$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$$

$$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$$

$$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$$

$$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$$

$$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 2

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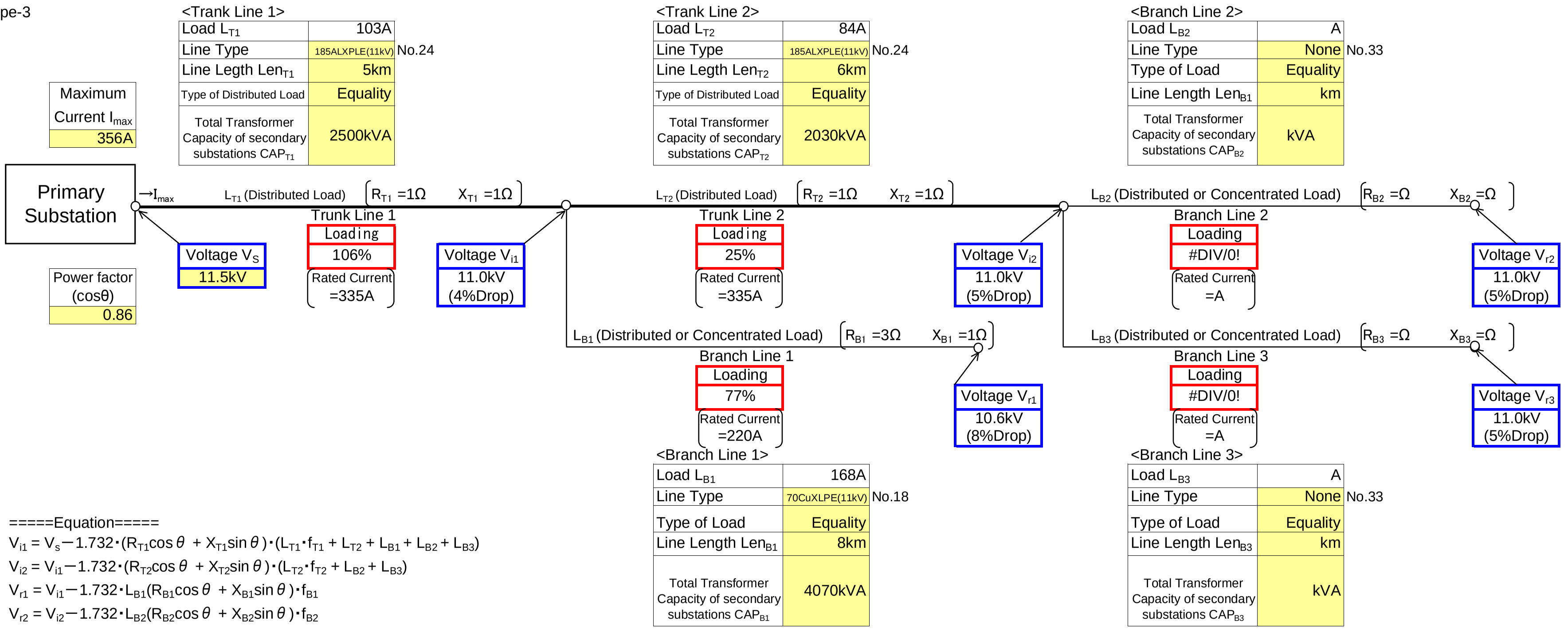
Type-3



Maximum Current I_{max}
356A

Power factor (cosθ)
0.86

<Trank Line 1>

Load L_{T1}	103A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	84A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	168A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 2

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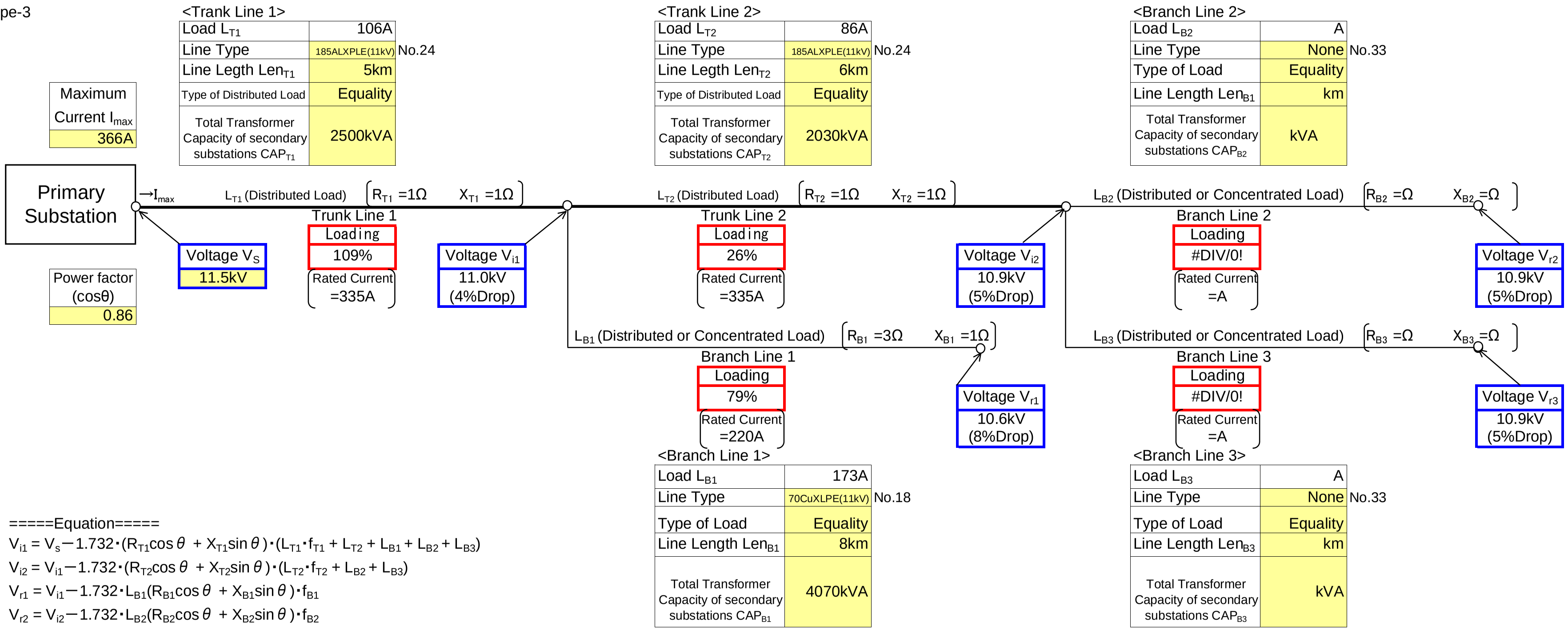
Type-3



<Trank Line 1>

Load L_{T1}	106A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	86A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	173A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 2

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	109A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

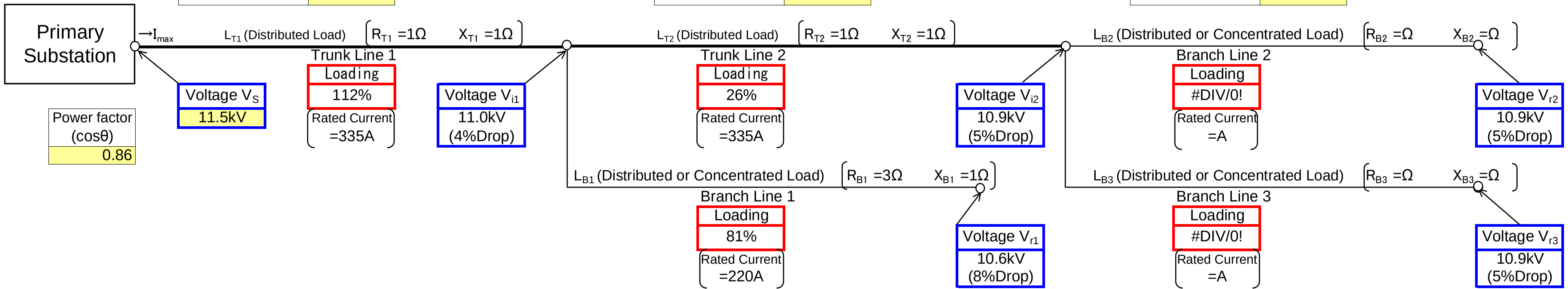
<Trank Line 2>

Load L_{T2}	89A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
375A



<Branch Line 1>

Load L_{B1}	177A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1} \cos\theta + X_{T1} \sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2} \cos\theta + X_{T2} \sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1} (R_{B1} \cos\theta + X_{B1} \sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2} (R_{B2} \cos\theta + X_{B2} \sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3} (R_{B3} \cos\theta + X_{B3} \sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 2

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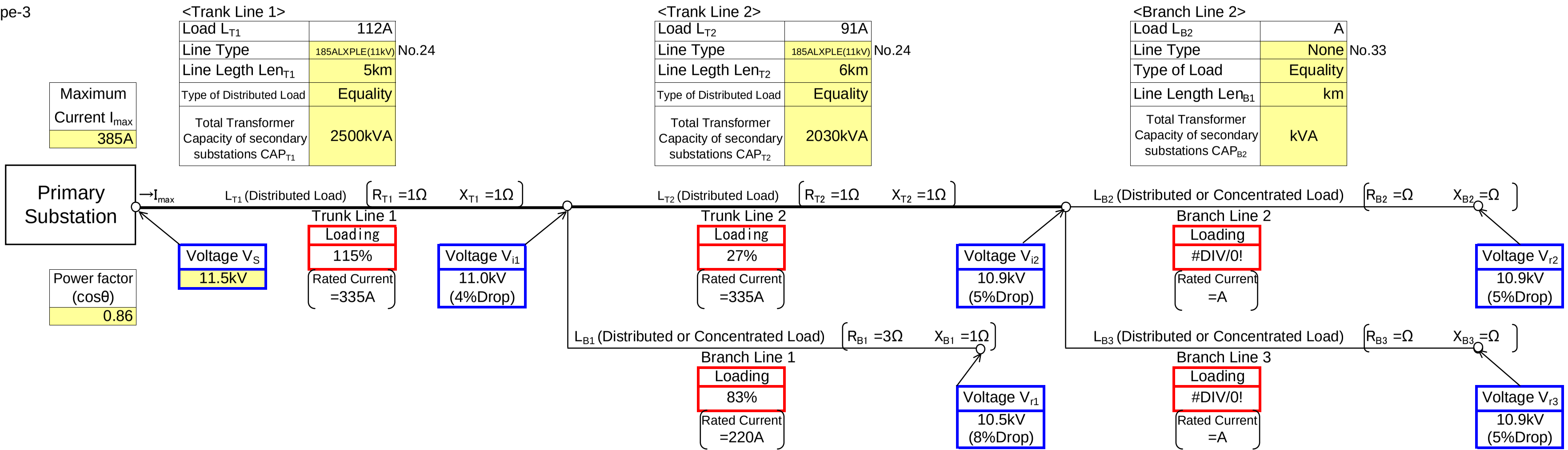
Type-3



Maximum Current I_{max}
385A

Power factor (cosθ)
0.86

<Trank Line 1>

Load L_{T1}	112A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	91A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	182A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 2

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Type-3

Maximum Current I_{max}
395A

<Trank Line 1>

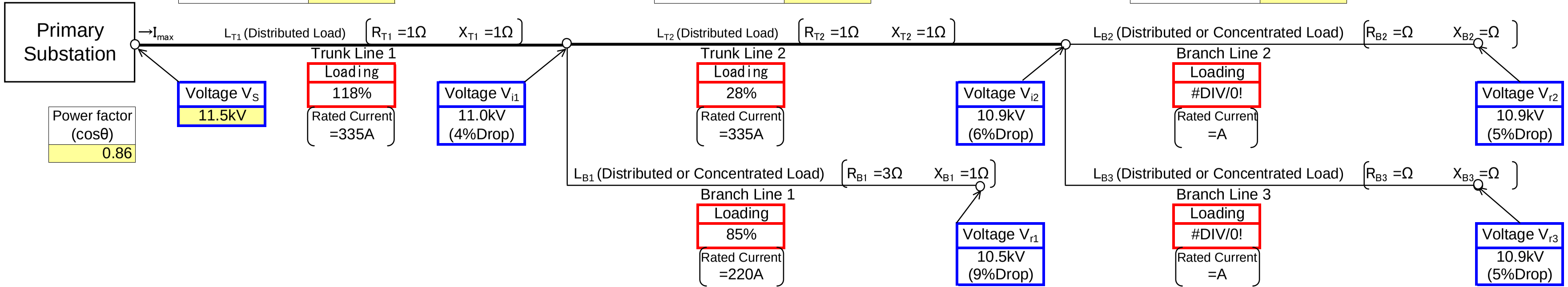
Load L_{T1}	115A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	93A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	187A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 2

