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

Substation Name	STATION D
Feeder Name	D16

: Input data in colored cells

Type-3

Maximum Current I_{max}
827.0A

Power factor (cosθ)
0.85

<Trank Line 1>

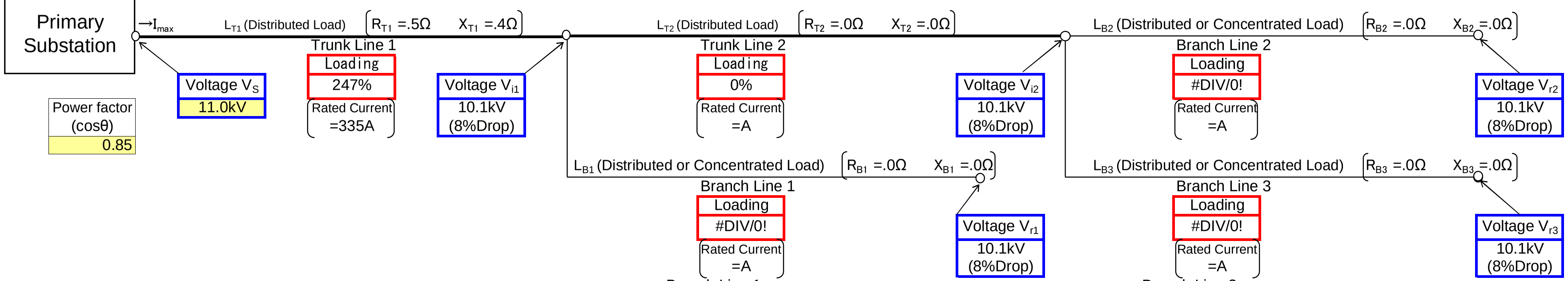
Load L_{T1}	827A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6180kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 D
Feeder Name	D16

: Input data in colored cells

Type-3

Maximum Current I_{max}: 898.0A

Power factor (cosθ): 0.85

<Trank Line 1>

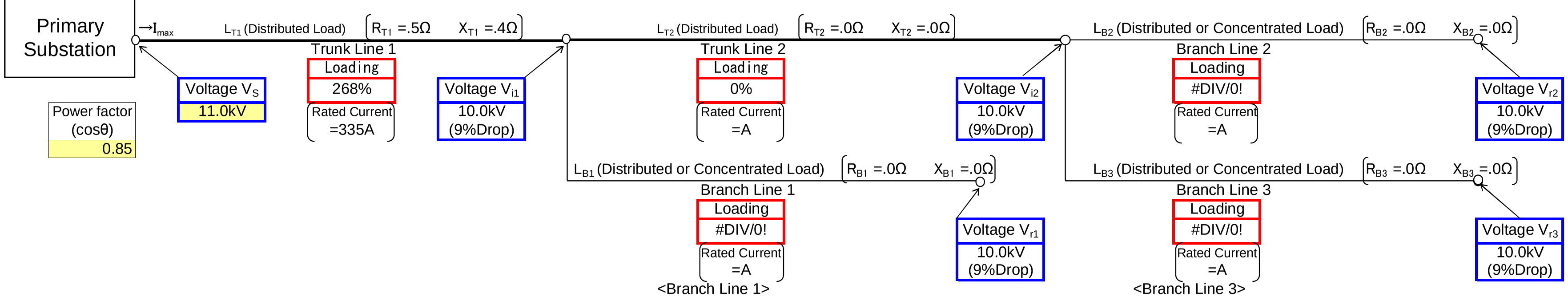
Load L_{T1}	898A
Line Type	185ALXPLE(11kV) No.24
Line Legth Len_{T1}	3.2km
Type of Distributed Load	Concentrated
Total Transformer Capacity of secondary substations CAP_{T1}	6180kVA

<Trank Line 2>

Load L_{T2}	A
Line Type	None No.57
Line Legth Len_{T2}	
Type of Distributed Load	
Total Transformer Capacity of secondary substations CAP_{T2}	

<Branch Line 2>

Load L_{B2}	A
Line Type	None No.57
Line Length Len_{B1}	
Type of Distributed Load	
Total Transformer Capacity of secondary substations CAP_{B2}	



<Branch Line 1>

Load L_{B1}	A
Line Type	None No.57
Line Length Len_{B1}	
Type of Distributed Load	
Total Transformer Capacity of secondary substations CAP_{B1}	

<Branch Line 3>

Load L_{B3}	A
Line Type	None No.57
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	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 D
Feeder Name	D16

: Input data in colored cells

Type-3

Maximum Current I_{max}
975.0A

Power factor ($\cos\theta$)
0.85

Primary Substation $\rightarrow I_{max}$

<Trank Line 1>

Load L_{T1}	975A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6180kVA	

L_{T1} (Distributed Load) R_{T1} =.5Ω X_{T1} =.4Ω

Voltage V_S: 11.0kV

Trunk Line 1: Loading 291%, Rated Current =335A

Voltage V_{i1}: 10.0kV (9%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.0kV (9%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.0kV (9%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.0kV (9%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.0kV (9%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$,
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
V_{r3} : Received Voltage	L_{B3} : Load (Branch Line 3)	$\cos\theta$: Power Factor

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

Substation Name	STATION D
Feeder Name	D24

: Input data in colored cells

Type-3

Maximum Current I_{max}
241.0A

Power factor (cosθ)
0.85

<Trank Line 1>

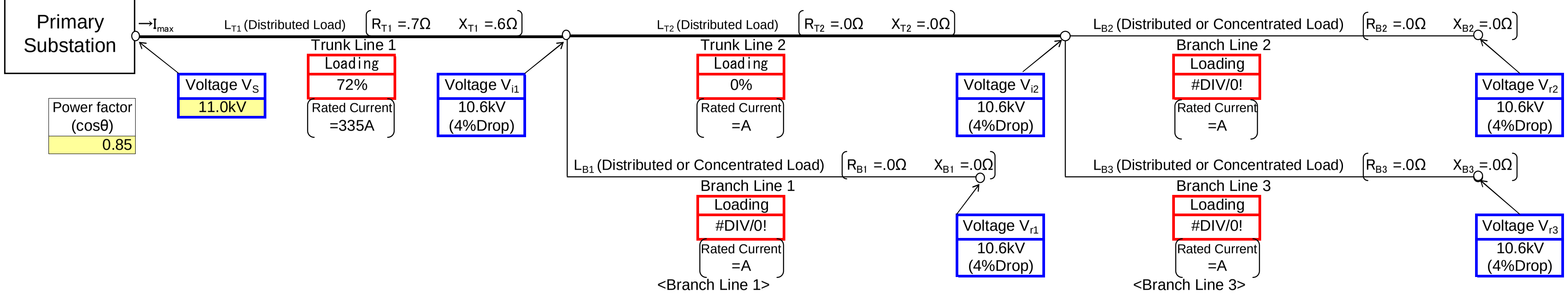
Load L_{T1}	241A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$,
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 D
Feeder Name	D24

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	253A
Line Type	185ALXPLE(11kV) No.24
Line Legth Len_{T1}	4.8km
Type of Distributed Load	Concentrated
Total Transformer Capacity of secondary substations CAP_{T1}	6915kVA

<Trank Line 2>

Load L_{T2}	A
Line Type	None No.57
Line Legth Len_{T2}	
Type of Distributed Load	
Total Transformer Capacity of secondary substations CAP_{T2}	

<Branch Line 2>

Load L_{B2}	A
Line Type	None No.57
Line Length Len_{B1}	
Type of Distributed Load	
Total Transformer Capacity of secondary substations CAP_{B2}	

Maximum Current I_{max}	253.0A
Power factor (cosθ)	0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) R_{T1} =.7Ω X_{T1} =.6Ω

Trunk Line 1: Loading 76%, Rated Current =335A

Voltage V_{i1}: 10.6kV (4%Drop)

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.6kV (4%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.6kV (4%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.6kV (4%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.6kV (4%Drop)

<Branch Line 1>

Load L_{B1}	A
Line Type	None No.57
Line Length Len_{B1}	
Type of Distributed Load	
Total Transformer Capacity of secondary substations CAP_{B1}	

<Branch Line 3>

Load L_{B3}	A
Line Type	None No.57
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	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 D
Feeder Name	D24

: Input data in colored cells

Type-3

Maximum Current I_{max}
265.0A

Power factor (cosθ)
0.85

<Trank Line 1>

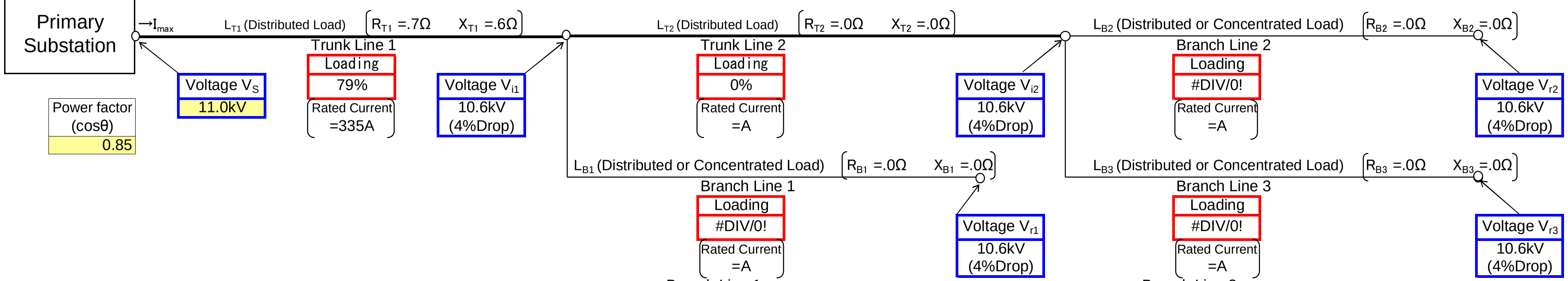
Load L_{T1}	265A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 D
Feeder Name	D24

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	278A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6915kVA	

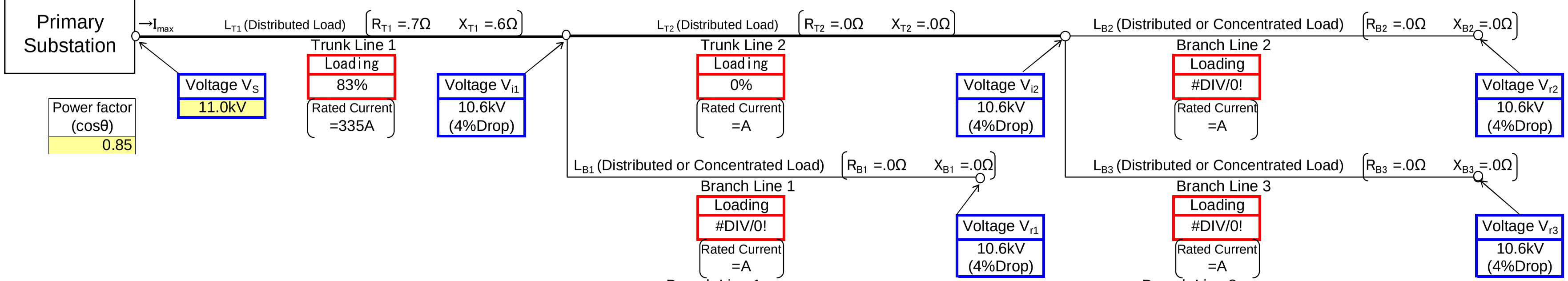
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	278.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 D
Feeder Name	D24

: Input data in colored cells

Type-3

Primary Substation

Maximum Current I_{max}	292.0A
Power factor (cosθ)	0.85

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	292A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6915kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.7Ω X_{T1} =.6Ω)

Trunk Line 1 Loading 87% (Rated Current =335A)

Voltage V_{i1} 10.5kV (4%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 Loading 0% (Rated Current =A)

Voltage V_{i2} 10.5kV (4%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 Loading #DIV/0! (Rated Current =A)

Voltage V_{r2} 10.5kV (4%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 Loading #DIV/0! (Rated Current =A)

Voltage V_{r1} 10.5kV (4%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 Loading #DIV/0! (Rated Current =A)

Voltage V_{r3} 10.5kV (4%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 D
Feeder Name	D24

: Input data in colored cells

Type-3

Maximum Current I_{max}
306.0A

<Trank Line 1>

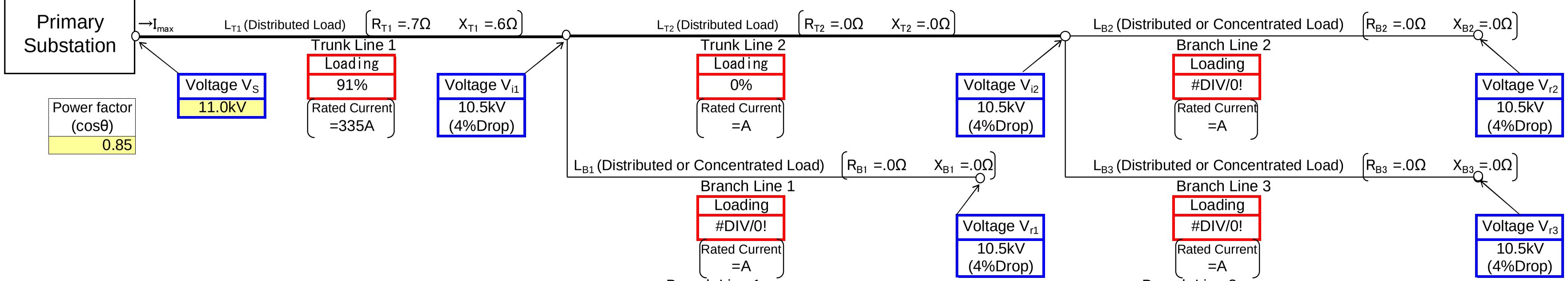
Load L_{T1}	306A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 D
Feeder Name	D24

: Input data in colored cells

Type-3

Maximum Current I_{max}	321.0A	
Power factor (cosθ)	0.85	

<Trank Line 1>

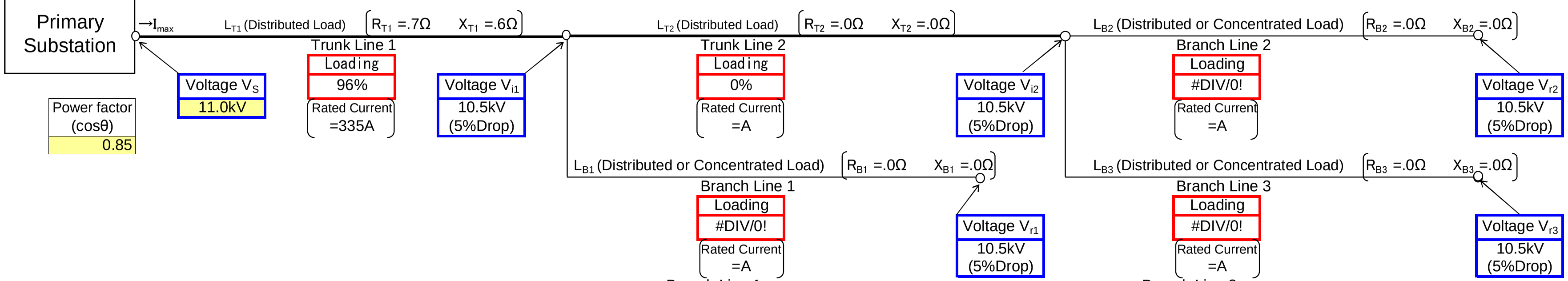
Load L_{T1}	321A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	STATION D
Feeder Name	D24

: Input data in colored cells

Type-3

Maximum Current I_{max}
337.0A

Power factor (cosθ)
0.85

<Trank Line 1>

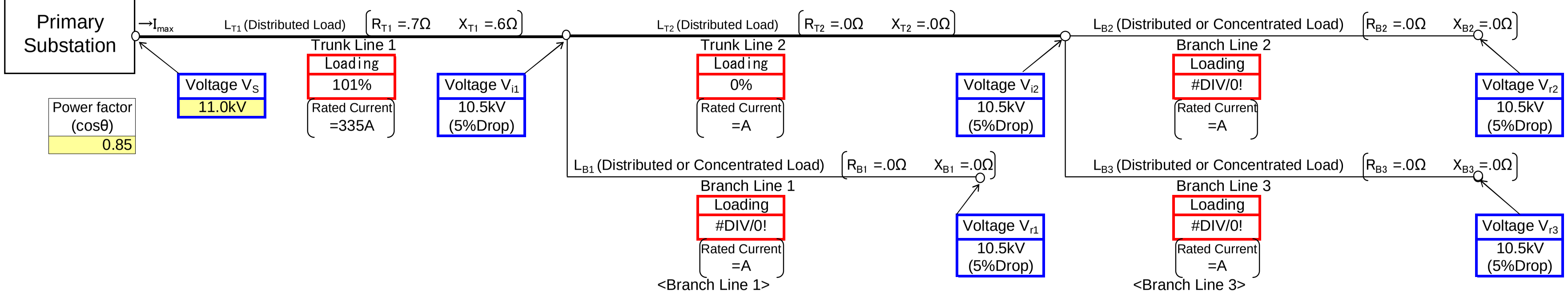
Load L_{T1}	337A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 D
Feeder Name	D24

: Input data in colored cells

Type-3

Primary Substation

Maximum Current I_{max}
353.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	353A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6915kVA	

→I_{max} L_{T1} (Distributed Load) R_{T1} =.7Ω X_{T1} =.6Ω

Voltage V_S 11.0kV

Trunk Line 1 Loading 105% Rated Current =335A

Voltage V_{i1} 10.4kV (5%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2 Loading 0% Rated Current =A

Voltage V_{i2} 10.4kV (5%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1 Loading #DIV/0! Rated Current =A

Voltage V_{r1} 10.4kV (5%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2 Loading #DIV/0! Rated Current =A

Voltage V_{r2} 10.4kV (5%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3 Loading #DIV/0! Rated Current =A

Voltage V_{r3} 10.4kV (5%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 D
Feeder Name	D24

: Input data in colored cells

Type-3

Maximum Current I_{max}
371.0A

Power factor (cosθ)
0.85

<Trank Line 1>

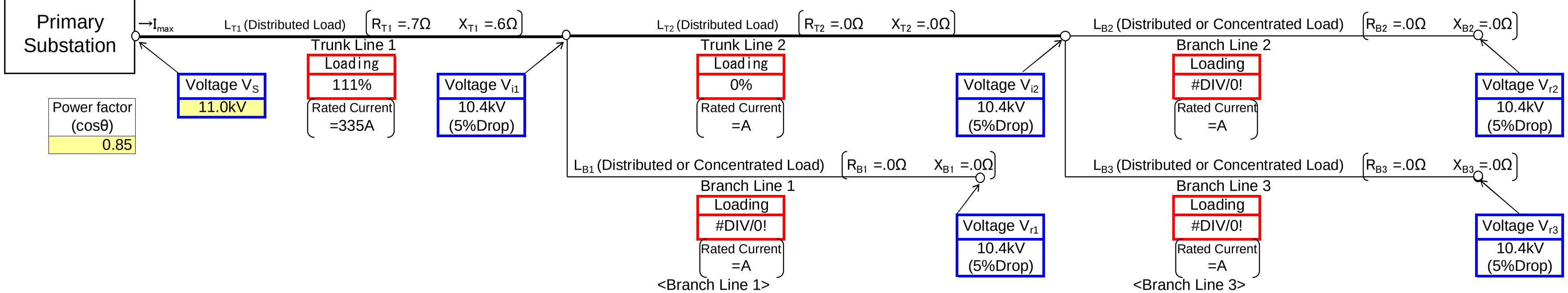
Load L_{T1}	371A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 D
Feeder Name	D24

: Input data in colored cells

Type-3

Maximum Current I_{max}
389.0A

Power factor (cosθ)
0.85

<Trank Line 1>

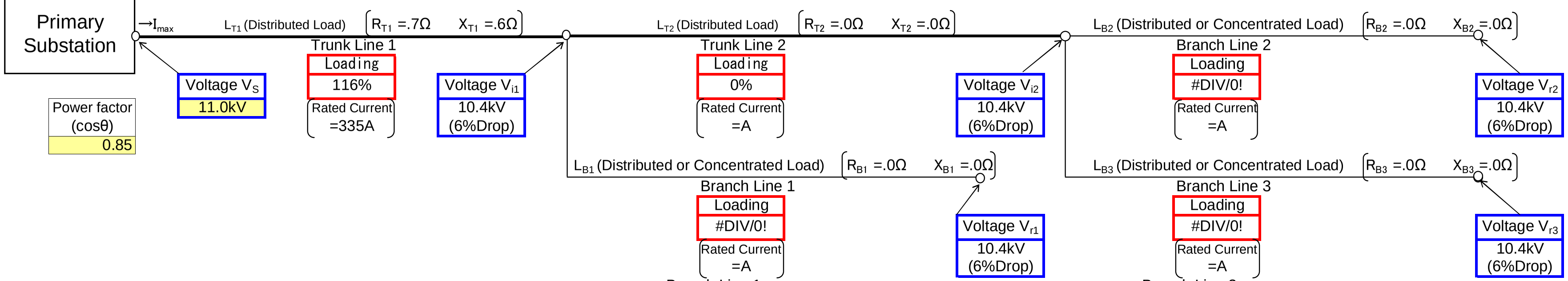
Load L_{T1}	389A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 D
Feeder Name	D24

: Input data in colored cells

Type-3

Maximum Current I_{max}
408.0A

<Trank Line 1>

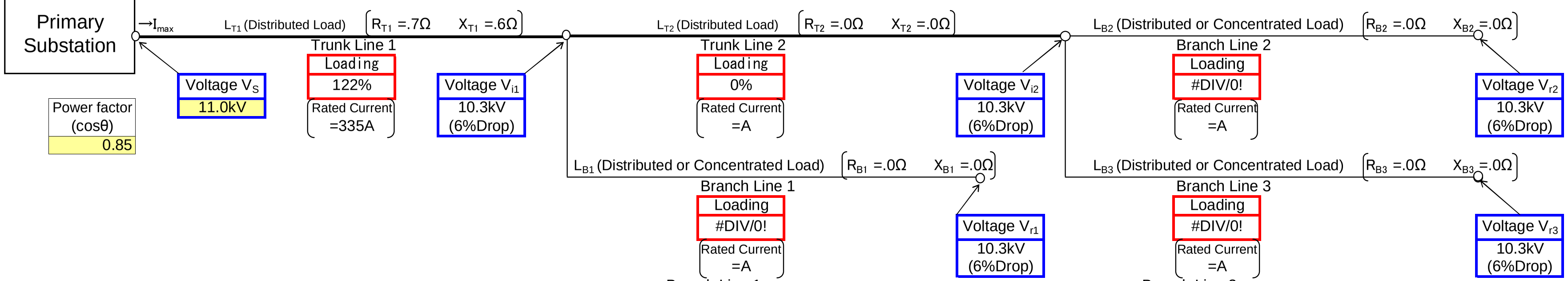
Load L_{T1}	408A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
Line Length Len_{B3}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

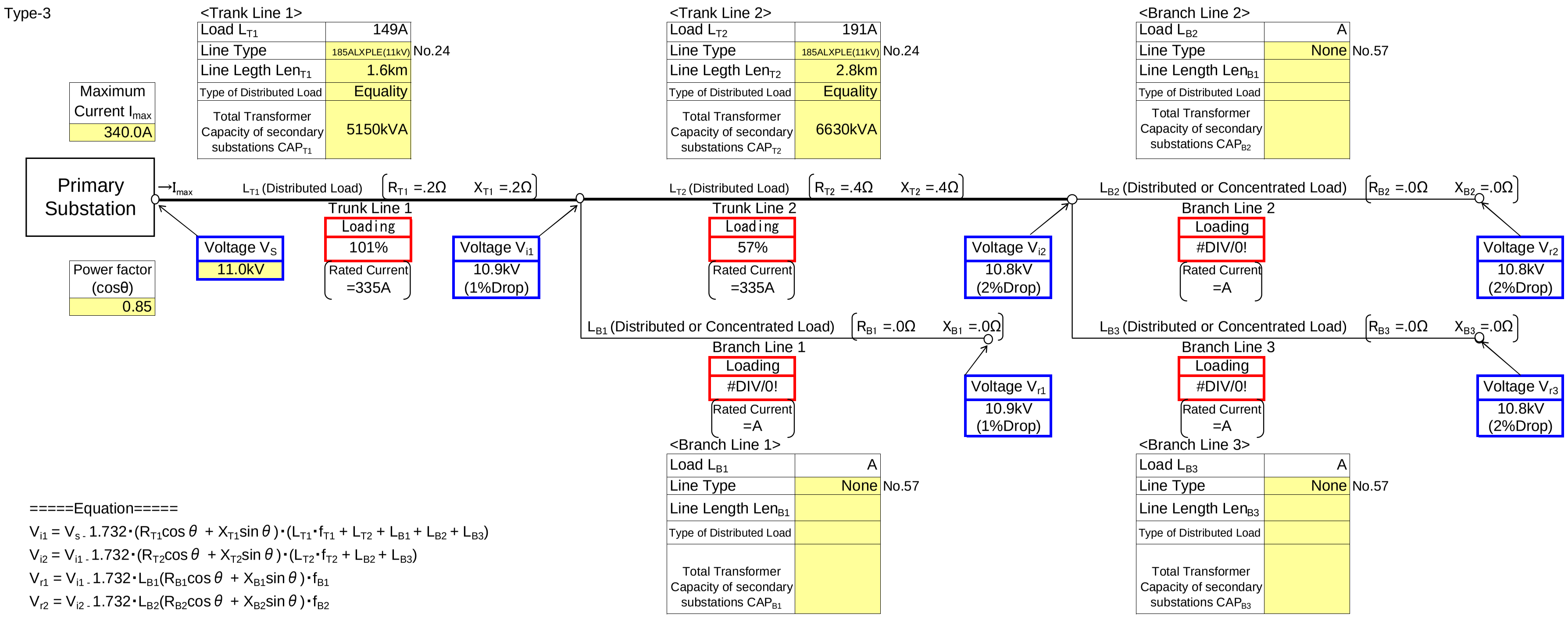
V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal 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	E07

: Input data in colored cells

Type-3



=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
328.0A

Power factor (cosθ)
0.85

<Trank Line 1>

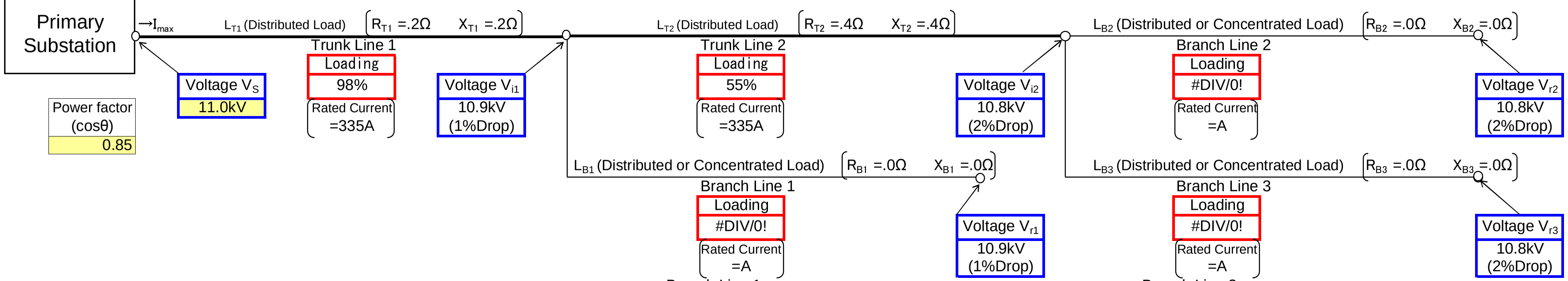
Load L_{T1}	143A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5150kVA	

<Trank Line 2>

Load L_{T2}	185A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	6630kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
374.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	164A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5150kVA	

<Trank Line 2>

Load L_{T2}	210A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	6630kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

→I_{max}

L_{T1} (Distributed Load) (R_{T1} =.2Ω X_{T1} =.2Ω)

Trunk Line 1: Loading 112%, Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.8kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.4Ω X_{T2} =.4Ω)

Trunk Line 2: Loading 63%, Rated Current =335A

Voltage V_{i2}: 10.7kV (2%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.7kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.8kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.7kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
392.0A

Power factor (cosθ)
0.85

<Trank Line 1>

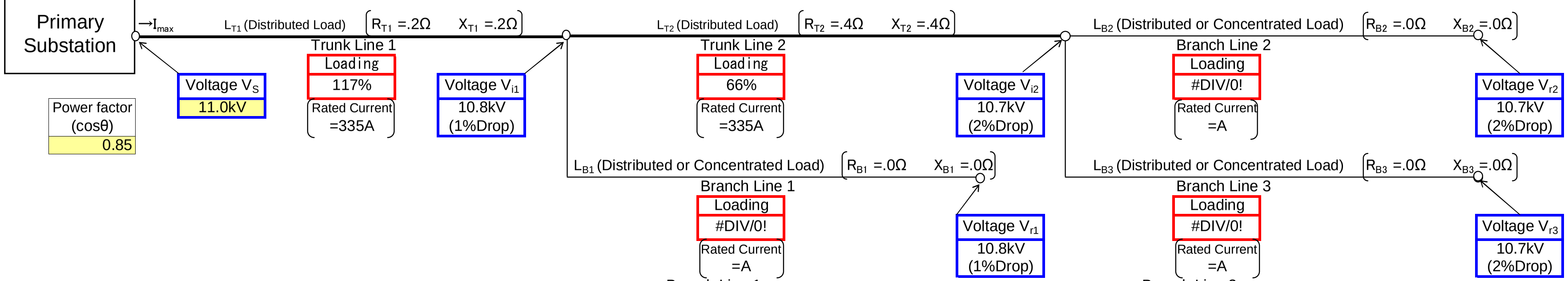
Load L_{T1}	171A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5150kVA	

<Trank Line 2>

Load L_{T2}	221A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	6630kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}: 412.0A

Power factor (cosθ): 0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	180A
Line Type	185ALXPLE(11kV) No.24
Line Legth Len_{T1}	1.6km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T1}	5150kVA

L_{T1} (Distributed Load) (R_{T1} =.2Ω X_{T1} =.2Ω)

Trunk Line 1 Loading 123% (Rated Current =335A)

Voltage V_{i1}: 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	232A
Line Type	185ALXPLE(11kV) No.24
Line Legth Len_{T2}	2.8km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T2}	6630kVA

L_{T2} (Distributed Load) (R_{T2} =.4Ω X_{T2} =.4Ω)

Trunk Line 2 Loading 69% (Rated Current =335A)

Voltage V_{i2}: 10.7kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 Loading #DIV/0! (Rated Current =A)

Voltage V_{r1}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A
Line Type	None No.57
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.57
Line Length Len_{B1}	
Type of Distributed Load	
Total Transformer Capacity of secondary substations CAP_{B2}	

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 Loading #DIV/0! (Rated Current =A)

Voltage V_{r2}: 10.7kV (3%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 Loading #DIV/0! (Rated Current =A)

Voltage V_{r3}: 10.7kV (3%Drop)

<Branch Line 3>

Load L_{B3}	A
Line Type	None No.57
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	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	E08

: Input data in colored cells

Type-3

Primary Substation

Maximum Current I_{max}
432.0A

Power factor (cosθ)
0.85

$\rightarrow I_{max}$

Voltage V_s
11.0kV

<Trank Line 1>

Load L_{T1}	189A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5150kVA	

L_{T1} (Distributed Load) R_{T1} =.2Ω X_{T1} =.2Ω

Trunk Line 1

Loading
129%

Rated Current =335A

Voltage V_{i1}
10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	243A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	6630kVA	

L_{T2} (Distributed Load) R_{T2} =.4Ω X_{T2} =.4Ω

Trunk Line 2

Loading
73%

Rated Current =335A

Voltage V_{i2}
10.7kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1

Loading
#DIV/0!

Rated Current =A

Voltage V_{r1}
10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2

Loading
#DIV/0!

Rated Current =A

Voltage V_{r2}
10.7kV (3%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3

Loading
#DIV/0!

Rated Current =A

Voltage V_{r3}
10.7kV (3%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
453.0A

<Trank Line 1>

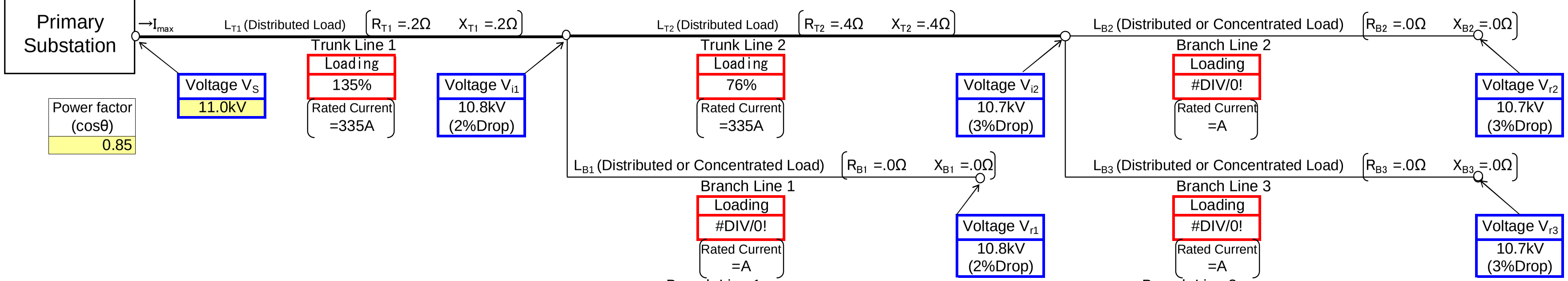
Load L_{T1}	198A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5150kVA	

<Trank Line 2>

Load L_{T2}	255A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	6630kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



Power factor (cosθ)
0.85

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
475.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	208A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5150kVA	

<Trank Line 2>

Load L_{T2}	267A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	6630kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

→I_{max}

L_{T1} (Distributed Load) (R_{T1} =.2Ω X_{T1} =.2Ω)

Trunk Line 1: Loading 142%; Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.8kV (2%Drop)

L_{T2} (Distributed Load) (R_{T2} =.4Ω X_{T2} =.4Ω)

Trunk Line 2: Loading 80%; Rated Current =335A

Voltage V_{i2}: 10.7kV (3%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.7kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.7kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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	E08

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	217A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5150kVA	

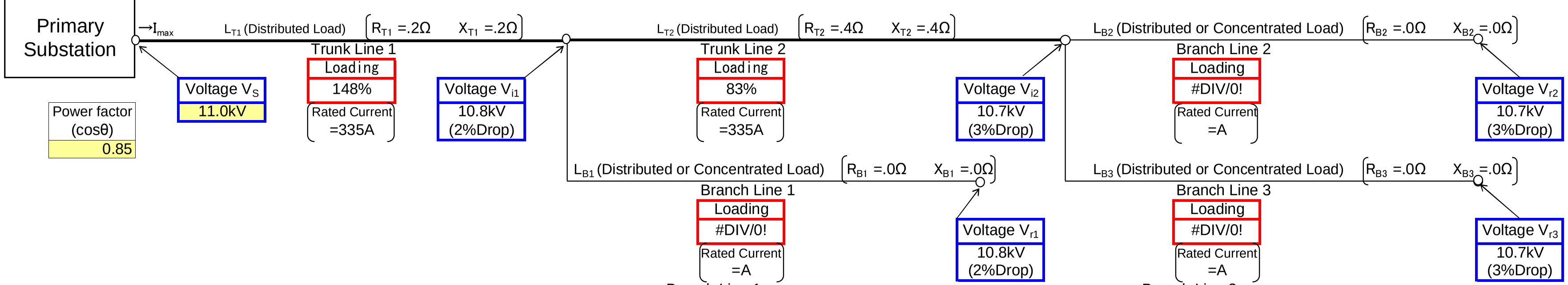
<Trank Line 2>

Load L_{T2}	279A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	6630kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	496.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	E08

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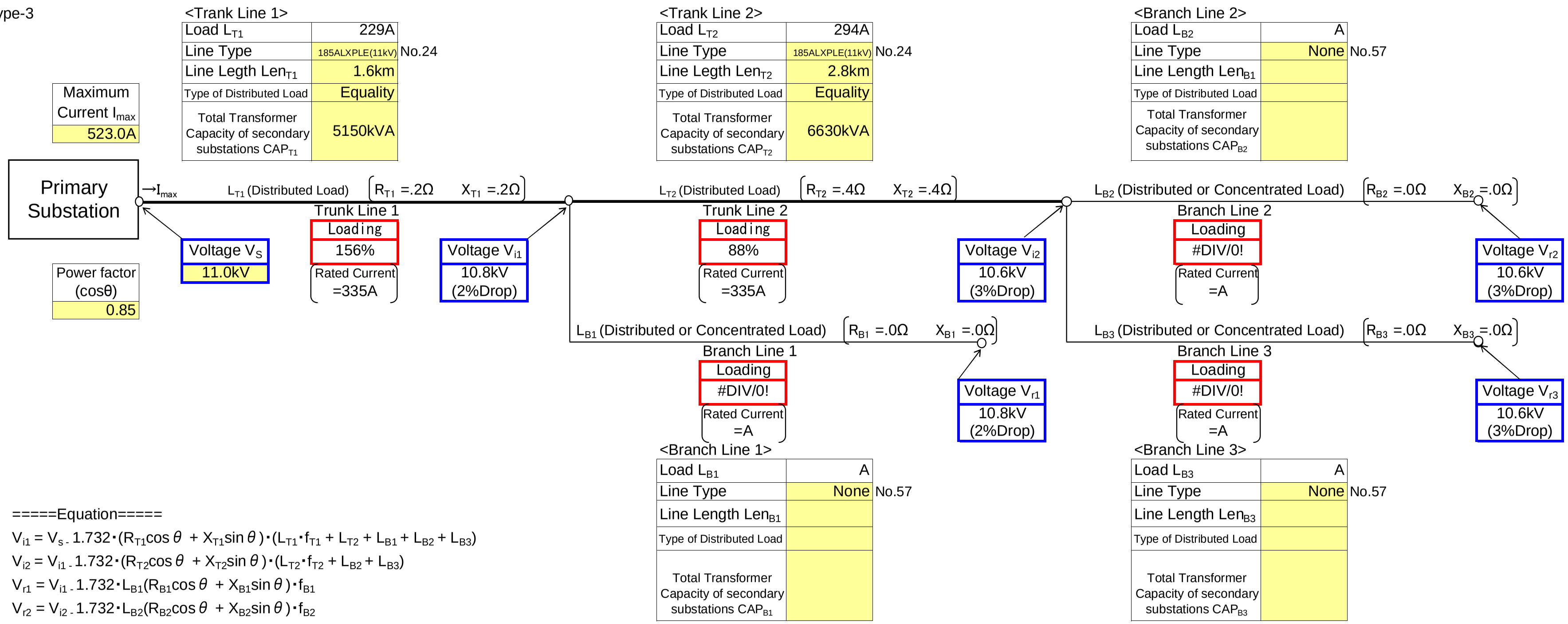
Type-3



=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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	E08

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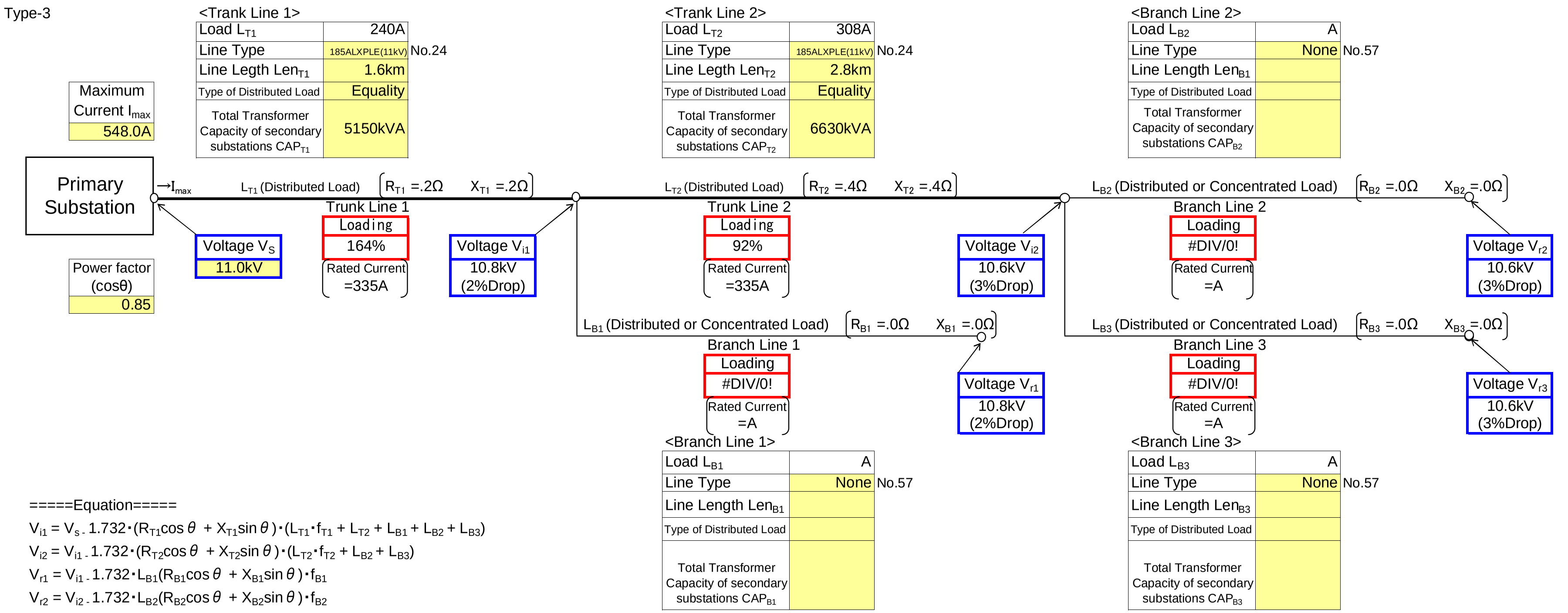


=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
575.0A

Power factor (cosθ)
0.85

<Trank Line 1>

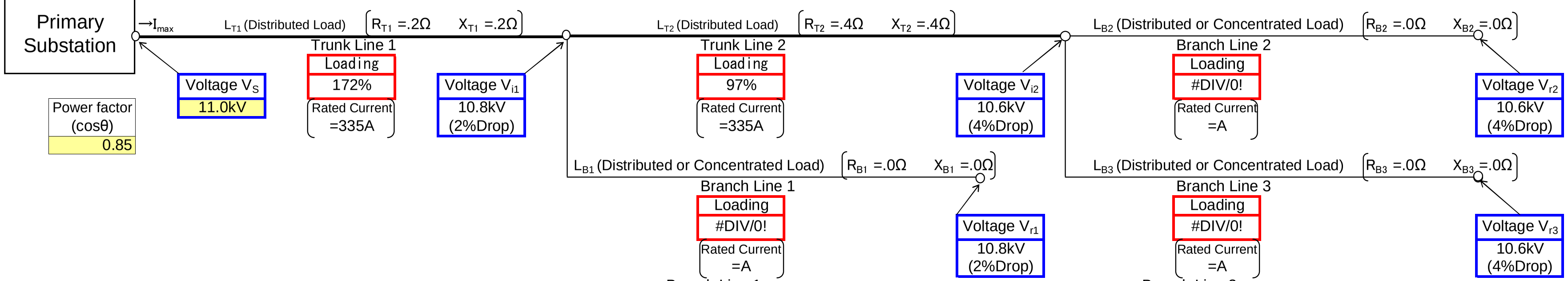
Load L_{T1}	251A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5150kVA	

<Trank Line 2>

Load L_{T2}	324A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	6630kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
315.0A

<Trank Line 1>

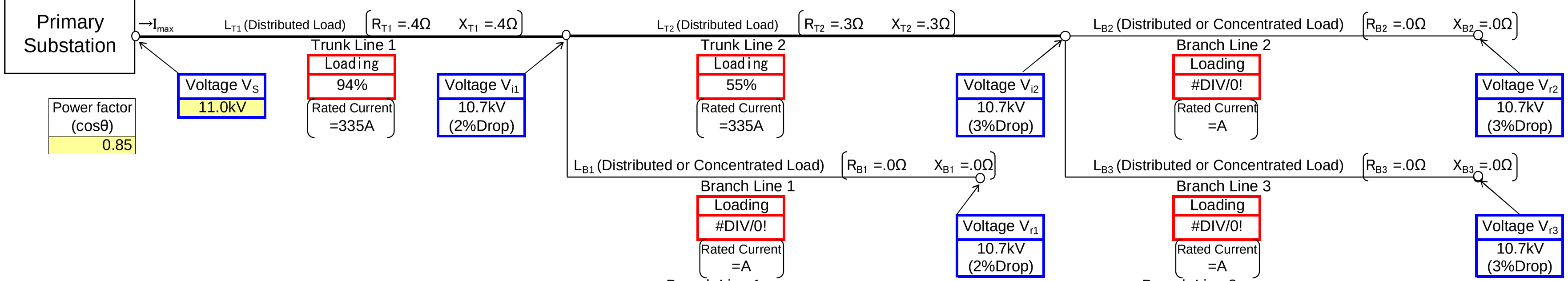
Load L_{T1}	131A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5430kVA	

<Trank Line 2>

Load L_{T2}	184A	
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}	7615kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



Power factor (cosθ)
0.85

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
Line Length Len_{B3}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

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

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

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

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

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

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

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

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

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

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

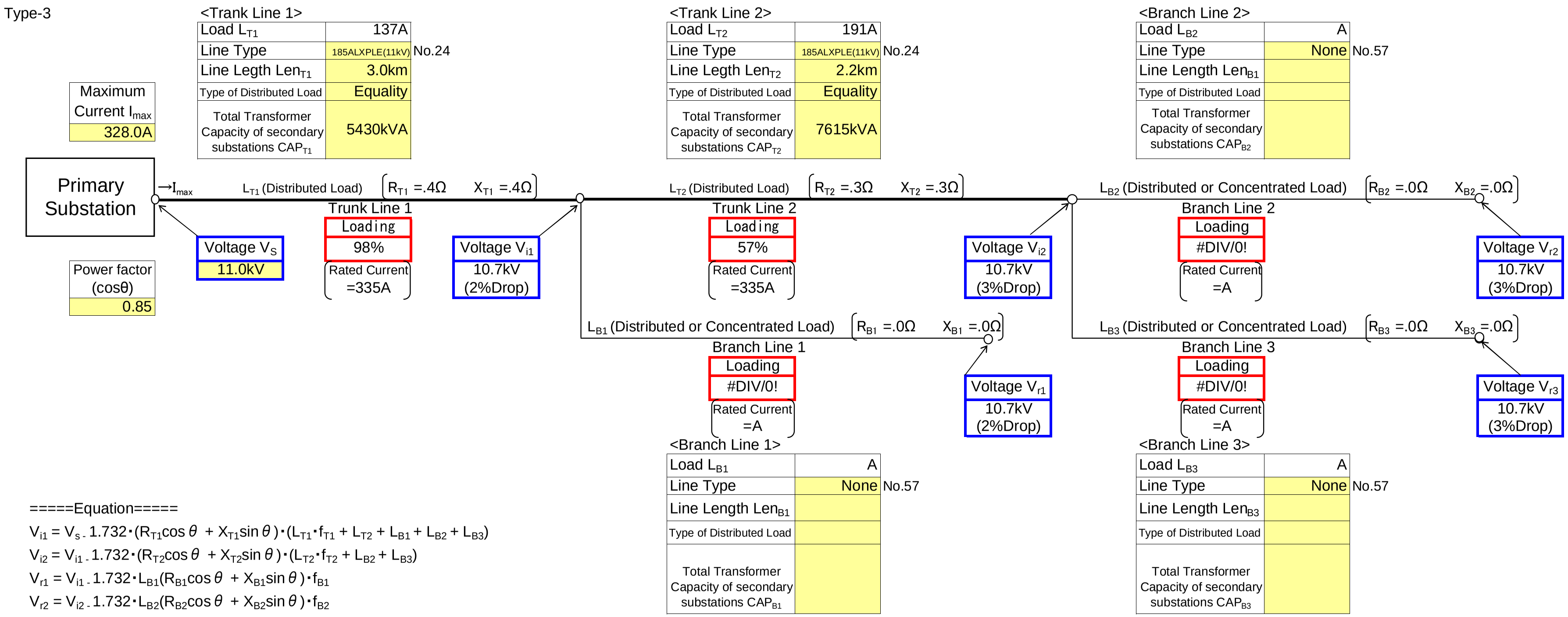
$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	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	E08

: Input data in colored cells



=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
341.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	142A	
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}	5430kVA	

<Trank Line 2>

Load L_{T2}	199A	
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}	7615kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation →I_{max}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.4Ω)

Trunk Line 1: Loading 102%, Rated Current =335A

Voltage V_{i1}: 10.7kV (2%Drop)

L_{T2} (Distributed Load) (R_{T2} =.3Ω X_{T2} =.3Ω)

Trunk Line 2: Loading 59%, Rated Current =335A

Voltage V_{i2}: 10.7kV (3%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.7kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.7kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.7kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}	355.0A	
Power factor ($\cos\theta$)	0.85	

<Trank Line 1>

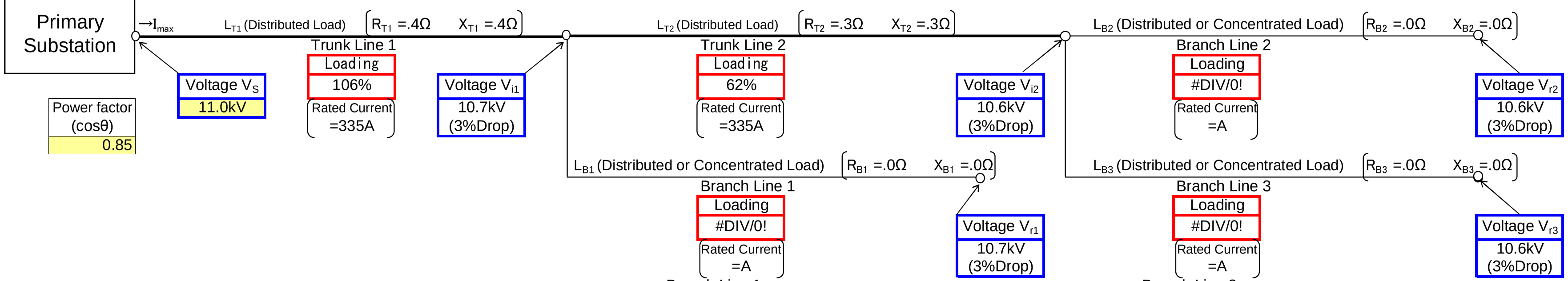
Load L_{T1}	148A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5430kVA	

<Trank Line 2>

Load L_{T2}	207A	
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}	7615kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION E
Feeder Name	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
370.0A

Power factor (cosθ)
0.85

Primary Substation

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	154A	
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}	5430kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.4Ω)

Trunk Line 1: Loading 110%, Rated Current =335A

Voltage V_{i1}: 10.7kV (3%Drop)

<Trank Line 2>

Load L_{T2}	216A	
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}	7615kVA	

L_{T2} (Distributed Load) (R_{T2} =.3Ω X_{T2} =.3Ω)

Trunk Line 2: Loading 64%, Rated Current =335A

Voltage V_{i2}: 10.6kV (3%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.6kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.7kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.6kV (3%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
385.0A

Power factor (cosθ)
0.85

<Trank Line 1>

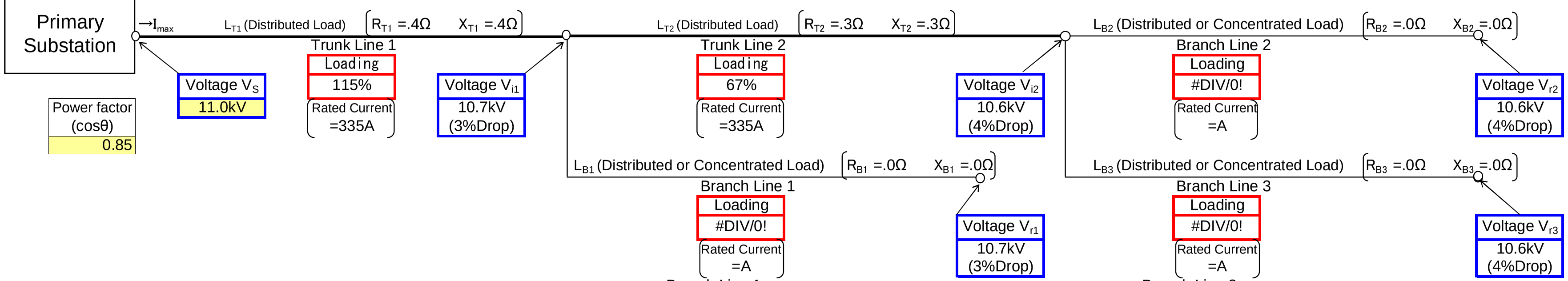
Load L_{T1}	160A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5430kVA	

<Trank Line 2>

Load L_{T2}	225A	
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}	7615kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
Line Length Len_{B3}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

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

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

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

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

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

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

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

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

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

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

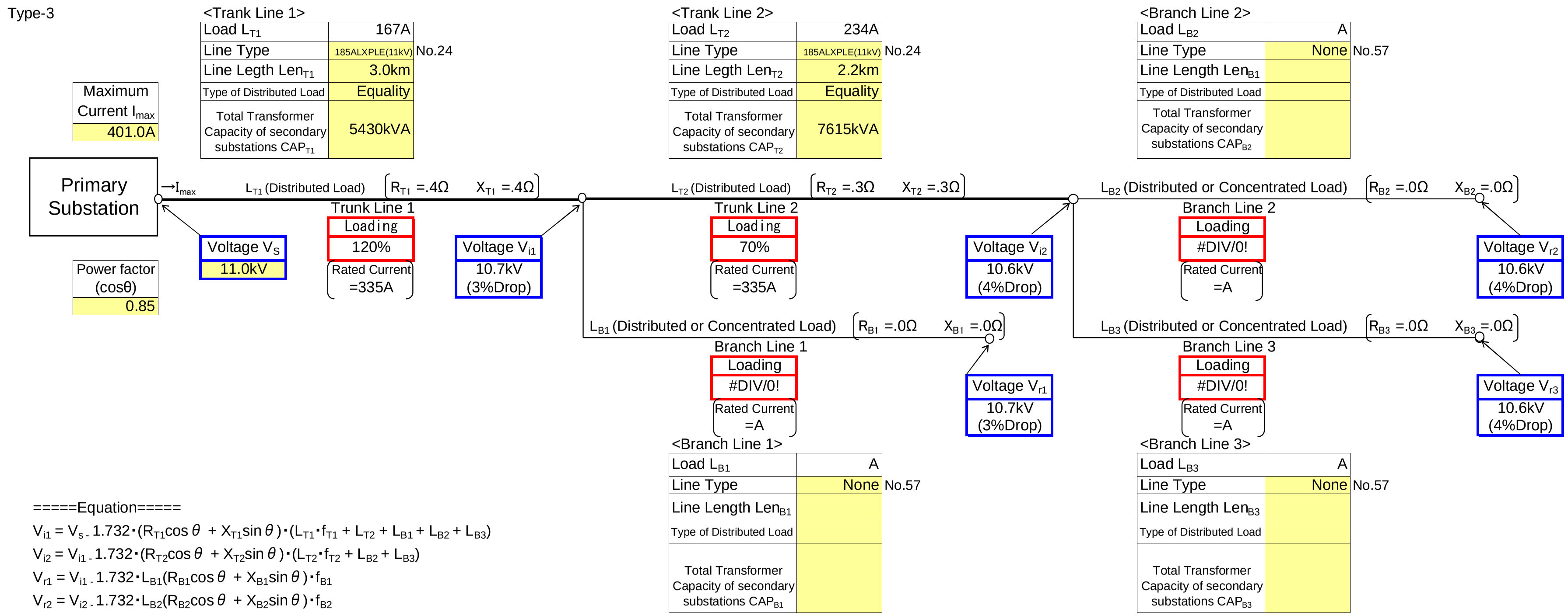
$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage	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	E08

: Input data in colored cells



=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
418.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	174A	
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}	5430kVA	

<Trank Line 2>

Load L_{T2}	244A	
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}	7615kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation →I_{max}

Voltage V_S 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.4Ω)

Trunk Line 1: Loading 125%, Rated Current =335A

Voltage V_{i1} 10.7kV (3%Drop)

L_{T2} (Distributed Load) (R_{T2} =.3Ω X_{T2} =.3Ω)

Trunk Line 2: Loading 73%, Rated Current =335A

Voltage V_{i2} 10.6kV (4%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2} 10.6kV (4%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1} 10.7kV (3%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3} 10.6kV (4%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
435.0A

Power factor (cosθ)
0.85

<Trank Line 1>

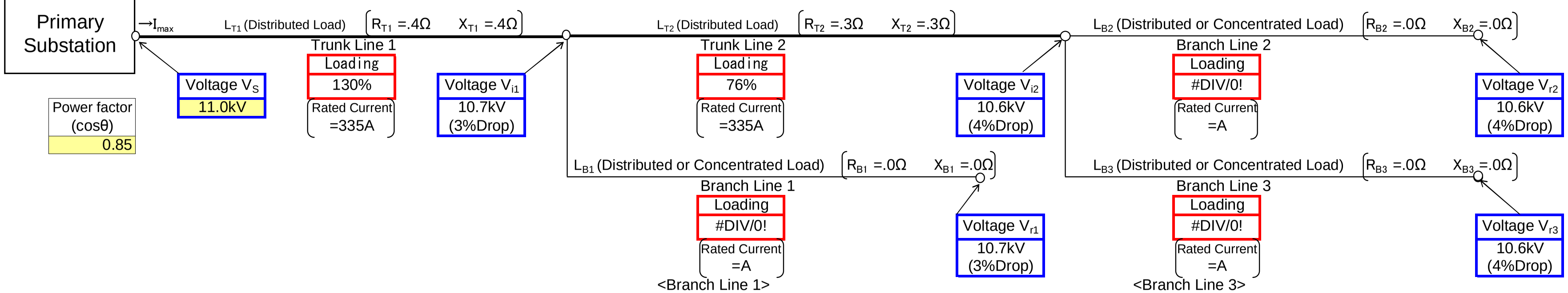
Load L_{T1}	181A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5430kVA	

<Trank Line 2>

Load L_{T2}	254A	
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}	7615kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}	453.0A
Power factor (cosθ)	0.85

<Trank Line 1>

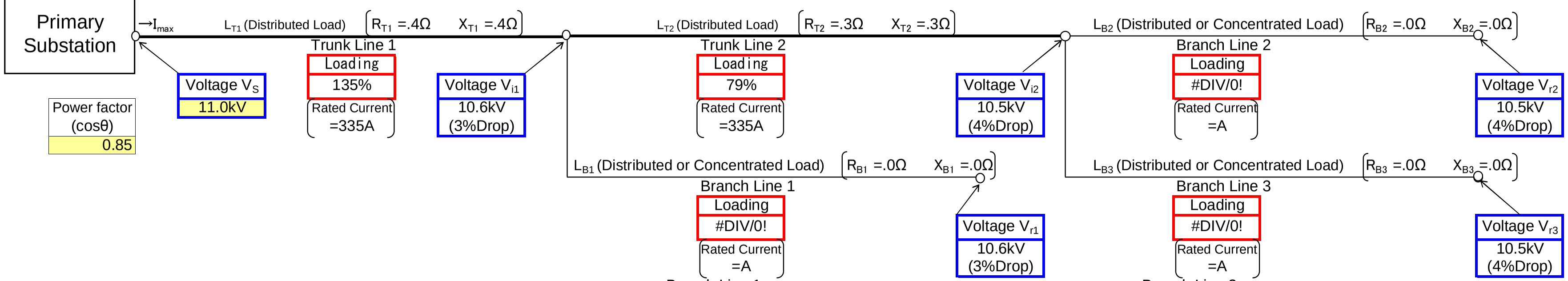
Load L_{T1}	189A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5430kVA	

<Trank Line 2>

Load L_{T2}	264A	
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}	7615kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
471.0A

Power factor (cosθ)
0.85

<Trank Line 1>

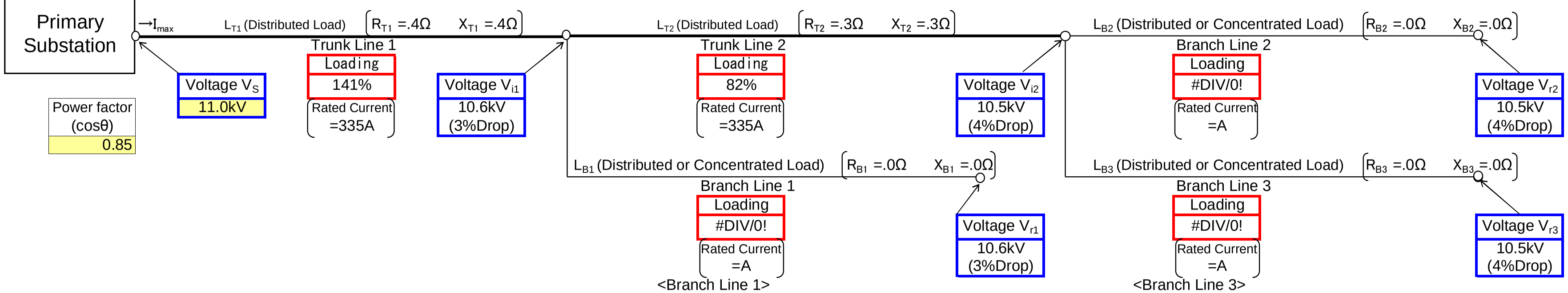
Load L_{T1}	196A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5430kVA	

<Trank Line 2>

Load L_{T2}	275A	
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}	7615kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	STATION E
Feeder Name	E08

: Input data in colored cells

Type-3

Maximum Current I_{max}
490.0A

Power factor (cosθ)
0.85

<Trank Line 1>

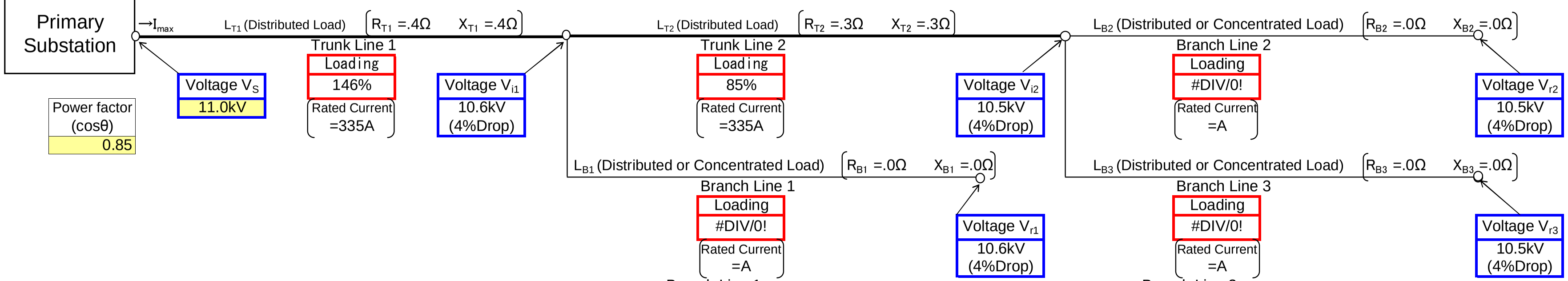
Load L_{T1}	204A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5430kVA	

<Trank Line 2>

Load L_{T2}	286A	
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}	7615kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E150

: Input data in colored cells

Type-3

Maximum Current I_{max}
270.0A

Power factor (cosθ)
0.85

<Trank Line 1>

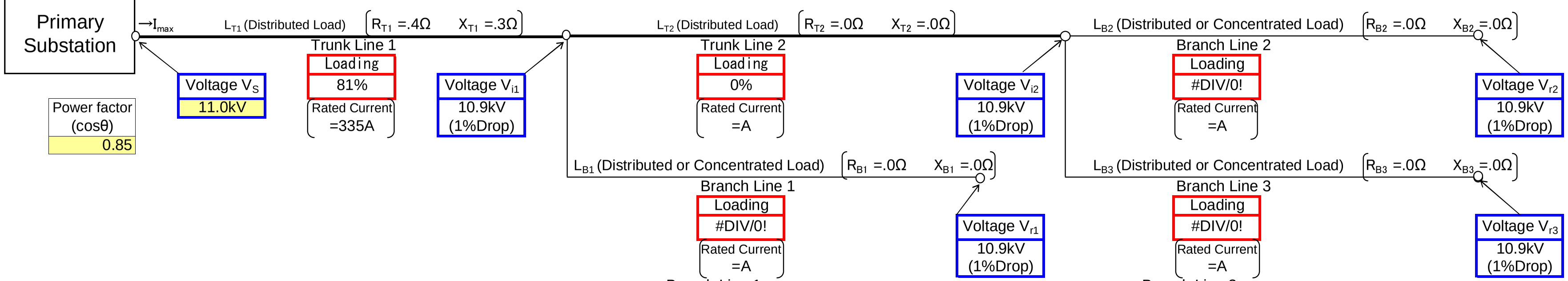
Load L_{T1}	270A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E150

: Input data in colored cells

Type-3

Maximum Current I_{max}
283.0A

Power factor (cosθ)
0.85

<Trank Line 1>

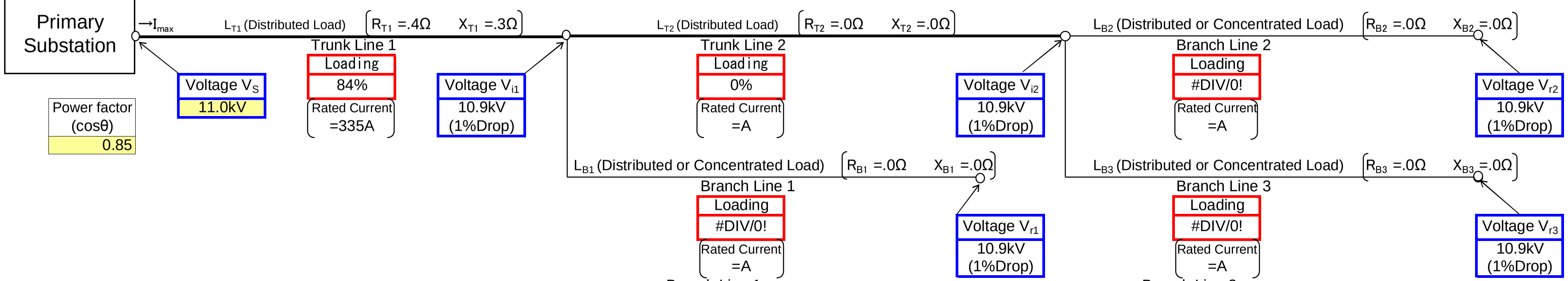
Load L_{T1}	283A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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	E150

: Input data in colored cells

Type-3

Maximum Current I_{max}: 297.0A

Power factor ($\cos\theta$): 0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_s: 11.0kV

<Trank Line 1>

Load L_{T1}	297A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.3Ω)

Trunk Line 1: Loading 89%, Rated Current =335A

Voltage V_{i1}: 10.9kV (1%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION E
Feeder Name	E150

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	312A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

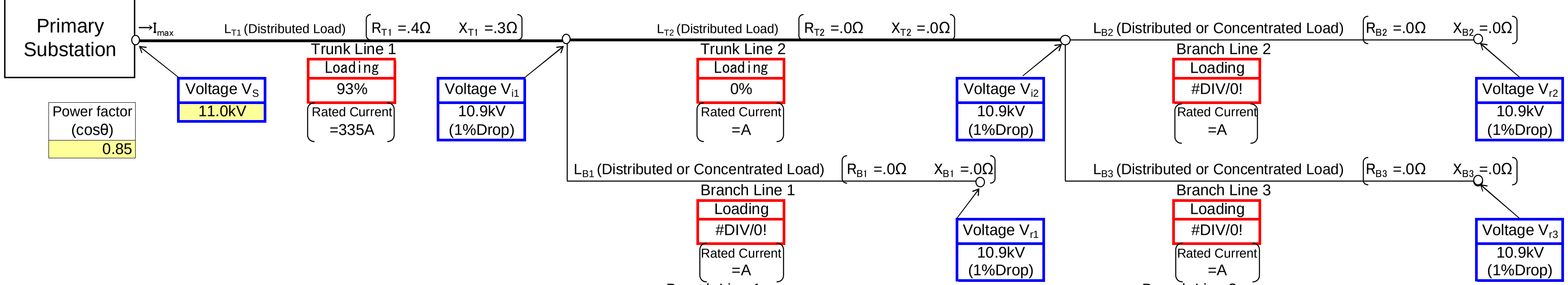
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	312.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E150

: Input data in colored cells

Type-3

Maximum Current I_{max}
327.0A

Power factor (cosθ)
0.85

<Trank Line 1>

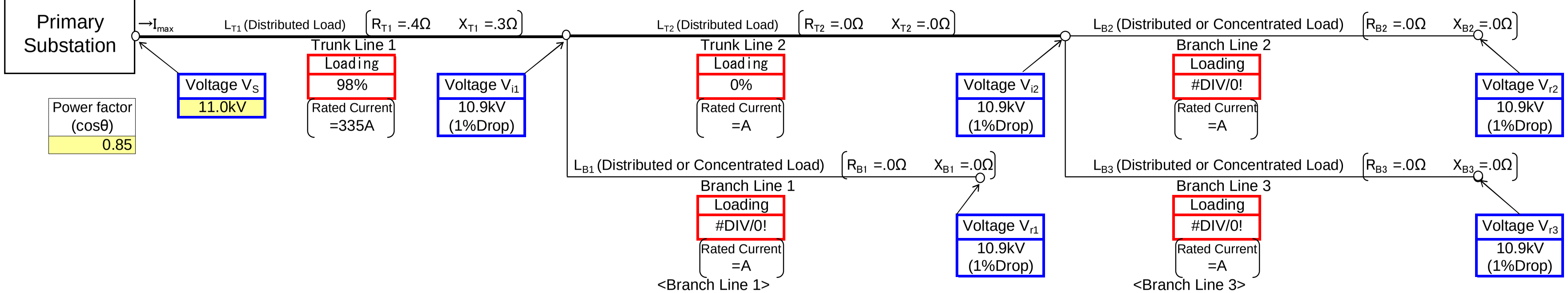
Load L_{T1}	327A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E150

: Input data in colored cells

Type-3

Maximum Current I_{max}
343.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	343A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation →I_{max}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.3Ω)

Trunk Line 1 — Loading 102% — Rated Current =335A

Voltage V_{i1}: 10.8kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 — Loading 0% — Rated Current =A

Voltage V_{i2}: 10.8kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2}: 10.8kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 — Loading #DIV/0! — Rated Current =A

Voltage V_{r1}: 10.8kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3}: 10.8kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E150

: Input data in colored cells

Type-3

Maximum Current I_{max}
360.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	360A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

→I_{max}

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.3Ω)

Trunk Line 1: Loading 107%, Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.8kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.8kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.8kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.8kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.8kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E150

: Input data in colored cells

Type-3

Maximum Current I_{max}
377.0A

Power factor (cosθ)
0.85

<Trank Line 1>

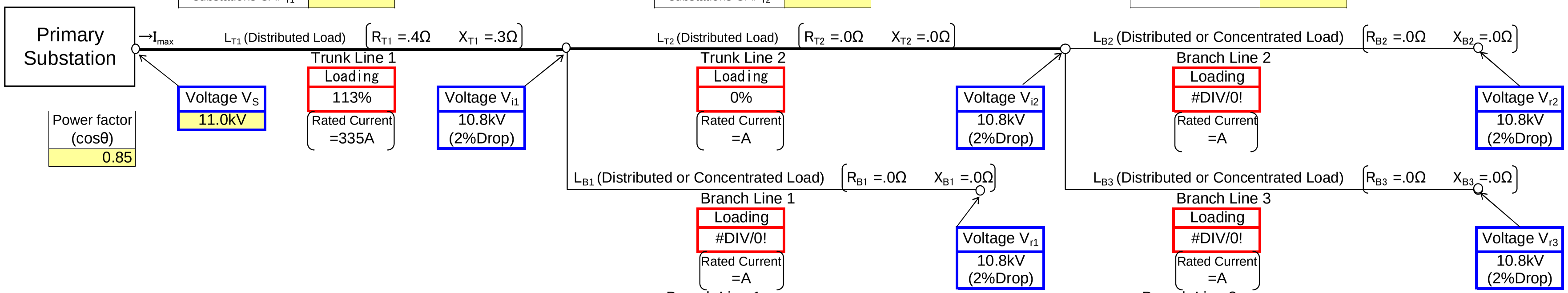
Load L_{T1}	377A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E150

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	396A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	396.0A
Power factor (cosθ)	0.85

Primary Substation

→I_{max}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) R_{T1} =.4Ω X_{T1} =.3Ω

Trunk Line 1: Loading 118%; Rated Current =335A

Voltage V_{i1}: 10.8kV (2%Drop)

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2: Loading 0%; Rated Current =A

Voltage V_{i2}: 10.8kV (2%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E150

: Input data in colored cells

Type-3

Maximum Current I_{max}
415.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	415A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation →I_{max}

Voltage V_S 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.3Ω)

Trunk Line 1: Loading 124%, Rated Current =335A

Voltage V_{i1} 10.8kV (2%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2} 10.8kV (2%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2} 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1} 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3} 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E150

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	436A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}
436.0A

Power factor ($\cos\theta$)
0.85

Primary Substation

$\rightarrow I_{max}$

L_{T1} (Distributed Load) R_{T1} =.4Ω X_{T1} =.3Ω

Trunk Line 1: Loading 130%, Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.8kV (2%Drop)

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.8kV (2%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
V_{r3} : Received Voltage	L_{B3} : Load (Branch Line 3)	$\cos\theta$: Power Factor

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

Substation Name	STATION E
Feeder Name	E150

: Input data in colored cells

Type-3

Maximum Current I_{max}
457.0A

<Trank Line 1>

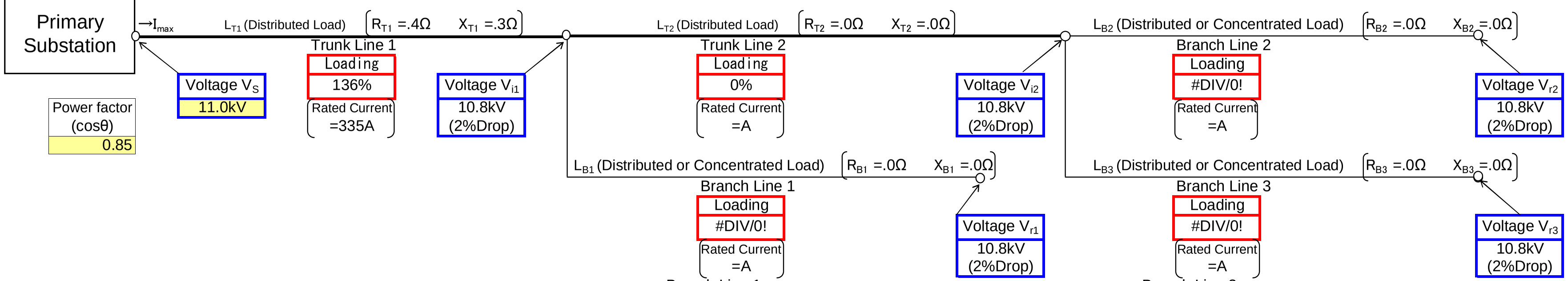
Load L_{T1}	457A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E20

: Input data in colored cells

Type-3

Maximum Current I_{max}
215.0A

Power factor (cosθ)
0.85

<Trank Line 1>

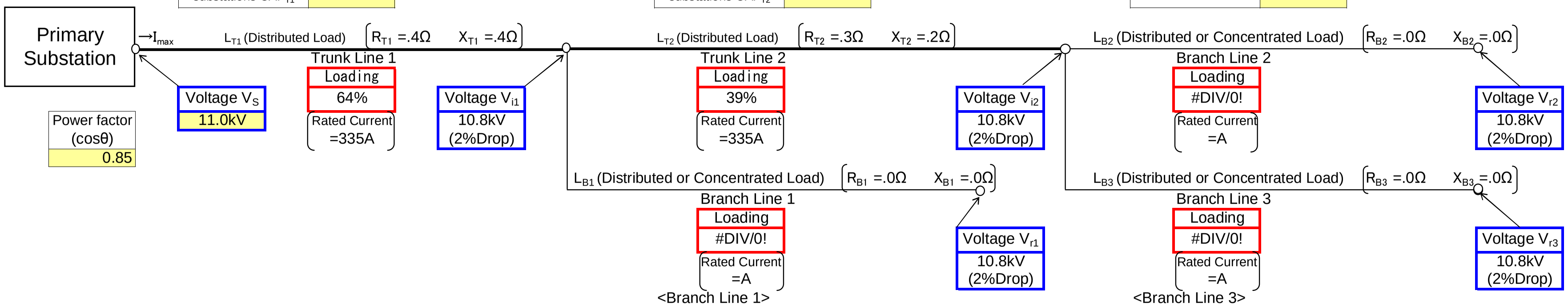
Load L_{T1}	83A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2700kVA	

<Trank Line 2>

Load L_{T2}	132A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4265kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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	E20

: Input data in colored cells

Type-3

Maximum Current I_{max}	226.0A
Power factor ($\cos\theta$)	0.85

<Trank Line 1>

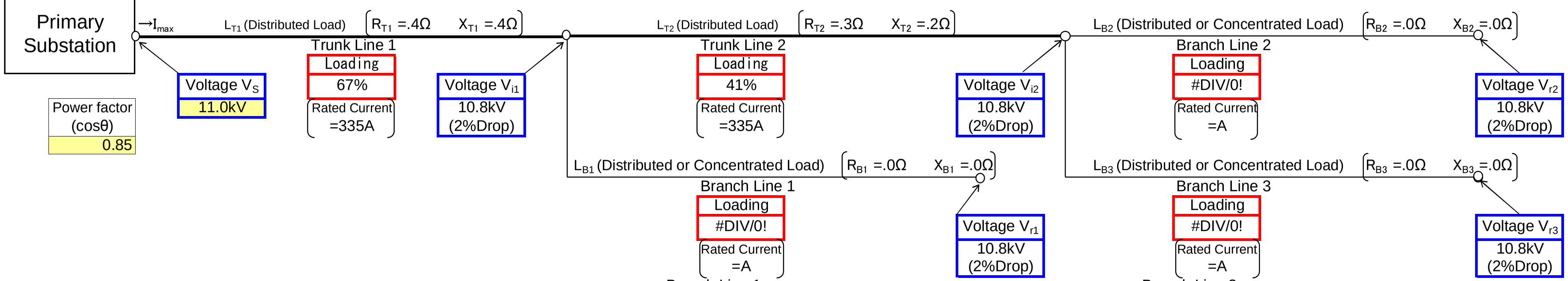
Load L_{T1}	88A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2700kVA	

<Trank Line 2>

Load L_{T2}	138A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4265kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION E
Feeder Name	E20

: Input data in colored cells

Type-3

Maximum Current I_{max}	
237.0A	

Power factor (cosθ)	
0.85	

<Trank Line 1>

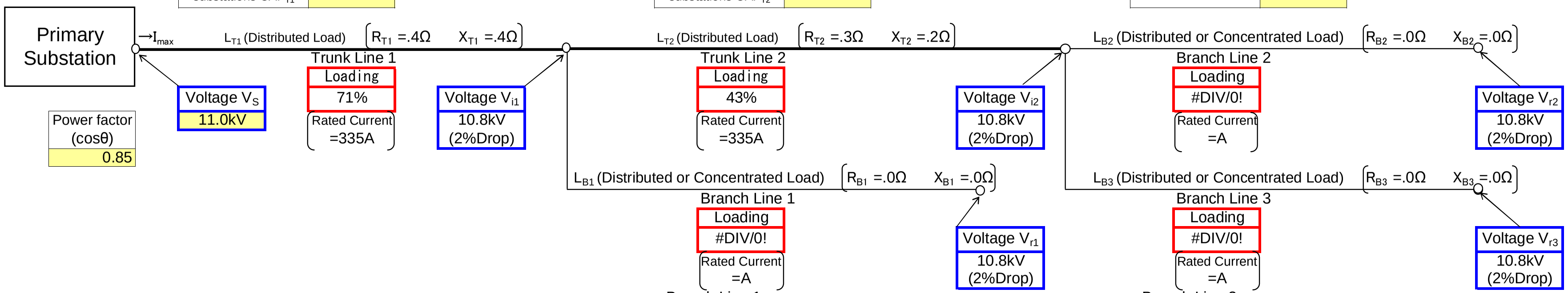
Load L_{T1}	92A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2700kVA	

<Trank Line 2>

Load L_{T2}	145A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4265kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E20

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	96A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2700kVA	

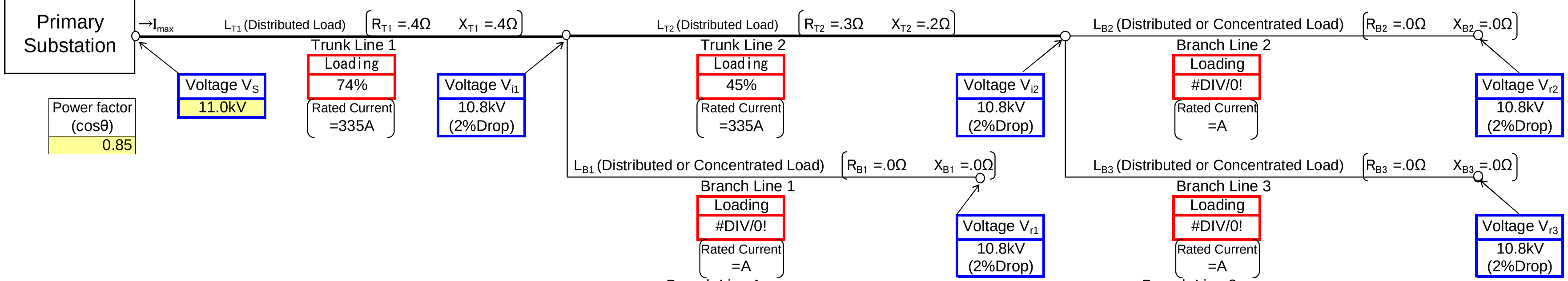
<Trank Line 2>

Load L_{T2}	152A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4265kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	248.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E20

: Input data in colored cells

Type-3

Maximum Current I_{max}
260.0A

<Trank Line 1>

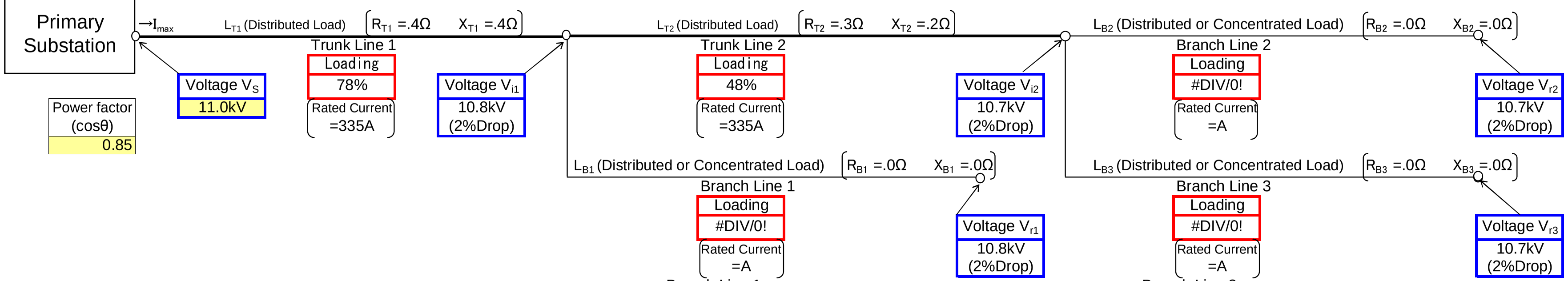
Load L_{T1}	101A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2700kVA	

<Trank Line 2>

Load L_{T2}	159A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4265kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E20

: Input data in colored cells

Type-3

Maximum Current I_{max}
273.0A

Primary Substation

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	106A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2700kVA	

<Trank Line 2>

Load L_{T2}	167A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4265kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

→I_{max}

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.4Ω)

Trunk Line 1: Loading 81%; Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.8kV (2%Drop)

L_{T2} (Distributed Load) (R_{T2} =.3Ω X_{T2} =.2Ω)

Trunk Line 2: Loading 50%; Rated Current =335A

Voltage V_{i2}: 10.7kV (2%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.7kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.7kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E20

: Input data in colored cells

Type-3

Maximum Current I_{max}
286.0A

Power factor (cosθ)
0.85

<Trank Line 1>

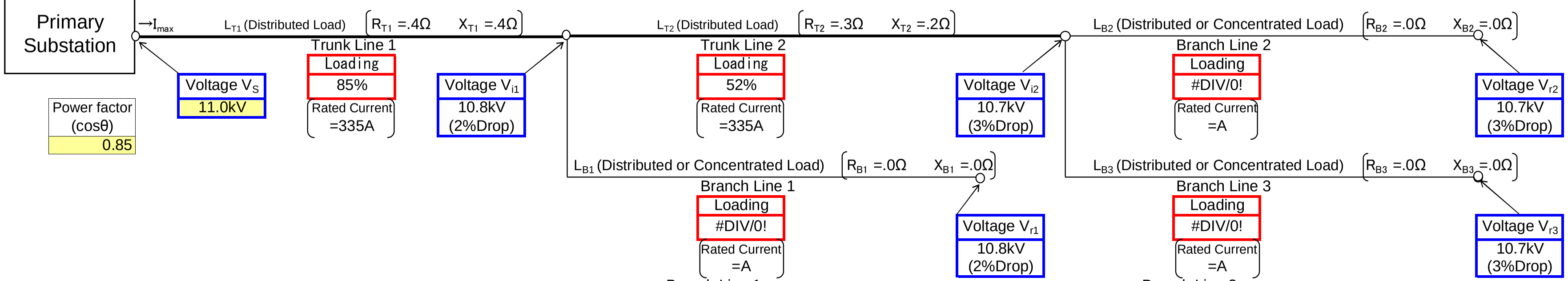
Load L_{T1}	111A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2700kVA	

<Trank Line 2>

Load L_{T2}	175A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4265kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E20

: Input data in colored cells

Type-3

Maximum Current I_{max}
300.0A

Power factor (cosθ)
0.85

<Trank Line 1>

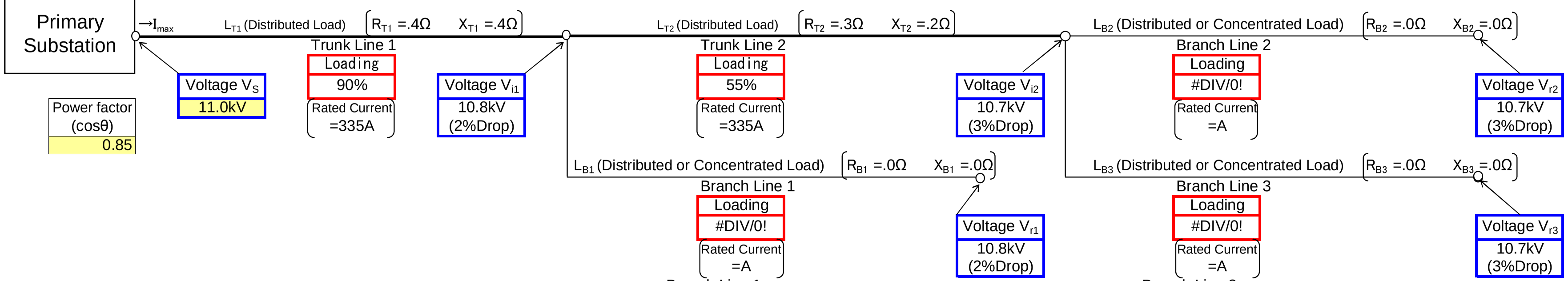
Load L_{T1}	116A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2700kVA	

<Trank Line 2>

Load L_{T2}	184A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4265kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E20

: Input data in colored cells

Type-3

Maximum Current I_{max}: 315.0A

Power factor (cosθ): 0.85

Primary Substation

Voltage V_s: 11.0kV

<Trank Line 1>

Load L_{T1}	122A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2700kVA	

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.4Ω)

Trunk Line 1: Loading 94%; Rated Current =335A

Voltage V_{i1}: 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	193A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4265kVA	

L_{T2} (Distributed Load) (R_{T2} =.3Ω X_{T2} =.2Ω)

Trunk Line 2: Loading 58%; Rated Current =335A

Voltage V_{i2}: 10.7kV (3%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.7kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.7kV (3%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E20

: Input data in colored cells

Type-3

Maximum Current I_{max}
331.0A

Power factor (cosθ)
0.85

<Trank Line 1>

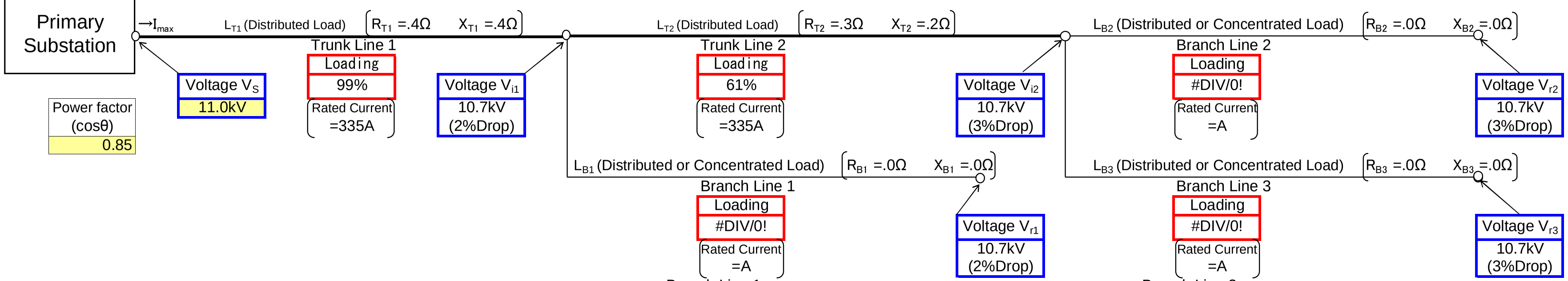
Load L_{T1}	128A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2700kVA	

<Trank Line 2>

Load L_{T2}	203A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4265kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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},
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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	E20