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Type-3

<Trank Line 1>

Load L_{T1}	118A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

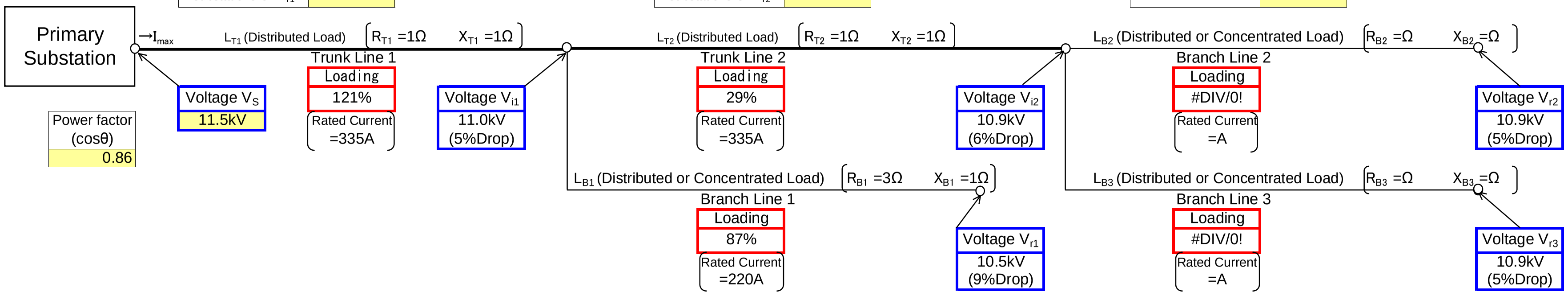
Load L_{T2}	96A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
405A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	192A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 2

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	121A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

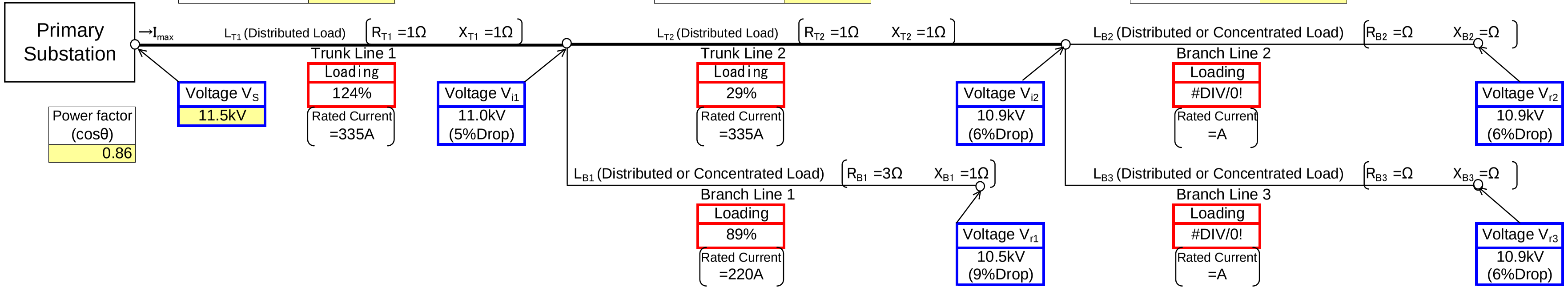
Load L_{T2}	98A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
415A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	196A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 2

▭ : Input data in colored cells

Type-3

Maximum Current I_{max}
426A

<Trank Line 1>

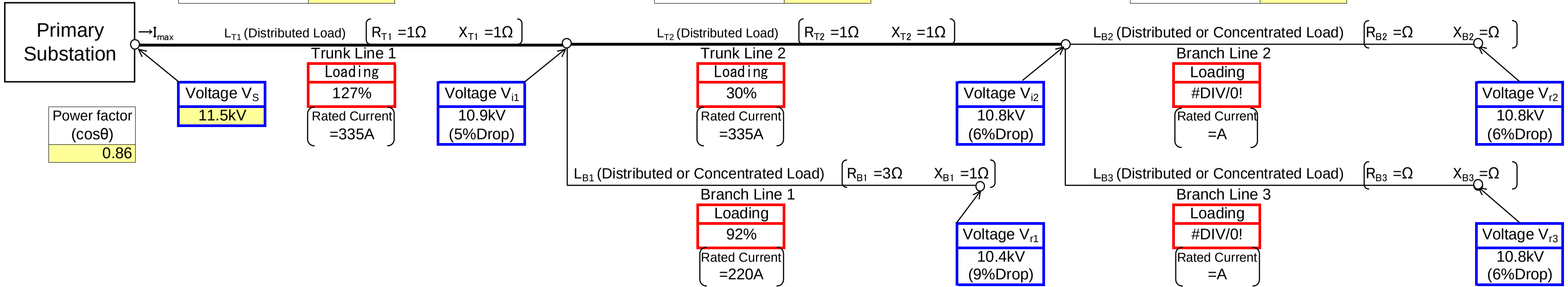
Load L_{T1}	124A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	101A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	202A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

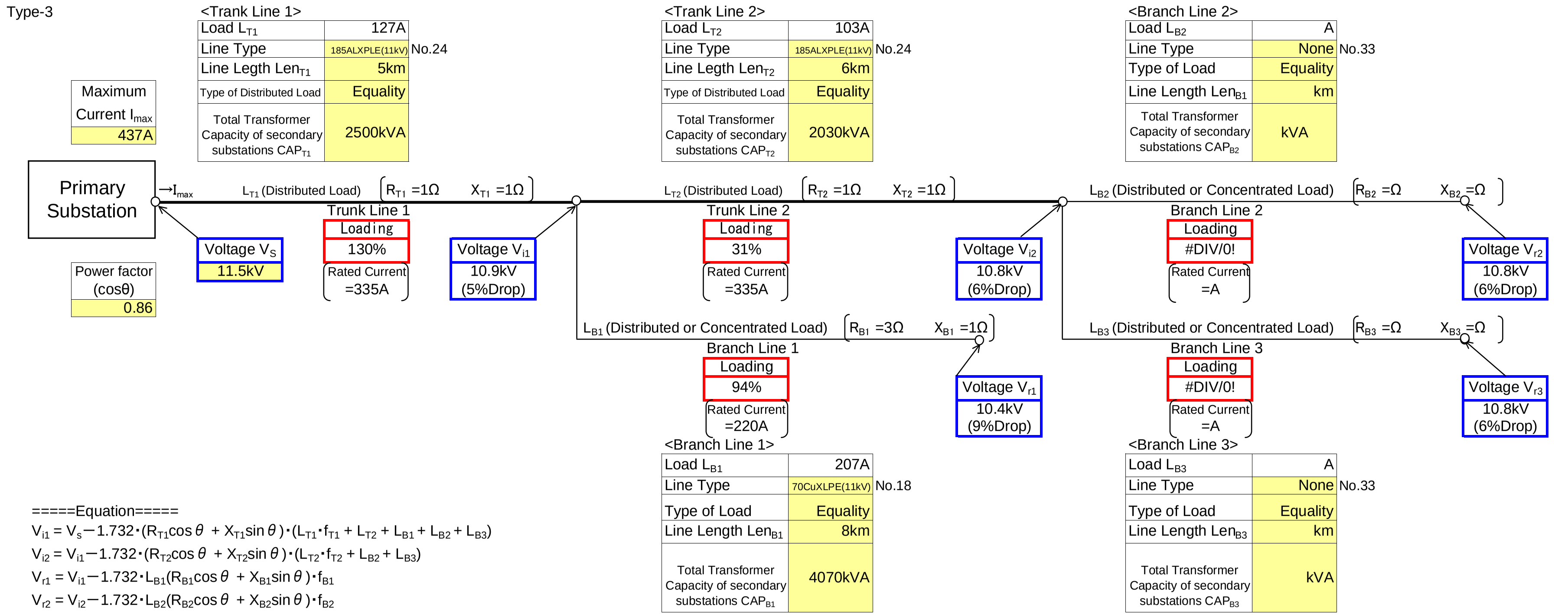
V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 2

🟨 : Input data in colored cells

Type-3



<Trank Line 1>

Load L_{T1}	127A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	103A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	207A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	8km	
Total Transformer Capacity of secondary substations CAP_{B1}	4070kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$$

$$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$$

$$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$$

$$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$$

$$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$$

$$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - Power System Analysis for existing system using Macro demand forecast -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 3

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
160A

Power factor (cosθ)
0.86

<Trank Line 1>

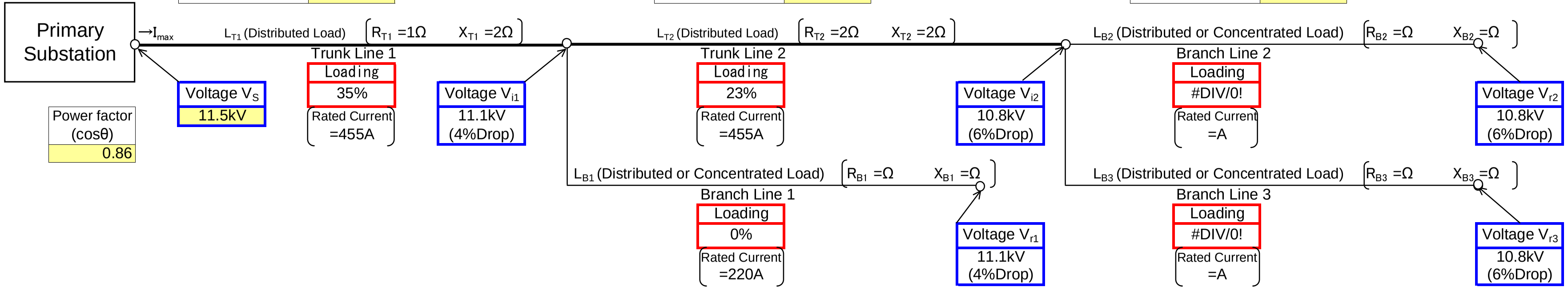
Load L_{T1}	53A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	107A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
$CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3}$: Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 3

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	54A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

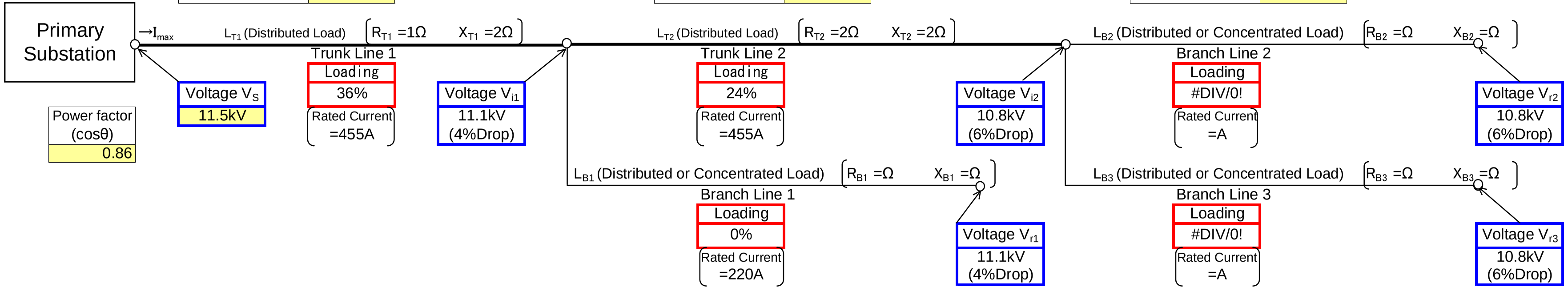
<Trank Line 2>

Load L_{T2}	110A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
164A



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 3

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
169A

<Trank Line 1>

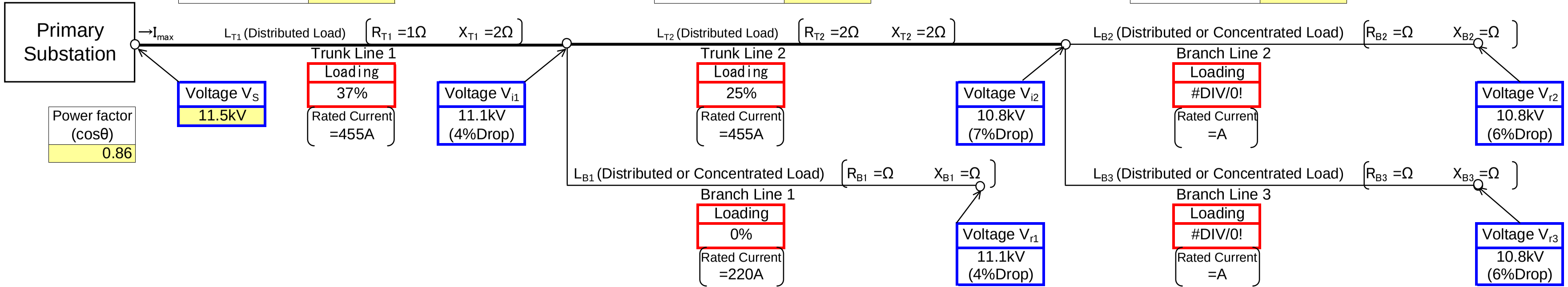
Load L_{T1}	56A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	113A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$$

$$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$$

$$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$$

$$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$$

$$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$$

$$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$$

$$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 3

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	58A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

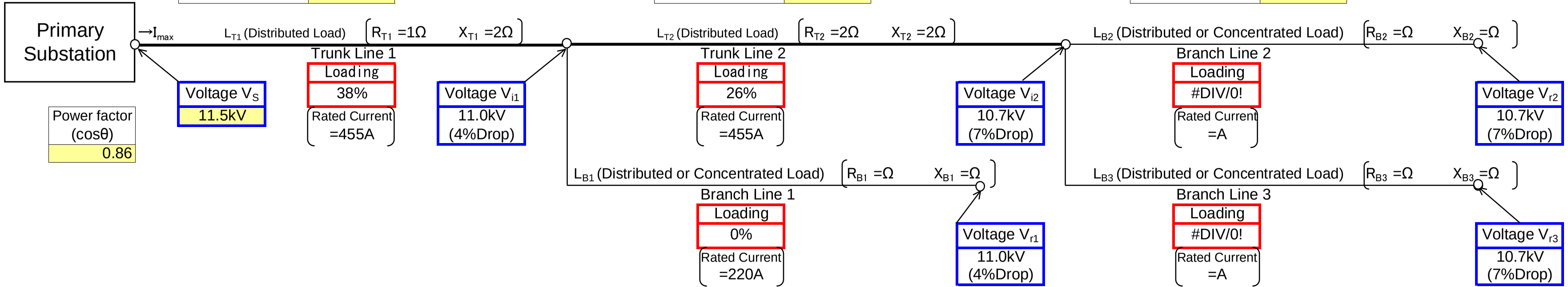
<Trank Line 2>

Load L_{T2}	116A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
174A



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 3

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
179A

Power factor (cosθ)
0.86

<Trank Line 1>

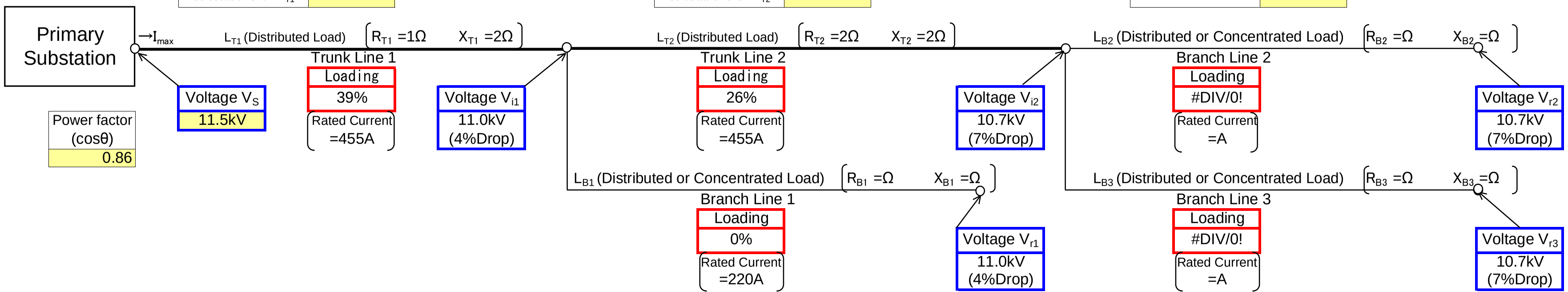
Load L_{T1}	59A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	120A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732\cdot(R_{T1}\cos\theta + X_{T1}\sin\theta)\cdot(L_{T1}\cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732\cdot(R_{T2}\cos\theta + X_{T2}\sin\theta)\cdot(L_{T2}\cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732\cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta)\cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732\cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta)\cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732\cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta)\cdot f_{B3}$

$L_{T1} = I_{max}\cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max}\cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max}\cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max}\cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max}\cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 3

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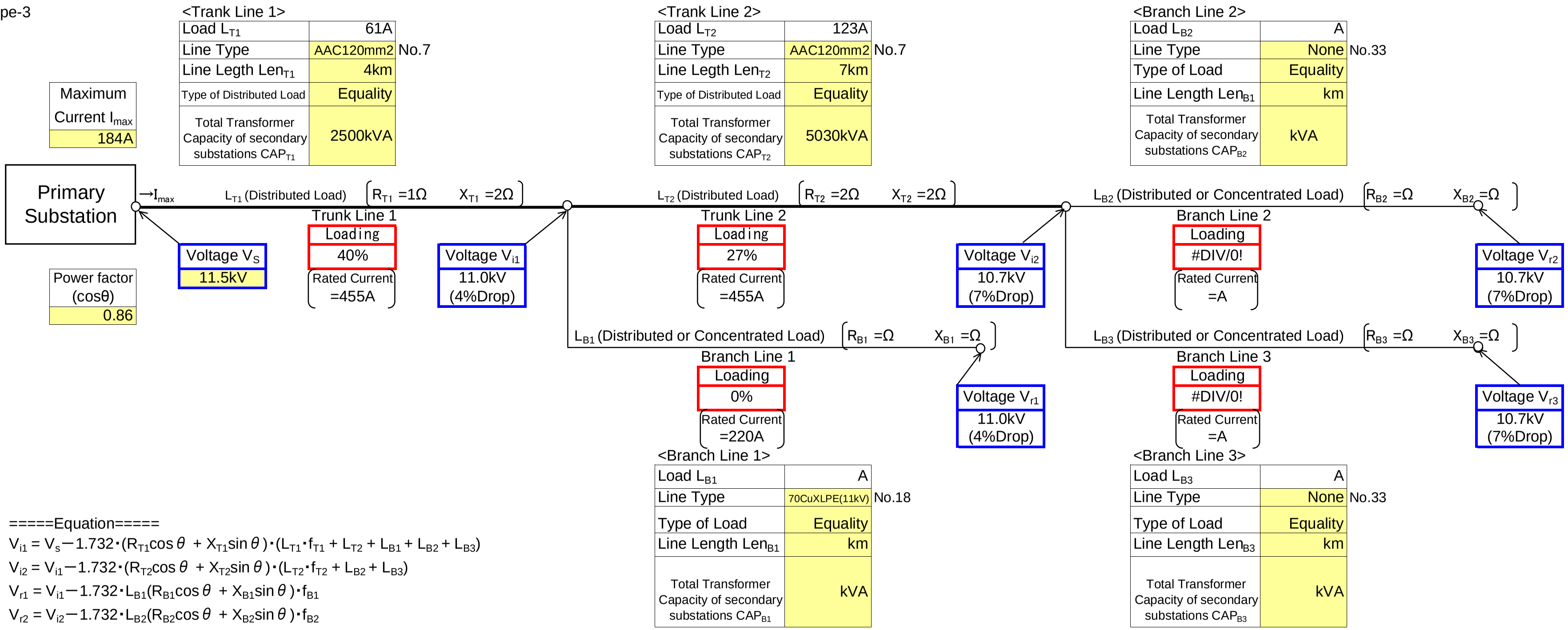
Type-3



<Trank Line 1>

Load L_{T1}	61A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	123A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 3

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Type-3

Maximum Current I_{max}
189A

Power factor (cosθ)
0.86

<Trank Line 1>

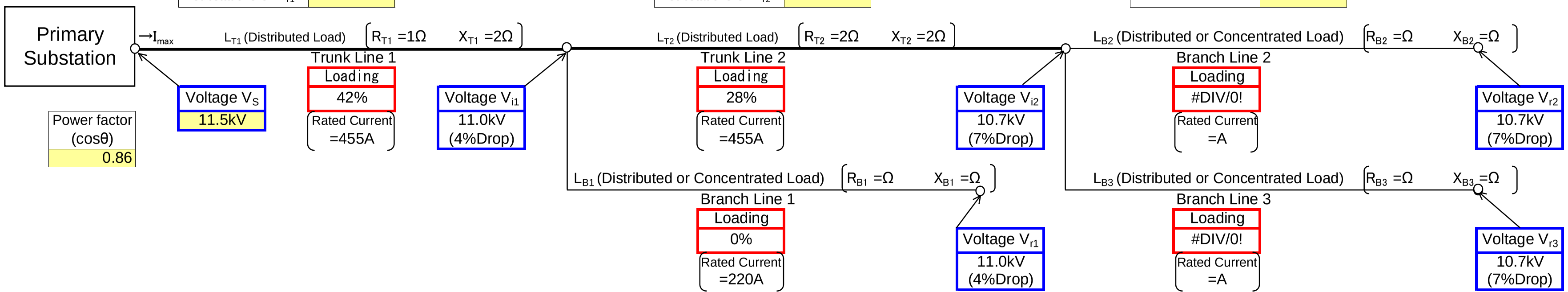
Load L_{T1}	63A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	126A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1} \cos\theta + X_{T1} \sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2} \cos\theta + X_{T2} \sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1} (R_{B1} \cos\theta + X_{B1} \sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2} (R_{B2} \cos\theta + X_{B2} \sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3} (R_{B3} \cos\theta + X_{B3} \sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 3

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Type-3

<Trank Line 1>

Load L_{T1}	64A
Line Type	AAC120mm2 No.7
Line Legth Len_{T1}	4km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA

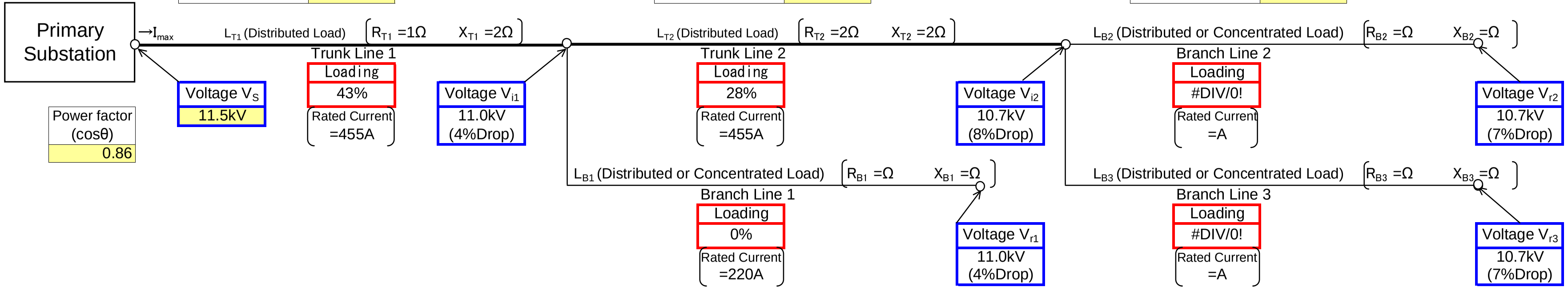
<Trank Line 2>

Load L_{T2}	130A
Line Type	AAC120mm2 No.7
Line Legth Len_{T2}	7km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T2}	5030kVA

<Branch Line 2>

Load L_{B2}	A
Line Type	None No.33
Type of Load	Equality
Line Length Len_{B1}	km
Total Transformer Capacity of secondary substations CAP_{B2}	kVA

Maximum Current I_{max}
194A



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	A
Line Type	70CuXLPE(11kV) No.18
Type of Load	Equality
Line Length Len_{B1}	km
Total Transformer Capacity of secondary substations CAP_{B1}	kVA

<Branch Line 3>

Load L_{B3}	A
Line Type	None No.33
Type of Load	Equality
Line Length Len_{B3}	km
Total Transformer Capacity of secondary substations CAP_{B3}	kVA

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 3

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	66A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

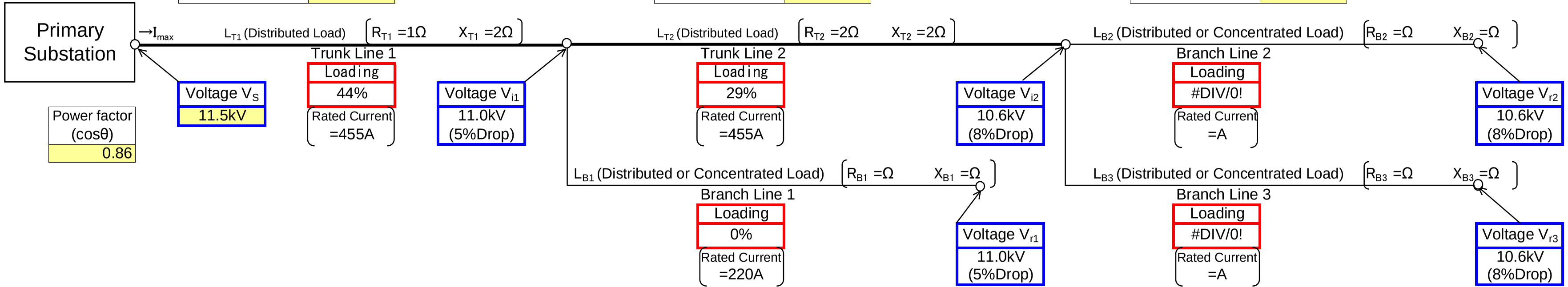
Load L_{T2}	133A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
199A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

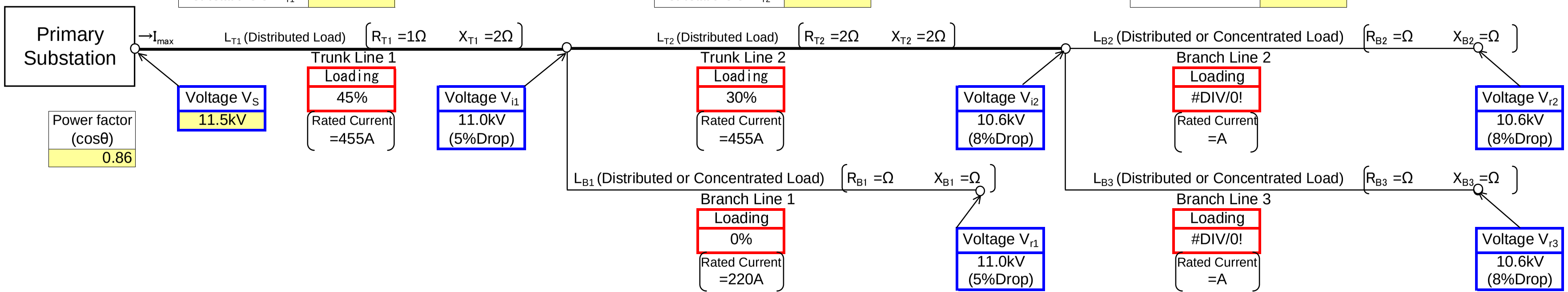
V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 3

: Input data in colored cells

Type-3



Maximum Current I_{max}
205A

Power factor (cosθ)
0.86

<Trank Line 1>

Load L_{T1}	68A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	137A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

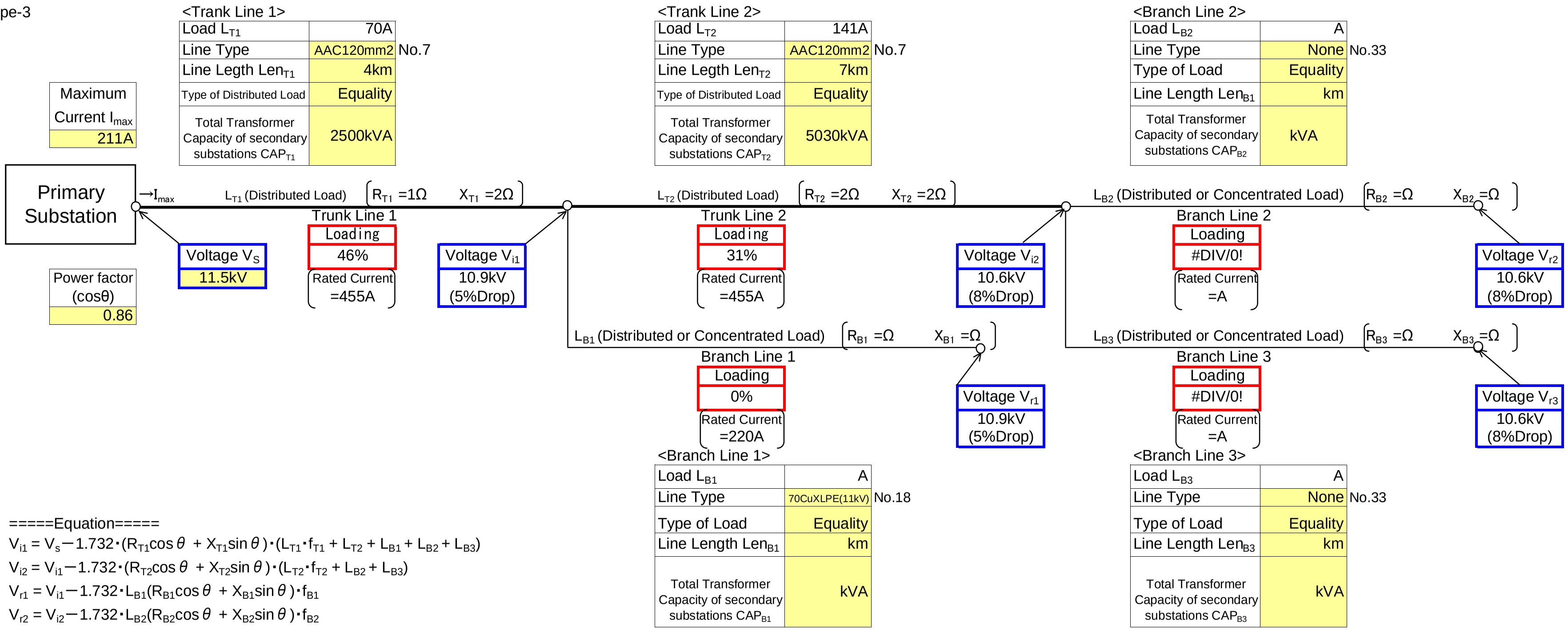
V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 3

: Input data in colored cells

Type-3



Maximum Current I_{max}
211A

Power factor (cosθ)
0.86

<Trank Line 1>

Load L_{T1}	70A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	141A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 3

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
216A

Power factor (cosθ)
0.86

<Trank Line 1>

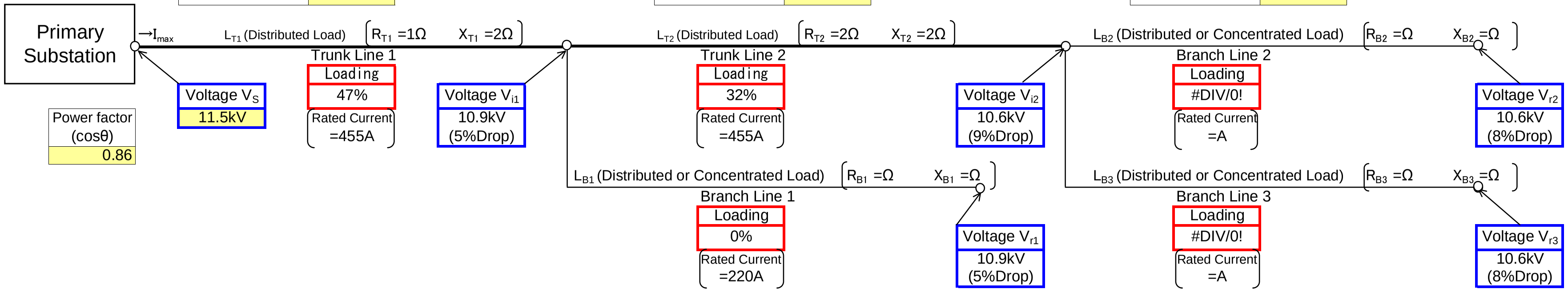
Load L_{T1}	72A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2500kVA	

<Trank Line 2>

Load L_{T2}	144A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	5030kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

2006

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 1

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Type-3

Maximum Current I_{max}
85A

Power factor (cosθ)
0.86

<Trank Line 1>

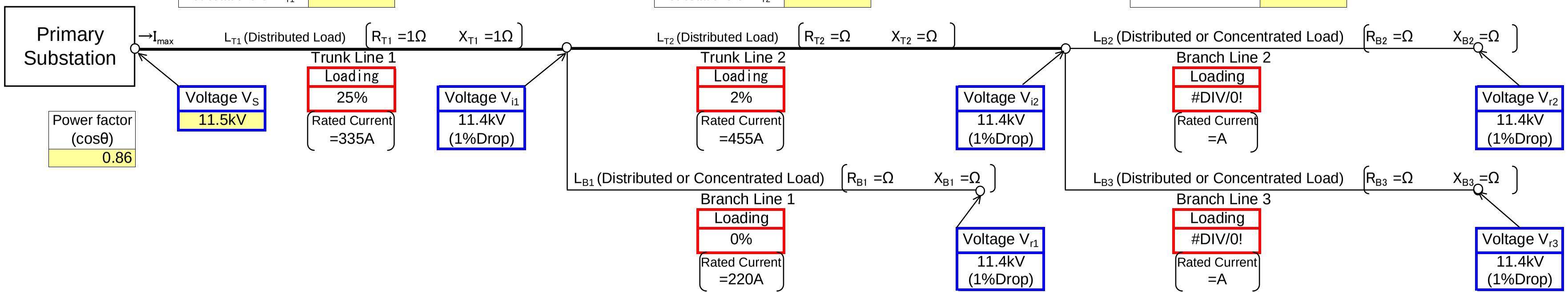
Load L_{T1}	77A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1845kVA	

<Trank Line 2>

Load L_{T2}	8A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 1

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	79A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1845kVA	