: Input data in colored cells

Type-3

Maximum Current I_{max}
347.0A

Power factor (cosθ)
0.85

<Trank Line 1>

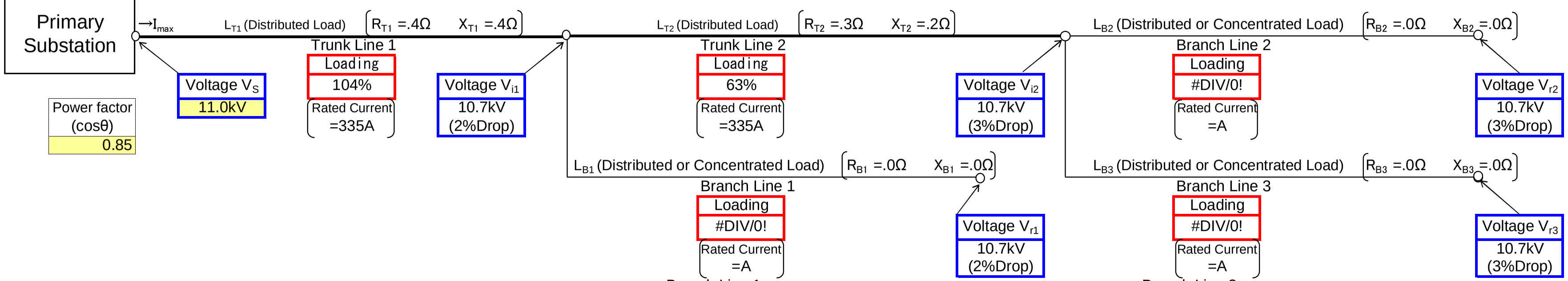
Load L_{T1}	135A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2700kVA	

<Trank Line 2>

Load L_{T2}	212A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4265kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E20

: Input data in colored cells

Type-3

Maximum Current I_{max}
364.0A

Power factor (cosθ)
0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	141A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2700kVA	

L_{T1} (Distributed Load) R_{T1} =.4Ω X_{T1} =.4Ω

Trunk Line 1 Loading 109% Rated Current =335A

Voltage V_{i1} 10.7kV (3%Drop)

<Trank Line 2>

Load L_{T2}	223A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4265kVA	

L_{T2} (Distributed Load) R_{T2} =.3Ω X_{T2} =.2Ω

Trunk Line 2 Loading 67% Rated Current =335A

Voltage V_{i2} 10.6kV (3%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2 Loading #DIV/0! Rated Current =A

Voltage V_{r2} 10.6kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1 Loading #DIV/0! Rated Current =A

Voltage V_{r1} 10.7kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3 Loading #DIV/0! Rated Current =A

Voltage V_{r3} 10.6kV (3%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E26

: Input data in colored cells

Type-3

Maximum Current I_{max}: 146.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	146A	
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}	2800kVA	

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.4Ω)

Trunk Line 1: Loading 44% (Rated Current =335A)

Voltage V_{i1}: 10.9kV (1%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0% (Rated Current =A)

Voltage V_{i2}: 10.9kV (1%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0! (Rated Current =A)

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0! (Rated Current =A)

Voltage V_{r1}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0! (Rated Current =A)

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E26

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	153A	
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}	2800kVA	

<Trank Line 2>

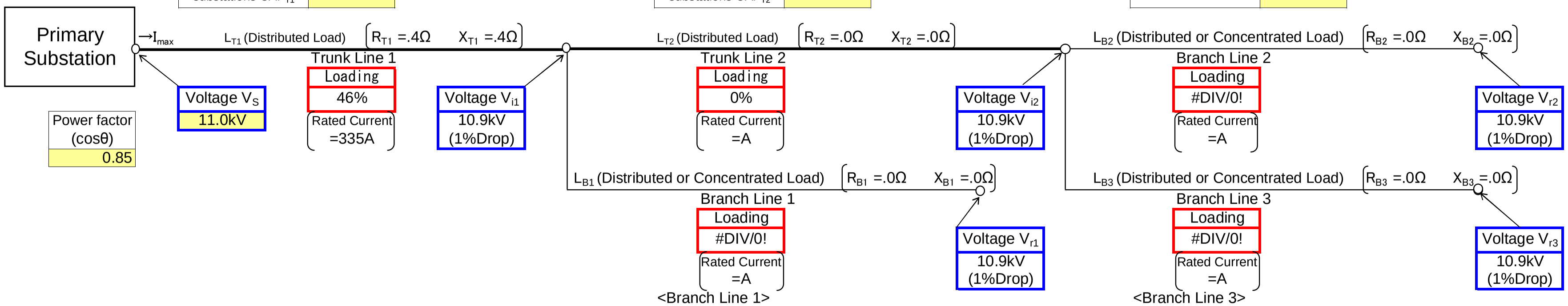
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}
153.0A

Power factor (cosθ)
0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E26

: Input data in colored cells

Type-3

Primary Substation

Maximum Current I_{max}
161.0A

Power factor (cosθ)
0.85

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	161A	
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}	2800kVA	

→I_{max} L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.4Ω)

Trunk Line 1 — Loading: 48% — Rated Current =335A

Voltage V_{i1}: 10.9kV (1%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 — Loading: 0% — Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 — Loading: #DIV/0! — Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading: #DIV/0! — Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading: #DIV/0! — Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E26

: Input data in colored cells

Type-3

Maximum Current I_{max}: 169.0A

Power factor (cosθ): 0.85

<Trank Line 1>

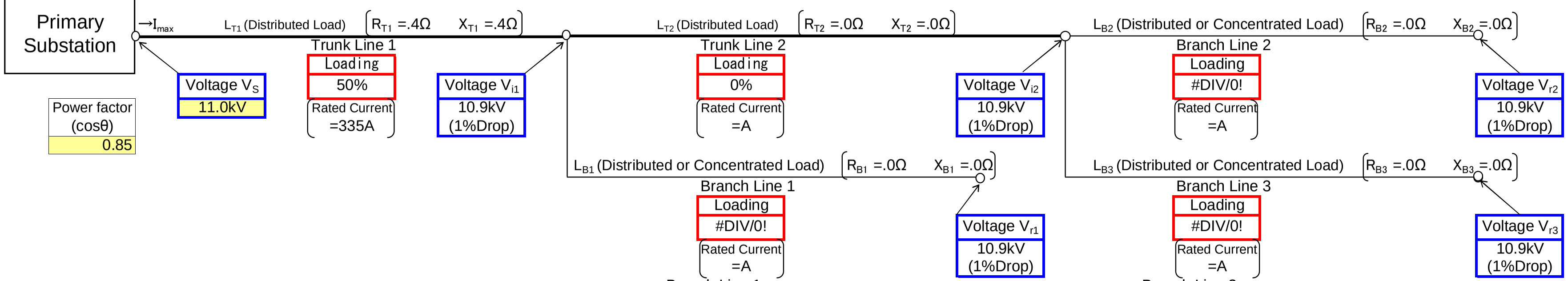
Load L_{T1}	169A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2800kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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	E26

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	177A	
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}	2800kVA	

<Trank Line 2>

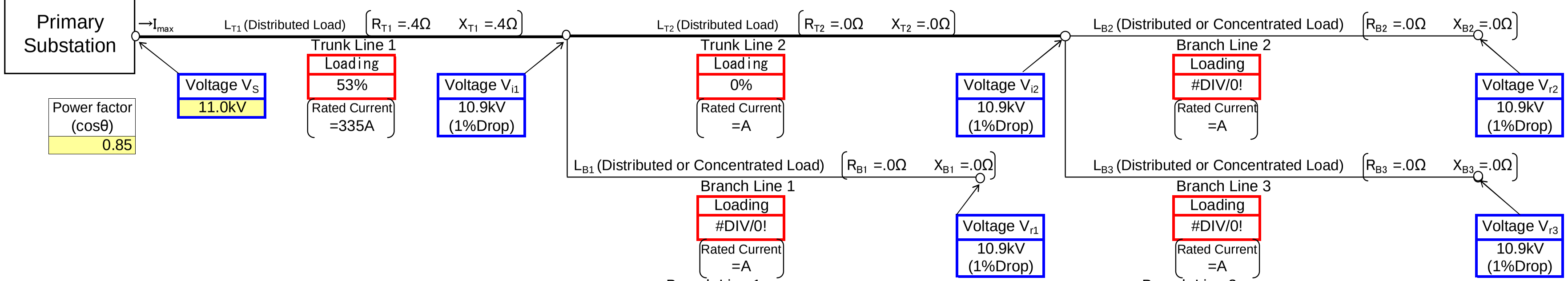
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	177.0A

Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E26

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	185A	
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}	2800kVA	

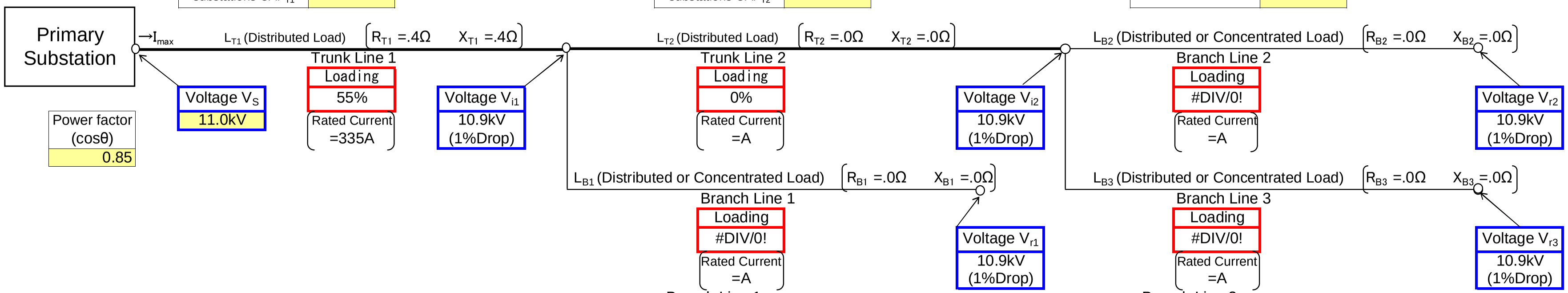
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	185.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E26

: Input data in colored cells

Type-3

Maximum Current I_{max}
195.0A

Power factor (cosθ)
0.85

<Trank Line 1>

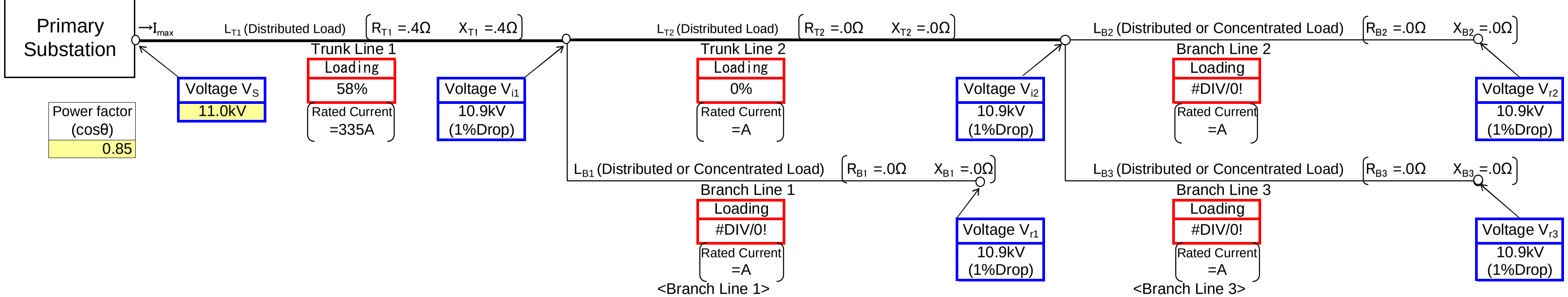
Load L_{T1}	195A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2800kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E26

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	204A	
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}	2800kVA	

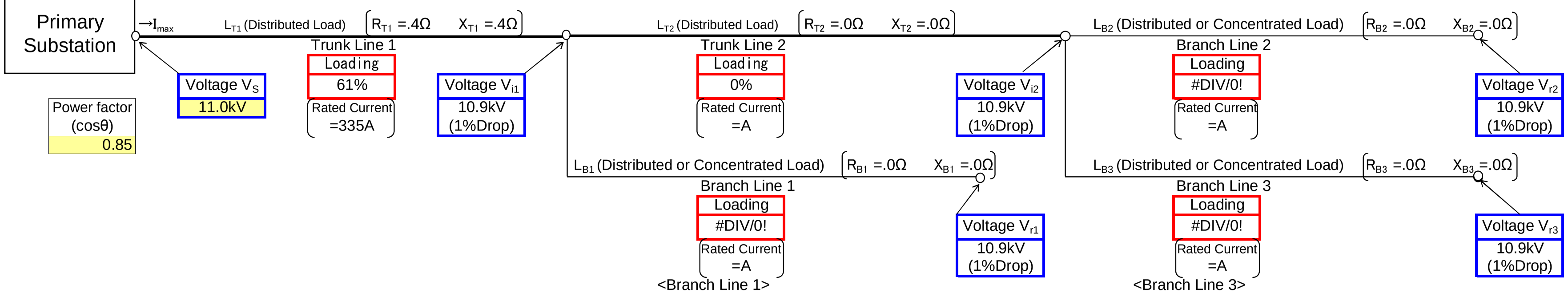
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	204.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E26

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	214A	
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}	2800kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	214.0A
Power factor (cosθ)	0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.4Ω)

Trunk Line 1: Loading 64% (Rated Current =335A)

Voltage V_{i1}: 10.9kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0% (Rated Current =A)

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0! (Rated Current =A)

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0! (Rated Current =A)

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0! (Rated Current =A)

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E26

: Input data in colored cells

Type-3

Maximum Current I_{max}
225.0A

<Trank Line 1>

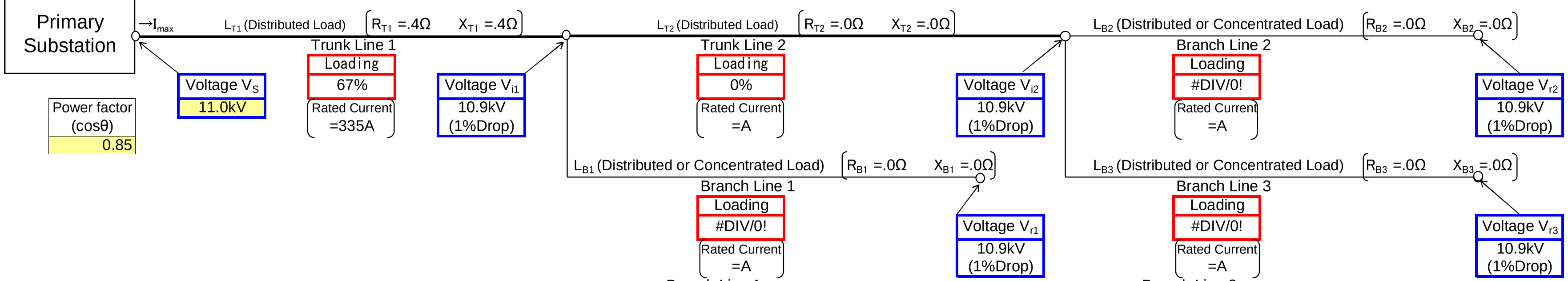
Load L_{T1}	225A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2800kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E26

: Input data in colored cells

Type-3

Maximum Current I_{max}
236.0A

Power factor (cosθ)
0.85

<Trank Line 1>

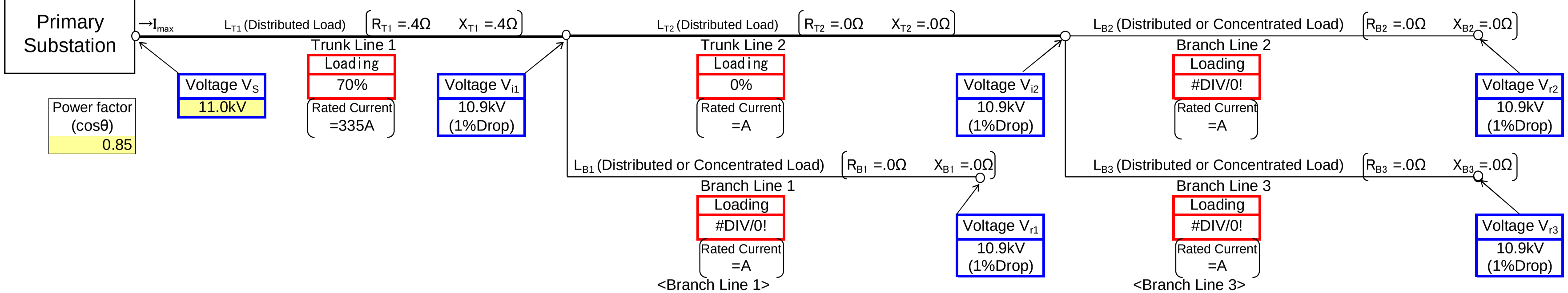
Load L_{T1}	236A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2800kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	E26

: Input data in colored cells

Type-3

Maximum Current I_{max}
247.0A

Power factor (cosθ)
0.85

<Trank Line 1>

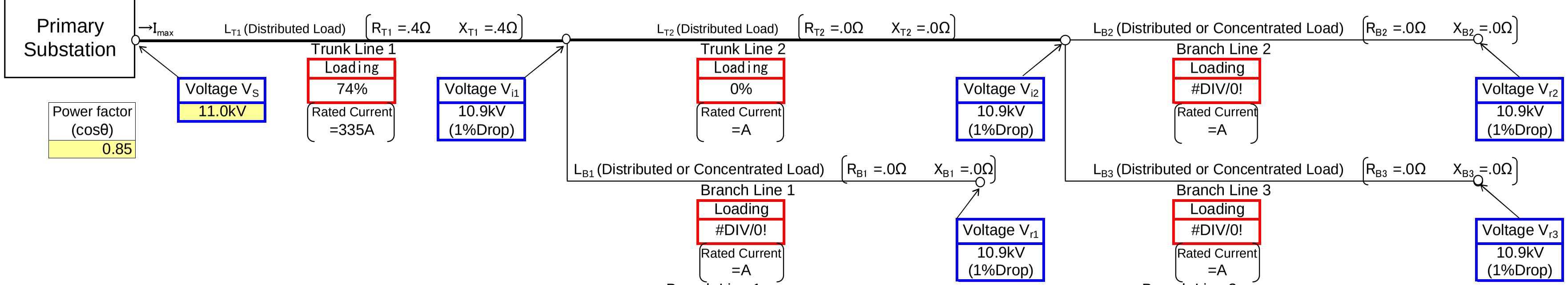
Load L_{T1}	247A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2800kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	EG14

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	260A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6545kVA	

<Trank Line 2>

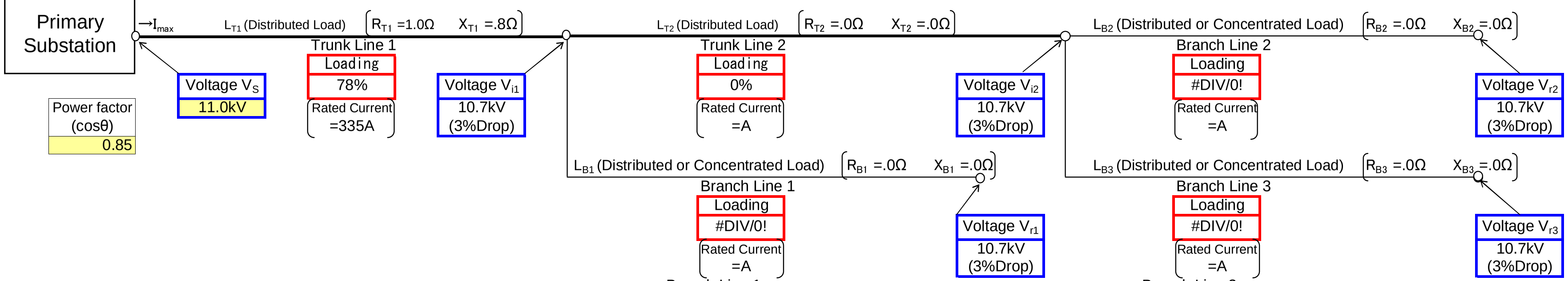
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	260.0A

Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	EG14

: Input data in colored cells

Type-3

Maximum Current I_{max}
281.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_s: 11.0kV

<Trank Line 1>

Load L_{T1}	281A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6545kVA	

L_{T1} (Distributed Load) R_{T1} =1.0Ω X_{T1} =.8Ω

Trunk Line 1: Loading 84%; Rated Current =335A

Voltage V_{i1}: 10.7kV (3%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2: Loading 0%; Rated Current =A

Voltage V_{i2}: 10.7kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.7kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.7kV (3%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.7kV (3%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	EG14

: Input data in colored cells

Type-3

Maximum Current I_{max}
303.0A

Power factor (cosθ)
0.85

<Trank Line 1>

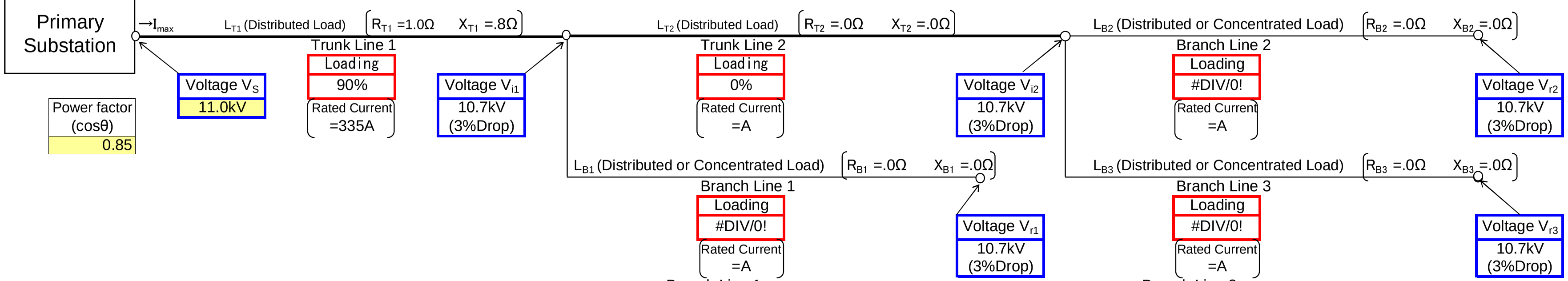
Load L_{T1}	303A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6545kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	EG14

: Input data in colored cells

Type-3

Maximum Current I_{max}
327.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	327A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6545kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

→I_{max}

L_{T1} (Distributed Load) (R_{T1} =1.0Ω X_{T1} =.8Ω)

Trunk Line 1: Loading 98%, Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.6kV (3%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.6kV (3%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.6kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.6kV (3%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.6kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	EG14

: Input data in colored cells

Type-3

Maximum Current I_{max}	353.0A
Power factor (cosθ)	0.85

<Trank Line 1>

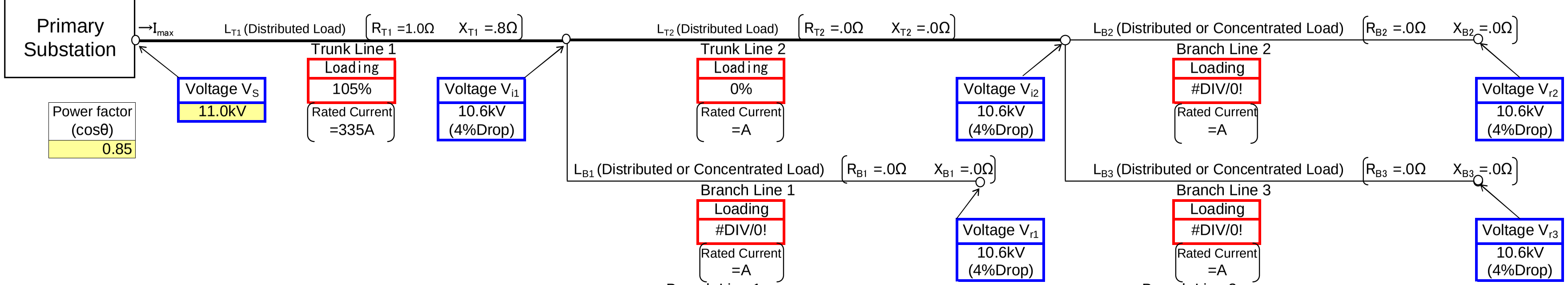
Load L_{T1}	353A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6545kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	EG14

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	381A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6545kVA	

<Trank Line 2>

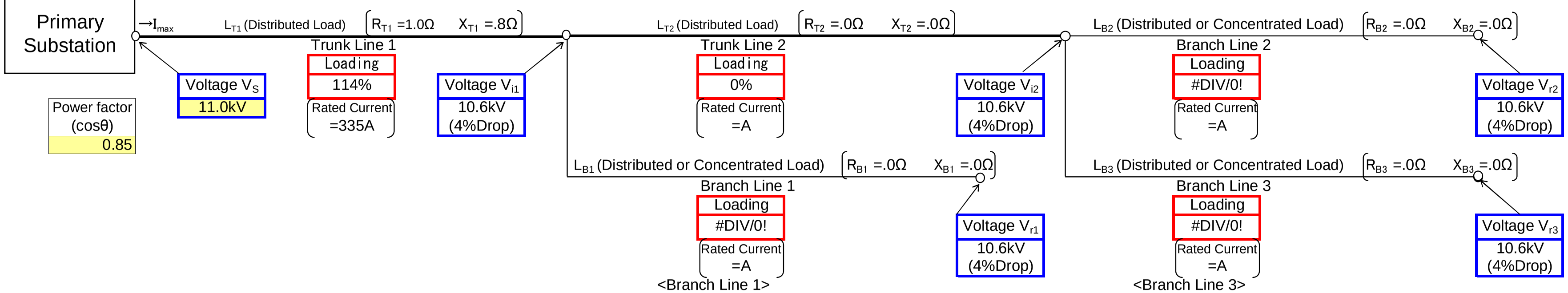
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}
381.0A

Power factor ($\cos\theta$)
0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$: Power Factor

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

Substation Name	STATION E
Feeder Name	EG14

: Input data in colored cells

Type-3

Maximum Current I_{max}
412.0A

Power factor (cosθ)
0.85

<Trank Line 1>

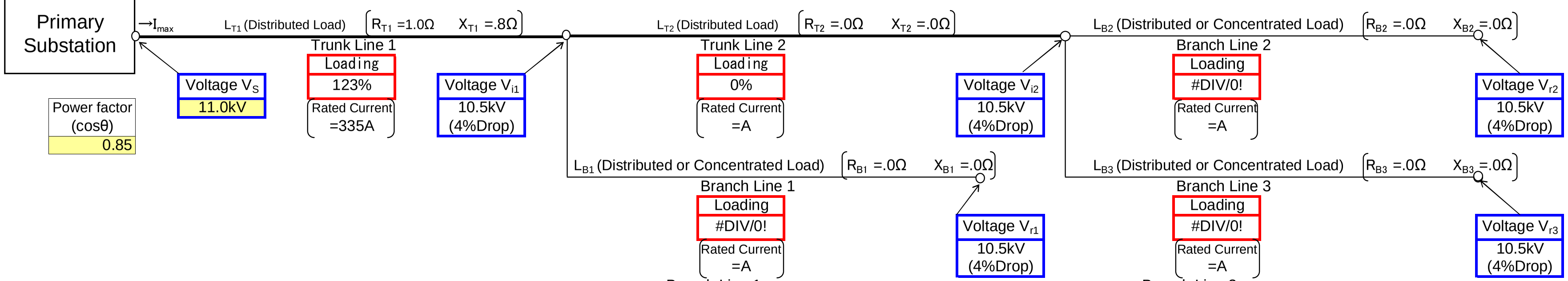
Load L_{T1}	412A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6545kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	EG14

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	444A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6545kVA	

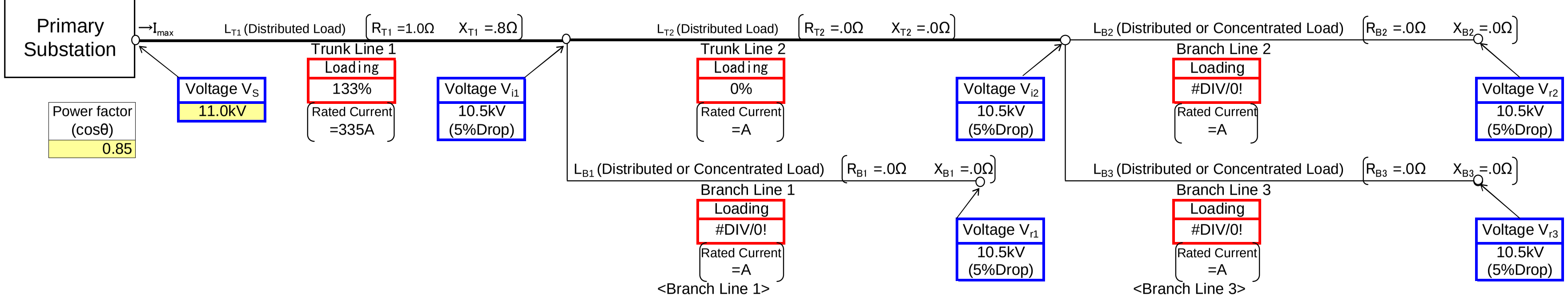
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	444.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
Line Length Len_{B3}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

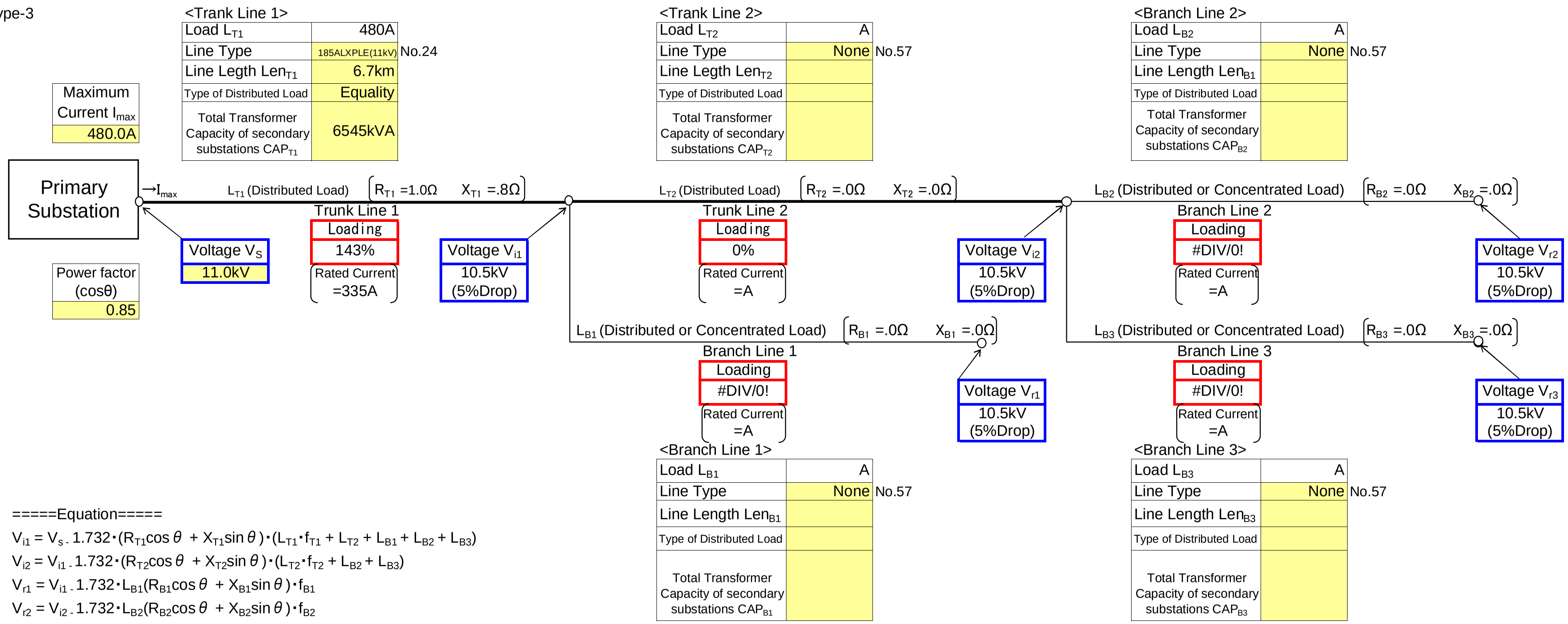
V_s : Supply Voltage	I_{max} : Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal 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	EG14

: Input data in colored cells

Type-3



=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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	EG14

: Input data in colored cells

Type-3

Maximum Current I_{max}
518.0A

Power factor (cosθ)
0.85

<Trank Line 1>

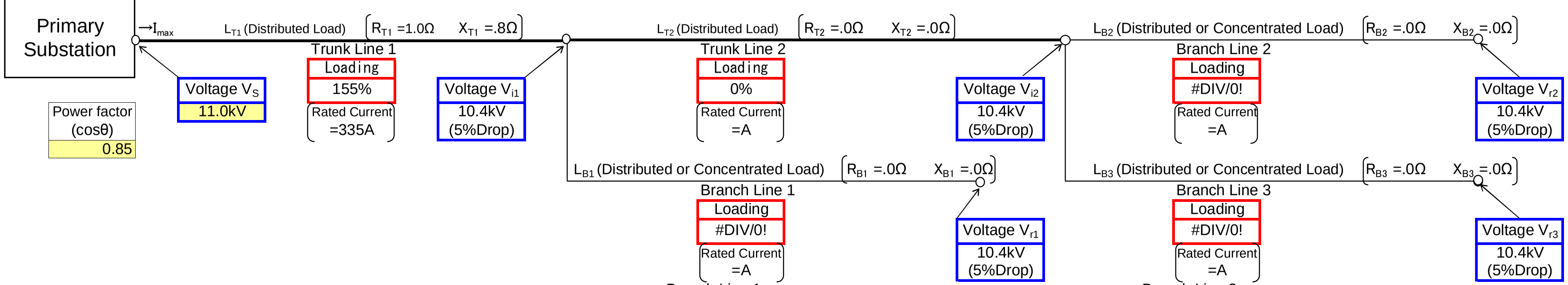
Load L_{T1}	518A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6545kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	EG14

: Input data in colored cells

Type-3

Maximum Current I_{max}
559.0A

Power factor (cosθ)
0.85

<Trank Line 1>

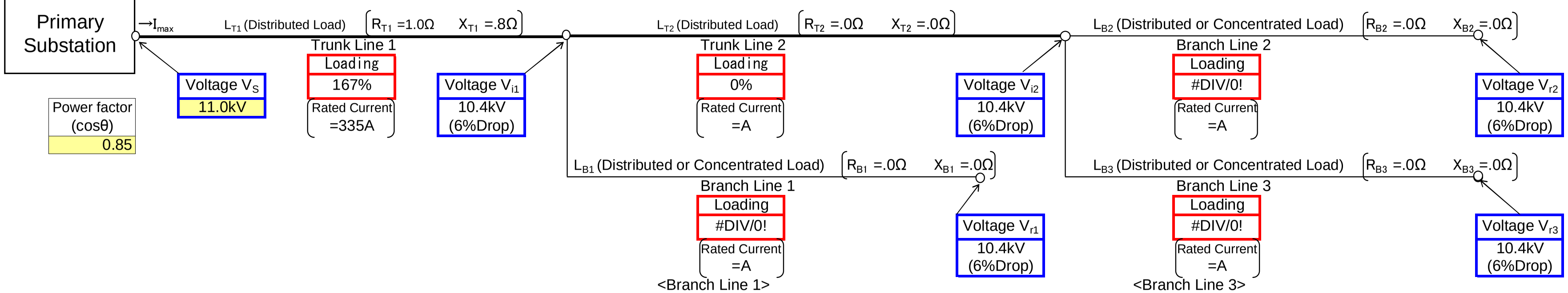
Load L_{T1}	559A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6545kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	EG14

: Input data in colored cells

Type-3

Maximum Current I_{max}: 603.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	603A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6545kVA	

L_{T1} (Distributed Load) (R_{T1} =1.0Ω X_{T1} =.8Ω)

Trunk Line 1: Loading 180%; Rated Current =335A

Voltage V_{i1}: 10.3kV (6%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%; Rated Current =A

Voltage V_{i2}: 10.3kV (6%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.3kV (6%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.3kV (6%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.3kV (6%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 F
Feeder Name	F01

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	230A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

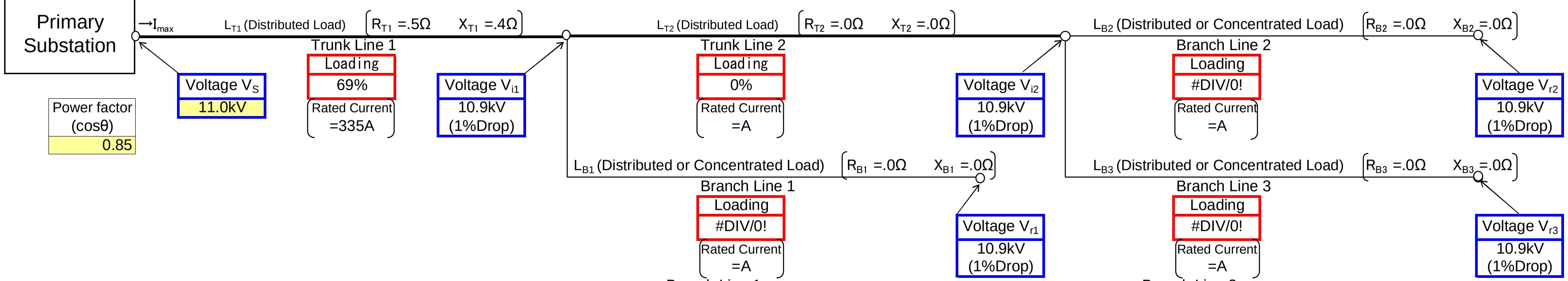
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	230.0A

Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F01

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	242A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

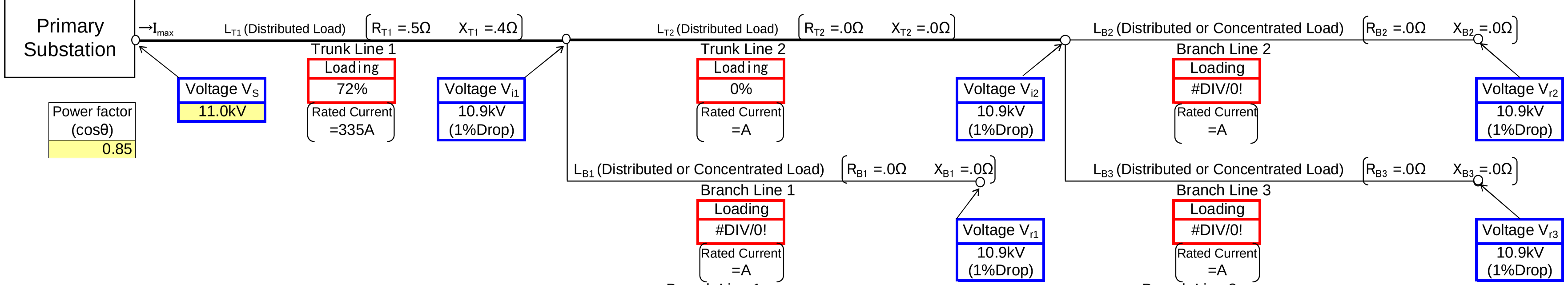
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}
242.0A

Power factor (cosθ)
0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 F
Feeder Name	F01

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	253A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	253.0A
Power factor (cosθ)	0.85

Primary Substation $\rightarrow I_{max}$

L_{T1} (Distributed Load) [R_{T1} =.5Ω X_{T1} =.4Ω]

Trunk Line 1: Loading 76%; Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.9kV (1%Drop)

L_{T2} (Distributed Load) [R_{T2} =.0Ω X_{T2} =.0Ω]

Trunk Line 2: Loading 0%; Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) [R_{B2} =.0Ω X_{B2} =.0Ω]

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) [R_{B1} =.0Ω X_{B1} =.0Ω]

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) [R_{B3} =.0Ω X_{B3} =.0Ω]

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F01

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	265A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

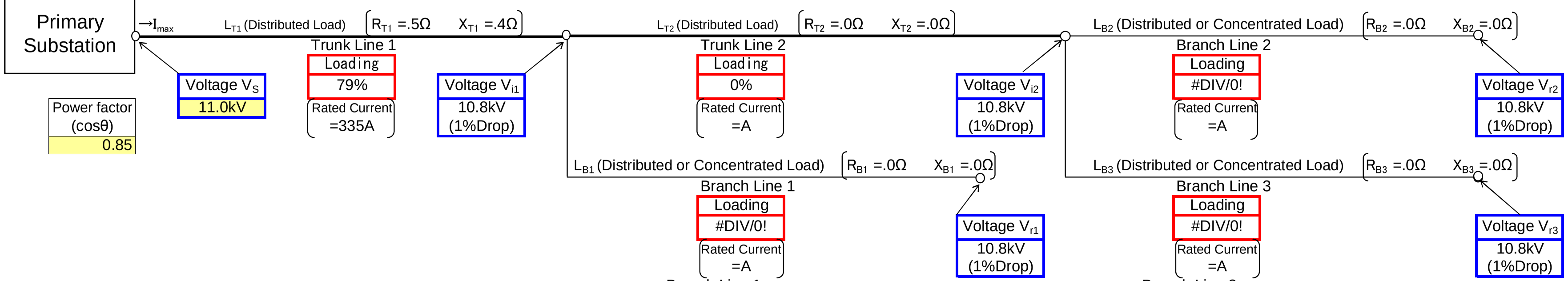
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	265.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
Line Length Len_{B3}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

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

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

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

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

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

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

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

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

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

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

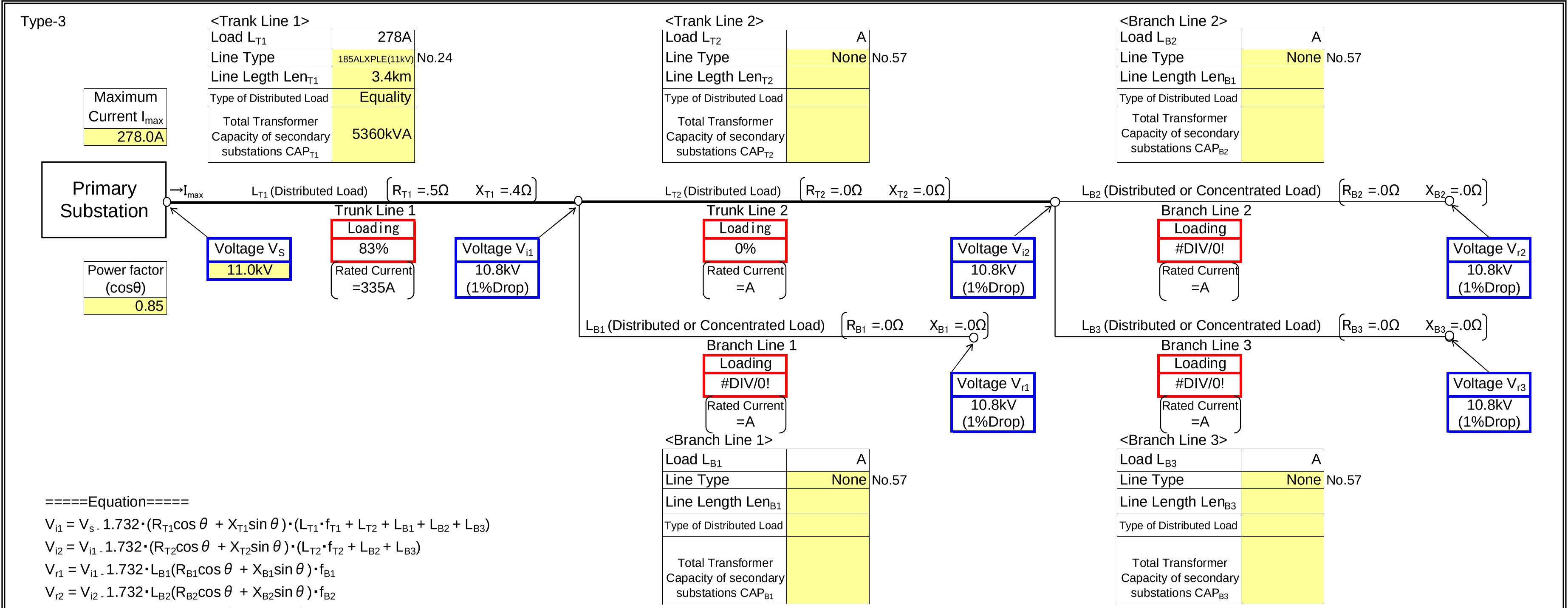
$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage	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 F
Feeder Name	F01

: Input data in colored cells



=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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 F
Feeder Name	F01

: Input data in colored cells

Type-3

Maximum Current I_{max}
292.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	292A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

$\rightarrow I_{max}$

L_{T1} (Distributed Load) R_{T1} =.5Ω X_{T1} =.4Ω

Trunk Line 1: Loading 87%; Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.8kV (2%Drop)

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2: Loading 0%; Rated Current =A

Voltage V_{i2}: 10.8kV (2%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F01