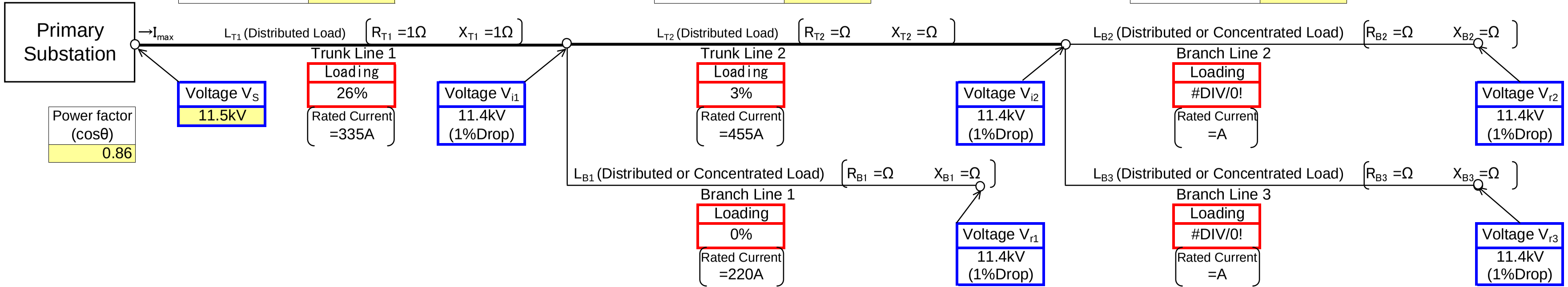
<Trank Line 2>

Load L_{T2}	9A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}	88A
Power factor (cosθ)	0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 1

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
92A

Power factor (cosθ)
0.86

<Trank Line 1>

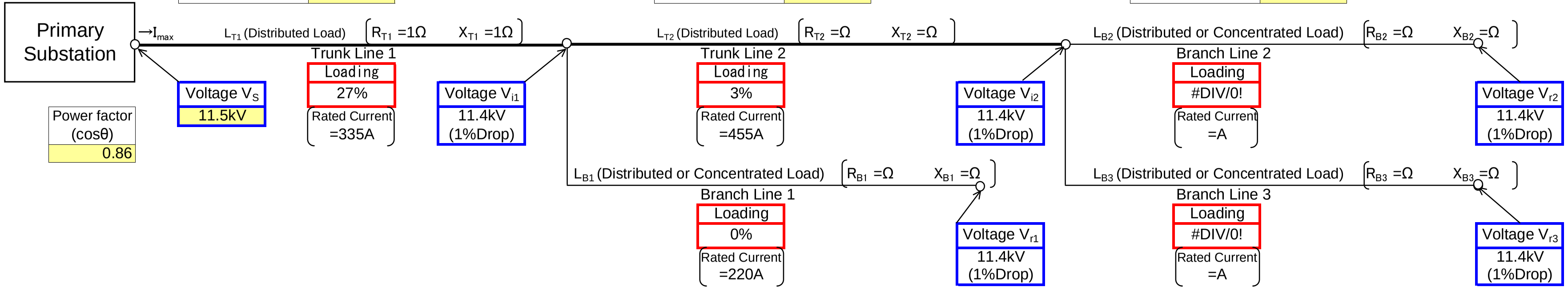
Load L_{T1}	83A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1845kVA	

<Trank Line 2>

Load L_{T2}	9A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 1

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max}
95A

<Trank Line 1>

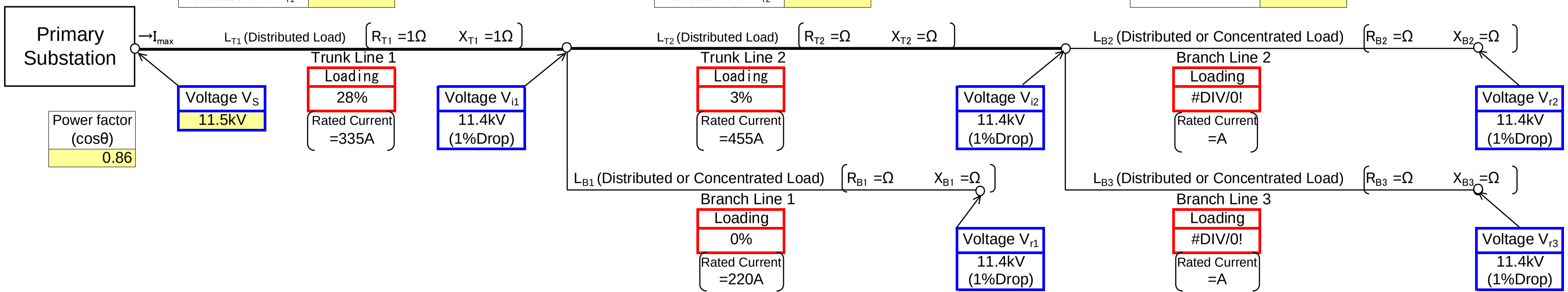
Load L_{T1}	86A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1845kVA	

<Trank Line 2>

Load L_{T2}	9A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



Power factor (cosθ)
0.86

<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage	I_{max} : Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1} : Received Voltage	L_{B1} : Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3} : Received Voltage	L_{B3} : Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 1

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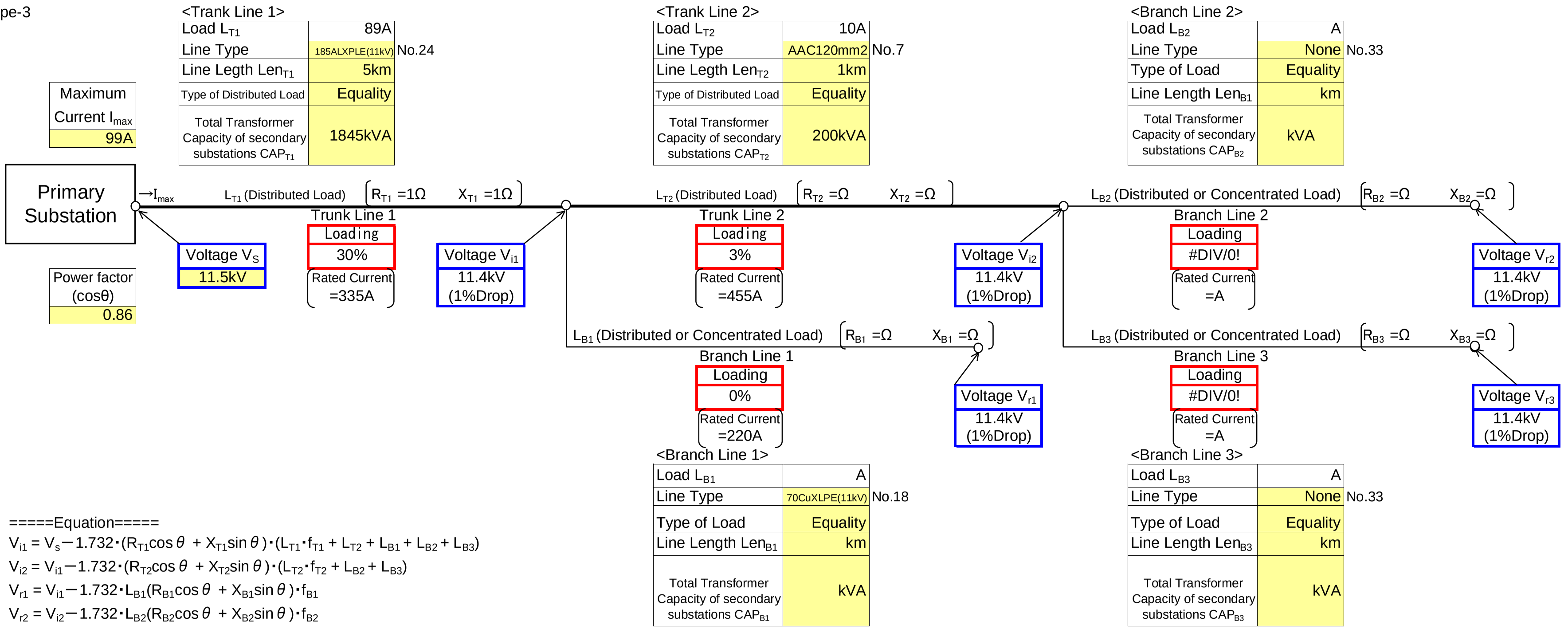
Type-3



<Trank Line 1>

Load L_{T1}	89A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1845kVA	

<Trank Line 2>

Load L_{T2}	10A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 1

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Type-3

<Trank Line 1>

Load L_{T1}	92A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1845kVA	

<Trank Line 2>

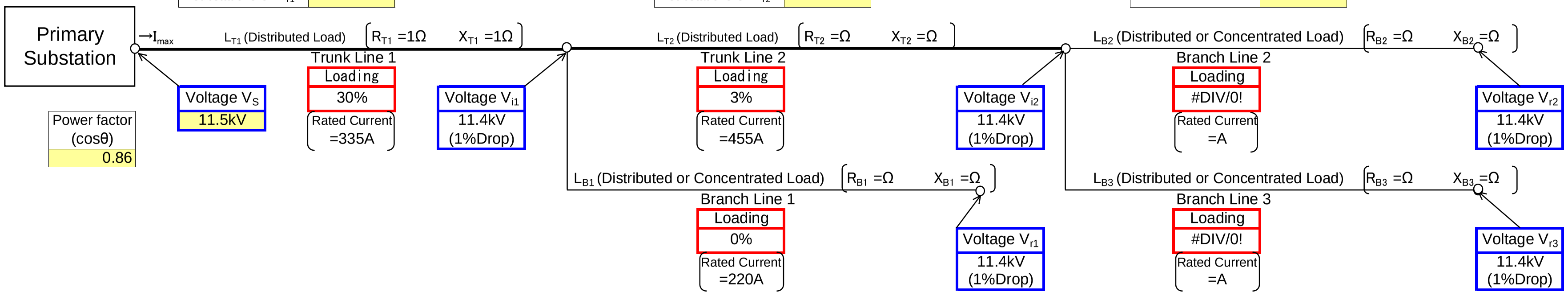
Load L_{T2}	10A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
102A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 1

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
106A

<Trank Line 1>

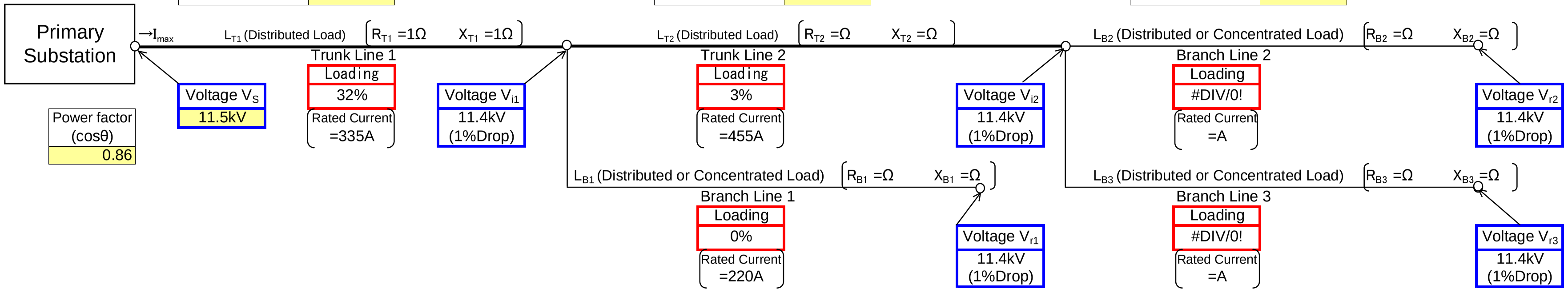
Load L_{T1}	96A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1845kVA	

<Trank Line 2>

Load L_{T2}	10A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 1

▭ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	99A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1845kVA	