: Input data in colored cells

Type-3

Maximum Current I_{max}
306.0A

Power factor (cosθ)
0.85

<Trank Line 1>

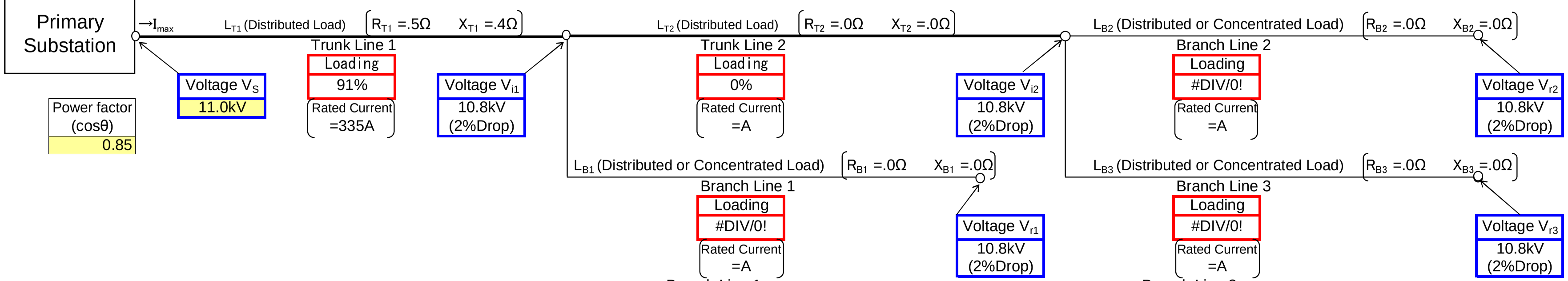
Load L_{T1}	306A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F01

: Input data in colored cells

Type-3

Maximum Current I_{max}
321.0A

Power factor (cosθ)
0.85

<Trank Line 1>

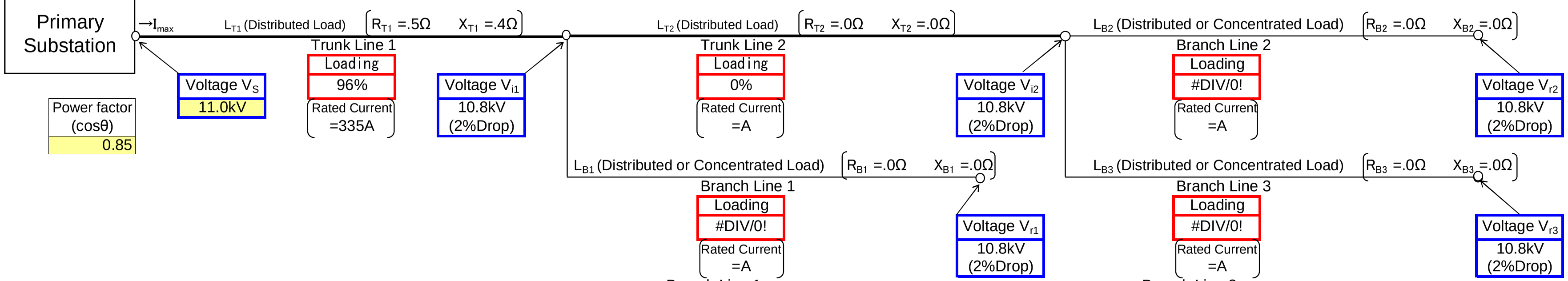
Load L_{T1}	321A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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}
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 F
Feeder Name	F01

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	337A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

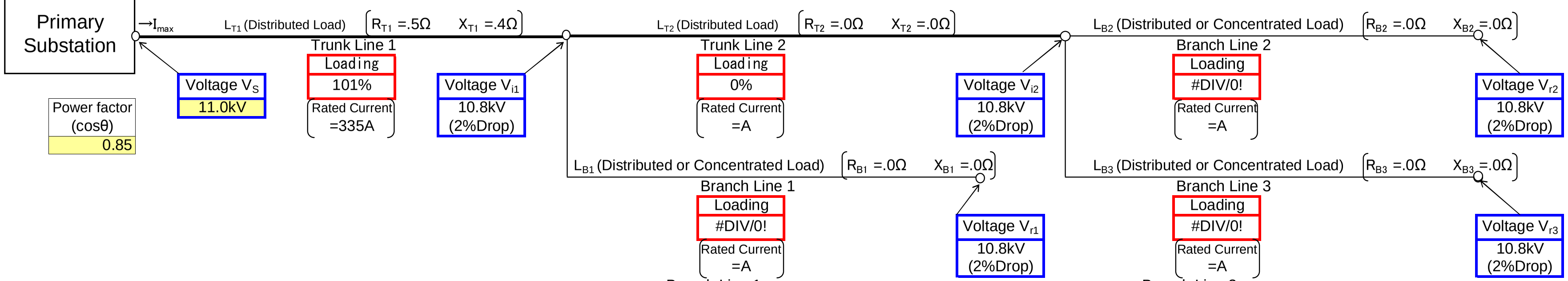
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	337.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F01

: Input data in colored cells

Type-3

Maximum Current I_{max}
354.0A

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

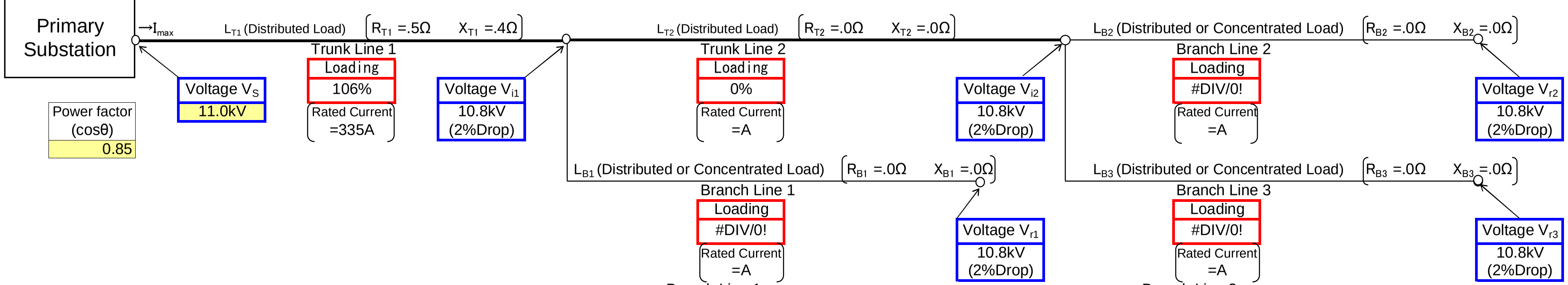
Load L_{T1}	354A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION F
Feeder Name	F01

: Input data in colored cells

Type-3

Maximum Current I_{max}
371.0A

Power factor (cosθ)
0.85

<Trank Line 1>

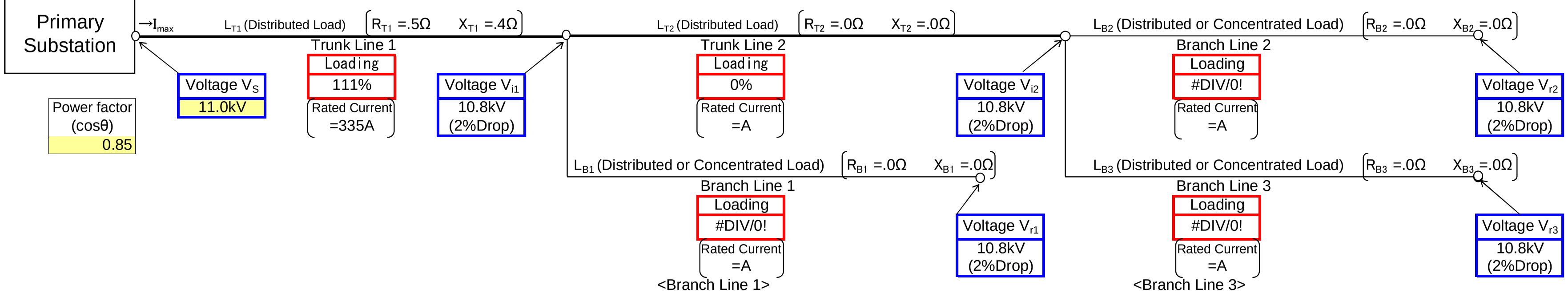
Load L_{T1}	371A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F01

: Input data in colored cells

Type-3

Maximum Current I_{max}
389.0A

Power factor (cosθ)
0.85

<Trank Line 1>

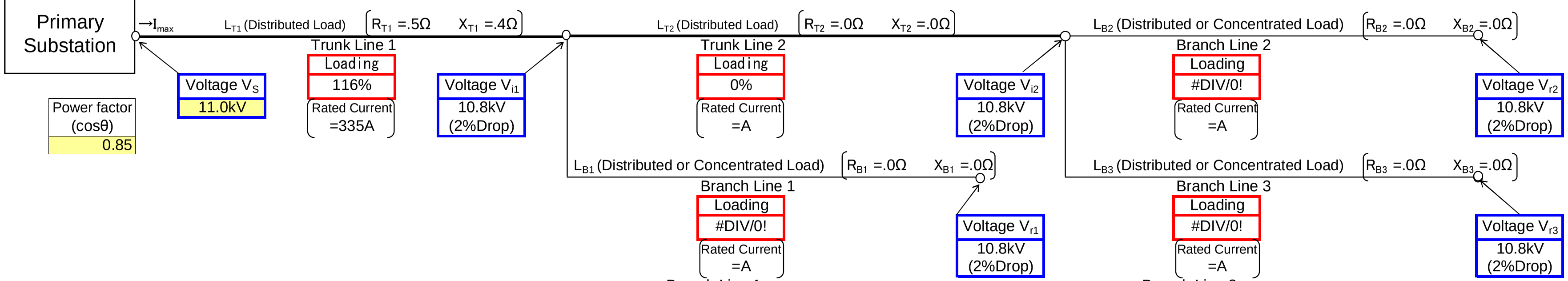
Load L_{T1}	389A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5360kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F11

: Input data in colored cells

Type-3

Maximum Current I_{max}	200.0A
Power factor (cosθ)	0.85

Primary Substation

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	200A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3100kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.5Ω X_{T1} =.4Ω)

Trunk Line 1: Loading 60%; Rated Current =335A

Voltage V_{i1}: 10.9kV (1%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%; Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F11

: Input data in colored cells

Type-3

Maximum Current I_{max}
210.0A

Power factor (cosθ)
0.85

<Trank Line 1>

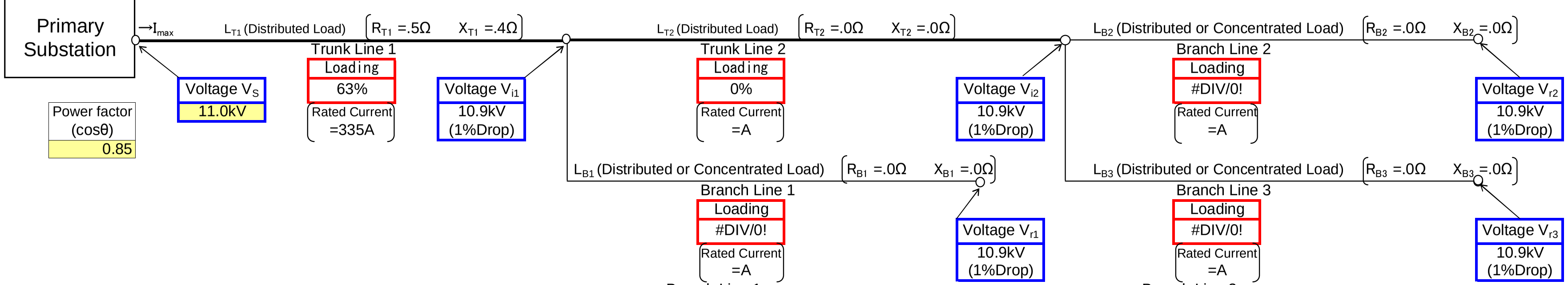
Load L_{T1}	210A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3100kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F11

: Input data in colored cells

Type-3

Maximum Current I_{max}	220.0A
Power factor (cosθ)	0.85

<Trank Line 1>

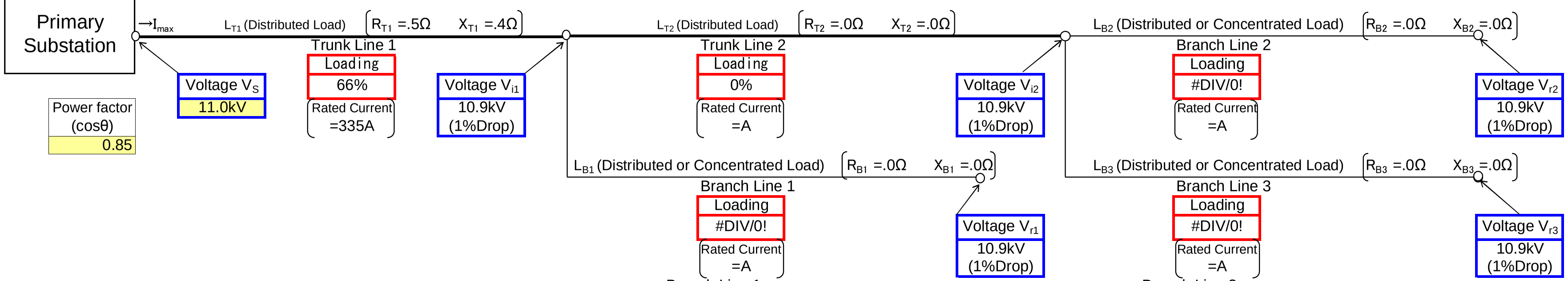
Load L_{T1}	220A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3100kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F11

: Input data in colored cells

Type-3

Maximum Current I_{max}
231.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	231A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3100kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation →I_{max}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.5Ω X_{T1} =.4Ω)

Trunk Line 1 — Loading 69% — Rated Current =335A

Voltage V_{i1}: 10.9kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 — Loading 0% — Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 — Loading #DIV/0! — Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 F
Feeder Name	F11

: Input data in colored cells

Type-3

Maximum Current I_{max}
242.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	242A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3100kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation →I_{max}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) [R_{T1} =.5Ω X_{T1} =.4Ω]
Trunk Line 1 — Loading 72% — Rated Current =335A

Voltage V_{i1}: 10.9kV (1%Drop)

L_{T2} (Distributed Load) [R_{T2} =.0Ω X_{T2} =.0Ω]
Trunk Line 2 — Loading 0% — Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) [R_{B2} =.0Ω X_{B2} =.0Ω]
Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) [R_{B1} =.0Ω X_{B1} =.0Ω]
Branch Line 1 — Loading #DIV/0! — Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) [R_{B3} =.0Ω X_{B3} =.0Ω]
Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F11

: Input data in colored cells

Type-3

Maximum Current I_{max}
254.0A

Power factor (cosθ)
0.85

<Trank Line 1>

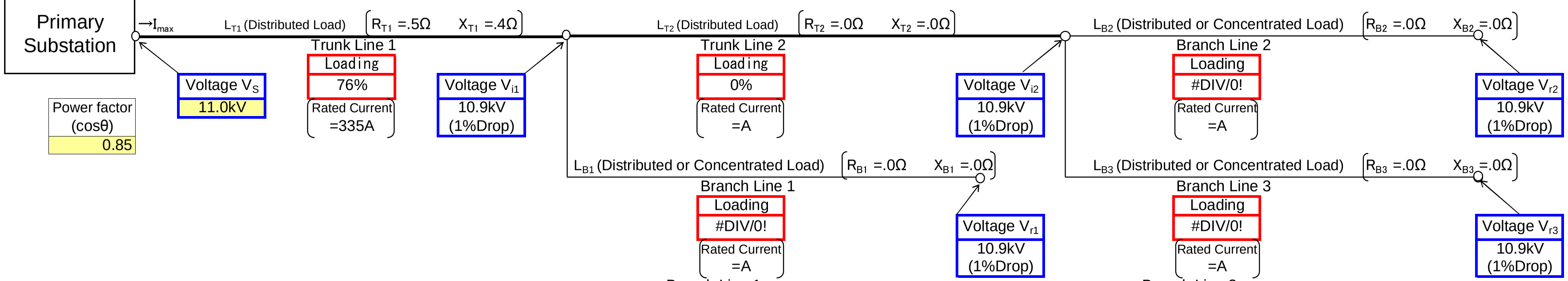
Load L_{T1}	254A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3100kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F11

: Input data in colored cells

Type-3

Maximum Current I_{max}
266.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	266A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3100kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

$\rightarrow I_{max}$

L_{T1} (Distributed Load) R_{T1} =.5Ω X_{T1} =.4Ω

Voltage V_S 11.0kV

Trunk Line 1 Loading 79% Rated Current =335A

Voltage V_{i1} 10.8kV (1%Drop)

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2 Loading 0% Rated Current =A

Voltage V_{i2} 10.8kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2 Loading #DIV/0! Rated Current =A

Voltage V_{r2} 10.8kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1 Loading #DIV/0! Rated Current =A

Voltage V_{r1} 10.8kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3 Loading #DIV/0! Rated Current =A

Voltage V_{r3} 10.8kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F11

: Input data in colored cells

Type-3

Maximum Current I_{max}	280.0A
Power factor (cosθ)	0.85

<Trank Line 1>

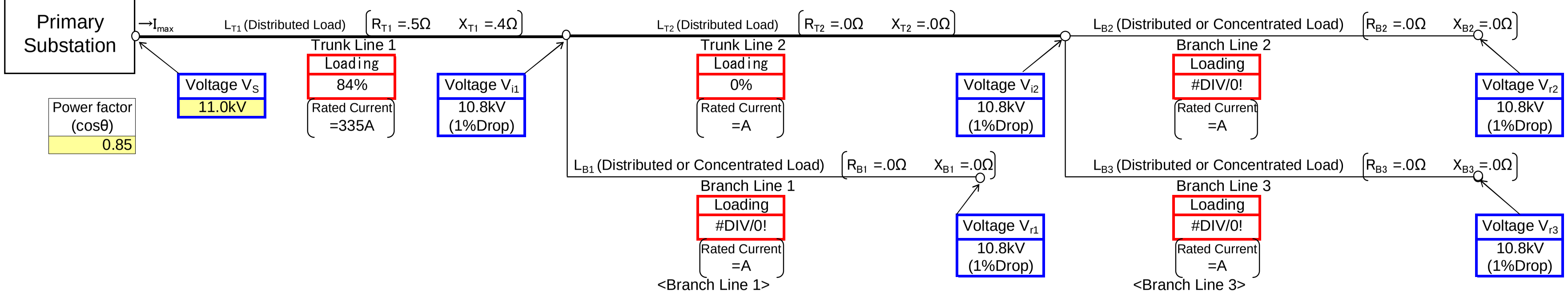
Load L_{T1}	280A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3100kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F11

: Input data in colored cells

Type-3

Maximum Current I_{max}
293.0A

<Trank Line 1>

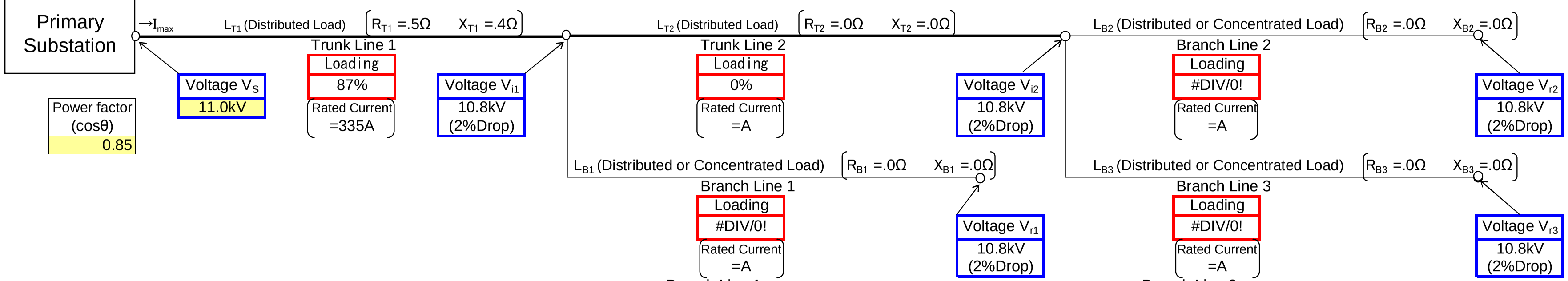
Load L_{T1}	293A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3100kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F11

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	308A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3100kVA	

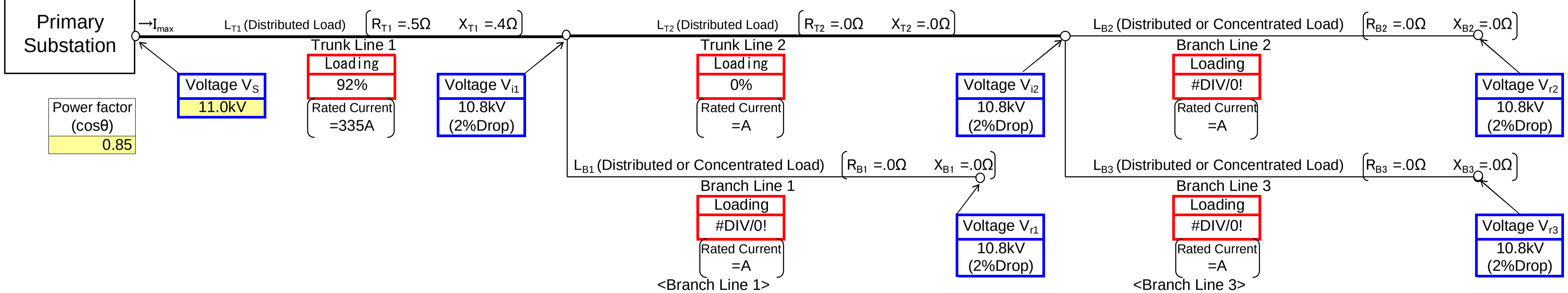
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	308.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F11

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	323A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3100kVA	

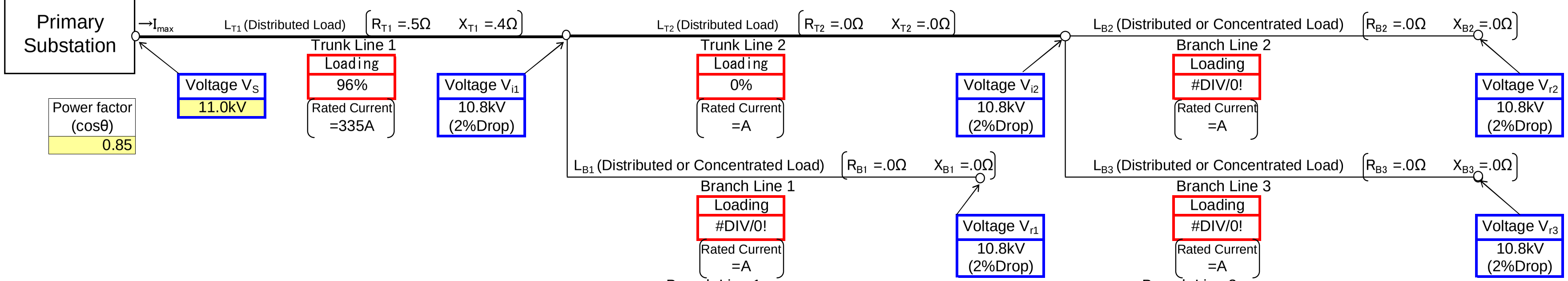
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	323.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 F
Feeder Name	F11

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	338A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3100kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	
338.0A	
Power factor (cosθ)	
0.85	

Primary Substation $\rightarrow I_{max}$

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) R_{T1} =.5Ω X_{T1} =.4Ω

Trunk Line 1 — Loading 101% — Rated Current =335A

Voltage V_{i1}: 10.8kV (2%Drop)

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2 — Loading 0% — Rated Current =A

Voltage V_{i2}: 10.8kV (2%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1 — Loading #DIV/0! — Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G05

: Input data in colored cells

Type-3

Maximum Current I_{max}
160.0A

Power factor (cosθ)
0.85

<Trank Line 1>

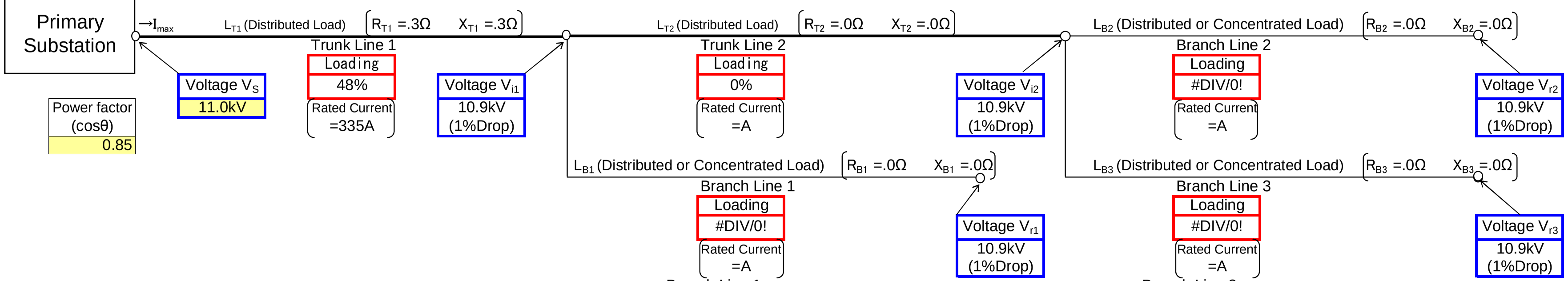
Load L_{T1}	160A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G05

: Input data in colored cells

Type-3

Maximum Current I_{max}: 168.0A

Power factor (cosθ): 0.85

<Trank Line 1>

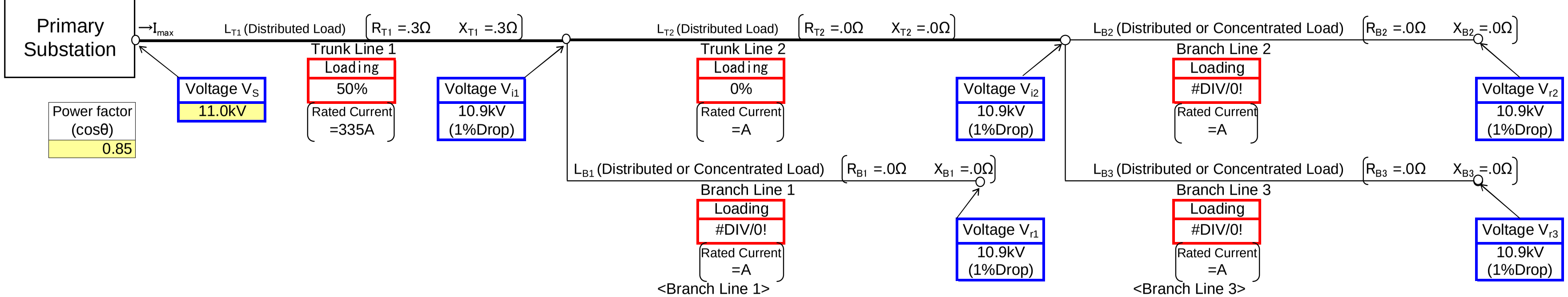
Load L_{T1}	168A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 G
Feeder Name	G05

: Input data in colored cells

Type-3

Maximum Current I_{max}
176.0A

<Trank Line 1>

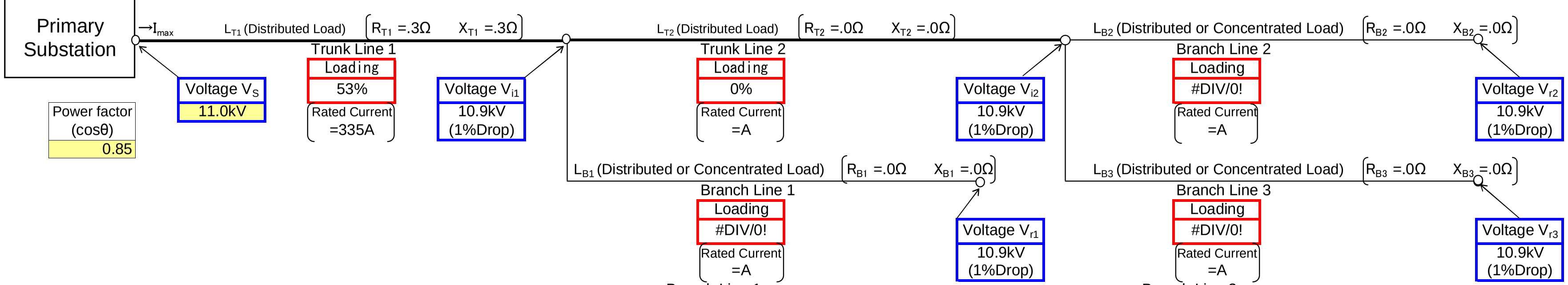
Load L_{T1}	176A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 G
Feeder Name	G05

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	185A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1915kVA	

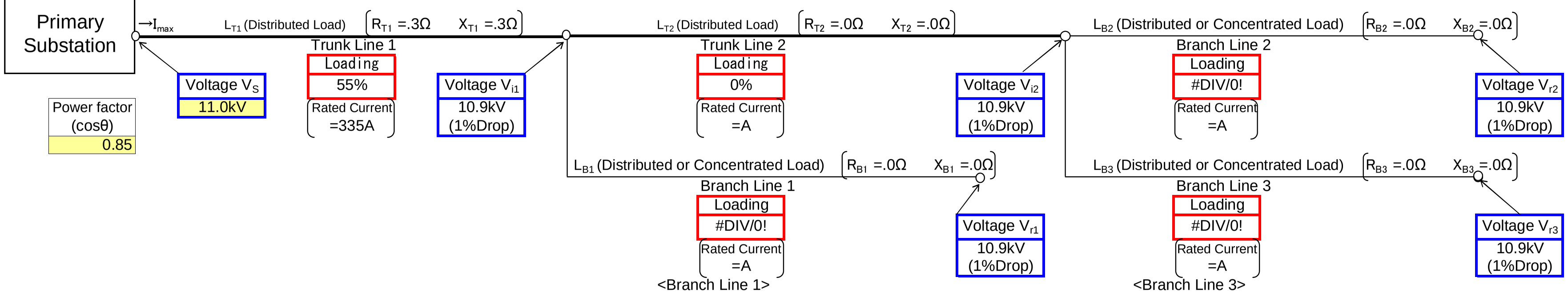
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	185.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 G
Feeder Name	G05

: Input data in colored cells

Type-3

Maximum Current I_{max}
194.0A

Power factor (cosθ)
0.85

<Trank Line 1>

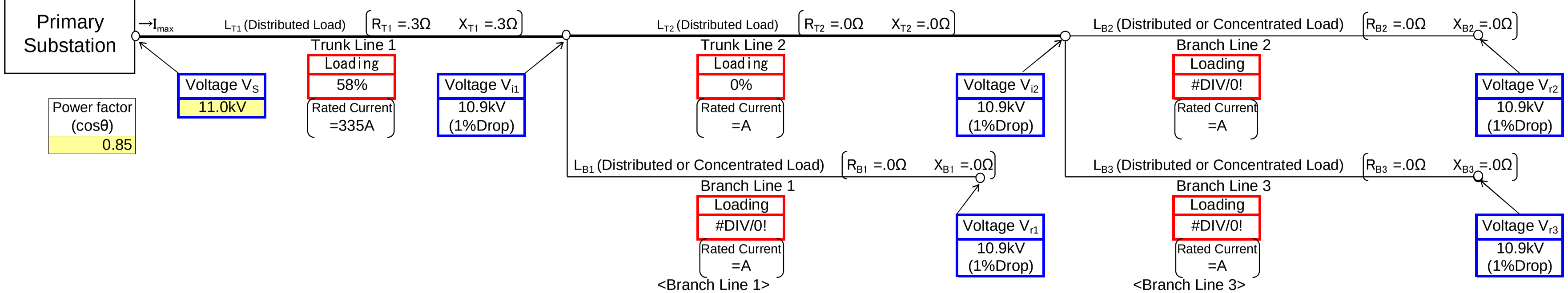
Load L_{T1}	194A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G05

: Input data in colored cells

Type-3

Maximum Current I_{max}
203.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	203A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation →I_{max}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.3Ω X_{T1} =.3Ω)

Trunk Line 1 — Loading 61% — (Rated Current =335A)

Voltage V_{i1}: 10.9kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 — Loading 0% — (Rated Current =A)

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading #DIV/0! — (Rated Current =A)

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 — Loading #DIV/0! — (Rated Current =A)

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading #DIV/0! — (Rated Current =A)

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G05

: Input data in colored cells

Type-3

Maximum Current I_{max}
213.0A

Power factor (cosθ)
0.85

Primary Substation → I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	213A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1915kVA	

L_{T1} (Distributed Load) (R_{T1} =.3Ω X_{T1} =.3Ω)

Trunk Line 1: Loading 64%, Rated Current =335A

Voltage V_{i1}: 10.9kV (1%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G05

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	224A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1915kVA	

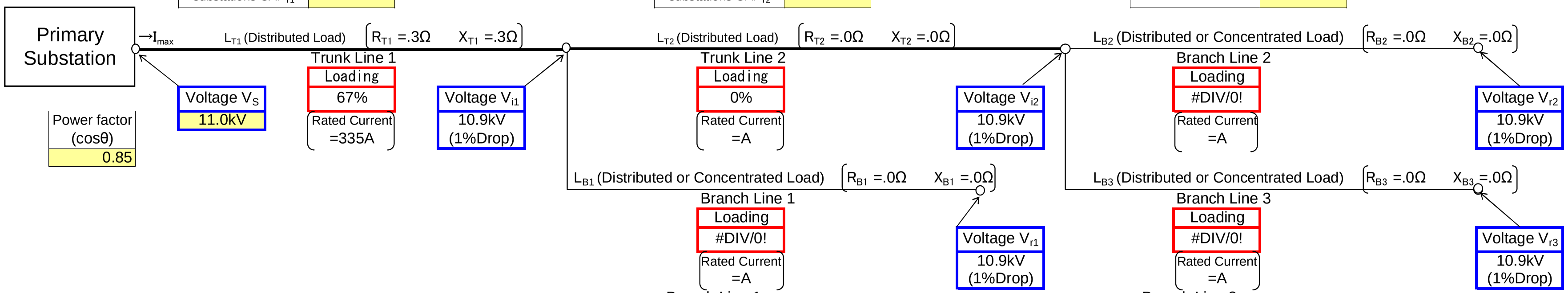
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	224.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G05

: Input data in colored cells

Type-3

Maximum Current I_{max}
235.0A

Power factor (cosθ)
0.85

<Trank Line 1>

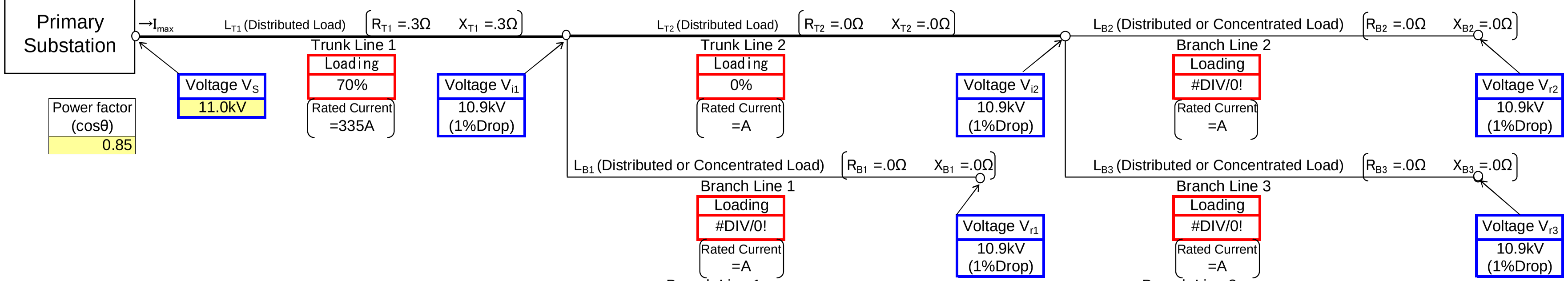
Load L_{T1}	235A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G05

: Input data in colored cells

Type-3

Maximum Current I_{max}
246.0A

Power factor (cosθ)
0.85

<Trank Line 1>

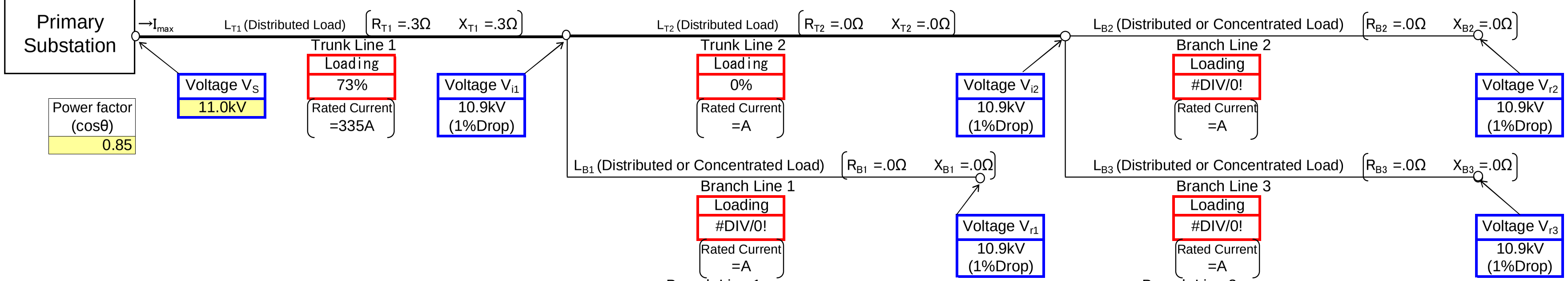
Load L_{T1}	246A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 G
Feeder Name	G05

: Input data in colored cells

Type-3

Maximum Current I_{max}
258.0A

Power factor (cosθ)
0.85

<Trank Line 1>

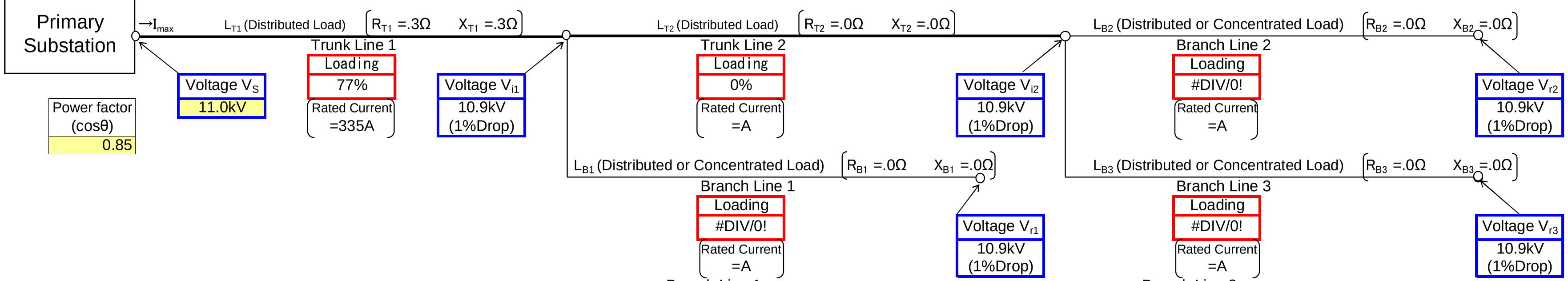
Load L_{T1}	258A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 G
Feeder Name	G05

: Input data in colored cells

Type-3

Maximum Current I_{max}
271.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	271A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1915kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

→I_{max}

L_{T1} (Distributed Load) (R_{T1} =.3Ω X_{T1} =.3Ω)

Trunk Line 1: Loading 81%, Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.9kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G25

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	310A	
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}	5325kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}: 310.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) R_{T1} =.4Ω X_{T1} =.4Ω

Trunk Line 1 — Loading 93% — Rated Current =335A

Voltage V_{i1}: 10.8kV (1%Drop)

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2 — Loading 0% — Rated Current =A

Voltage V_{i2}: 10.8kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2}: 10.8kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1 — Loading #DIV/0! — Rated Current =A

Voltage V_{r1}: 10.8kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3}: 10.8kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G25

: Input data in colored cells

Type-3

Maximum Current I_{max}: 325.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	325A	
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}	5325kVA	

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.4Ω)

Trunk Line 1: Loading 97%, Rated Current =335A

Voltage V_{i1}: 10.8kV (1%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.8kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.8kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.8kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.8kV (1%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 G
Feeder Name	G25

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	341A	
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}	5325kVA	

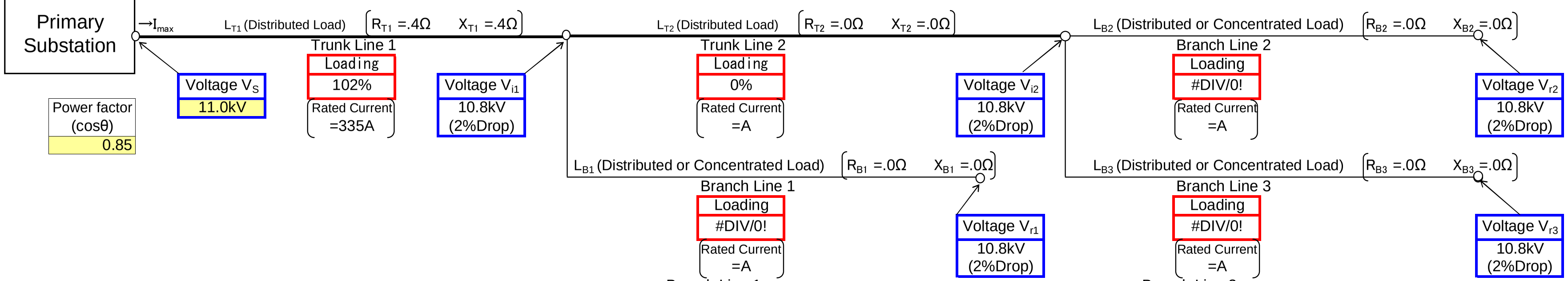
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	341.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
Line Length Len_{B3}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

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

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

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

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

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

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

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

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

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

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

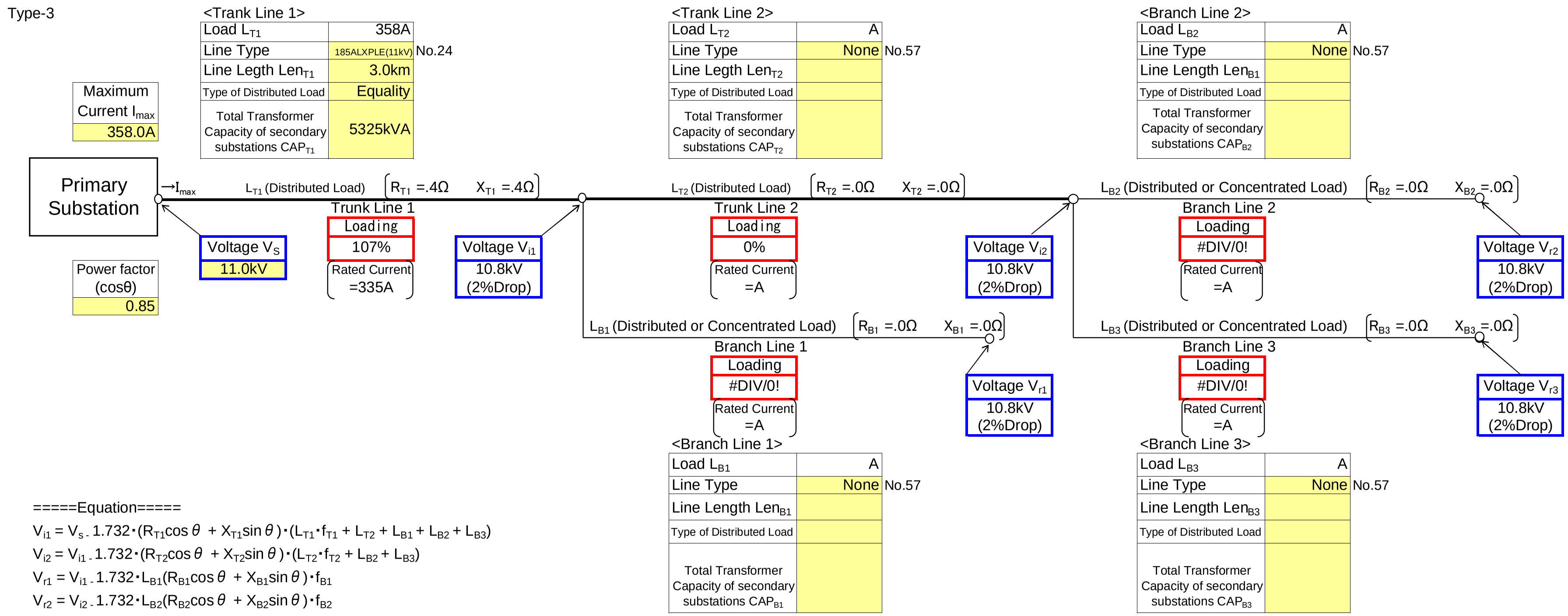
$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s	: Supply Voltage	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 G
Feeder Name	G25

: Input data in colored cells



=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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 G
Feeder Name	G25

: Input data in colored cells

Type-3

Maximum Current I_{max}
375.0A

<Trank Line 1>

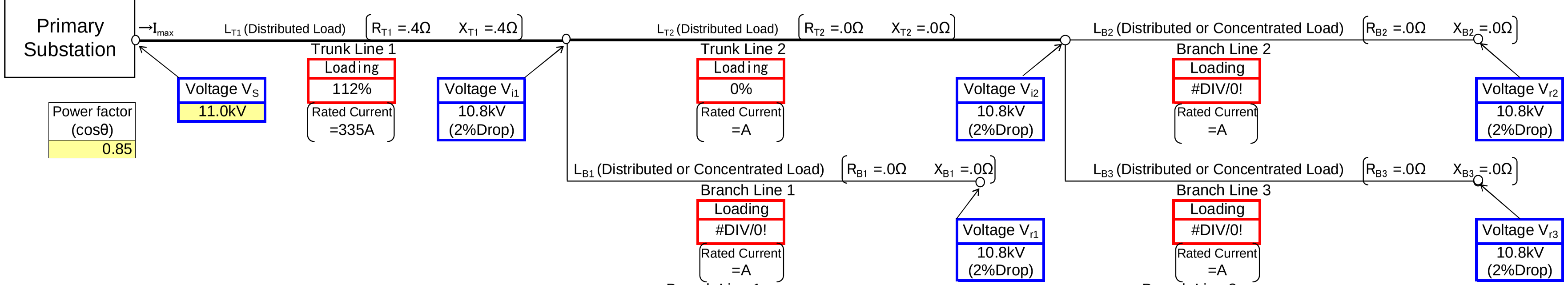
Load L_{T1}	375A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5325kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G25

: Input data in colored cells

Type-3

Maximum Current I_{max}: 394.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	394A	
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}	5325kVA	

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.4Ω)

Trunk Line 1: Loading 118%, Rated Current =335A

Voltage V_{i1}: 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.8kV (2%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G25

: Input data in colored cells

Type-3

Maximum Current I_{max}
413.0A

Power factor ($\cos\theta$)
0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	413A	
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}	5325kVA	

L_{T1} (Distributed Load) R_{T1} =.4Ω X_{T1} =.4Ω

Trunk Line 1 Loading 123% Rated Current =335A

Voltage V_{i1} 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2 Loading 0% Rated Current =A

Voltage V_{i2} 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1 Loading #DIV/0! Rated Current =A

Voltage V_{r1} 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2 Loading #DIV/0! Rated Current =A

Voltage V_{r2} 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3 Loading #DIV/0! Rated Current =A

Voltage V_{r3} 10.8kV (2%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION G
Feeder Name	G25

: Input data in colored cells

Type-3

Maximum Current I_{max}
433.0A

Power factor (cosθ)
0.85

<Trank Line 1>

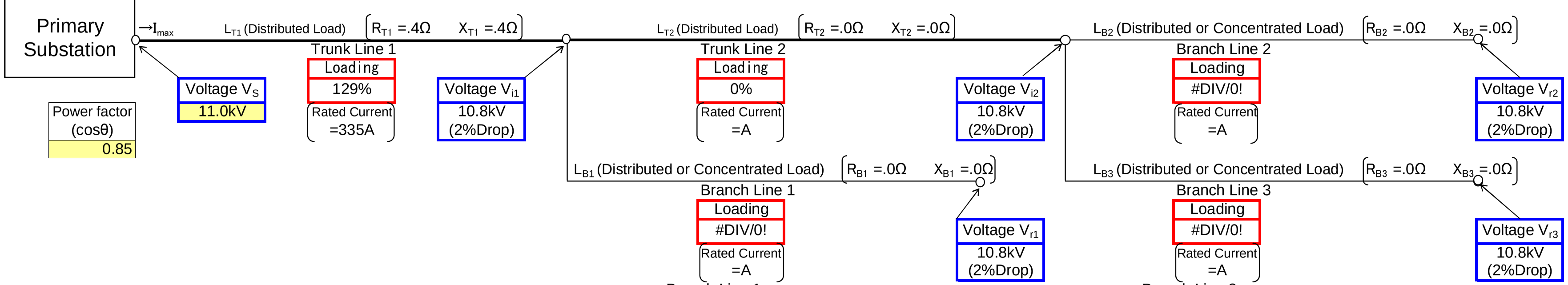
Load L_{T1}	433A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5325kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G25

: Input data in colored cells

Type-3

Maximum Current I_{max}	454.0A
Power factor (cosθ)	0.85

<Trank Line 1>

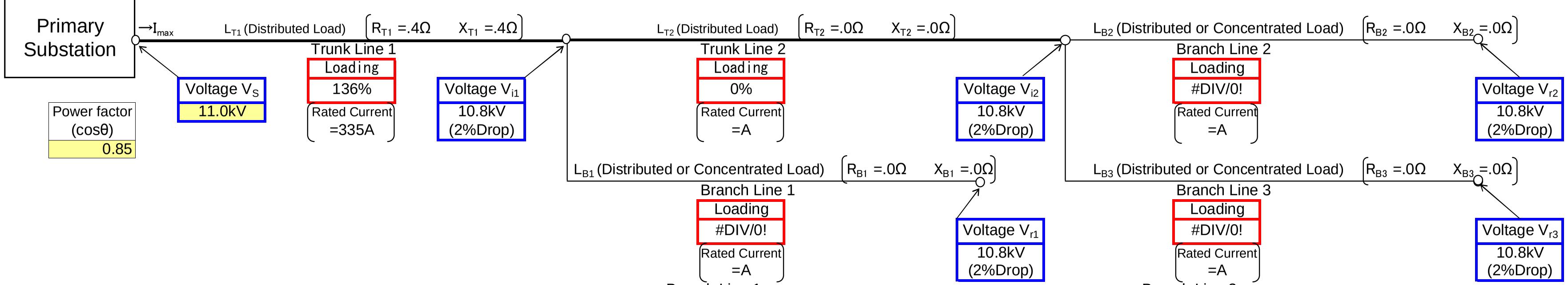
Load L_{T1}	454A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5325kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G25

: Input data in colored cells

Type-3

Maximum Current I_{max}: 477.0A

Power factor (cosθ): 0.85

<Trank Line 1>

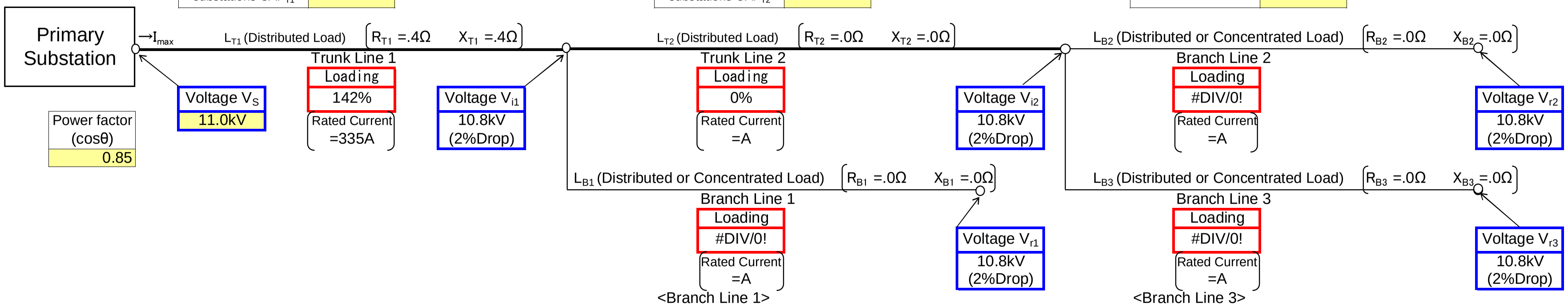
Load L_{T1}	477A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5325kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$,
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 G
Feeder Name	G25

: Input data in colored cells

Type-3

Maximum Current I_{max}	Power factor (cosθ)
500.0A	0.85

<Trank Line 1>

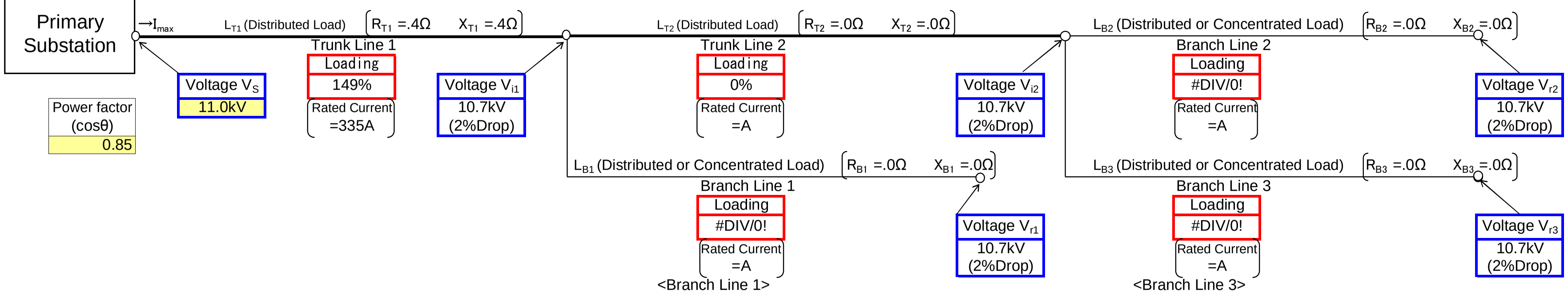
Load L_{T1}	500A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5325kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G25

: Input data in colored cells

Type-3

Maximum Current I_{max}
525.0A

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

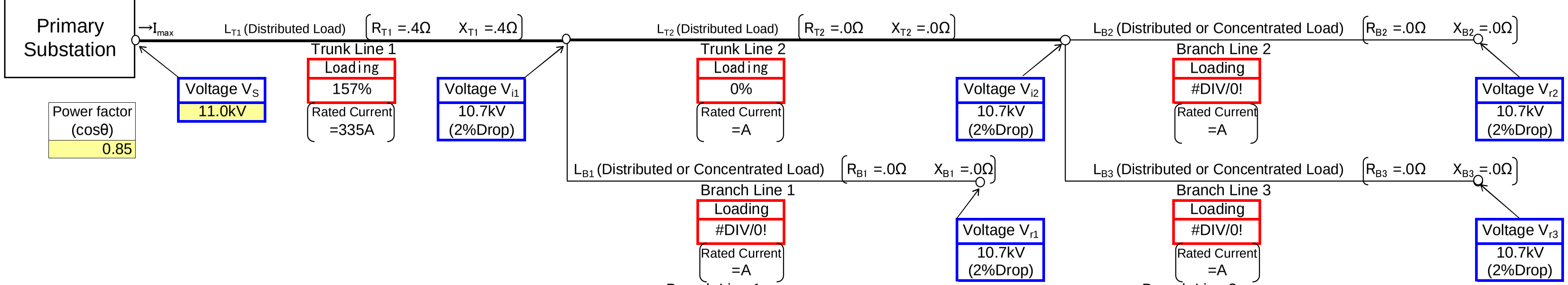
Load L_{T1}	525A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5325kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION G
Feeder Name	G32

: Input data in colored cells

Type-3

Maximum Current I_{max}	181.0A
Power factor (cosθ)	0.85

<Trank Line 1>

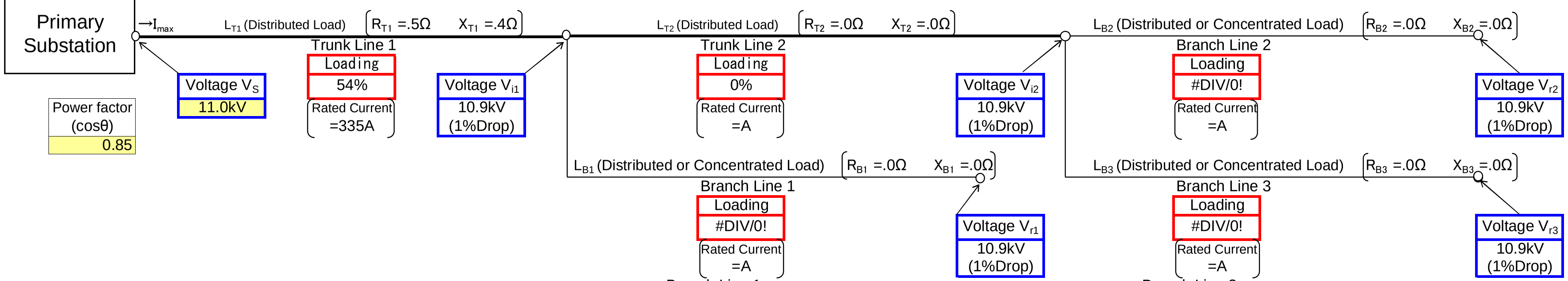
Load L_{T1}	181A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6665kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G32

: Input data in colored cells

Type-3

Maximum Current I_{max}
190.0A

Power factor (cosθ)
0.85

<Trank Line 1>

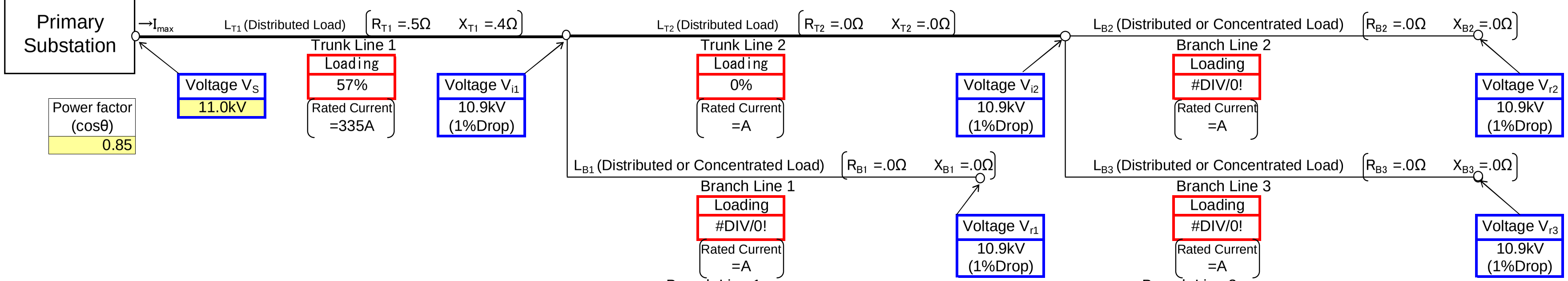
Load L_{T1}	190A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6665kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G32

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	199A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6665kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}
199.0A

Primary Substation

Power factor (cosθ)
0.85

$\rightarrow I_{max}$

L_{T1} (Distributed Load) R_{T1} =.5Ω X_{T1} =.4Ω

Trunk Line 1

Loading
59%

Rated Current =335A

Voltage V_S
11.0kV

Voltage V_{i1}
10.9kV (1%Drop)

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2

Loading
0%

Rated Current =A

Voltage V_{i2}
10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2

Loading
#DIV/0!

Rated Current =A

Voltage V_{r2}
10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1

Loading
#DIV/0!

Rated Current =A

Voltage V_{r1}
10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3

Loading
#DIV/0!

Rated Current =A

Voltage V_{r3}
10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G32

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	209A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6665kVA	

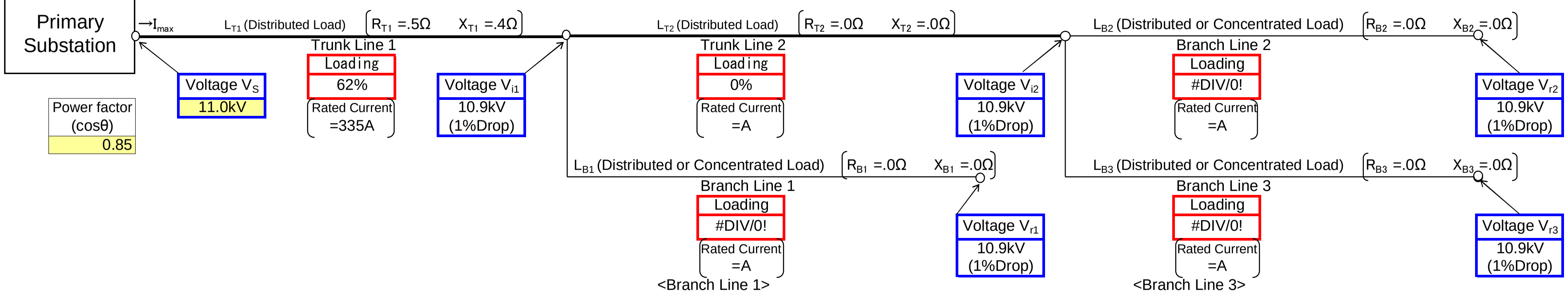
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	209.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G32

: Input data in colored cells

Type-3

Maximum Current I_{max}	219.0A
Power factor (cosθ)	0.85

<Trank Line 1>

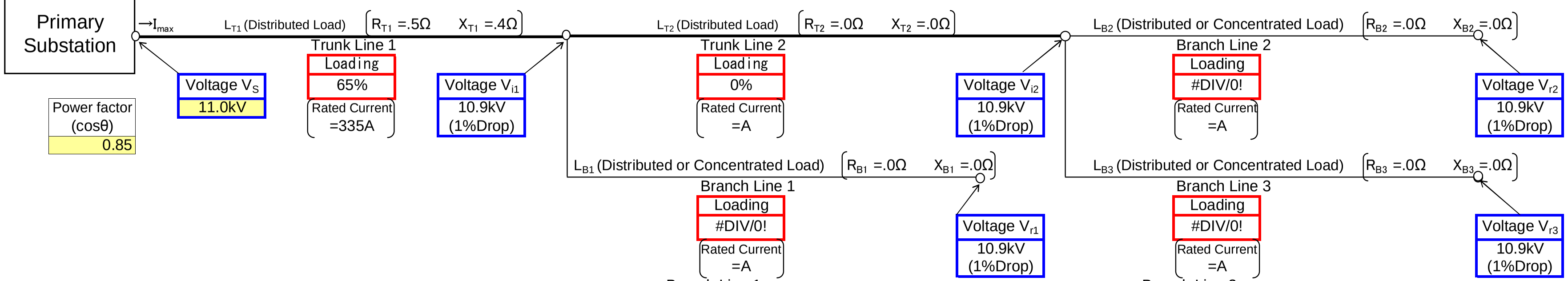
Load L_{T1}	219A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6665kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
Line Length Len_{B3}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

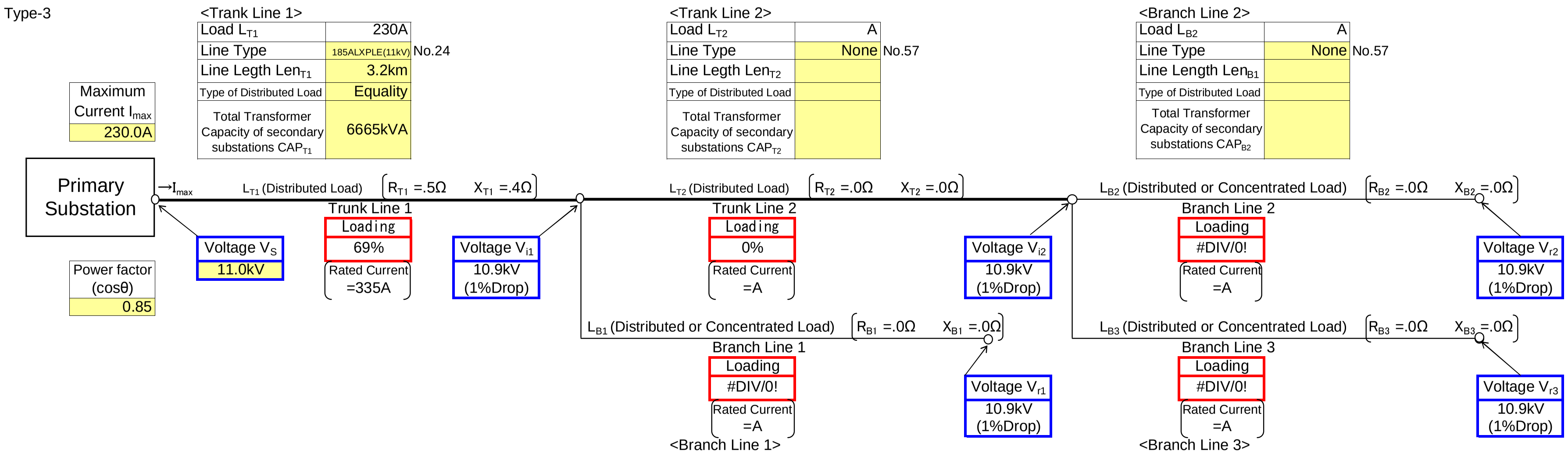
V_s : Supply Voltage	I_{max} : Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal 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 G
Feeder Name	G32

: Input data in colored cells

Type-3



=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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 G
Feeder Name	G32

: Input data in colored cells

Type-3

Maximum Current I_{max}	241.0A
Power factor (cosθ)	0.85

<Trank Line 1>

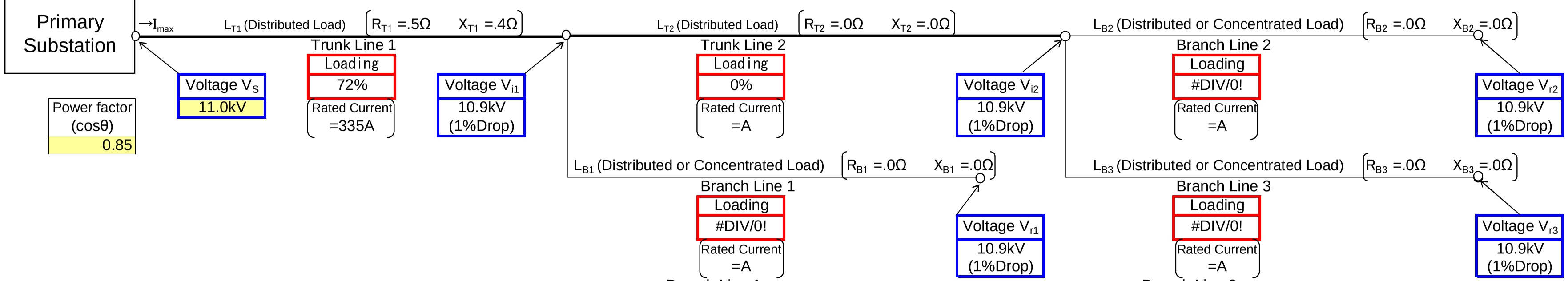
Load L_{T1}	241A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6665kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G32

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	253A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6665kVA	

<Trank Line 2>

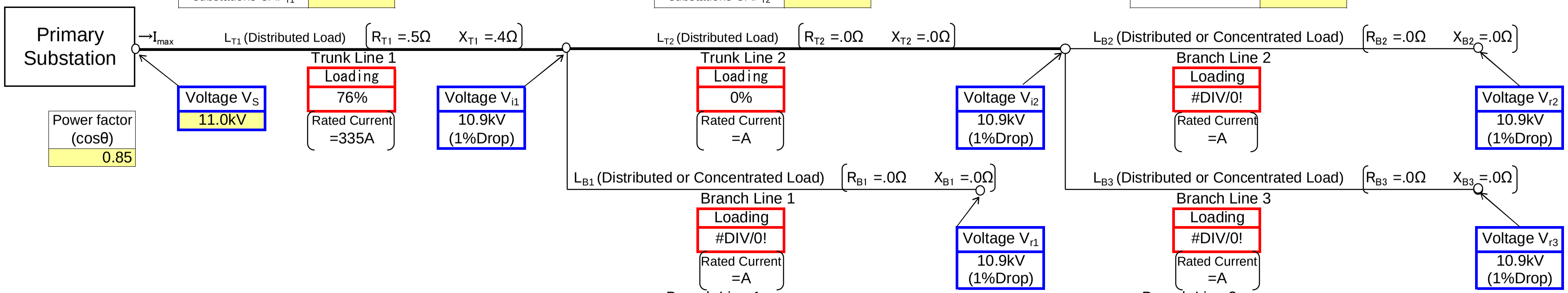
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}
253.0A

Power factor (cosθ)
0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G32

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	265A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6665kVA	

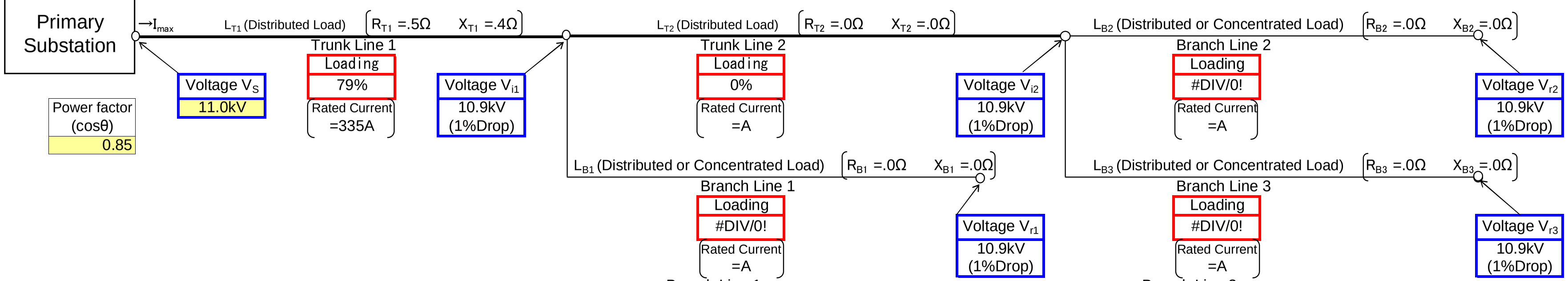
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	265.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	STATION G
Feeder Name	G32

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	278A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6665kVA	

<Trank Line 2>

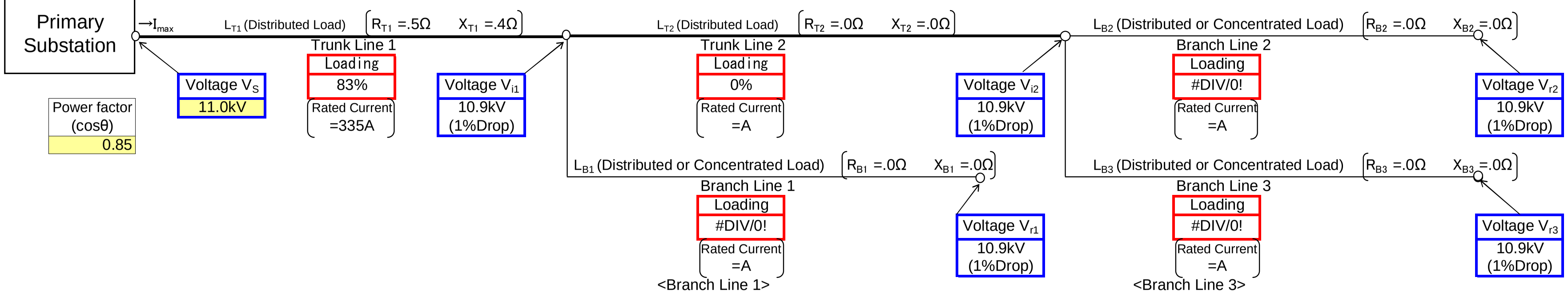
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}
278.0A

Power factor (cosθ)
0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G32

: Input data in colored cells

Type-3

Maximum Current I_{max}
292.0A

Power factor (cosθ)
0.85

<Trank Line 1>

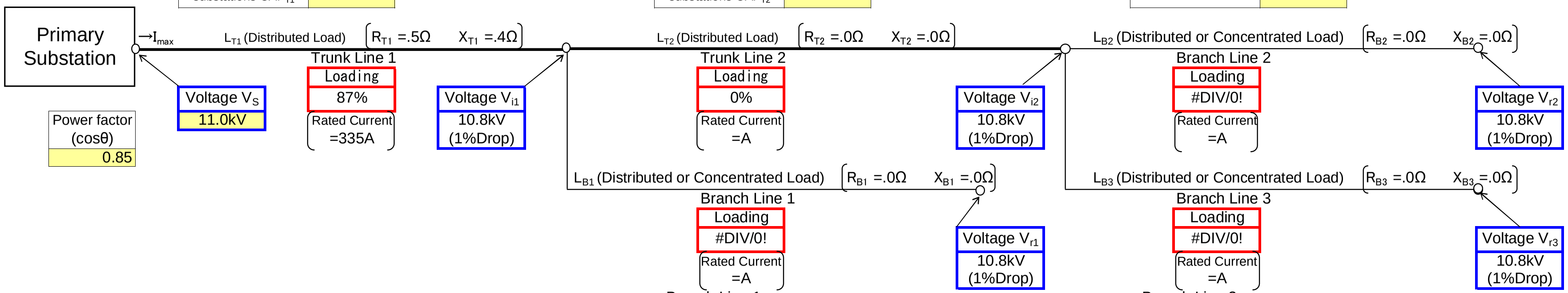
Load L_{T1}	292A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6665kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G32

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	306A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6665kVA	

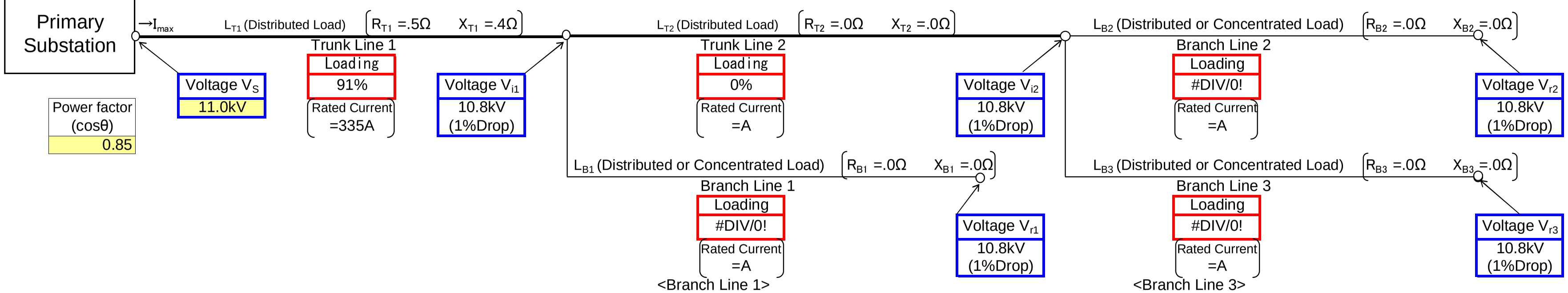
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	306.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G56

: Input data in colored cells

Type-3

Maximum Current I_{max}: 240.0A

Power factor (cosθ): 0.85

<Trank Line 1>

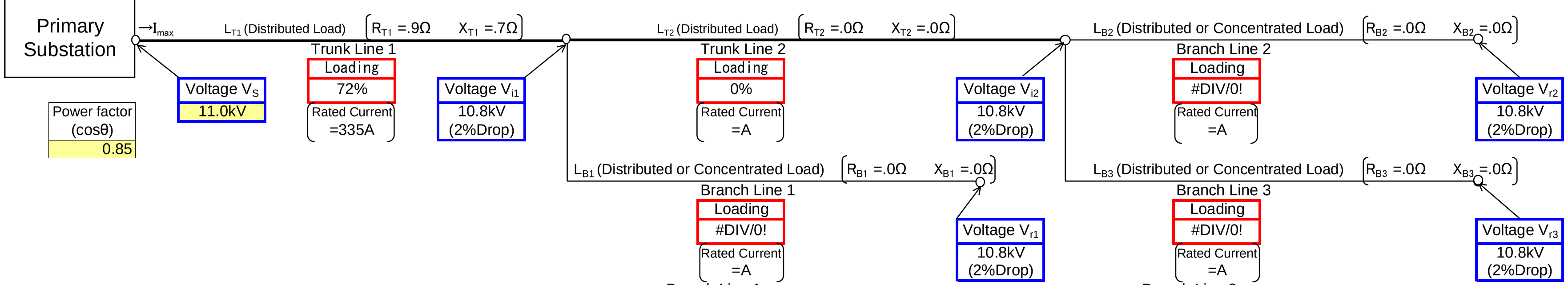
Load L_{T1}	240A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	8010kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 G
Feeder Name	G56

: Input data in colored cells

Type-3

Maximum Current I_{max}: 252.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	252A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	8010kVA	

L_{T1} (Distributed Load) (R_{T1} =.9Ω X_{T1} =.7Ω)

Trunk Line 1: Loading 75%, Rated Current =335A

Voltage V_{i1}: 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.8kV (2%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G56

: Input data in colored cells

Type-3

Maximum Current I_{max}
264.0A

Power factor (cosθ)
0.85

<Trank Line 1>

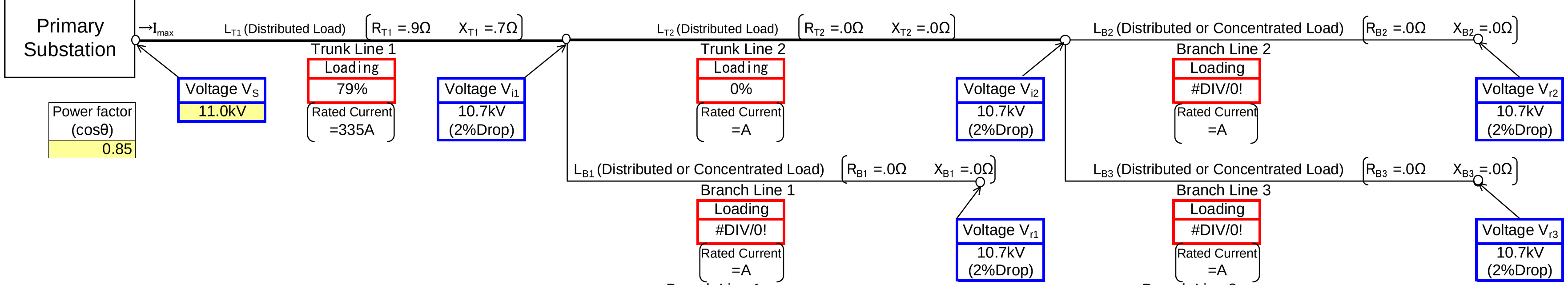
Load L_{T1}	264A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	8010kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G56

: Input data in colored cells

Type-3

Maximum Current I_{max}
277.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	277A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	8010kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation $\rightarrow I_{max}$

Voltage V_S 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.9Ω X_{T1} =.7Ω)

Trunk Line 1: Loading 83%, Rated Current =335A

Voltage V_{i1} 10.7kV (2%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2} 10.7kV (2%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2} 10.7kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1} 10.7kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3} 10.7kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G56

: Input data in colored cells

Type-3

Maximum Current I_{max}
291.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	291A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	8010kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

$\rightarrow I_{max}$

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.9Ω X_{T1} =.7Ω)

Trunk Line 1 — Loading 87% — Rated Current =335A

Voltage V_{i1}: 10.7kV (3%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 — Loading 0% — Rated Current =A

Voltage V_{i2}: 10.7kV (3%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2}: 10.7kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 — Loading #DIV/0! — Rated Current =A

Voltage V_{r1}: 10.7kV (3%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3}: 10.7kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G56

: Input data in colored cells

Type-3

Maximum Current I_{max}
305.0A

Power factor (cosθ)
0.85

<Trank Line 1>

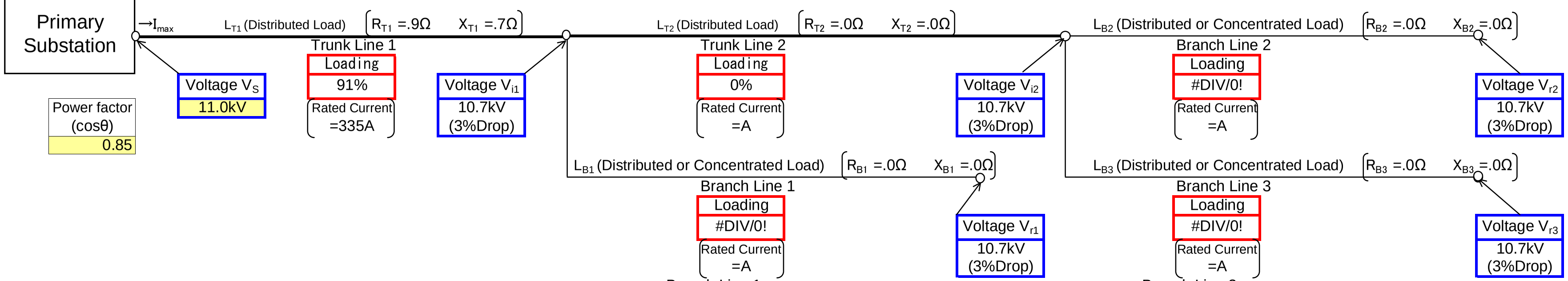
Load L_{T1}	305A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	8010kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G56

: Input data in colored cells

Type-3

Maximum Current I_{max}
320.0A

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

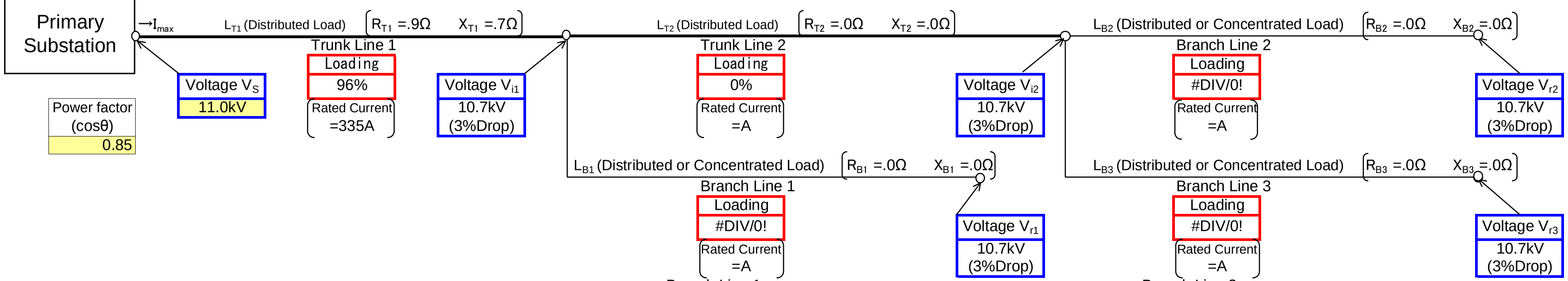
Load L_{T1}	320A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	8010kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION G
Feeder Name	G56

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	335A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	8010kVA	

<Trank Line 2>

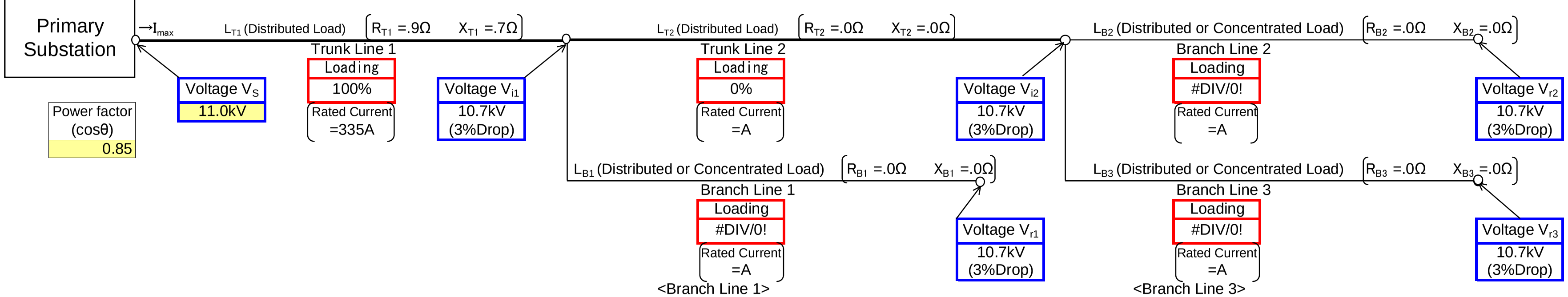
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}
335.0A

Power factor (cosθ)
0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G56

: Input data in colored cells

Type-3

Maximum Current I_{max}
352.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	352A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	8010kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation →I_{max}

Voltage V_S 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.9Ω X_{T1} =.7Ω)

Trunk Line 1 Loading 105% (Rated Current =335A)

Voltage V_{i1} 10.7kV (3%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 Loading 0% (Rated Current =A)

Voltage V_{i2} 10.7kV (3%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 Loading #DIV/0! (Rated Current =A)

Voltage V_{r2} 10.7kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 Loading #DIV/0! (Rated Current =A)

Voltage V_{r1} 10.7kV (3%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 Loading #DIV/0! (Rated Current =A)

Voltage V_{r3} 10.7kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G56

: Input data in colored cells

Type-3

Maximum Current I_{max}
369.0A

Power factor (cosθ)
0.85

<Trank Line 1>

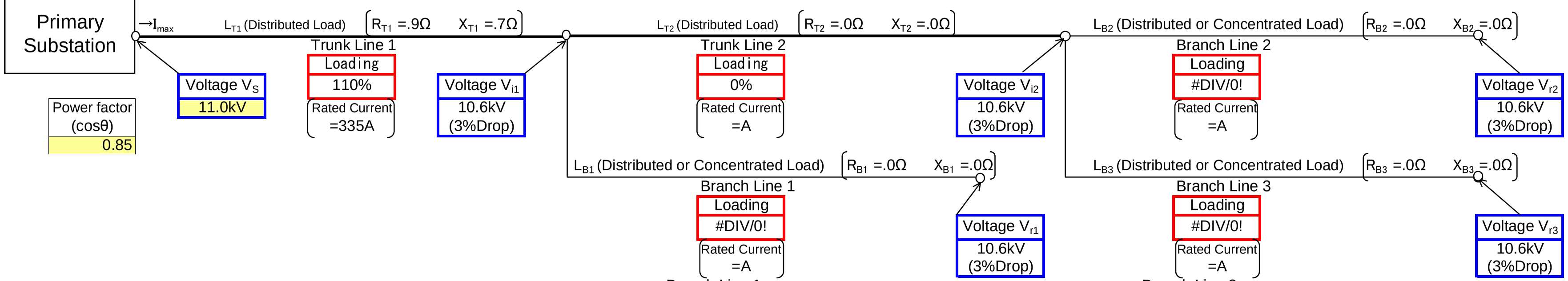
Load L_{T1}	369A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	8010kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G56

: Input data in colored cells

Type-3

Maximum Current I_{max}
387.0A

Power factor (cosθ)
0.85

<Trank Line 1>

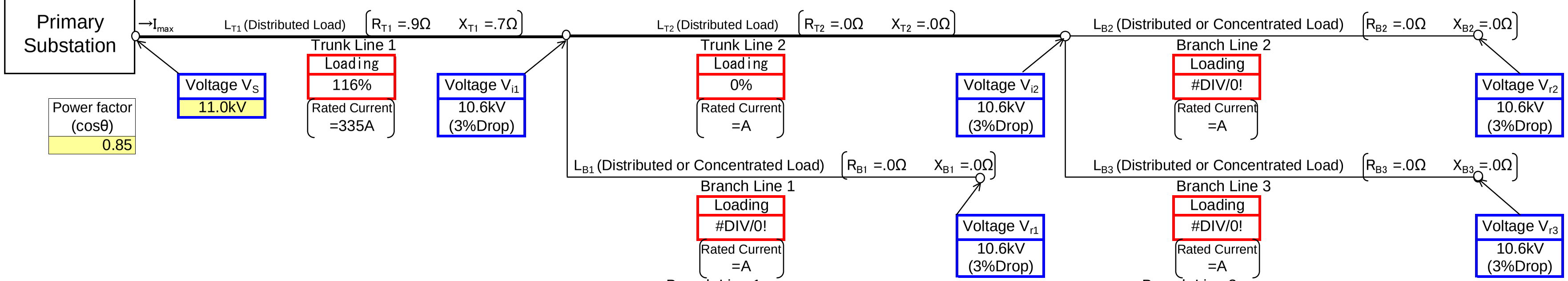
Load L_{T1}	387A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	8010kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	G56

: Input data in colored cells

Type-3

Maximum Current I_{max}
406.0A

<Trank Line 1>

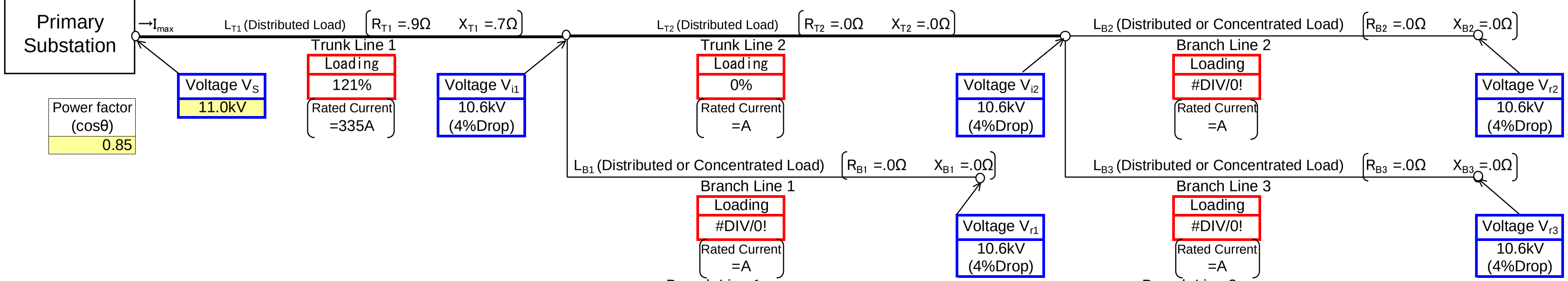
Load L_{T1}	406A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	8010kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 G
Feeder Name	GE19