<Trank Line 2>

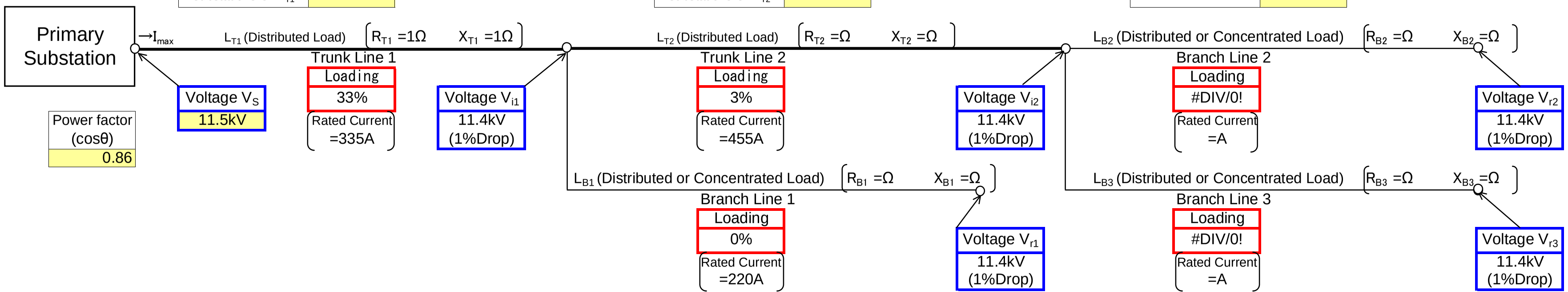
Load L_{T2}	11A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
110A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 1

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	103A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1845kVA	

<Trank Line 2>

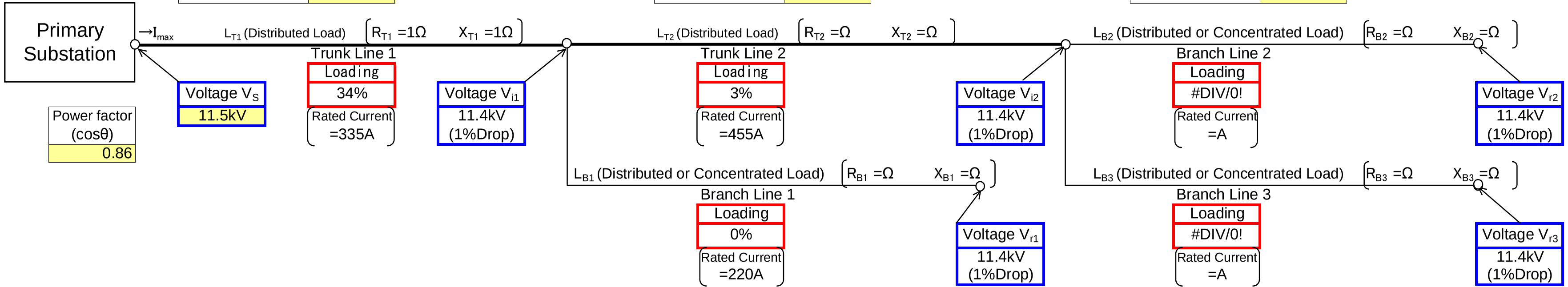
Load L_{T2}	11A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}	114A

Power factor (cosθ)	0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 1

▭ : Input data in colored cells

Type-3

Maximum Current I_{max}	119A

Power factor (cosθ)	0.86

<Trank Line 1>

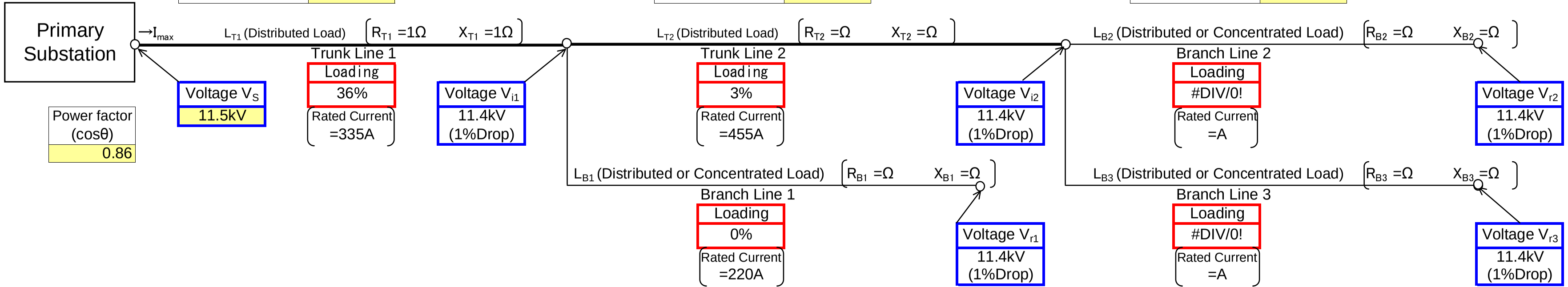
Load L_{T1}	107A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1845kVA	

<Trank Line 2>

Load L_{T2}	12A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 1

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	111A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1845kVA	

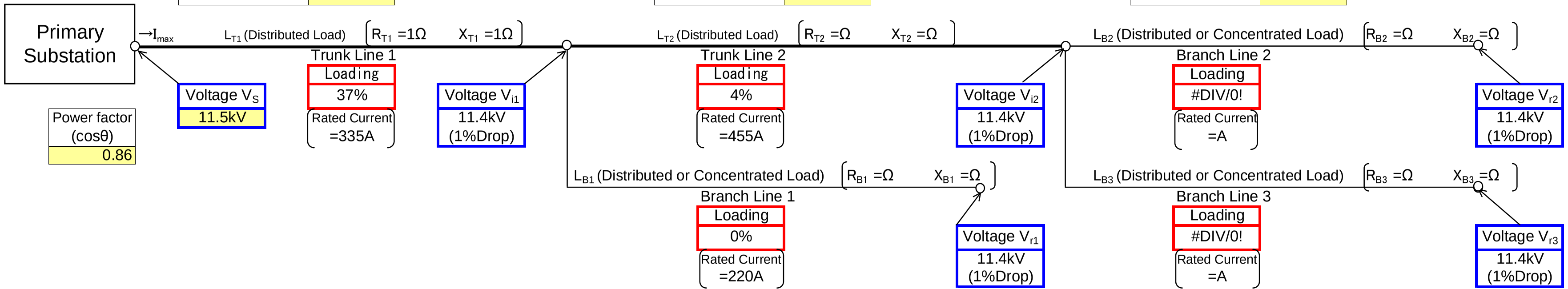
<Trank Line 2>

Load L_{T2}	12A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
123A



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	cape coast B.S.P.
Feeder Name	TOWN 1

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	115A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1845kVA	

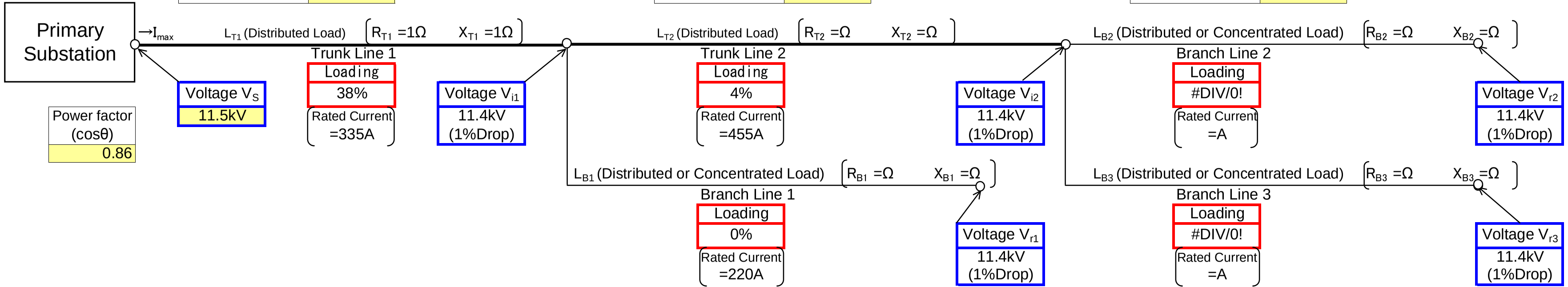
<Trank Line 2>

Load L_{T2}	13A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}	128A
Power factor (cosθ)	0.86



<Branch Line 1>

Load L_{B1}	A	
Line Type	70CuXLPE(11kV)	No.18
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B1}	kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$$
$$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$$
$$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$$
$$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$$
$$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$$
$$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$$
$$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$$
$$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$$
$$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$$
$$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$$
$$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	WINNEBA

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}	380A
Power factor (cosθ)	0.86

<Trank Line 1>

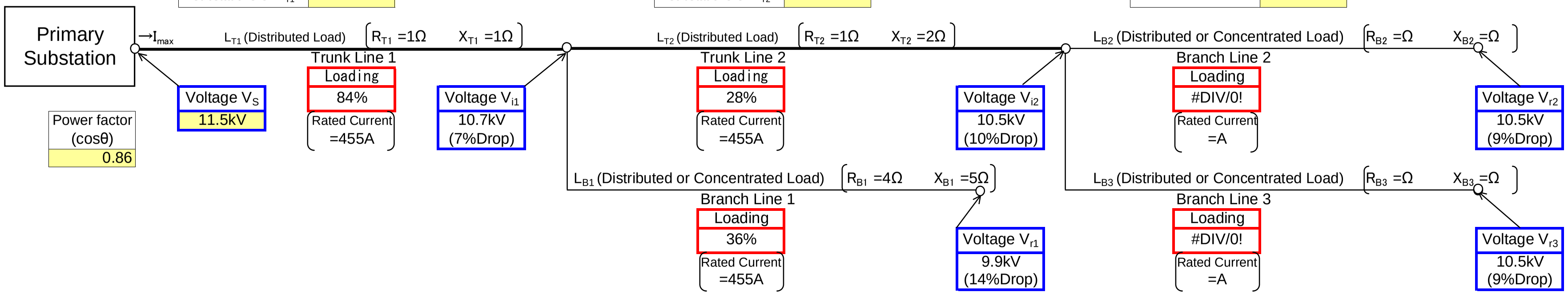
Load L_{T1}	87A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2015kVA	

<Trank Line 2>

Load L_{T2}	128A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2945kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	165A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	3815kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1} \cos\theta + X_{T1} \sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2} \cos\theta + X_{T2} \sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1} \cos\theta + X_{B1} \sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2} \cos\theta + X_{B2} \sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3} \cos\theta + X_{B3} \sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage	I_{max} : Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1} : Received Voltage	L_{B1} : Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3} : Received Voltage	L_{B3} : Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	WINNEBA

🟨 : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	92A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2015kVA	

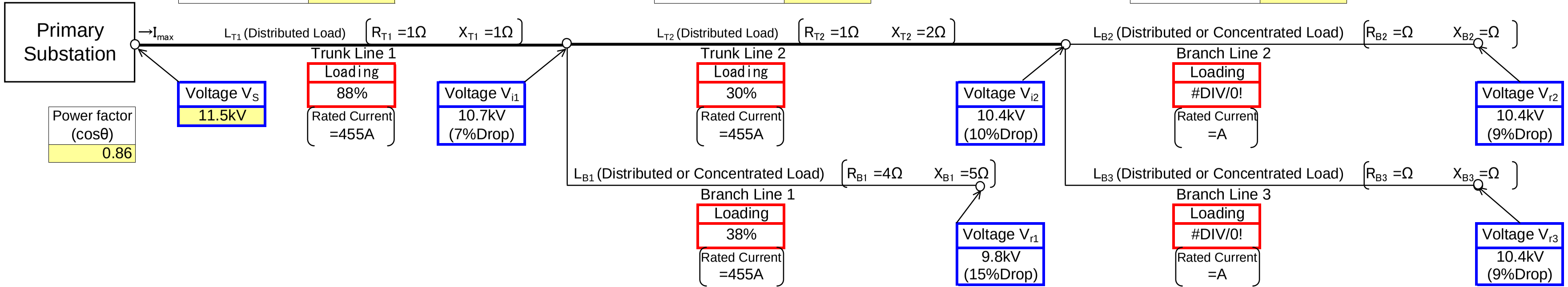
<Trank Line 2>

Load L_{T2}	135A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2945kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
402A



<Branch Line 1>

Load L_{B1}	175A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	3815kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	WINNEBA