: Input data in colored cells

Type-3

Maximum Current I_{max}
220.0A

Power factor (cosθ)
0.85

<Trank Line 1>

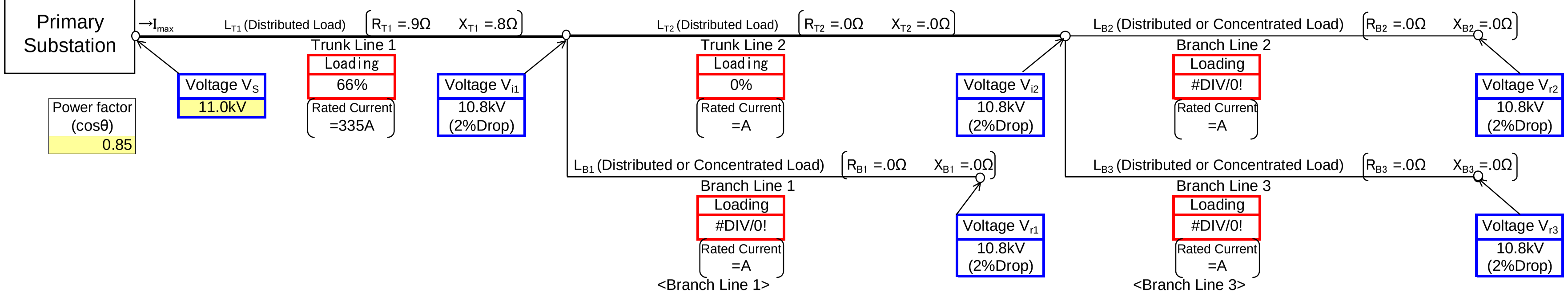
Load L_{T1}	220A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	9210kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	GE19

: Input data in colored cells

Type-3

Maximum Current I_{max}	231.0A
Power factor (cosθ)	0.85

Primary Substation →I_{max}

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	231A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	9210kVA	

L_{T1} (Distributed Load) (R_{T1} =.9Ω X_{T1} =.8Ω)

Trunk Line 1 Loading 69% (Rated Current =335A)

Voltage V_{i1} 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 Loading 0% (Rated Current =A)

Voltage V_{i2} 10.8kV (2%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 Loading #DIV/0! (Rated Current =A)

Voltage V_{r2} 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 Loading #DIV/0! (Rated Current =A)

Voltage V_{r1} 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 Loading #DIV/0! (Rated Current =A)

Voltage V_{r3} 10.8kV (2%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
Line Length Len_{B3}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

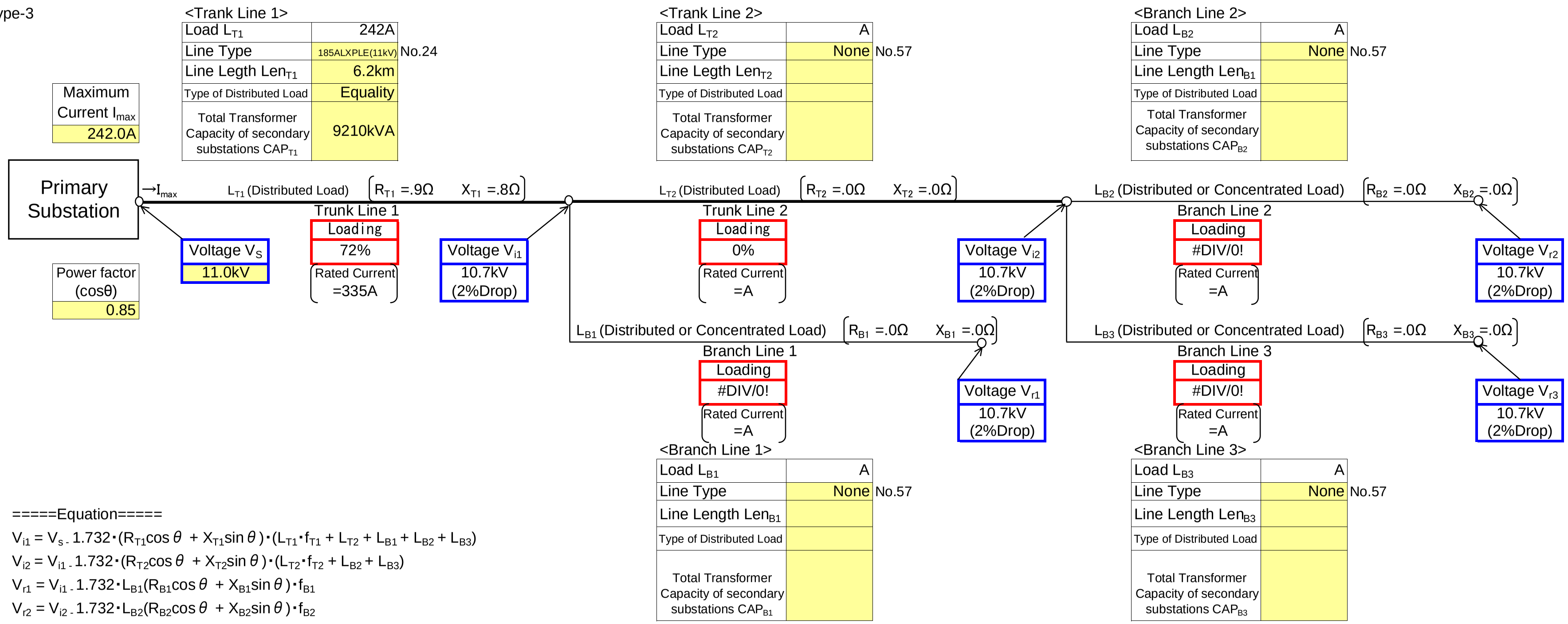
V_s : Supply Voltage	I_{max} : Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: 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 G
Feeder Name	GE19

: Input data in colored cells

Type-3



=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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 G
Feeder Name	GE19

: Input data in colored cells

Type-3

Maximum Current I_{max}: 254.0A

Power factor (cosθ): 0.85

<Trank Line 1>

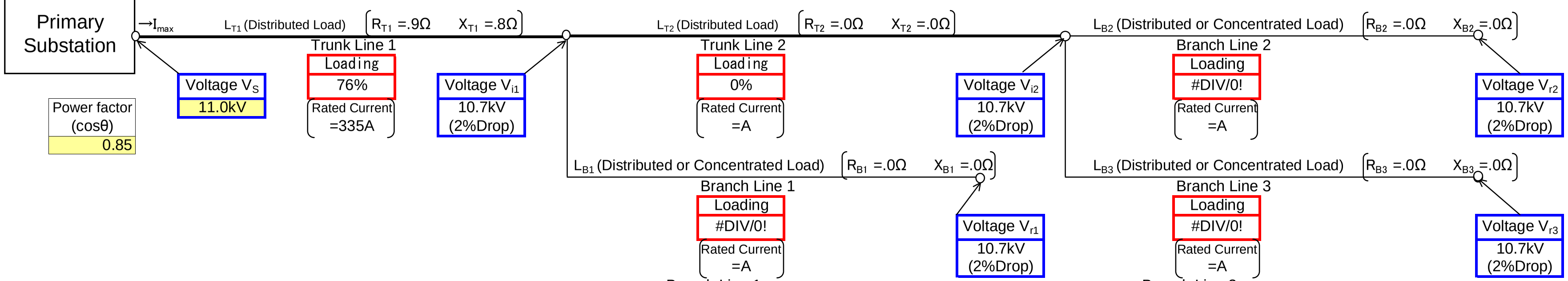
Load L_{T1}	254A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	9210kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	GE19

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	266A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	9210kVA	

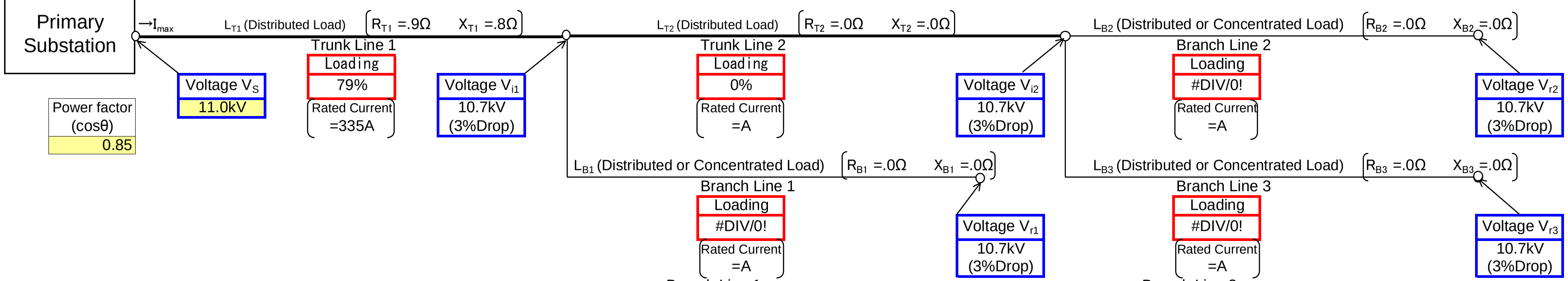
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	266.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 G
Feeder Name	GE19

: Input data in colored cells

Type-3

Maximum Current I_{max}
279.0A

Power factor (cosθ)
0.85

<Trank Line 1>

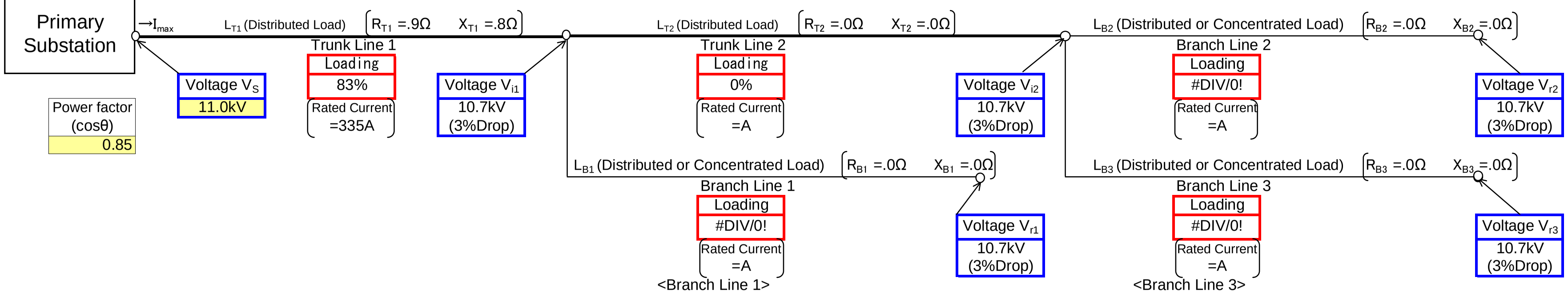
Load L_{T1}	279A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	9210kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	GE19

: Input data in colored cells

Type-3

Maximum Current I_{max}
293.0A

<Trank Line 1>

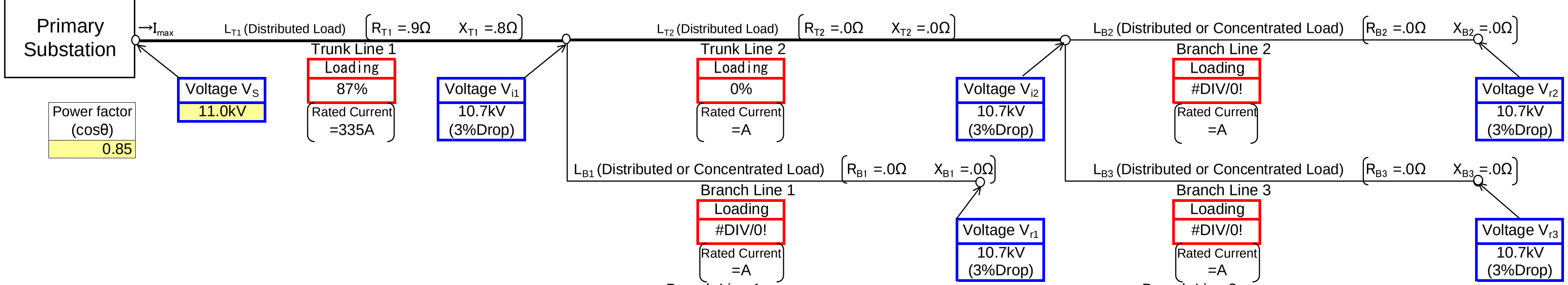
Load L_{T1}	293A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	9210kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	GE19

: Input data in colored cells

Type-3

Maximum Current I_{max}	307.0A
Power factor (cosθ)	0.85

<Trank Line 1>

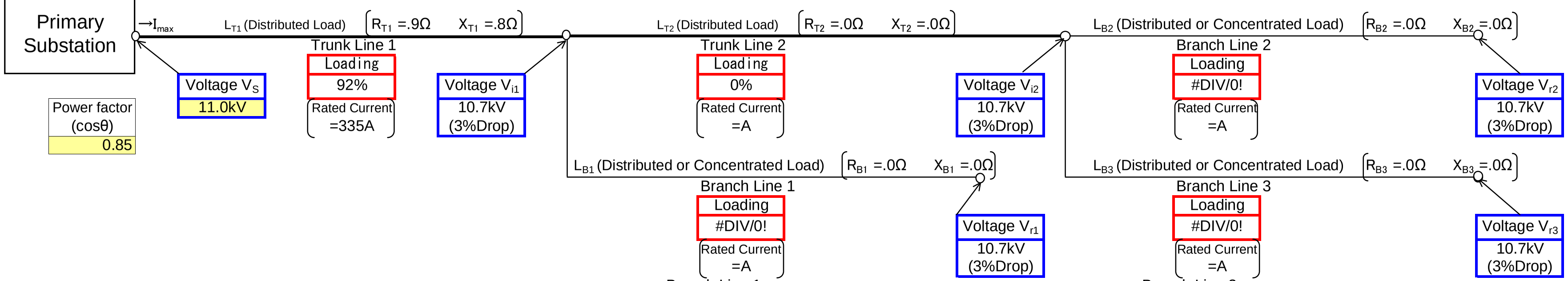
Load L_{T1}	307A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	9210kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	GE19

: Input data in colored cells

Type-3

Maximum Current I_{max}
323.0A

<Trank Line 1>

Load L_{T1}	323A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	9210kVA	

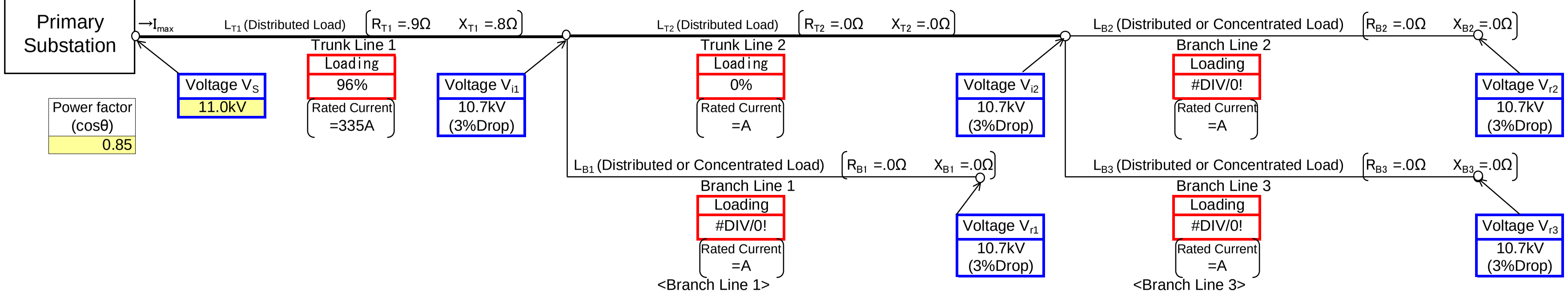
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Power factor (cosθ)
0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	GE19

: Input data in colored cells

Type-3

Maximum Current I_{max}: 338.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	338A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	9210kVA	

L_{T1} (Distributed Load) (R_{T1} =.9Ω X_{T1} =.8Ω)

Trunk Line 1: Loading 101%; Rated Current =335A

Voltage V_{i1}: 10.6kV (3%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%; Rated Current =A

Voltage V_{i2}: 10.6kV (3%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.6kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.6kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.6kV (3%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 G
Feeder Name	GE19

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	355A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	9210kVA	

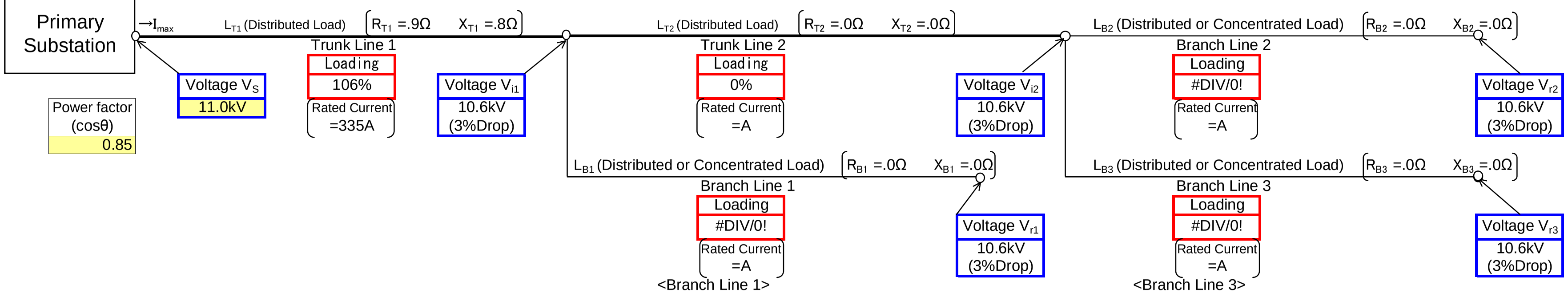
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	355.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$,
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 G
Feeder Name	GE19

: Input data in colored cells

Type-3

Maximum Current I_{max}
372.0A

Power factor ($\cos\theta$)
0.85

Primary Substation $\rightarrow I_{max}$

<Trank Line 1>

Load L_{T1}	372A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	9210kVA	

L_{T1} (Distributed Load) (R_{T1} =.9Ω X_{T1} =.8Ω)

Voltage V_S: 11.0kV

Trunk Line 1: Loading 111%, Rated Current =335A

Voltage V_{i1}: 10.6kV (4%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.6kV (4%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.6kV (4%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.6kV (4%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.6kV (4%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION N
Feeder Name	NSAWAM-ACCRA

: Input data in colored cells

Type-3

Maximum Current I_{max}
260.0A

Power factor (cosθ)
0.85

<Trank Line 1>

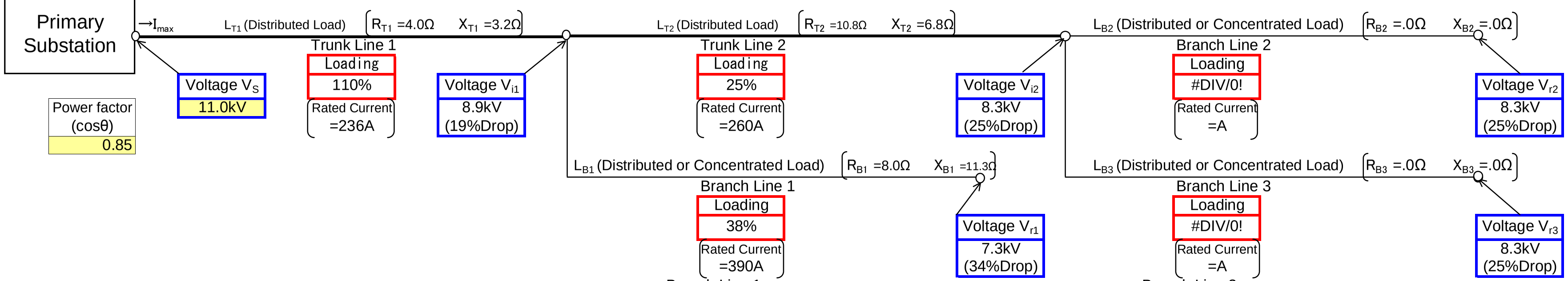
Load L_{T1}	53A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1785kVA	

<Trank Line 2>

Load L_{T2}	60A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	17.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2000kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	147A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	31.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4910kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 N
Feeder Name	NSAWAM-ACCRA

: Input data in colored cells

Type-3

Maximum Current I_{max}	
273.0A	

Power factor (cosθ)	
0.85	

Primary Substation $\rightarrow I_{max}$

<Trank Line 1>

Load L_{T1}	56A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1785kVA	

L_{T1} (Distributed Load) (R_{T1} =4.0Ω X_{T1} =3.2Ω)

Trunk Line 1: Loading 116% (Rated Current =236A)

Voltage V_S: 11.0kV

Voltage V_{i1}: 8.8kV (20%Drop)

<Trank Line 2>

Load L_{T2}	63A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	17.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2000kVA	

L_{T2} (Distributed Load) (R_{T2} =10.8Ω X_{T2} =6.8Ω)

Trunk Line 2: Loading 27% (Rated Current =260A)

Voltage V_{i2}: 8.1kV (26%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =8.0Ω X_{B1} =11.3Ω)

Branch Line 1: Loading 40% (Rated Current =390A)

Voltage V_{r1}: 7.1kV (35%Drop)

<Branch Line 1>

Load L_{B1}	154A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	31.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4910kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0! (Rated Current =A)

Voltage V_{r2}: 8.1kV (26%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0! (Rated Current =A)

Voltage V_{r3}: 8.1kV (26%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 N
Feeder Name	NSAWAM-ACCRA

: Input data in colored cells

Type-3

Maximum Current I_{max}
286.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	59A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1785kVA	

<Trank Line 2>

Load L_{T2}	66A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	17.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2000kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

$\rightarrow I_{max}$

L_{T1} (Distributed Load) (R_{T1} =4.0Ω X_{T1} =3.2Ω)

Trunk Line 1

Loading
121%

(Rated Current =236A)

Voltage V_S
11.0kV

Voltage V_{i1}
8.7kV (21%Drop)

L_{T2} (Distributed Load) (R_{T2} =10.8Ω X_{T2} =6.8Ω)

Trunk Line 2

Loading
28%

(Rated Current =260A)

Voltage V_{i2}
8.0kV (27%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2

Loading
#DIV/0!

(Rated Current =A)

Voltage V_{r2}
8.0kV (27%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =8.0Ω X_{B1} =11.3Ω)

Branch Line 1

Loading
41%

(Rated Current =390A)

Voltage V_{r1}
6.9kV (37%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3

Loading
#DIV/0!

(Rated Current =A)

Voltage V_{r3}
8.0kV (27%Drop)

<Branch Line 1>

Load L_{B1}	162A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	31.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4910kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 N
Feeder Name	NSAWAM-ACCRA

: Input data in colored cells

Type-3

Maximum Current I_{max}
300.0A

Power factor (cosθ)
0.85

<Trank Line 1>

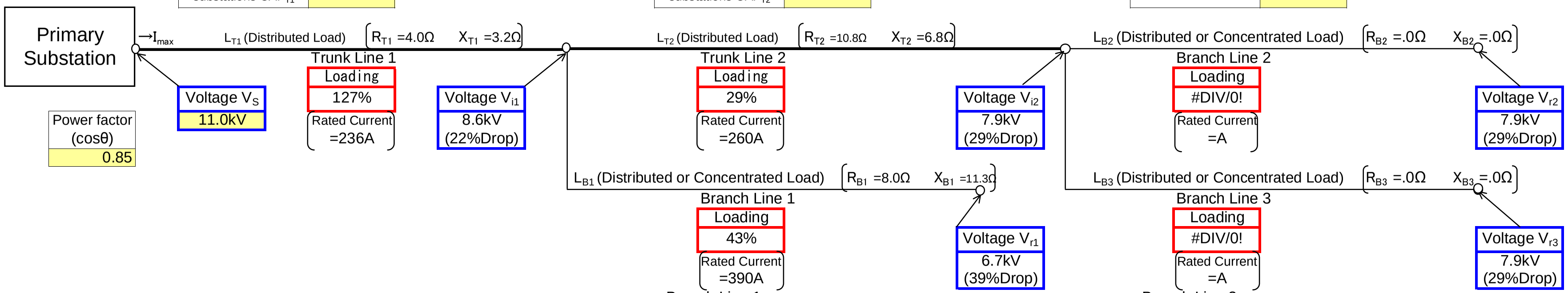
Load L_{T1}	62A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1785kVA	

<Trank Line 2>

Load L_{T2}	69A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	17.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2000kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	169A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	31.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4910kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 N
Feeder Name	NSAWAM-ACCRA

: Input data in colored cells

Type-3

Maximum Current I_{max}
315.0A

Power factor (cosθ)
0.85

<Trank Line 1>

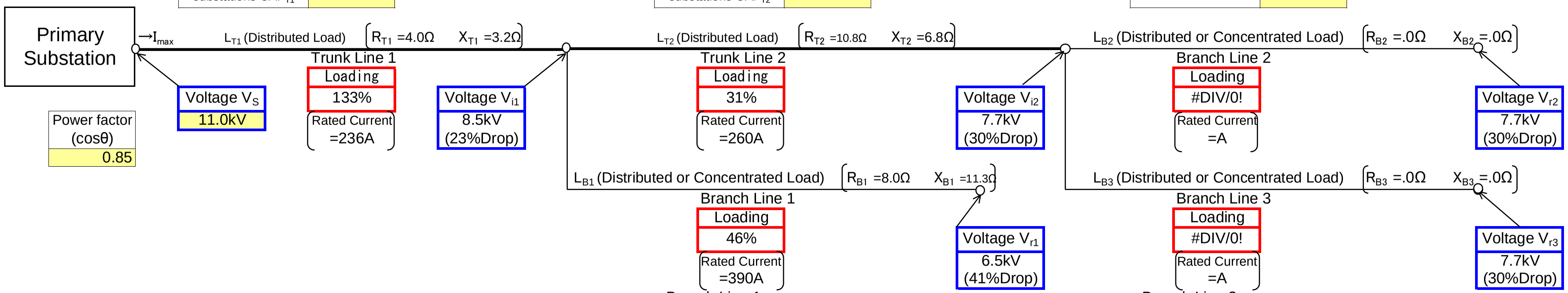
Load L_{T1}	65A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1785kVA	

<Trank Line 2>

Load L_{T2}	72A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	17.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2000kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	178A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	31.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4910kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 N
Feeder Name	NSAWAM-ACCRA

: Input data in colored cells

Type-3

Maximum Current I_{max}	
330.0A	

Power factor (cosθ)	
0.85	

<Trank Line 1>

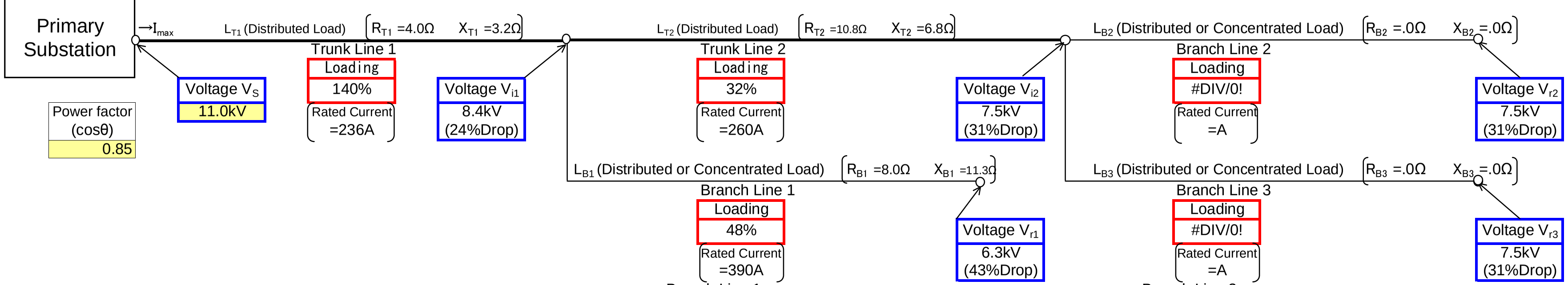
Load L_{T1}	68A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1785kVA	

<Trank Line 2>

Load L_{T2}	76A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	17.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2000kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	186A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	31.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4910kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 N
Feeder Name	NSAWAM-ACCRA

: Input data in colored cells

Type-3

Maximum Current I_{max}
346.0A

Power factor (cosθ)
0.85

<Trank Line 1>

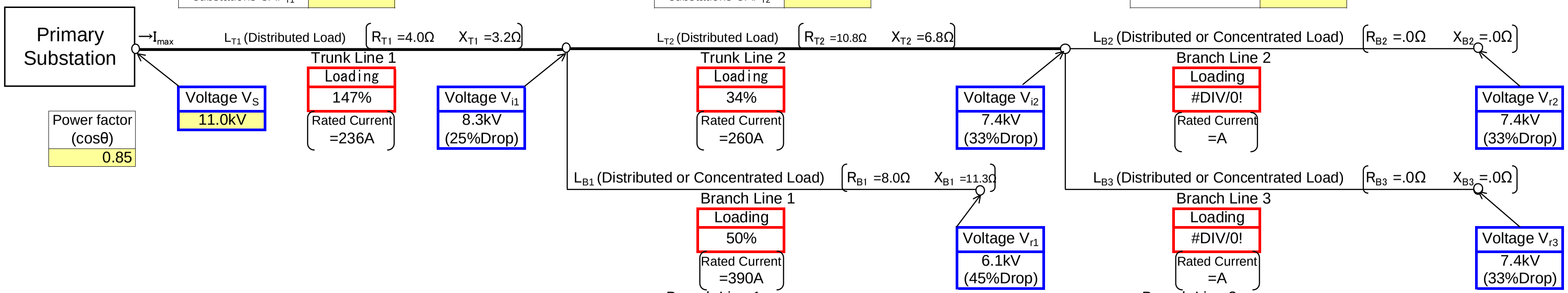
Load L_{T1}	71A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1785kVA	

<Trank Line 2>

Load L_{T2}	80A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	17.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2000kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	195A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	31.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4910kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 N
Feeder Name	NSAWAM-ACCRA

: Input data in colored cells

Type-3

Maximum Current I_{max}
363.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_s
11.0kV

<Trank Line 1>

Load L_{T1}	75A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1785kVA	

L_{T1} (Distributed Load) (R_{T1} =4.0Ω X_{T1} =3.2Ω)

Trunk Line 1

Loading
154%

(Rated Current =236A)

Voltage V_{i1}
8.1kV (26%Drop)

<Trank Line 2>

Load L_{T2}	83A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	17.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2000kVA	

L_{T2} (Distributed Load) (R_{T2} =10.8Ω X_{T2} =6.8Ω)

Trunk Line 2

Loading
35%

(Rated Current =260A)

Voltage V_{i2}
7.2kV (35%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =8.0Ω X_{B1} =11.3Ω)

Branch Line 1

Loading
53%

(Rated Current =390A)

Voltage V_{r1}
5.8kV (47%Drop)

<Branch Line 1>

Load L_{B1}	205A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	31.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4910kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2

Loading
#DIV/0!

(Rated Current =A)

Voltage V_{r2}
7.2kV (35%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3

Loading
#DIV/0!

(Rated Current =A)

Voltage V_{r3}
7.2kV (35%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 N
Feeder Name	NSAWAM-ACCRA

: Input data in colored cells

Type-3

Maximum Current I_{max}
381.0A

Power factor (cosθ)
0.85

Primary Substation

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	78A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1785kVA	

<Trank Line 2>

Load L_{T2}	88A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	17.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2000kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

→I_{max}

L_{T1} (Distributed Load) (R_{T1} =4.0Ω X_{T1} =3.2Ω)

Trunk Line 1: Loading 161%, Rated Current =236A

Voltage V_{i1}: 8.0kV (27%Drop)

L_{T2} (Distributed Load) (R_{T2} =10.8Ω X_{T2} =6.8Ω)

Trunk Line 2: Loading 37%, Rated Current =260A

Voltage V_{i2}: 7.0kV (36%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 7.0kV (36%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =8.0Ω X_{B1} =11.3Ω)

Branch Line 1: Loading 55%, Rated Current =390A

Voltage V_{r1}: 5.6kV (49%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 7.0kV (36%Drop)

<Branch Line 1>

Load L_{B1}	215A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	31.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4910kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 N
Feeder Name	NSAWAM-ACCRA

: Input data in colored cells

Type-3

Maximum Current I_{max}	400.0A
Power factor (cosθ)	0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	82A
Line Type	35CUBARE No.33
Line Legth Len_{T1}	6.8km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T1}	1785kVA

L_{T1} (Distributed Load) (R_{T1} =4.0Ω X_{T1} =3.2Ω)

Trunk Line 1 — Loading 169% (Rated Current =236A)

Voltage V_{i1}: 7.8kV (29%Drop)

<Trank Line 2>

Load L_{T2}	92A
Line Type	50ALBARE No.34
Line Legth Len_{T2}	17.7km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T2}	2000kVA

L_{T2} (Distributed Load) (R_{T2} =10.8Ω X_{T2} =6.8Ω)

Trunk Line 2 — Loading 39% (Rated Current =260A)

Voltage V_{i2}: 6.8kV (38%Drop)

<Branch Line 2>

Load L_{B2}	A
Line Type	None No.57
Line Length Len_{B1}	
Type of Distributed Load	
Total Transformer Capacity of secondary substations CAP_{B2}	

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading #DIV/0! (Rated Current =A)

Voltage V_{r2}: 6.8kV (38%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =8.0Ω X_{B1} =11.3Ω)

Branch Line 1 — Loading 58% (Rated Current =390A)

Voltage V_{r1}: 5.3kV (52%Drop)

<Branch Line 1>

Load L_{B1}	226A
Line Type	120ALBARE No.37
Line Length Len_{B1}	31.8km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{B1}	4910kVA

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading #DIV/0! (Rated Current =A)

Voltage V_{r3}: 6.8kV (38%Drop)

<Branch Line 3>

Load L_{B3}	A
Line Type	None No.57
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	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 N
Feeder Name	NSAWAM-ACCRA

: Input data in colored cells

Type-3

Maximum Current I_{max}
419.0A

Primary Substation

$\rightarrow I_{max}$

Power factor (cosθ)
0.85

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	86A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1785kVA	

L_{T1} (Distributed Load) (R_{T1} =4.0Ω X_{T1} =3.2Ω)

Trunk Line 1 — Loading: 178% (Rated Current =236A)

Voltage V_{i1}: 7.7kV (30%Drop)

<Trank Line 2>

Load L_{T2}	96A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	17.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2000kVA	

L_{T2} (Distributed Load) (R_{T2} =10.8Ω X_{T2} =6.8Ω)

Trunk Line 2 — Loading: 41% (Rated Current =260A)

Voltage V_{i2}: 6.6kV (40%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading: #DIV/0! (Rated Current =A)

Voltage V_{r2}: 6.6kV (40%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =8.0Ω X_{B1} =11.3Ω)

Branch Line 1 — Loading: 61% (Rated Current =390A)

Voltage V_{r1}: 5.1kV (54%Drop)

<Branch Line 1>

Load L_{B1}	237A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	31.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4910kVA	

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading: #DIV/0! (Rated Current =A)

Voltage V_{r3}: 6.6kV (40%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 N
Feeder Name	NSAWAM-ACCRA

: Input data in colored cells

Type-3

Maximum Current I_{max}
440.0A

Power factor (cosθ)
0.85

<Trank Line 1>

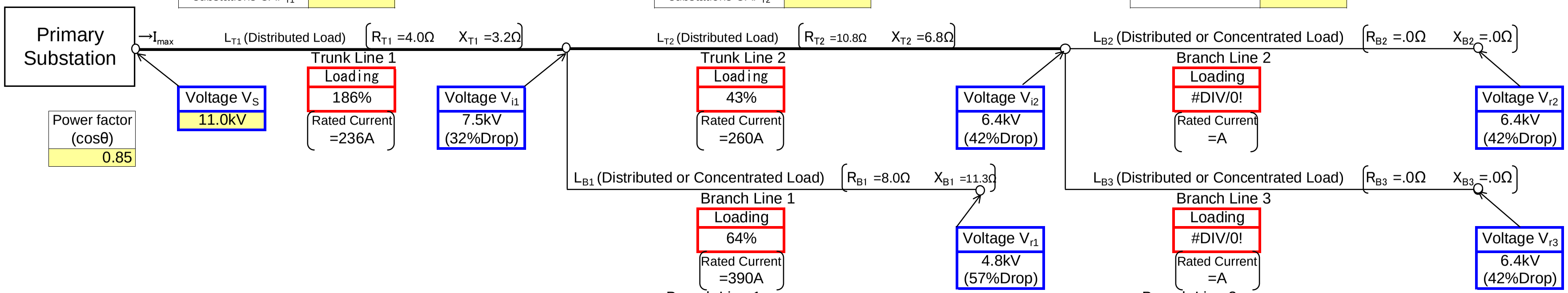
Load L_{T1}	90A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1785kVA	

<Trank Line 2>

Load L_{T2}	101A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	17.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2000kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	248A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	31.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4910kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R10

: Input data in colored cells

Type-3

Maximum Current I_{max}
74.0A

Primary Substation

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

Load L_{T1}	74A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

$\rightarrow I_{max}$

L_{T1} (Distributed Load) R_{T1} =.8Ω X_{T1} =.6Ω

Trunk Line 1: Loading 22%, Rated Current =335A

Voltage V_S 11.0kV

Voltage V_{i1} 10.9kV (1%Drop)

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2} 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2} 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1} 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3} 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION R
Feeder Name	R10

: Input data in colored cells

Type-3

Maximum Current I_{max}
78.0A

<Trank Line 1>

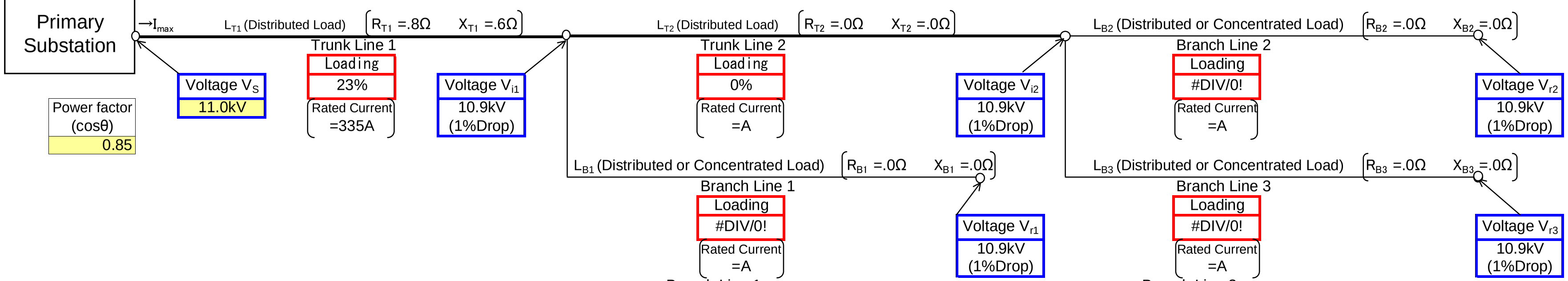
Load L_{T1}	78A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R10

: Input data in colored cells

Type-3

Maximum Current I_{max}
81.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	81A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation

$\rightarrow I_{max}$

Voltage V_S 11.0kV

L_{T1} (Distributed Load) $(R_{T1}$ =.8Ω X_{T1} =.6Ω)

Trunk Line 1 Loading 24% Rated Current =335A

Voltage V_{i1} 10.9kV (1%Drop)

L_{T2} (Distributed Load) $(R_{T2}$ =.0Ω X_{T2} =.0Ω)

Trunk Line 2 Loading 0% Rated Current =A

Voltage V_{i2} 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) $(R_{B2}$ =.0Ω X_{B2} =.0Ω)

Branch Line 2 Loading #DIV/0! Rated Current =A

Voltage V_{r2} 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) $(R_{B1}$ =.0Ω X_{B1} =.0Ω)

Branch Line 1 Loading #DIV/0! Rated Current =A

Voltage V_{r1} 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) $(R_{B3}$ =.0Ω X_{B3} =.0Ω)

Branch Line 3 Loading #DIV/0! Rated Current =A

Voltage V_{r3} 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 R
Feeder Name	R10

: Input data in colored cells

Type-3

Maximum Current I_{max}
85.0A

Power factor (cosθ)
0.85

<Trank Line 1>

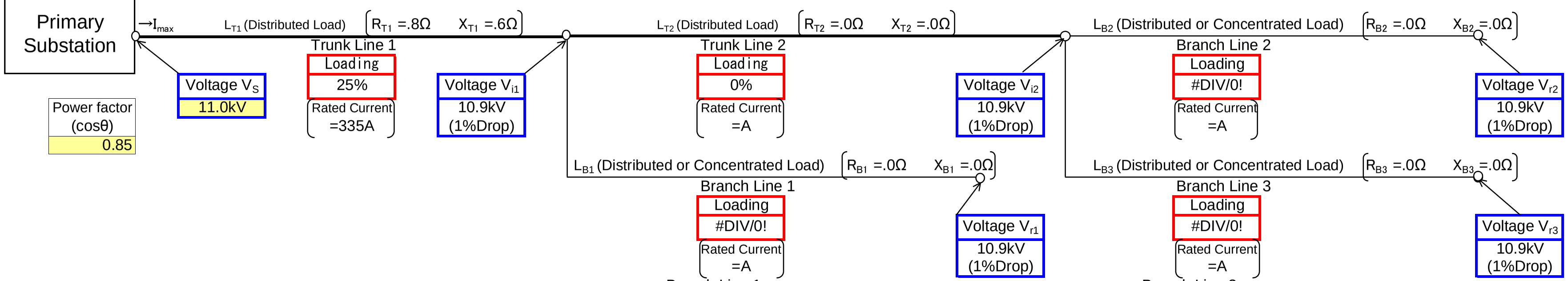
Load L_{T1}	85A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R10

: Input data in colored cells

Type-3

Maximum Current I_{max}: 90.0A

Power factor ($\cos\theta$): 0.85

<Trank Line 1>

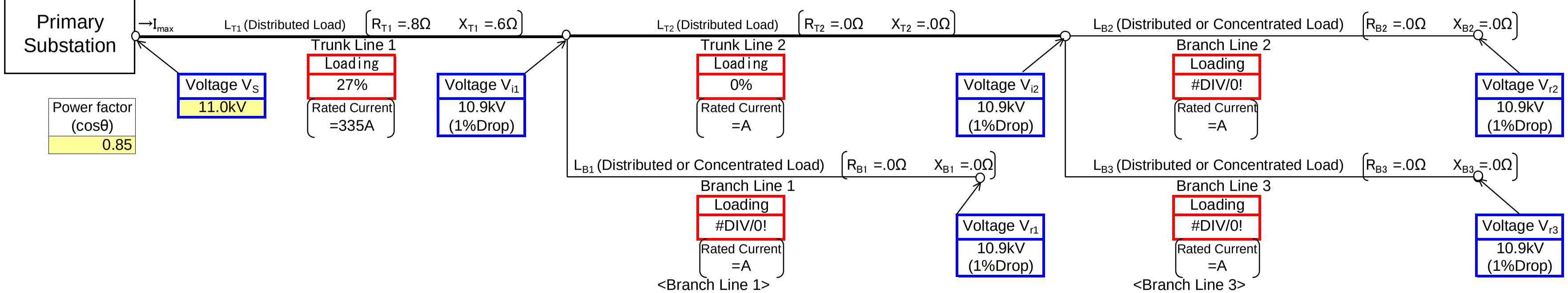
Load L_{T1}	90A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION R
Feeder Name	R10

: Input data in colored cells

Type-3

Maximum Current I_{max}	94.0A
Power factor (cosθ)	0.85

<Trank Line 1>

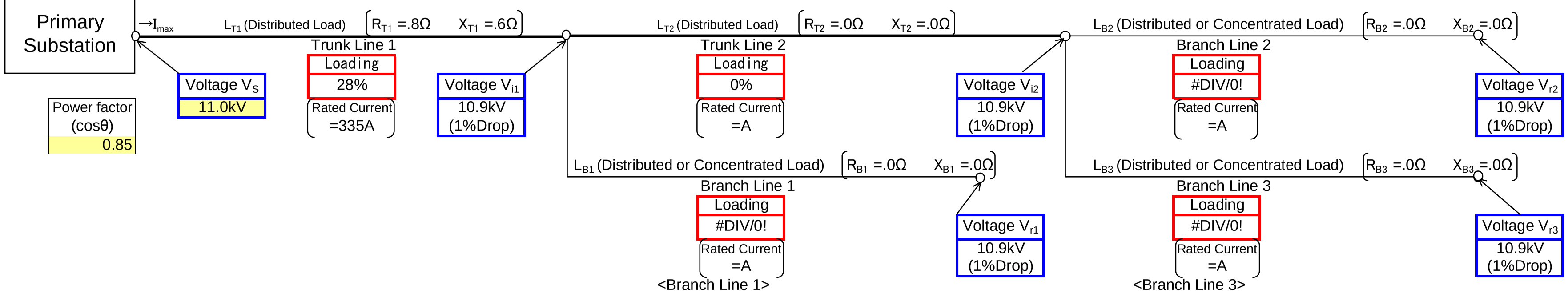
Load L_{T1}	94A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 R
Feeder Name	R10