▨ : Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	98A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2015kVA	

<Trank Line 2>

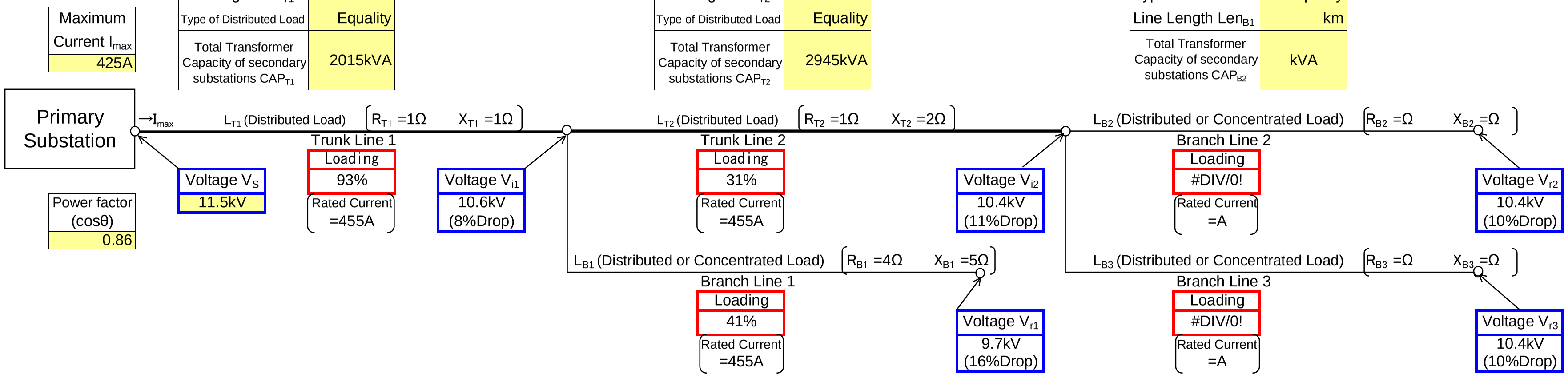
Load L_{T2}	143A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2945kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
425A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	185A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	3815kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$ CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	WINNEBA

▨ : Input data in colored cells

Type-3

Maximum Current I_{max}
450A

<Trank Line 1>

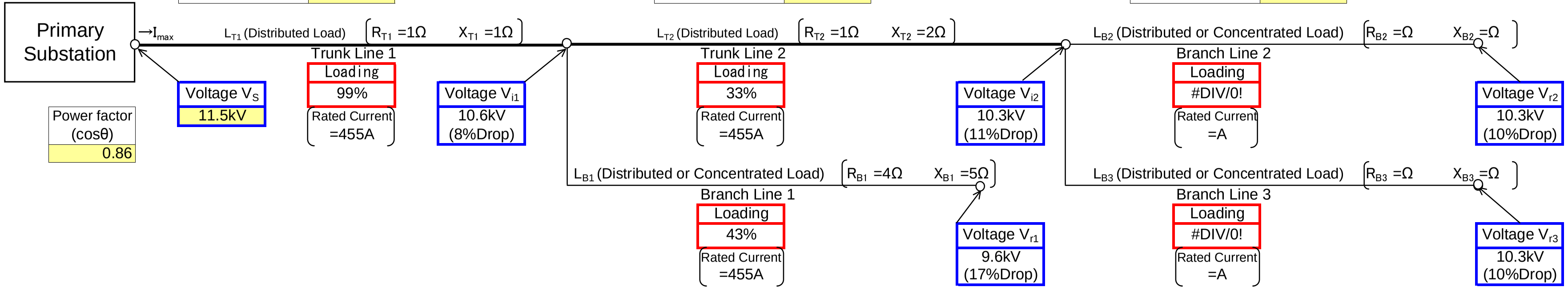
Load L_{T1}	103A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2015kVA	

<Trank Line 2>

Load L_{T2}	151A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2945kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	196A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	3815kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	WINNEBA

: Input data in colored cells

Type-3

Maximum Current I_{max}	476A
Power factor (cosθ)	0.86

<Trank Line 1>

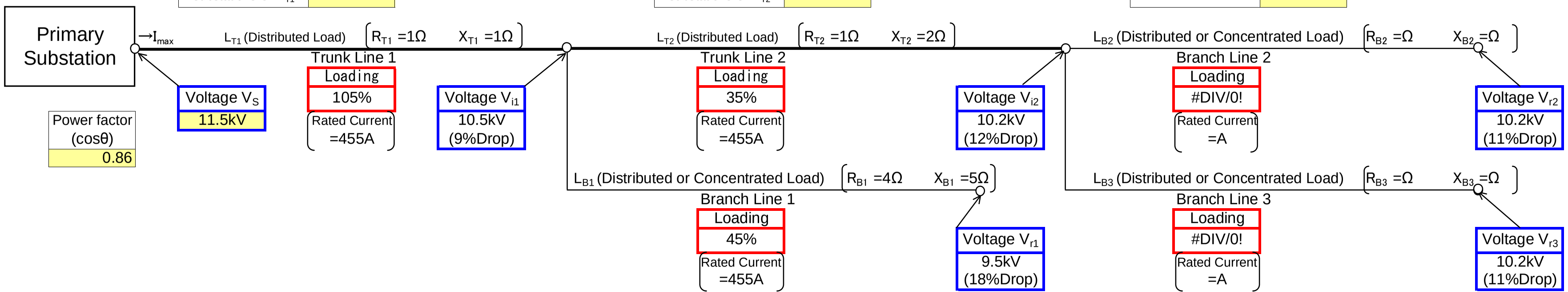
Load L_{T1}	109A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2015kVA	

<Trank Line 2>

Load L_{T2}	160A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2945kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	207A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	3815kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	WINNEBA

: Input data in colored cells

Type-3

Maximum Current I_{max}	504A
Power factor (cosθ)	0.86

<Trank Line 1>

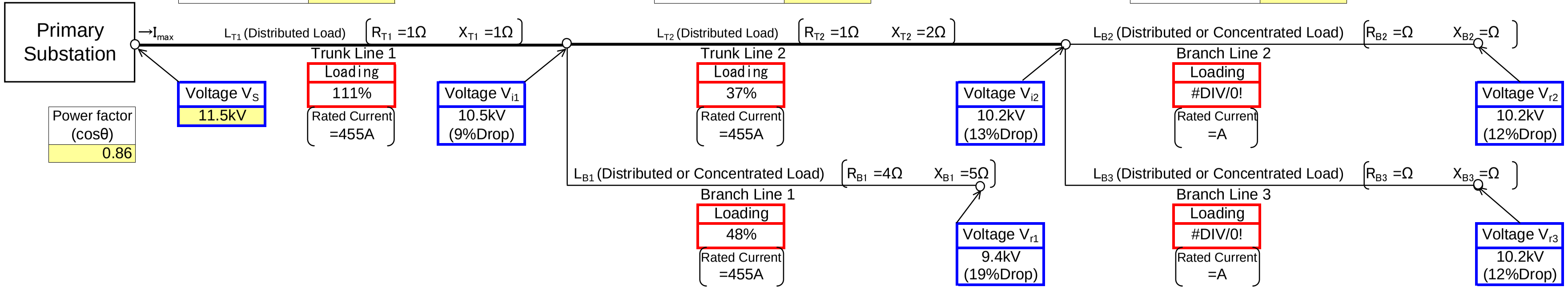
Load L_{T1}	116A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2015kVA	

<Trank Line 2>

Load L_{T2}	169A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2945kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	219A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	3815kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	WINNEBA

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Type-3

<Trank Line 1>

Load L_{T1}	122A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2015kVA	

<Trank Line 2>

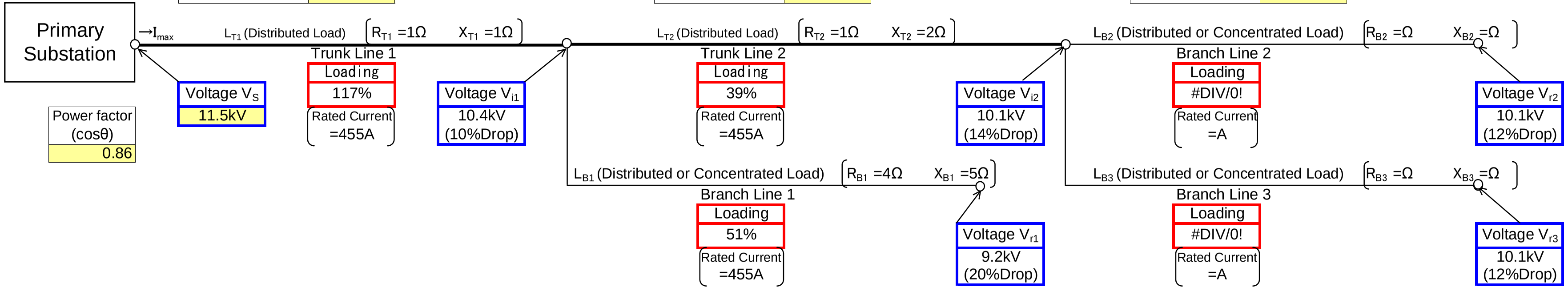
Load L_{T2}	179A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2945kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

Maximum Current I_{max}
533A

Power factor (cosθ)
0.86



<Branch Line 1>

Load L_{B1}	232A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	3815kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

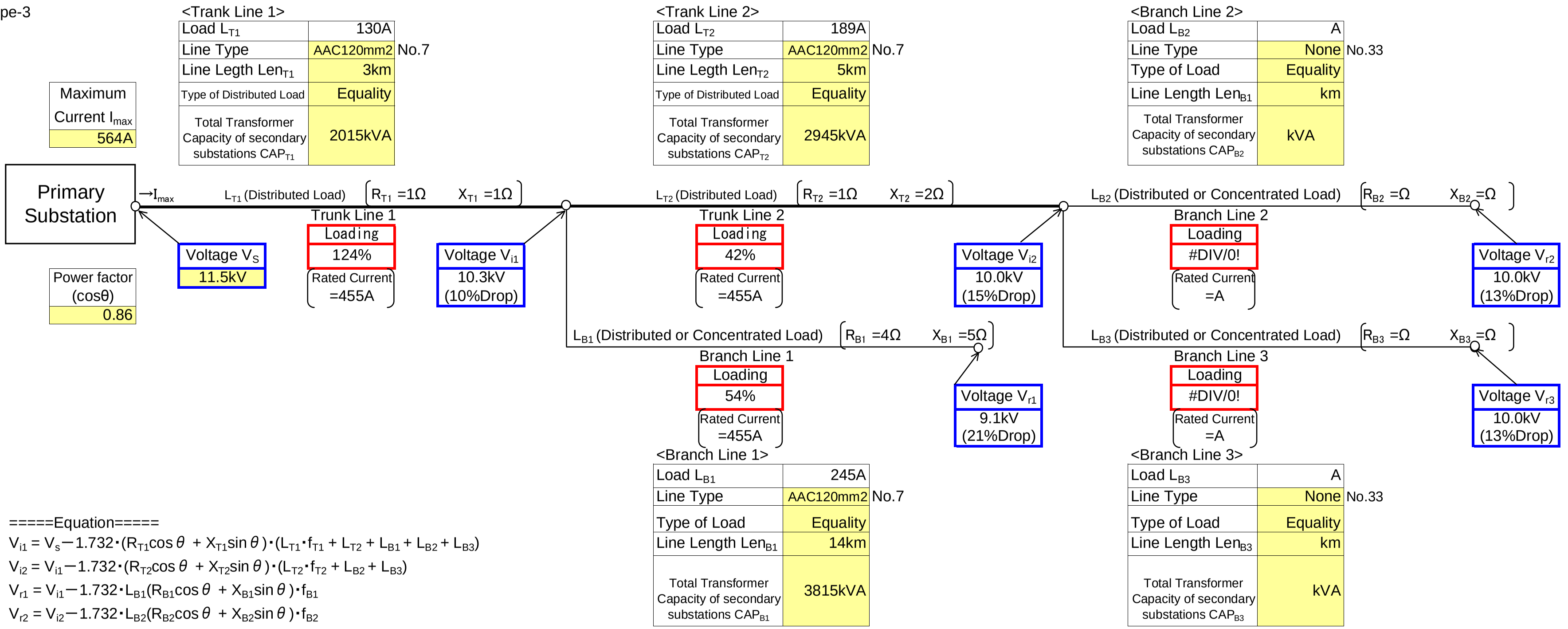
V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	WINNEBA