: Input data in colored cells

Type-3

Maximum Current I_{max}
95.0A

Power factor (cosθ)
0.85

<Trank Line 1>

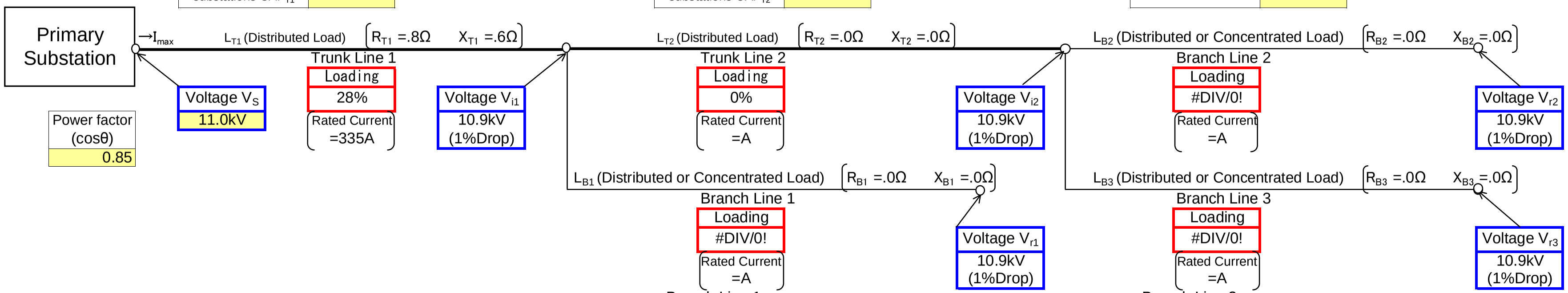
Load L_{T1}	95A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R10

: Input data in colored cells

Type-3

Maximum Current I_{max}
103.0A

Power factor (cosθ)
0.85

<Trank Line 1>

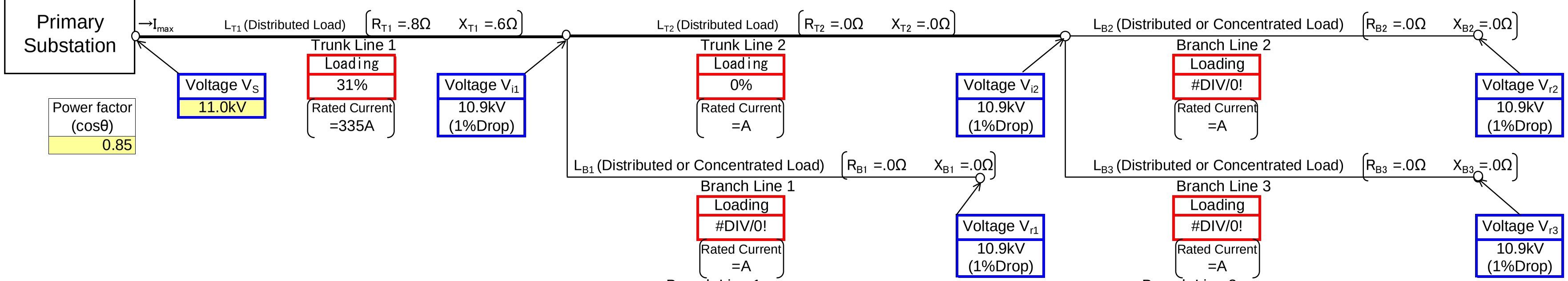
Load L_{T1}	103A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R10

: Input data in colored cells

Type-3

Maximum Current I_{max}: 108.0A

Power factor (cosθ): 0.85

<Trank Line 1>

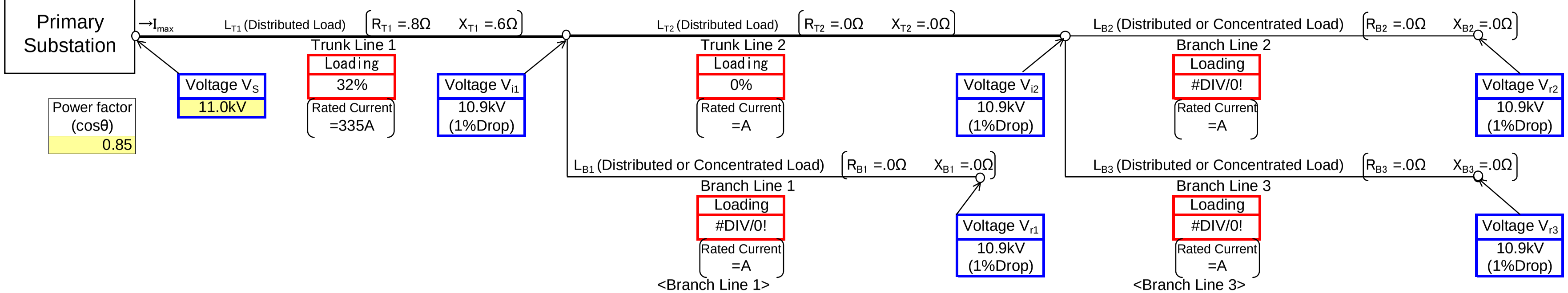
Load L_{T1}	108A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$,
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 R
Feeder Name	R10

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	114A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	114.0A
Power factor (cosθ)	0.85

Primary Substation →I_{max}

Voltage V_S 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.8Ω X_{T1} =.6Ω)
Trunk Line 1
Loading 34%
Rated Current =335A

Voltage V_{i1} 10.9kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)
Trunk Line 2
Loading 0%
Rated Current =A

Voltage V_{i2} 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)
Branch Line 2
Loading #DIV/0!
Rated Current =A

Voltage V_{r2} 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)
Branch Line 1
Loading #DIV/0!
Rated Current =A

Voltage V_{r1} 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)
Branch Line 3
Loading #DIV/0!
Rated Current =A

Voltage V_{r3} 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R10

: Input data in colored cells

Type-3

Maximum Current I_{max}
119.0A

Primary Substation →I_{max}

Power factor (cosθ)
0.85

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	119A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

L_{T1} (Distributed Load) (R_{T1} =.8Ω X_{T1} =.6Ω)

Trunk Line 1: Loading 36%; Rated Current =335A

Voltage V_{i1}: 10.9kV (1%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%; Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R10

: Input data in colored cells

Type-3

Maximum Current I_{max}	125.0A

Power factor (cosθ)	0.85

<Trank Line 1>

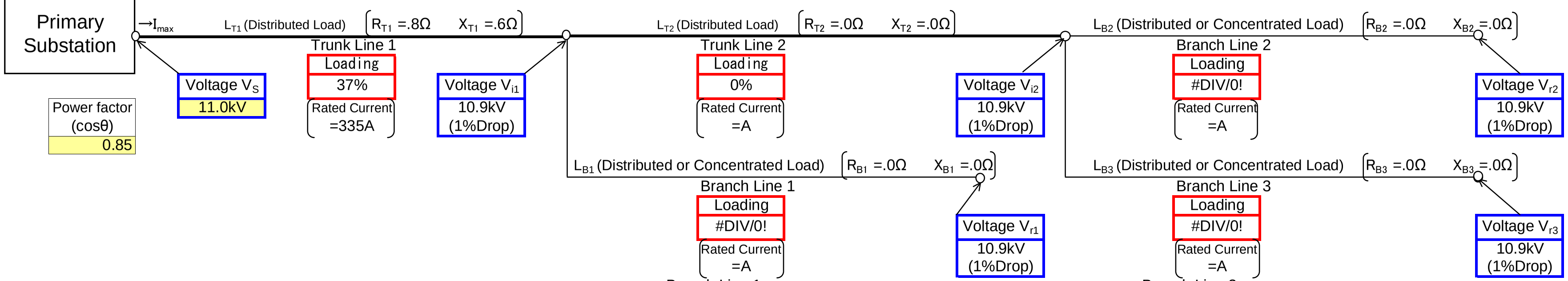
Load L_{T1}	125A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R11

: Input data in colored cells

Type-3

Maximum Current I_{max}
280.0A

Power factor (cosθ)
0.85

<Trank Line 1>

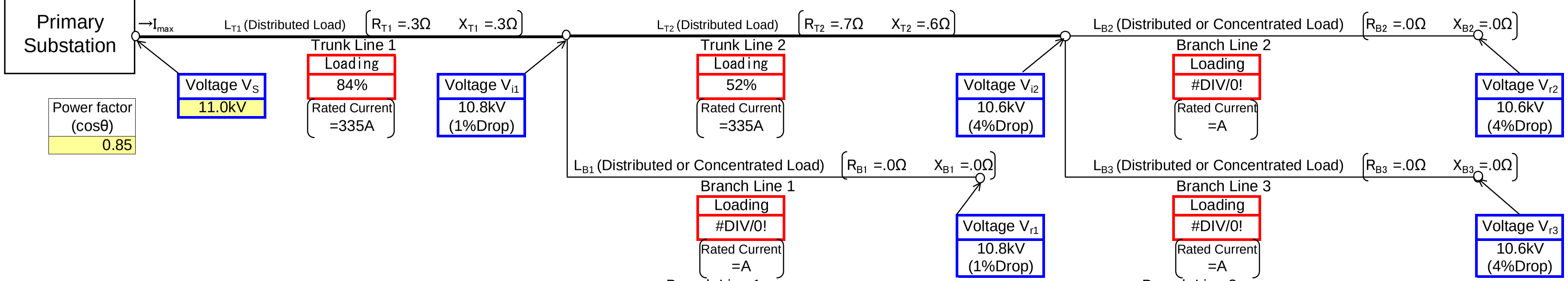
Load L_{T1}	106A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1950kVA	

<Trank Line 2>

Load L_{T2}	174A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	4.8km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}	3200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 R
Feeder Name	R11

: Input data in colored cells

Type-3

Maximum Current I_{max}
294.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	111A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1950kVA	

<Trank Line 2>

Load L_{T2}	183A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	4.8km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}	3200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

→I_{max}

L_{T1} (Distributed Load) (R_{T1} =.3Ω X_{T1} =.3Ω)

Trunk Line 1: Loading 88%, Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.8kV (2%Drop)

L_{T2} (Distributed Load) (R_{T2} =.7Ω X_{T2} =.6Ω)

Trunk Line 2: Loading 55%, Rated Current =335A

Voltage V_{i2}: 10.5kV (4%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.5kV (4%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.5kV (4%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 R
Feeder Name	R11

: Input data in colored cells

Type-3

Maximum Current I_{max}
308.0A

Power factor ($\cos\theta$)
0.85

Primary Substation →I_{max}

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	117A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1950kVA	

L_{T1} (Distributed Load) (R_{T1} =.3Ω X_{T1} =.3Ω)

Trunk Line 1 Loading 92% (Rated Current =335A)

Voltage V_{i1} 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	191A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	4.8km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}	3200kVA	

L_{T2} (Distributed Load) (R_{T2} =.7Ω X_{T2} =.6Ω)

Trunk Line 2 Loading 57% (Rated Current =335A)

Voltage V_{i2} 10.5kV (4%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 Loading #DIV/0! (Rated Current =A)

Voltage V_{r1} 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 Loading #DIV/0! (Rated Current =A)

Voltage V_{r2} 10.5kV (4%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 Loading #DIV/0! (Rated Current =A)

Voltage V_{r3} 10.5kV (4%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION R
Feeder Name	R11

: Input data in colored cells

Type-3

Maximum Current I_{max}
323.0A

Power factor (cosθ)
0.85

Primary Substation

→I_{max}

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	122A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1950kVA	

L_{T1} (Distributed Load) (R_{T1} =.3Ω X_{T1} =.3Ω)

Trunk Line 1: Loading 96%, Rated Current =335A

Voltage V_{i1} 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	201A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	4.8km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}	3200kVA	

L_{T2} (Distributed Load) (R_{T2} =.7Ω X_{T2} =.6Ω)

Trunk Line 2: Loading 60%, Rated Current =335A

Voltage V_{i2} 10.5kV (5%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2} 10.5kV (5%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1} 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3} 10.5kV (5%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R11

: Input data in colored cells

Type-3

Maximum Current I_{max}	
339.0A	

Power factor (cosθ)
0.85

<Trank Line 1>

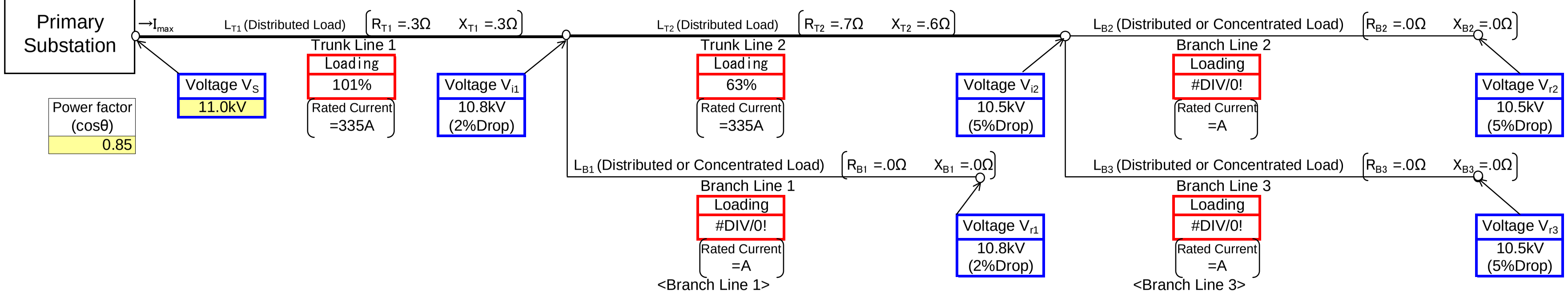
Load L_{T1}	128A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1950kVA	

<Trank Line 2>

Load L_{T2}	211A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	4.8km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}	3200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R11

: Input data in colored cells

Type-3

Maximum Current I_{max}	
356.0A	

Power factor (cosθ)
0.85

<Trank Line 1>

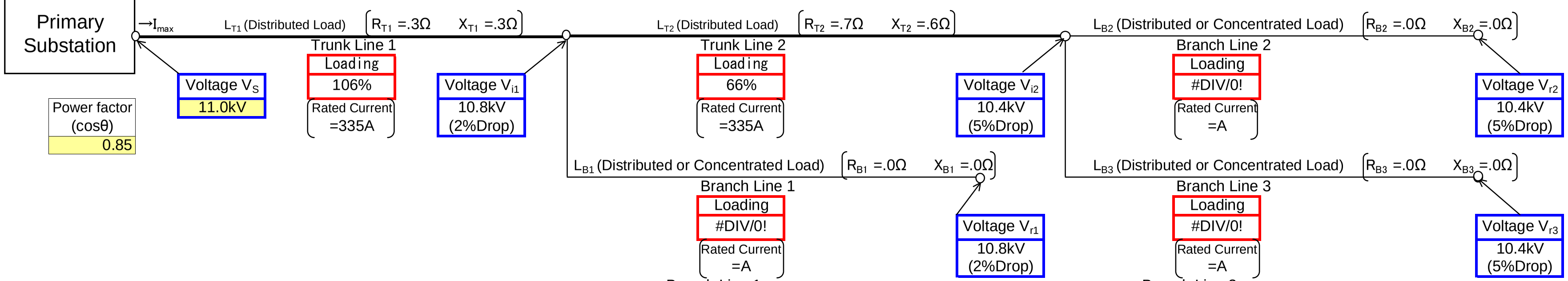
Load L_{T1}	135A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1950kVA	

<Trank Line 2>

Load L_{T2}	221A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	4.8km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}	3200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 R
Feeder Name	R11

: Input data in colored cells

Type-3

Maximum Current I_{max}	373.0A
Power factor (cosθ)	0.85

<Trank Line 1>

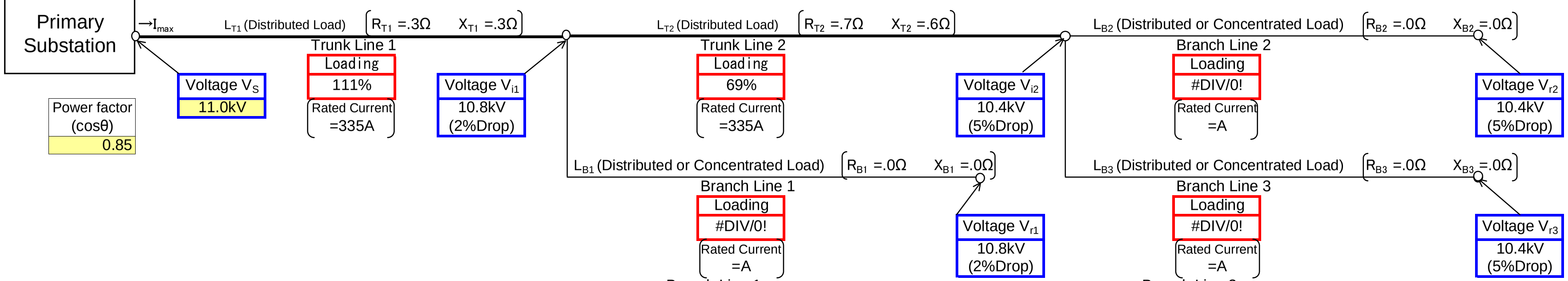
Load L_{T1}	141A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1950kVA	

<Trank Line 2>

Load L_{T2}	232A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	4.8km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}	3200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$,
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 R
Feeder Name	R11

: Input data in colored cells

Type-3

Maximum Current I_{max}
391.0A

Power factor (cosθ)
0.85

Primary Substation

$\rightarrow I_{max}$

<Trank Line 1>

Load L_{T1}	148A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1950kVA	

L_{T1} (Distributed Load) (R_{T1} =.3Ω X_{T1} =.3Ω)

Voltage V_S: 11.0kV

Trunk Line 1 — Loading: 117% (Rated Current =335A)

Voltage V_{i1}: 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	243A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	4.8km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}	3200kVA	

L_{T2} (Distributed Load) (R_{T2} =.7Ω X_{T2} =.6Ω)

Trunk Line 2 — Loading: 73% (Rated Current =335A)

Voltage V_{i2}: 10.4kV (6%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 — Loading: #DIV/0! (Rated Current =A)

Voltage V_{r1}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading: #DIV/0! (Rated Current =A)

Voltage V_{r2}: 10.4kV (6%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading: #DIV/0! (Rated Current =A)

Voltage V_{r3}: 10.4kV (6%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R11

: Input data in colored cells

Type-3

Maximum Current I_{max}	410.0A

Power factor (cosθ)	0.85

Primary Substation

→I_{max}

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	155A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1950kVA	

L_{T1} (Distributed Load) (R_{T1} =.3Ω X_{T1} =.3Ω)

Trunk Line 1
Loading
122%
(Rated Current =335A)

Voltage V_{i1} 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	255A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	4.8km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}	3200kVA	

L_{T2} (Distributed Load) (R_{T2} =.7Ω X_{T2} =.6Ω)

Trunk Line 2
Loading
76%
(Rated Current =335A)

Voltage V_{i2} 10.4kV (6%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2
Loading
#DIV/0!
(Rated Current =A)

Voltage V_{r2} 10.4kV (6%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1
Loading
#DIV/0!
(Rated Current =A)

Voltage V_{r1} 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3
Loading
#DIV/0!
(Rated Current =A)

Voltage V_{r3} 10.4kV (6%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R11

: Input data in colored cells

Type-3

Maximum Current I_{max}
431.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	163A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1950kVA	

<Trank Line 2>

Load L_{T2}	268A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	4.8km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}	3200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

$\rightarrow I_{max}$

L_{T1} (Distributed Load) R_{T1} =.3Ω X_{T1} =.3Ω

Trunk Line 1: Loading 129%, Rated Current =335A

Voltage V_S 11.0kV

Voltage V_{i1} 10.8kV (2%Drop)

L_{T2} (Distributed Load) R_{T2} =.7Ω X_{T2} =.6Ω

Trunk Line 2: Loading 80%, Rated Current =335A

Voltage V_{i2} 10.3kV (6%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2} 10.3kV (6%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1} 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3} 10.3kV (6%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R11

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	171A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1950kVA	

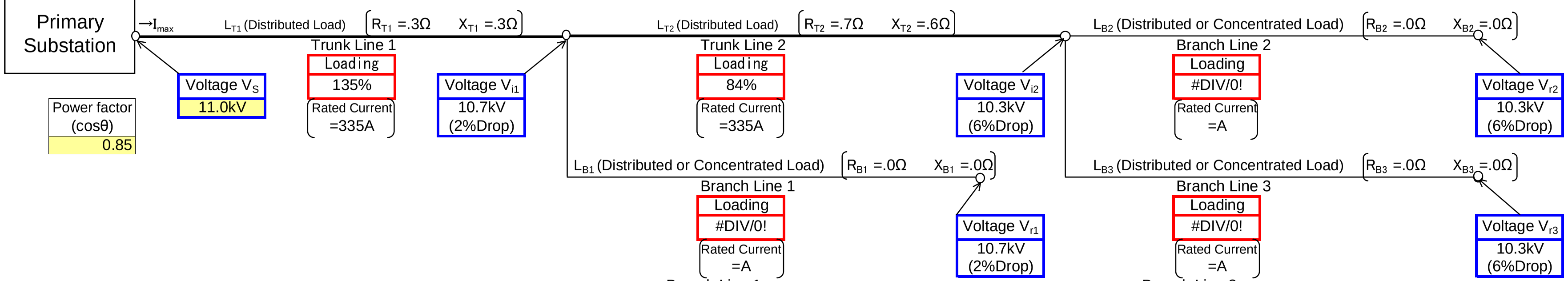
<Trank Line 2>

Load L_{T2}	281A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	4.8km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}	3200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	452.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R11

: Input data in colored cells

Type-3

Maximum Current I_{max}
474.0A

Power factor (cosθ)
0.85

<Trank Line 1>

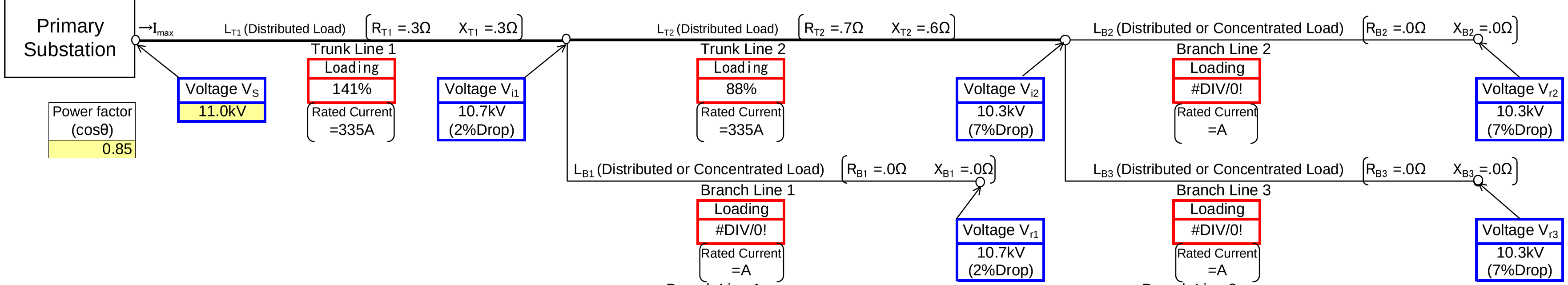
Load L_{T1}	179A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1950kVA	

<Trank Line 2>

Load L_{T2}	295A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	4.8km	
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}	3200kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R12

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	290A	
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}	7275kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	290.0A
Power factor (cosθ)	0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.7Ω X_{T1} =.6Ω)

Trunk Line 1 — Loading 87% — Rated Current =335A

Voltage V_{i1}: 10.8kV (2%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 — Loading 0% — Rated Current =A

Voltage V_{i2}: 10.8kV (2%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 — Loading #DIV/0! — Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R12

: Input data in colored cells

Type-3

Maximum Current I_{max}
299.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	299A	
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}	7275kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

→I_{max}

L_{T1} (Distributed Load) (R_{T1} =.7Ω X_{T1} =.6Ω)

Trunk Line 1: Loading 89%, Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.8kV (2%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.8kV (2%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R12

: Input data in colored cells

Type-3

Maximum Current I_{max}	309.0A
Power factor (cosθ)	0.85

<Trank Line 1>

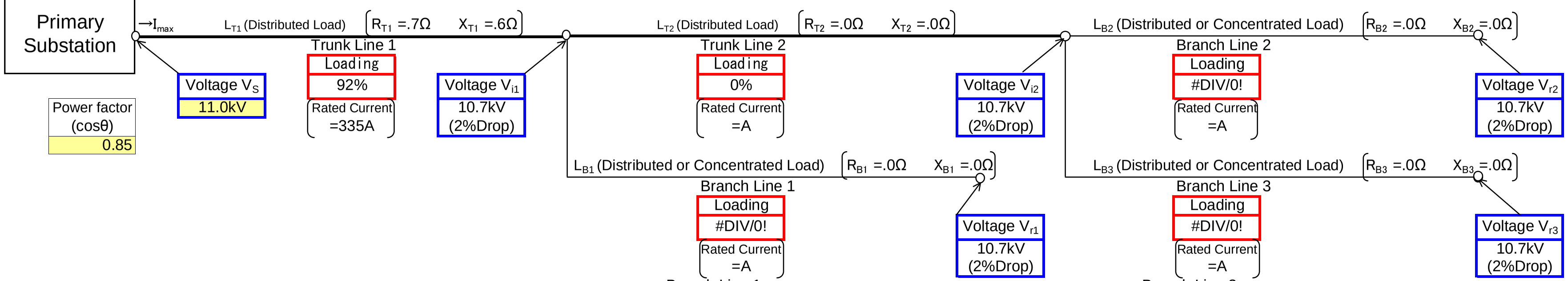
Load L_{T1}	309A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7275kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R12

: Input data in colored cells

Type-3

Maximum Current I_{max}
319.0A

Power factor (cosθ)
0.85

<Trank Line 1>

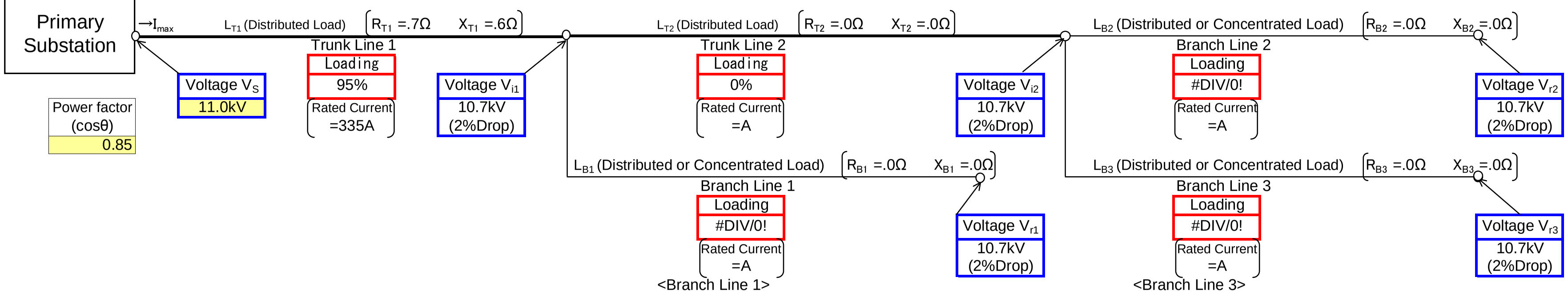
Load L_{T1}	319A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7275kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
Line Length Len_{B3}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

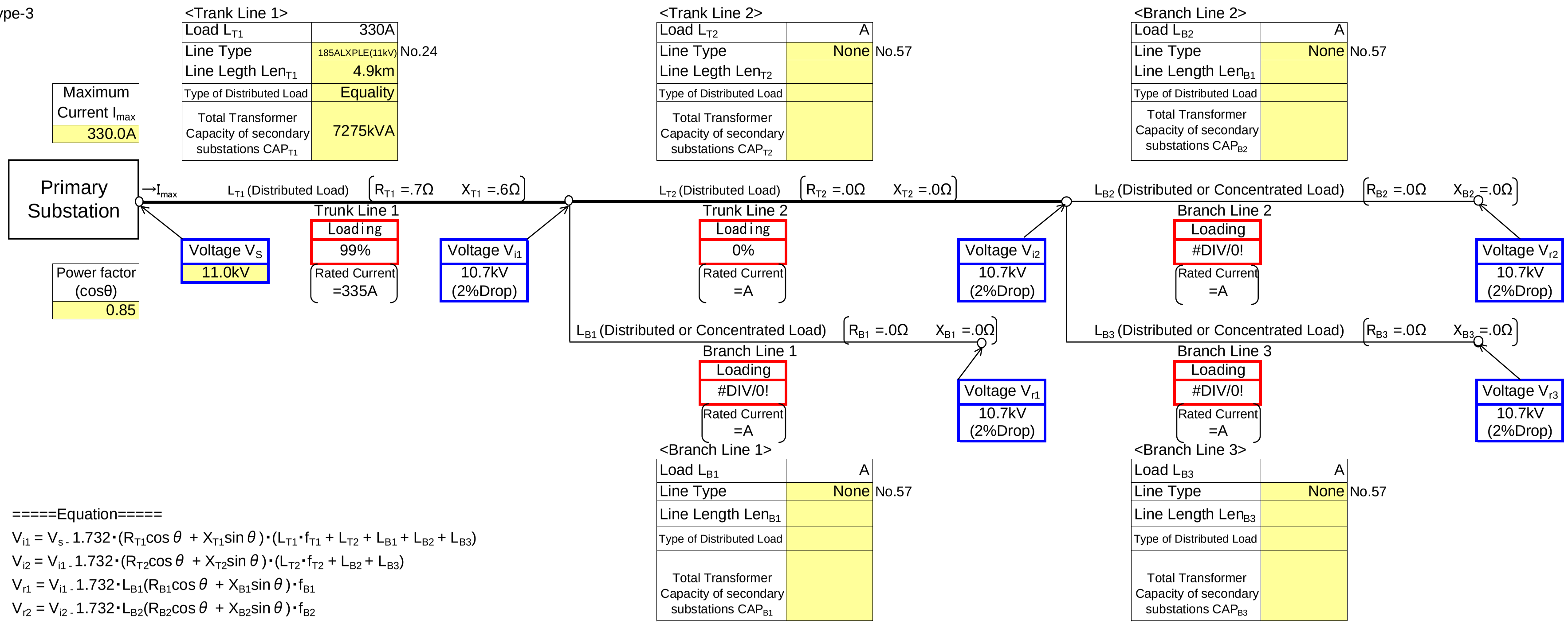
V_s : Supply Voltage	I_{max} : Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: 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	STATION R
Feeder Name	R12

: Input data in colored cells

Type-3



=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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 R
Feeder Name	R12

: Input data in colored cells

Type-3

Maximum Current I_{max}	340.0A
Power factor (cosθ)	0.85

<Trank Line 1>

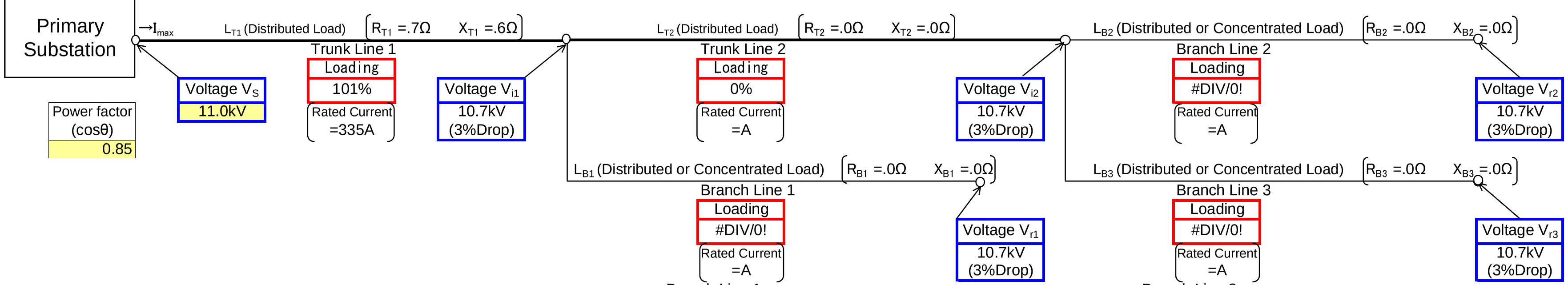
Load L_{T1}	340A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7275kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R12

: Input data in colored cells

Type-3

Maximum Current I_{max}
351.0A

Power factor (cosθ)
0.85

<Trank Line 1>

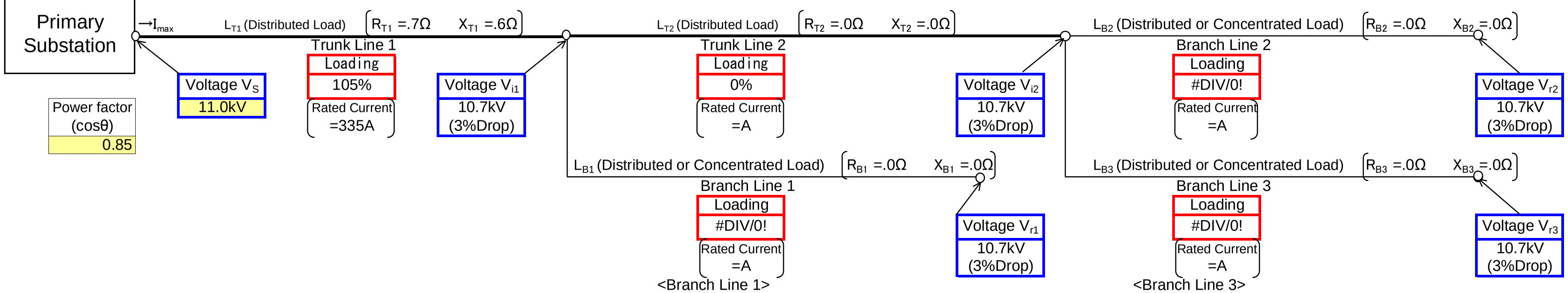
Load L_{T1}	351A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7275kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R12

: Input data in colored cells

Type-3

Maximum Current I_{max}
363.0A

Power factor (cosθ)
0.85

<Trank Line 1>

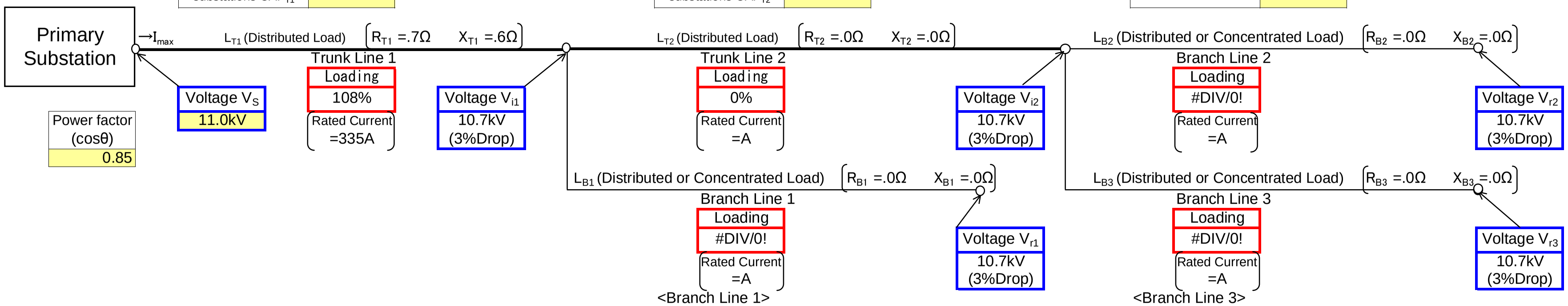
Load L_{T1}	363A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7275kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R12

: Input data in colored cells

Type-3

Maximum Current I_{max}	
375.0A	
Power factor (cosθ)	0.85

<Trank Line 1>

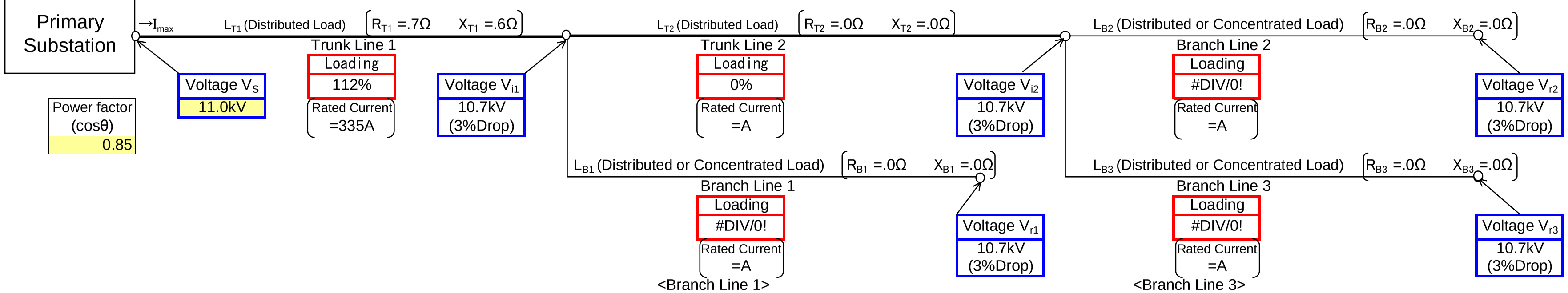
Load L_{T1}	375A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7275kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	STATION R
Feeder Name	R12

: Input data in colored cells

Type-3

Maximum Current I_{max}
387.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	387A	
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}	7275kVA	

L_{T1} (Distributed Load) (R_{T1} =.7Ω X_{T1} =.6Ω)

Trunk Line 1 Loading 116% (Rated Current =335A)

Voltage V_{i1} 10.7kV (3%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 Loading 0% (Rated Current =A)

Voltage V_{i2} 10.7kV (3%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 Loading #DIV/0! (Rated Current =A)

Voltage V_{r2} 10.7kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 Loading #DIV/0! (Rated Current =A)

Voltage V_{r1} 10.7kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 Loading #DIV/0! (Rated Current =A)

Voltage V_{r3} 10.7kV (3%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R12

: Input data in colored cells

Type-3

Maximum Current I_{max}
400.0A

<Trank Line 1>

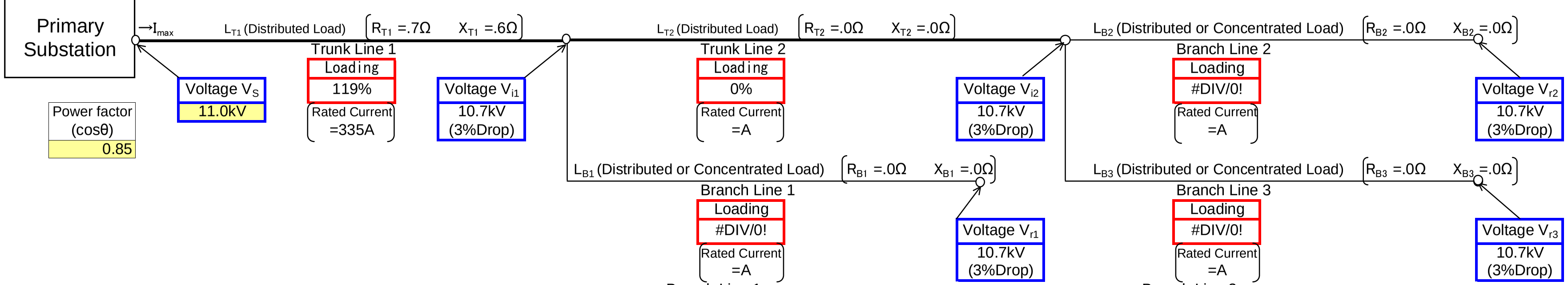
Load L_{T1}	400A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7275kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 R
Feeder Name	R12

: Input data in colored cells

Type-3

Maximum Current I_{max}
413.0A

Power factor (cosθ)
0.85

<Trank Line 1>

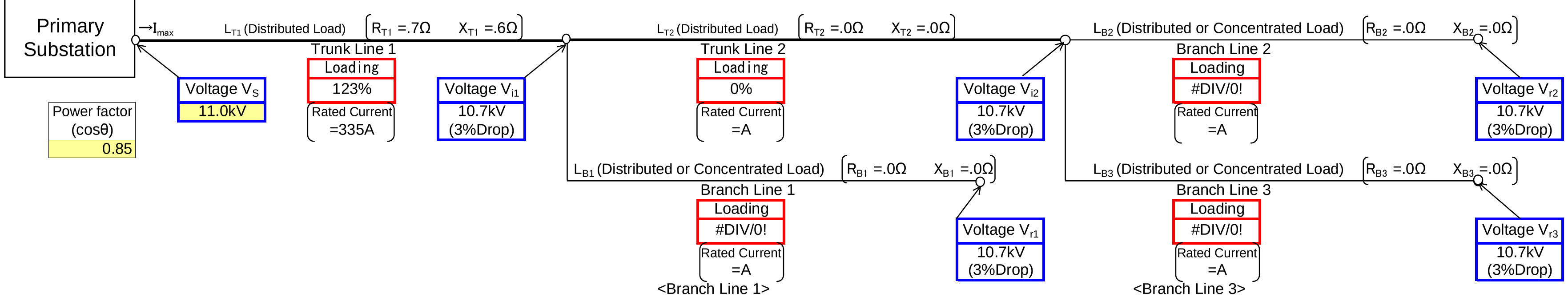
Load L_{T1}	413A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7275kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R13

: Input data in colored cells

Type-3

Maximum Current I_{max}
170.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	170A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4460kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation →I_{max}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) R_{T1} =.6Ω X_{T1} =.5Ω

Trunk Line 1: Loading 51%, Rated Current =335A

Voltage V_{i1}: 10.9kV (1%Drop)

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R13

: Input data in colored cells

Type-3

Maximum Current I_{max}
178.0A

Power factor (cosθ)
0.85

<Trank Line 1>

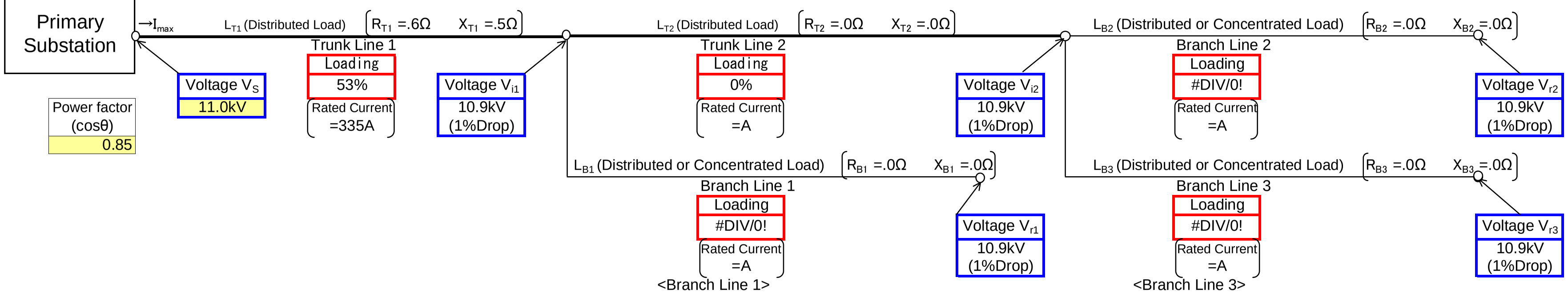
Load L_{T1}	178A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4460kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R13

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	187A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4460kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	187.0A
Power factor (cosθ)	0.85

Primary Substation

$\rightarrow I_{max}$

L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)

Trunk Line 1: Loading 56%, Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.9kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 R
Feeder Name	R13

: Input data in colored cells

Type-3

Primary Substation

Maximum Current I_{max}	196.0A
Power factor (cosθ)	0.85

<Trank Line 1>

Load L_{T1}	196A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4460kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

$\rightarrow I_{max}$

L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)

Trunk Line 1: Loading 59%; Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.9kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%; Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R13

: Input data in colored cells

Type-3

Maximum Current I_{max}: 206.0A

Power factor (cosθ): 0.85

<Trank Line 1>

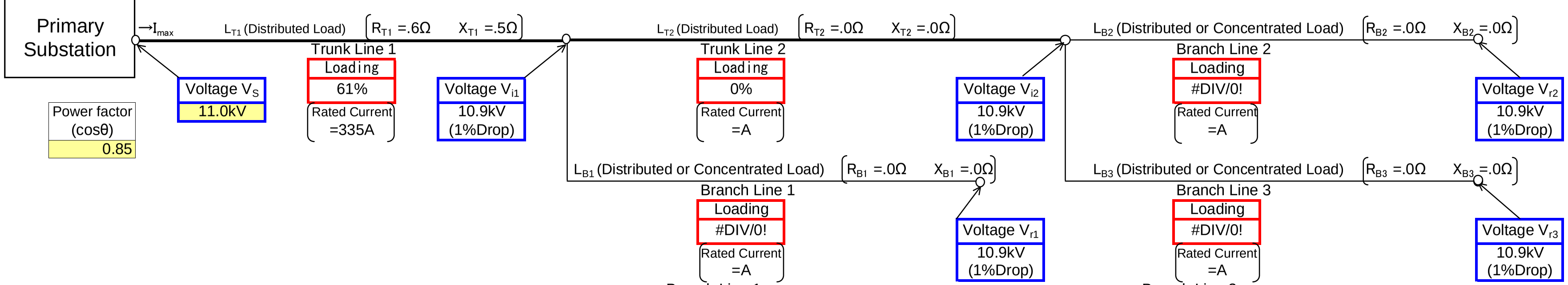
Load L_{T1}	206A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4460kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R13

: Input data in colored cells

Type-3

Maximum Current I_{max}: 216.0A

Power factor ($\cos\theta$): 0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_s: 11.0kV

<Trank Line 1>

Load L_{T1}	216A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4460kVA	

L_{T1} (Distributed Load) R_{T1} =.6Ω X_{T1} =.5Ω

Trunk Line 1: Loading 64%, Rated Current =335A

Voltage V_{i1}: 10.9kV (1%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$,
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
V_{r3} : Received Voltage	L_{B3} : Load (Branch Line 3)	$\cos\theta$: Power Factor

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

Substation Name	STATION R
Feeder Name	R13

: Input data in colored cells

Type-3

Maximum Current I_{max}
226.0A

Power factor (cosθ)
0.85

<Trank Line 1>

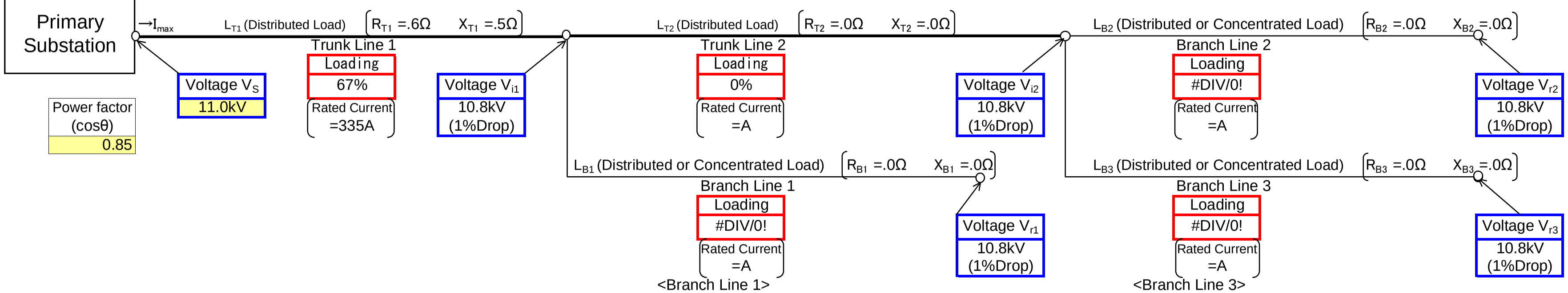
Load L_{T1}	226A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4460kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R13

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	238A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4460kVA	

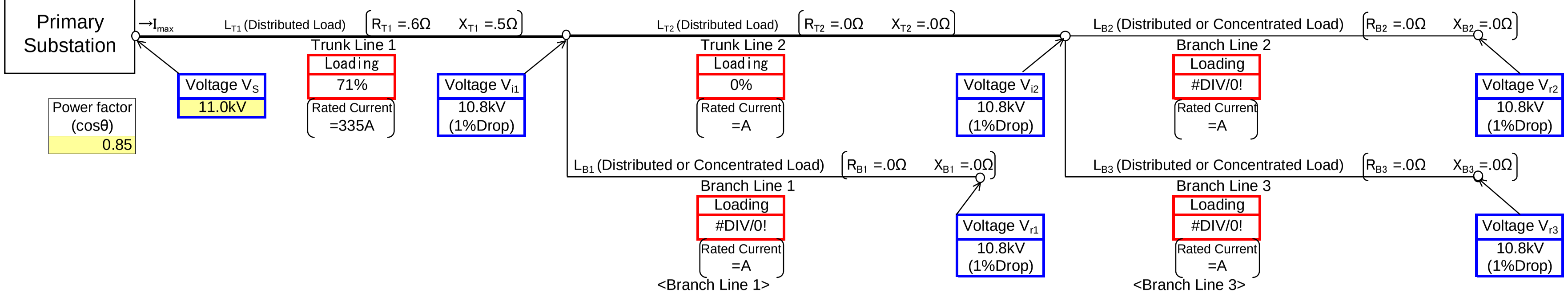
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	238.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 R
Feeder Name	R13

: Input data in colored cells

Type-3

Maximum Current I_{max}	
249.0A	

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

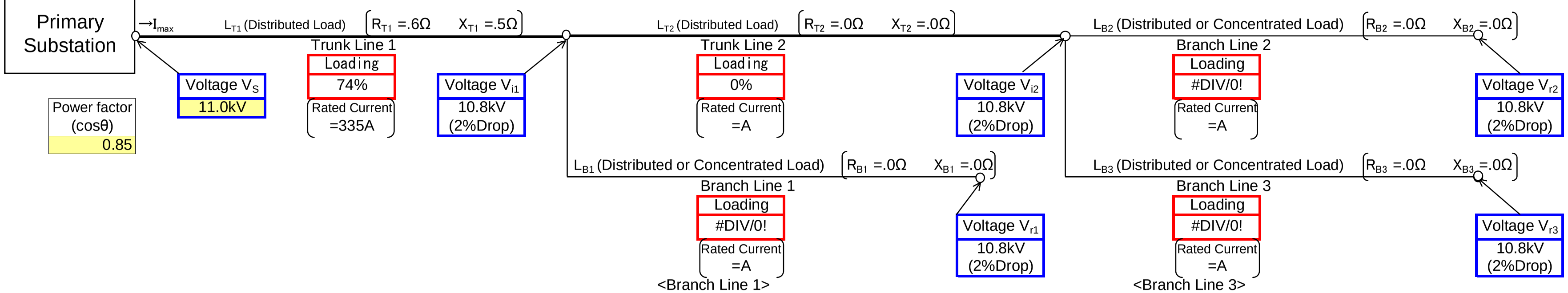
Load L_{T1}	249A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4460kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION R
Feeder Name	R13

: Input data in colored cells

Type-3

Maximum Current I_{max}
261.0A

Power factor (cosθ)
0.85

<Trank Line 1>

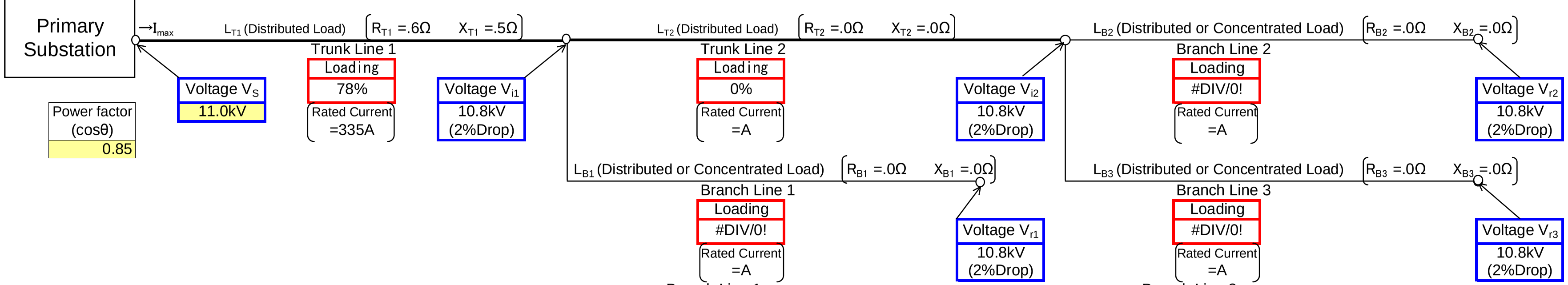
Load L_{T1}	261A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4460kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R13

: Input data in colored cells

Type-3

Maximum Current I_{max}	274.0A
Power factor ($\cos\theta$)	0.85

<Trank Line 1>

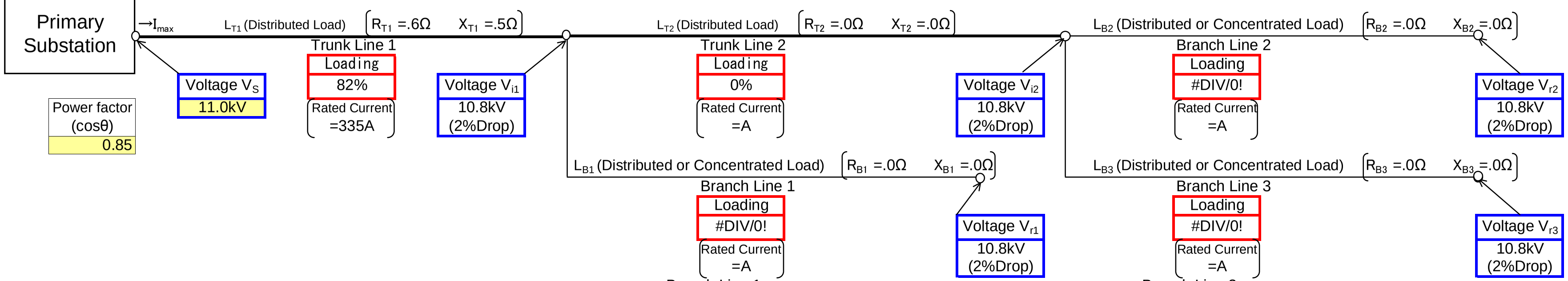
Load L_{T1}	274A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4460kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION R
Feeder Name	R13

: Input data in colored cells

Type-3

Maximum Current I_{max}: 288.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	288A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4460kVA	

L_{T1} (Distributed Load) R_{T1} =.6Ω X_{T1} =.5Ω

Trunk Line 1: Loading 86%, Rated Current =335A

Voltage V_{i1}: 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 R
Feeder Name	R3

: Input data in colored cells

Type-3

Maximum Current I_{max}
200.0A

Power factor (cosθ)
0.85

<Trank Line 1>

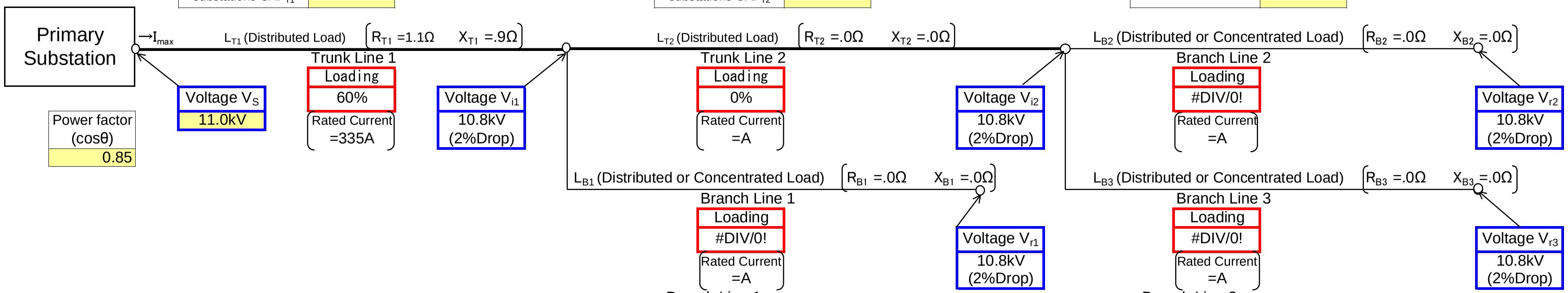
Load L_{T1}	200A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	7.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R3

(yellow): Input data in colored cells

Type-3

Maximum Current I_{max}	210.0A
Power factor (cosθ)	0.85

<Trank Line 1>

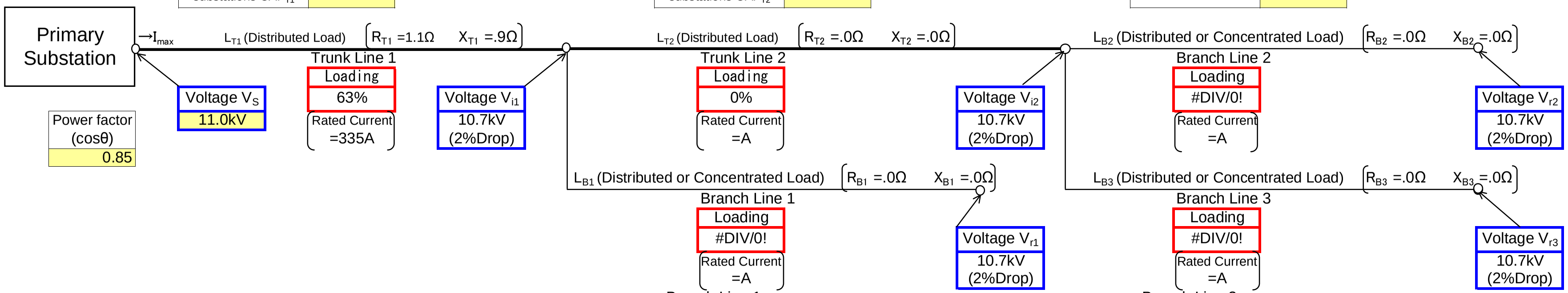
Load L_{T1}	210A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	7.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R3

: Input data in colored cells

Type-3

Maximum Current I_{max}
220.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	220A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	7.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation

→I_{max}

Voltage V_S 11.0kV

L_{T1} (Distributed Load) (R_{T1} =1.1Ω X_{T1} =.9Ω)

Trunk Line 1

Loading 66%

(Rated Current =335A)

Voltage V_{i1} 10.7kV (2%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2

Loading 0%

(Rated Current =A)

Voltage V_{i2} 10.7kV (2%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2

Loading #DIV/0!

(Rated Current =A)

Voltage V_{r2} 10.7kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1

Loading #DIV/0!

(Rated Current =A)

Voltage V_{r1} 10.7kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3

Loading #DIV/0!

(Rated Current =A)

Voltage V_{r3} 10.7kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R3

: Input data in colored cells

Type-3

Maximum Current I_{max}: 231.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	231A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	7.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4315kVA	

L_{T1} (Distributed Load) (R_{T1} =1.1Ω X_{T1} =.9Ω)

Trunk Line 1: Loading 69%, Rated Current =335A

Voltage V_{i1}: 10.7kV (3%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.7kV (3%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.7kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.7kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.7kV (3%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R3

: Input data in colored cells

Type-3

Maximum Current I_{max}
242.0A

Power factor (cosθ)
0.85

<Trank Line 1>

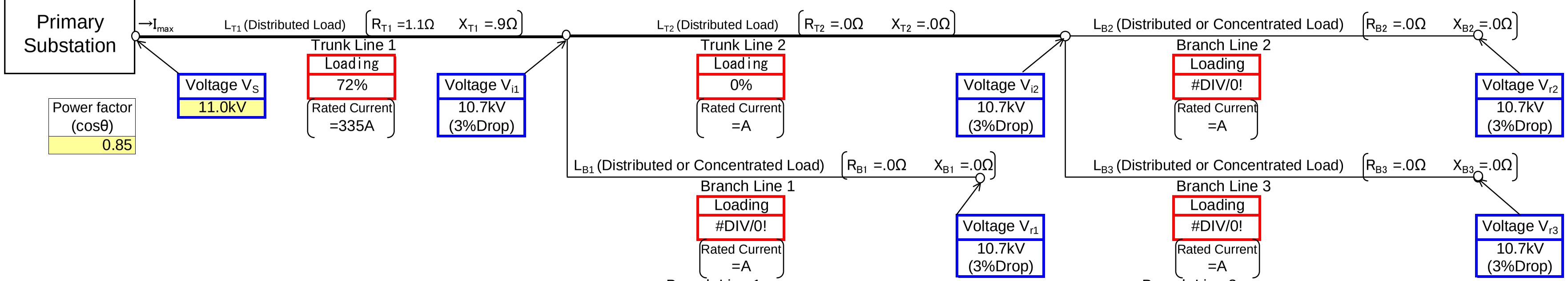
Load L_{T1}	242A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	7.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R3

: Input data in colored cells

Type-3

Maximum Current I_{max}
254.0A

Power factor (cosθ)
0.85

<Trank Line 1>

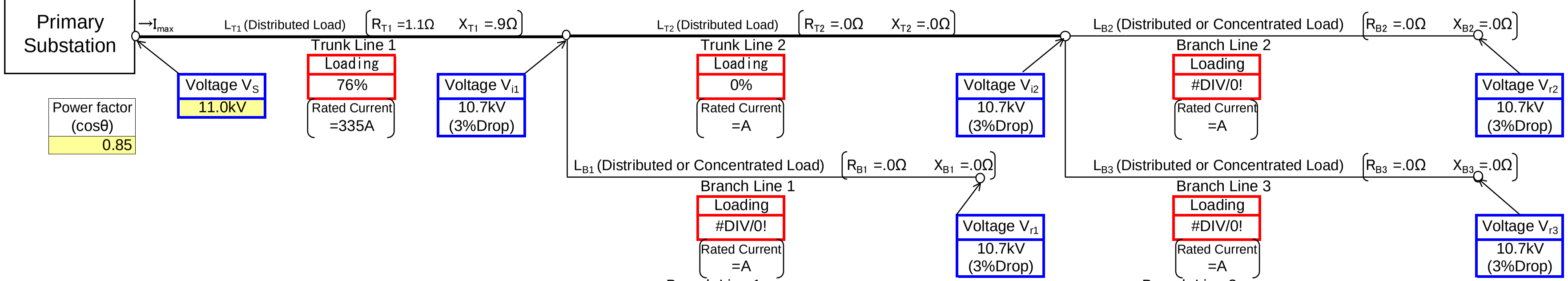
Load L_{T1}	254A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	7.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R3

: Input data in colored cells

Type-3

Maximum Current I_{max}
266.0A

Power factor (cosθ)
0.85

<Trank Line 1>

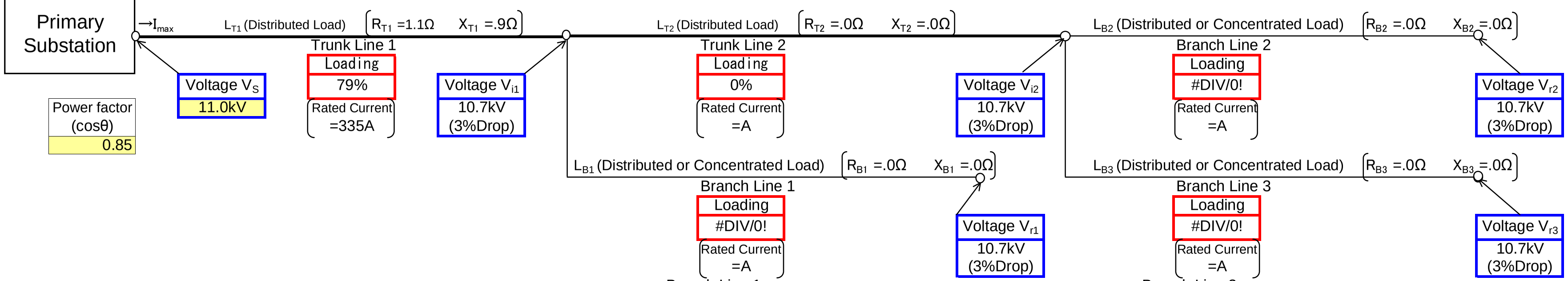
Load L_{T1}	266A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	7.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R3

: Input data in colored cells

Type-3

Maximum Current I_{max}
280.0A

<Trank Line 1>

Load L_{T1}	280A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	7.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4315kVA	

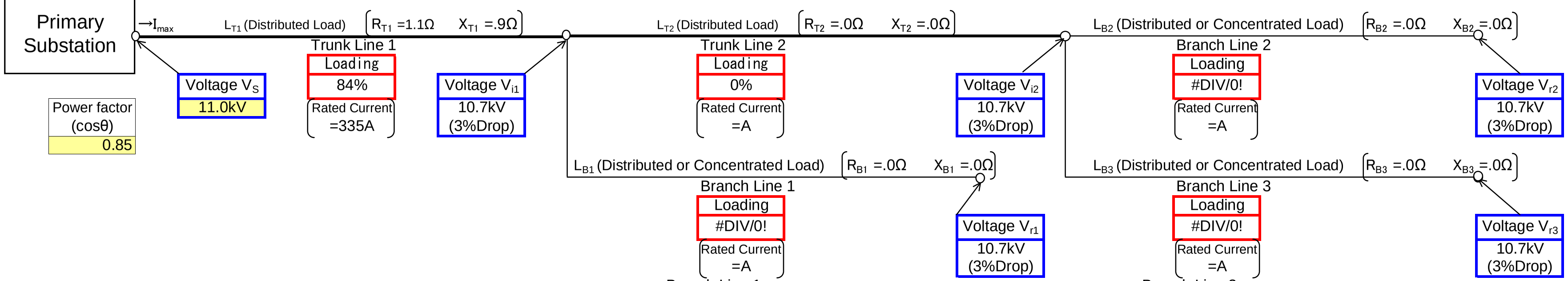
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Power factor (cosθ)
0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R3

: Input data in colored cells

Type-3

Maximum Current I_{max}: 293.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	293A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	7.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4315kVA	

L_{T1} (Distributed Load) (R_{T1} =1.1Ω X_{T1} =.9Ω)

Trunk Line 1: Loading 87%; Rated Current =335A

Voltage V_{i1}: 10.6kV (3%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%; Rated Current =A

Voltage V_{i2}: 10.6kV (3%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.6kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.6kV (3%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.6kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	STATION R
Feeder Name	R3

: Input data in colored cells

Type-3

Maximum Current I_{max}
308.0A

Power factor (cosθ)
0.85

<Trank Line 1>

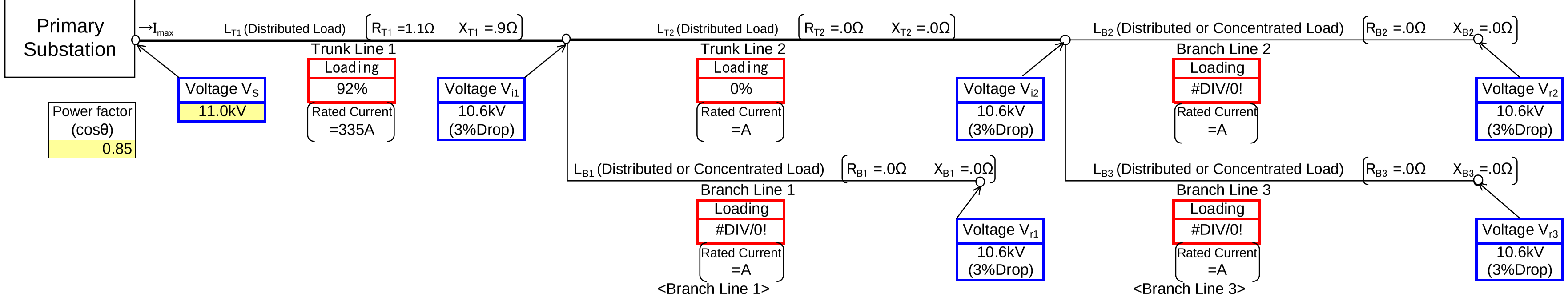
Load L_{T1}	308A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	7.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R3

: Input data in colored cells

Type-3

Maximum Current I_{max}: 323.0A

Power factor ($\cos\theta$): 0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	323A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	7.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4315kVA	

L_{T1} (Distributed Load) (R_{T1} =1.1Ω X_{T1} =.9Ω)

Trunk Line 1: Loading 96%, Rated Current =335A

Voltage V_{i1}: 10.6kV (4%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.6kV (4%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.6kV (4%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.6kV (4%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.6kV (4%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION R
Feeder Name	R3

: Input data in colored cells

Type-3

Maximum Current I_{max}
338.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	338A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	7.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation →I_{max}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =1.1Ω X_{T1} =.9Ω)

Trunk Line 1 — Loading: 101% — Rated Current =335A

Voltage V_{i1}: 10.6kV (4%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 — Loading: 0% — Rated Current =A

Voltage V_{i2}: 10.6kV (4%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading: #DIV/0! — Rated Current =A

Voltage V_{r2}: 10.6kV (4%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 — Loading: #DIV/0! — Rated Current =A

Voltage V_{r1}: 10.6kV (4%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading: #DIV/0! — Rated Current =A

Voltage V_{r3}: 10.6kV (4%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R4

: Input data in colored cells

Type-3

Maximum Current I_{max}
154.0A

Power factor (cosθ)
0.85

<Trank Line 1>

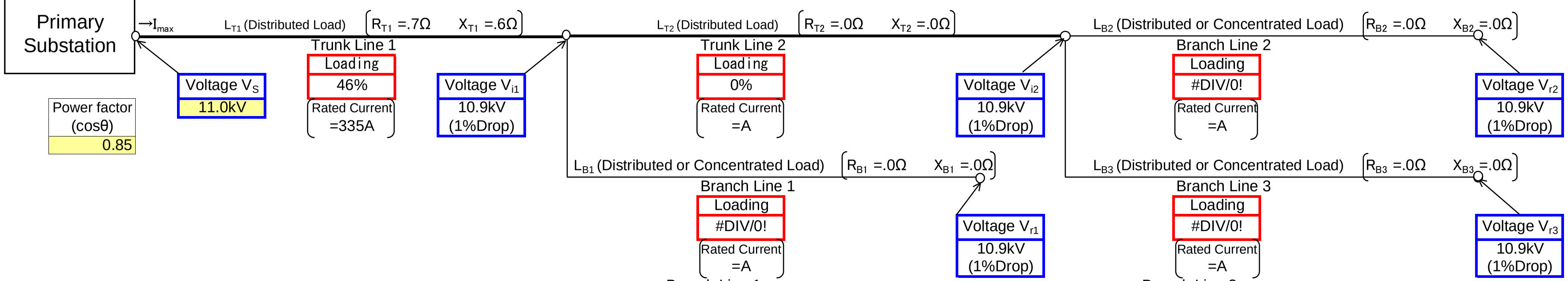
Load L_{T1}	154A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R4

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	161A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	161.0A

Primary Substation

$\rightarrow I_{max}$

Power factor (cosθ)	0.85

Voltage V_S	11.0kV

L_{T1} (Distributed Load) R_{T1} =.7Ω X_{T1} =.6Ω

Trunk Line 1

Loading
48%

Rated Current =335A

Voltage V_{i1}
10.9kV (1%Drop)

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2

Loading
0%

Rated Current =A

Voltage V_{i2}
10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2

Loading
#DIV/0!

Rated Current =A

Voltage V_{r2}
10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1

Loading
#DIV/0!

Rated Current =A

Voltage V_{r1}
10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3

Loading
#DIV/0!

Rated Current =A

Voltage V_{r3}
10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R4

: Input data in colored cells

Type-3

Maximum Current I_{max}	
	168.0A

Power factor (cosθ)	
	0.85

<Trank Line 1>

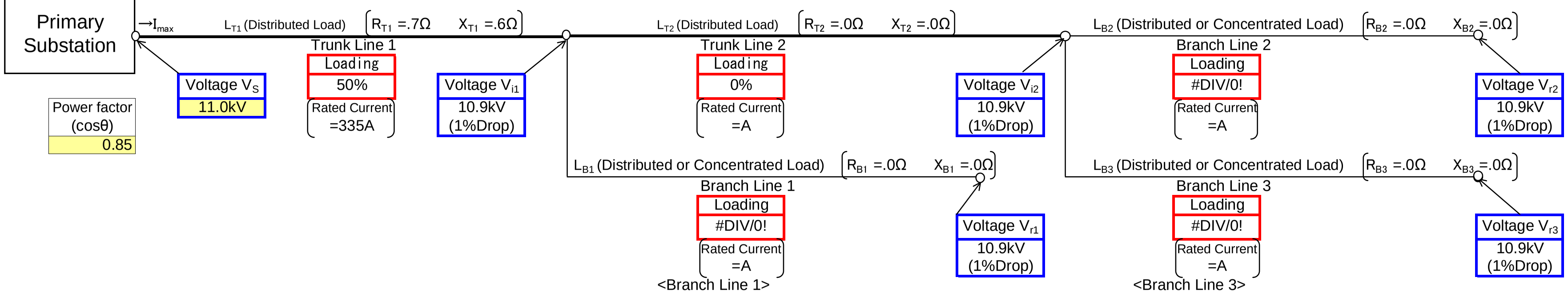
Load L_{T1}	168A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R4

: Input data in colored cells

Type-3

Maximum Current I_{max}	176.0A
Power factor (cosθ)	0.85

<Trank Line 1>

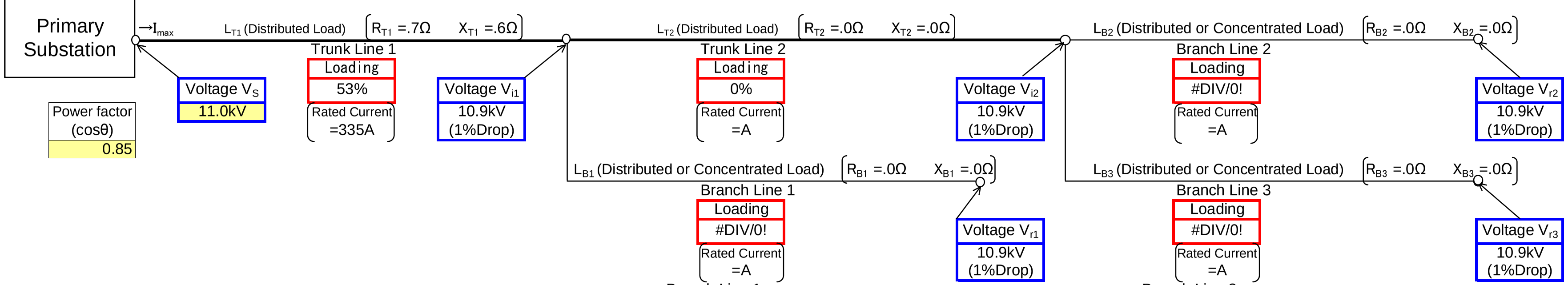
Load L_{T1}	176A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R4

: Input data in colored cells

Type-3

Maximum Current I_{max}
183.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	183A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

$\rightarrow I_{max}$

L_{T1} (Distributed Load) (R_{T1} =.7Ω X_{T1} =.6Ω)

Trunk Line 1: Loading 55%; Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.9kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%; Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R4

: Input data in colored cells

Type-3

Maximum Current I_{max}
192.0A

Power factor (cosθ)
0.85

<Trank Line 1>

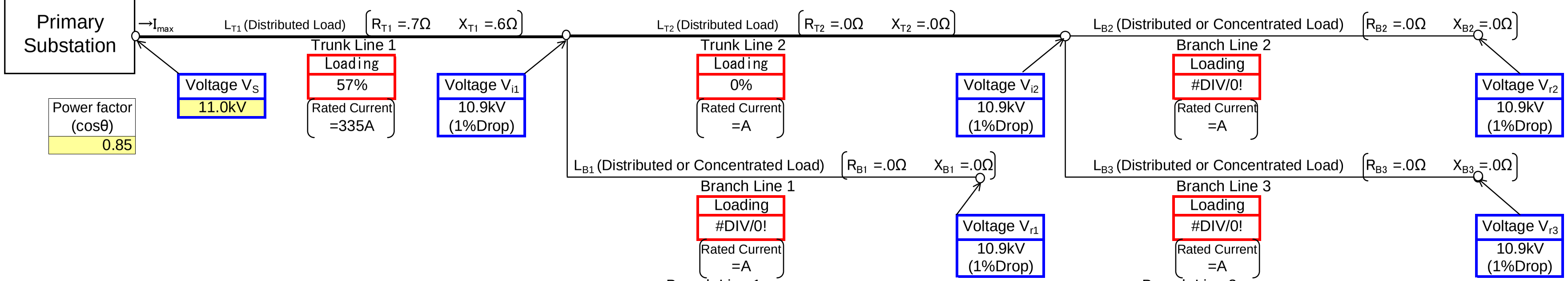
Load L_{T1}	192A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R4

: Input data in colored cells

Type-3

Maximum Current I_{max}	200.0A
Power factor (cosθ)	0.85

<Trank Line 1>

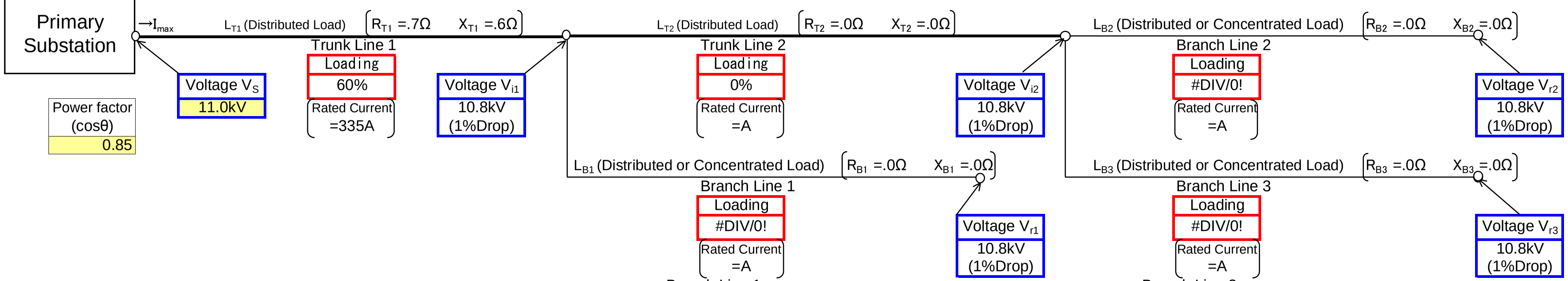
Load L_{T1}	200A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R4

: Input data in colored cells

Type-3

Maximum Current I_{max}
205.0A

Power factor (cosθ)
0.85

<Trank Line 1>

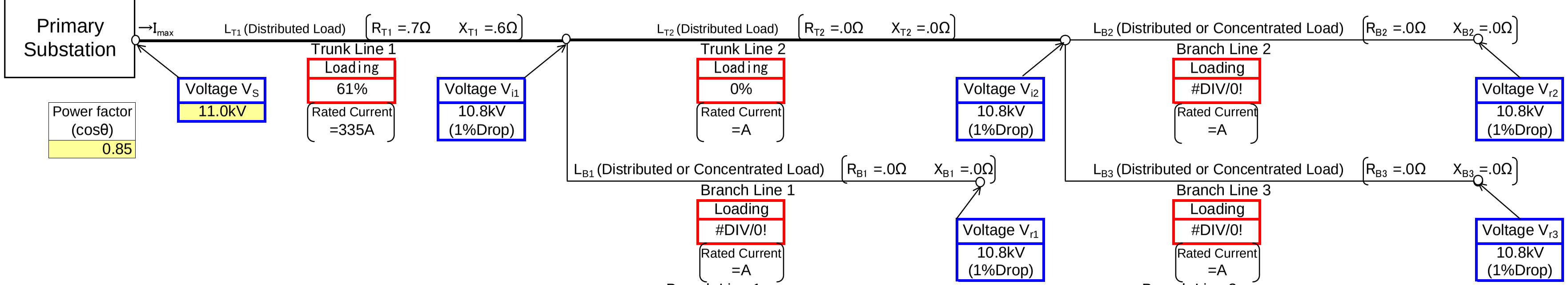
Load L_{T1}	205A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R4

: Input data in colored cells

Type-3

Maximum Current I_{max}
219.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	219A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

→I_{max}

L_{T1} (Distributed Load) (R_{T1} =.7Ω X_{T1} =.6Ω)

Trunk Line 1: Loading 65%, Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.8kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.8kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.8kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.8kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.8kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R4

: Input data in colored cells

Type-3

Maximum Current I_{max}	228.0A
Power factor (cosθ)	0.85

<Trank Line 1>

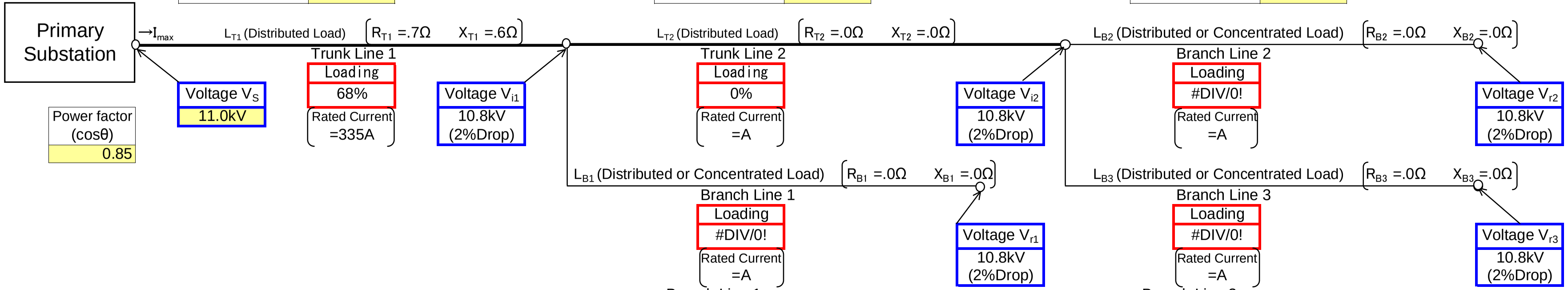
Load L_{T1}	228A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R4

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	239A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

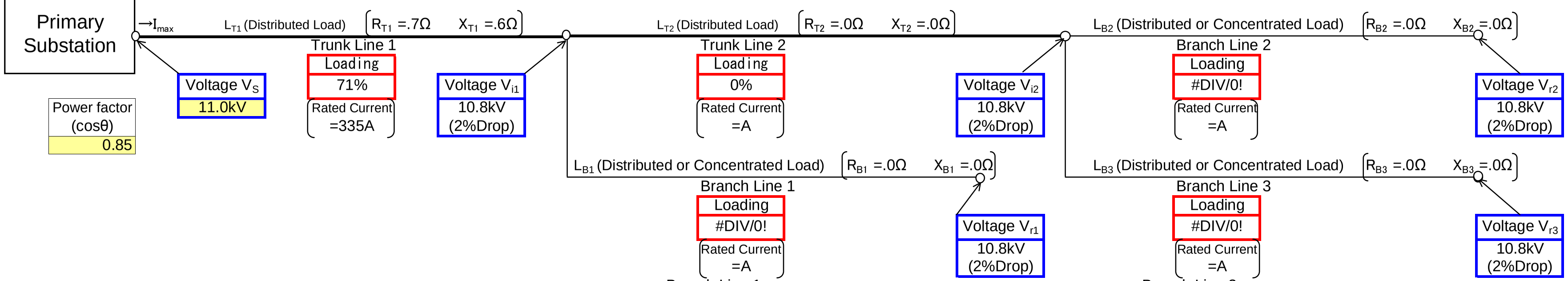
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	239.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 R
Feeder Name	R4

: Input data in colored cells

Type-3

Maximum Current I_{max}
249.0A

Power factor (cosθ)
0.85

<Trank Line 1>

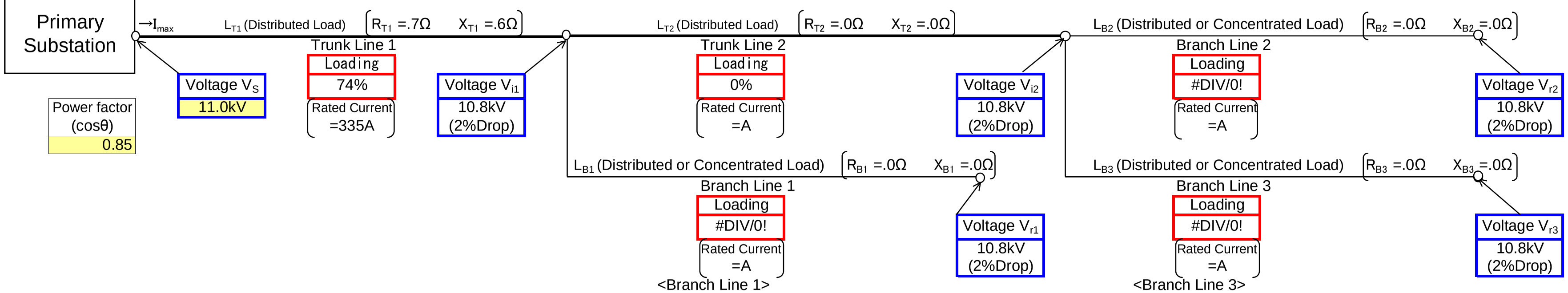
Load L_{T1}	249A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R5

: Input data in colored cells

Type-3

Maximum Current I_{max}	171.0A
Power factor (cosθ)	0.85

<Trank Line 1>

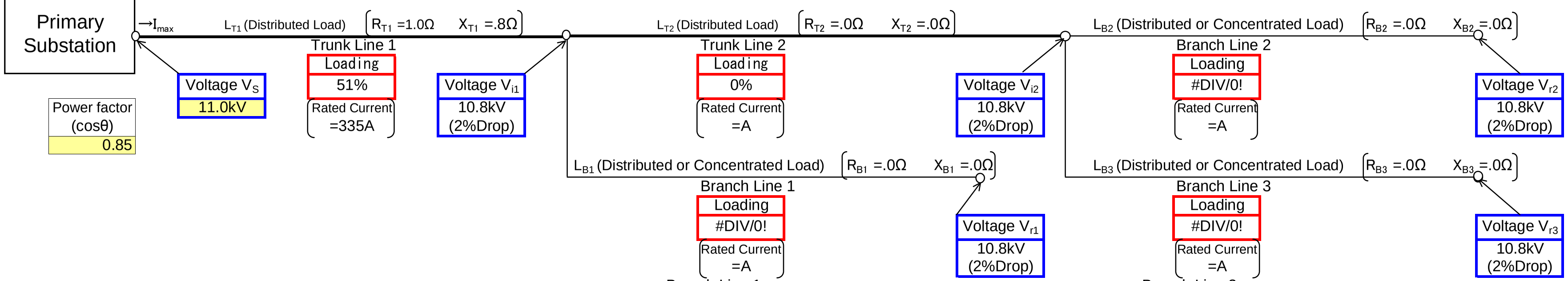
Load L_{T1}	171A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1850kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R5

: Input data in colored cells

Type-3

Maximum Current I_{max}
179.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	179A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1850kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

$\rightarrow I_{max}$

L_{T1} (Distributed Load) R_{T1} =1.0Ω X_{T1} =.8Ω

Trunk Line 1

Loading
53%

Rated Current =335A

Voltage V_S
11.0kV

Voltage V_{i1}
10.8kV (2%Drop)

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2

Loading
0%

Rated Current =A

Voltage V_{i2}
10.8kV (2%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2

Loading
#DIV/0!

Rated Current =A

Voltage V_{r2}
10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1

Loading
#DIV/0!

Rated Current =A

Voltage V_{r1}
10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3

Loading
#DIV/0!

Rated Current =A

Voltage V_{r3}
10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R5

: Input data in colored cells

Type-3

Maximum Current I_{max}: 188.0A

Power factor (cosθ): 0.85

<Trank Line 1>

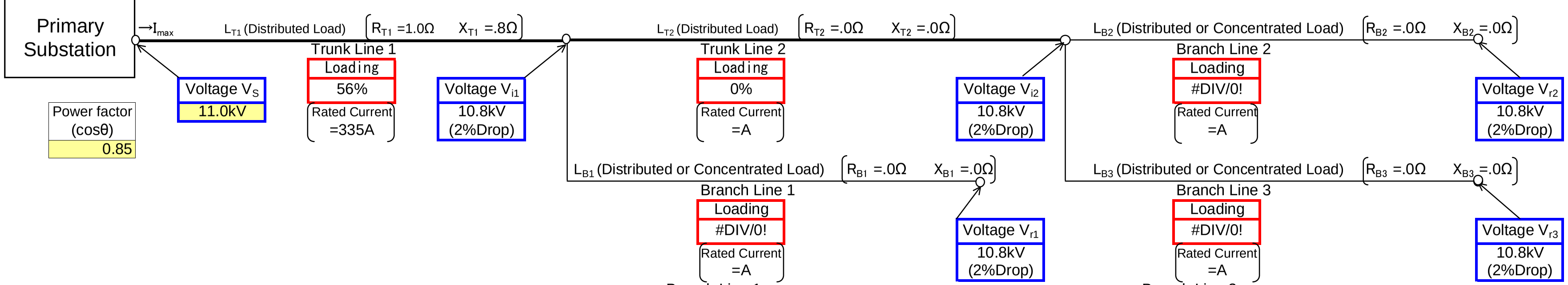
Load L_{T1}	188A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1850kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R5

: Input data in colored cells

Type-3

Maximum Current I_{max}
197.0A

Primary Substation

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	197A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1850kVA	

→I_{max} L_{T1} (Distributed Load) (R_{T1} =1.0Ω X_{T1} =.8Ω)

Trunk Line 1: Loading 59%; Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%; Rated Current =A

Voltage V_{i2}: 10.8kV (2%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R5

: Input data in colored cells

Type-3

Maximum Current I_{max}
207.0A

Power factor (cosθ)
0.85

<Trank Line 1>

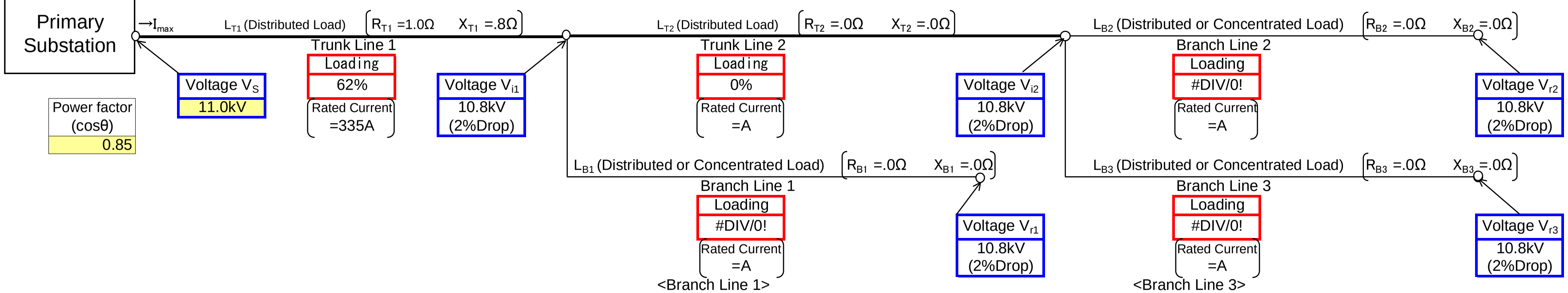
Load L_{T1}	207A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1850kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R5

: Input data in colored cells

Type-3

Maximum Current I_{max}	
217.0A	

Power factor (cosθ)
0.85

<Trank Line 1>