: Input data in colored cells

Type-3



Maximum Current I_{max}
564A

Power factor (cosθ)
0.86

<Trank Line 1>

Load L_{T1}	130A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2015kVA	

<Trank Line 2>

Load L_{T2}	189A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2945kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	245A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	3815kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage
V_{i1} : Interim Voltage
V_{i2} : Interim Voltage
V_{r1} : Received Voltage
V_{r2} : Received Voltage
V_{r3} : Received Voltage

I_{max} : Maximum Current
L_{T1} : Load (Trunk line 1)
L_{T2} : Load (Trunk line 2)
L_{B1} : Load (Branch Line 1)
L_{B2} : Load (Branch Line 2)
L_{B3} : Load (Branch Line 3)

R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3} : Dispersal Load Factor
CAP_{T1}, CAP_{T2}, CAP_{B1}, CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
cosθ : Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	WINNEBA

🟨: Input data in colored cells

Type-3

Maximum Current I_{max}
596A

<Trank Line 1>

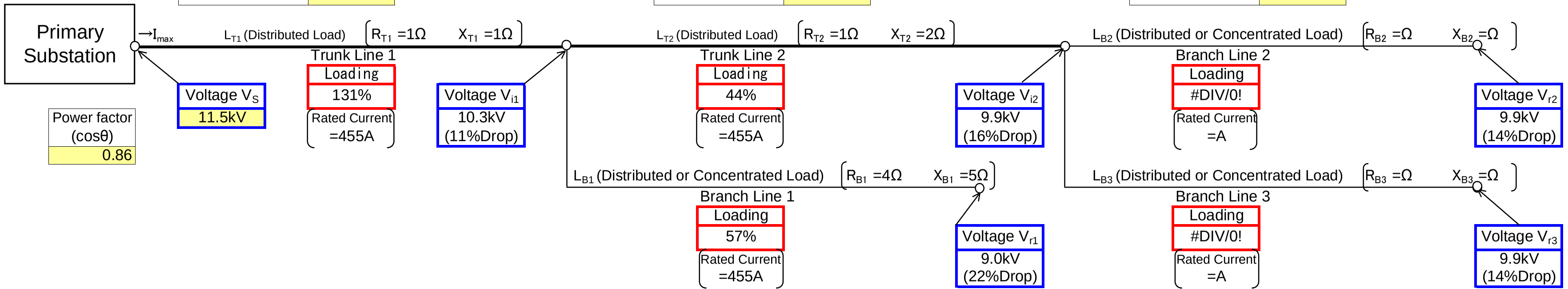
Load L_{T1}	137A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2015kVA	

<Trank Line 2>

Load L_{T2}	200A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2945kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	259A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	3815kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	WINNEBA

🟨 : Input data in colored cells

Type-3

Maximum Current I_{max} 631A

<Trank Line 1>

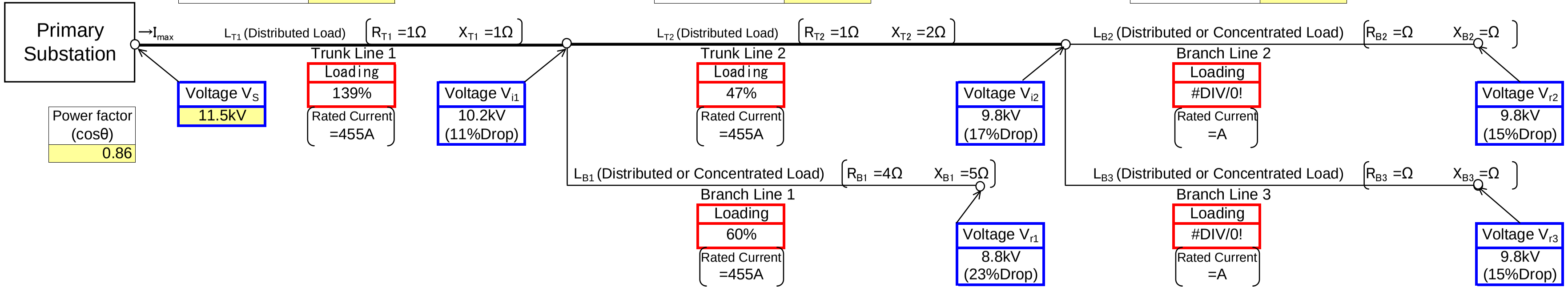
Load L_{T1}	145A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2015kVA	

<Trank Line 2>

Load L_{T2}	212A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2945kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	274A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	3815kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A - *Power System Analysis for existing system using Macro demand forecast* -

Substation Name	WINNEBA B.S.P.
Feeder Name	WINNEBA

▭ : Input data in colored cells

Type-3

Maximum Current I_{max}	
	668A

<Trank Line 1>

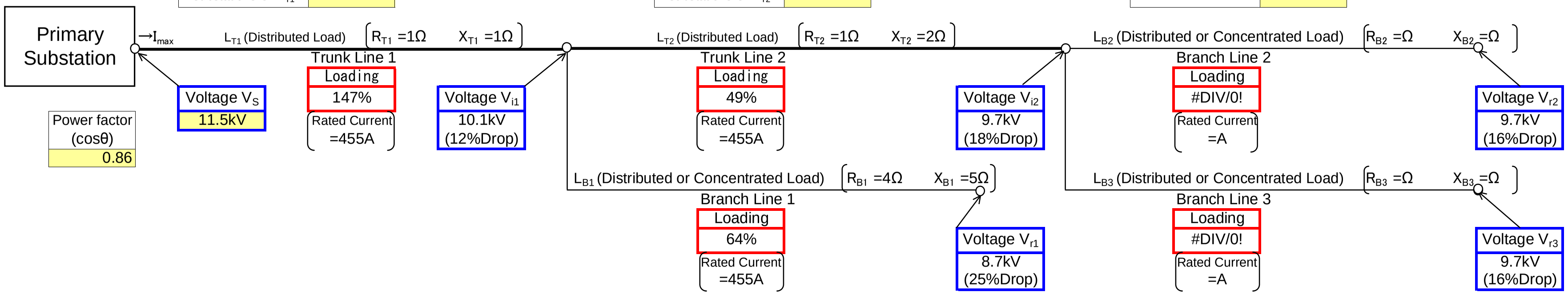
Load L_{T1}	153A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2015kVA	

<Trank Line 2>

Load L_{T2}	224A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2945kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	



<Branch Line 1>

Load L_{B1}	290A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	3815kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1} + CAP_{T2} + CAP_{B1} + CAP_{B2} + CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

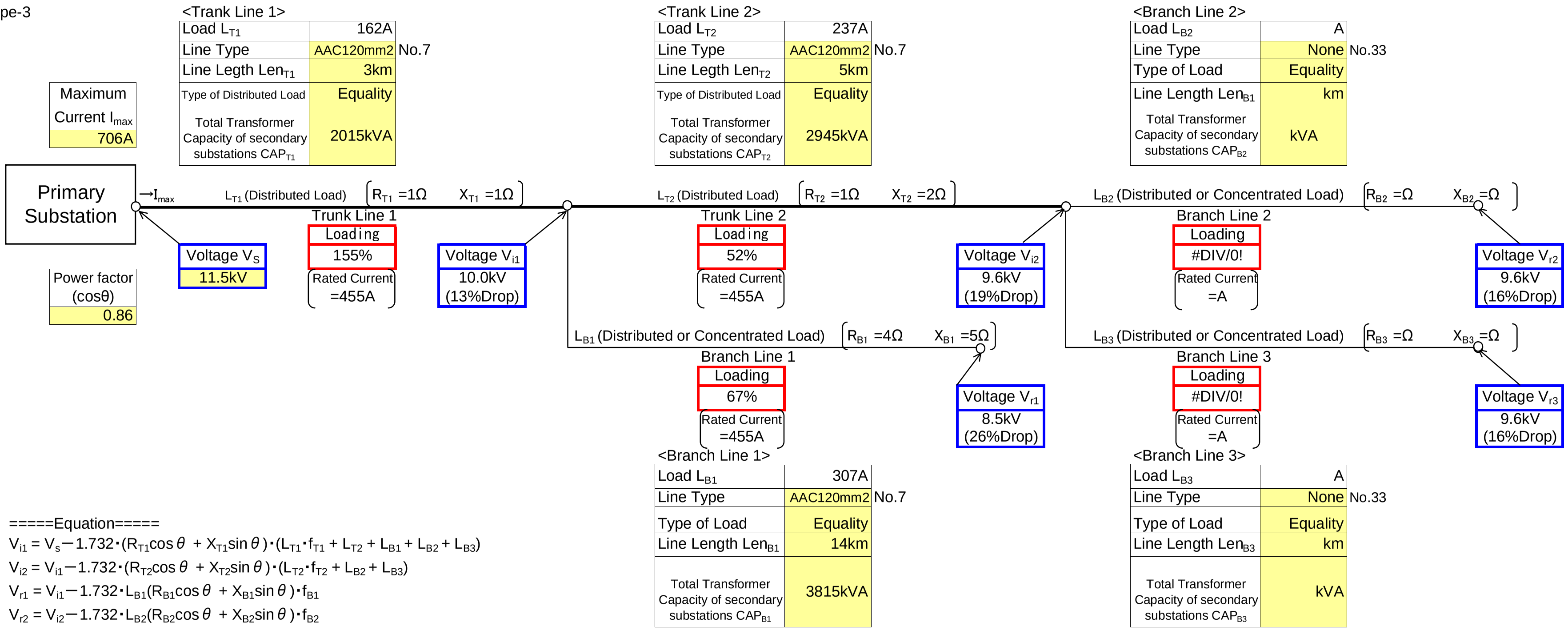
V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

Power System Analysis for Step A *- Power System Analysis for existing system using Macro demand forecast -*

Substation Name	WINNEBA B.S.P.
Feeder Name	WINNEBA

: Input data in colored cells

Type-3



<Trank Line 1>

Load L_{T1}	162A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T1}	3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2015kVA	

<Trank Line 2>

Load L_{T2}	237A	
Line Type	AAC120mm2	No.7
Line Legth Len_{T2}	5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2945kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B1}	km	
Total Transformer Capacity of secondary substations CAP_{B2}	kVA	

<Branch Line 1>

Load L_{B1}	307A	
Line Type	AAC120mm2	No.7
Type of Load	Equality	
Line Length Len_{B1}	14km	
Total Transformer Capacity of secondary substations CAP_{B1}	3815kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.33
Type of Load	Equality	
Line Length Len_{B3}	km	
Total Transformer Capacity of secondary substations CAP_{B3}	kVA	

=====Equation=====

$V_{i1} = V_s - 1.732 \cdot (R_{T1}\cos\theta + X_{T1}\sin\theta) \cdot (L_{T1} \cdot f_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3})$

$V_{i2} = V_{i1} - 1.732 \cdot (R_{T2}\cos\theta + X_{T2}\sin\theta) \cdot (L_{T2} \cdot f_{T2} + L_{B2} + L_{B3})$

$V_{r1} = V_{i1} - 1.732 \cdot L_{B1}(R_{B1}\cos\theta + X_{B1}\sin\theta) \cdot f_{B1}$

$V_{r2} = V_{i2} - 1.732 \cdot L_{B2}(R_{B2}\cos\theta + X_{B2}\sin\theta) \cdot f_{B2}$

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	CAP_{T1}, CAP_{T2}, CAP_{B1} CAP_{B2}, CAP_{B3}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)		
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor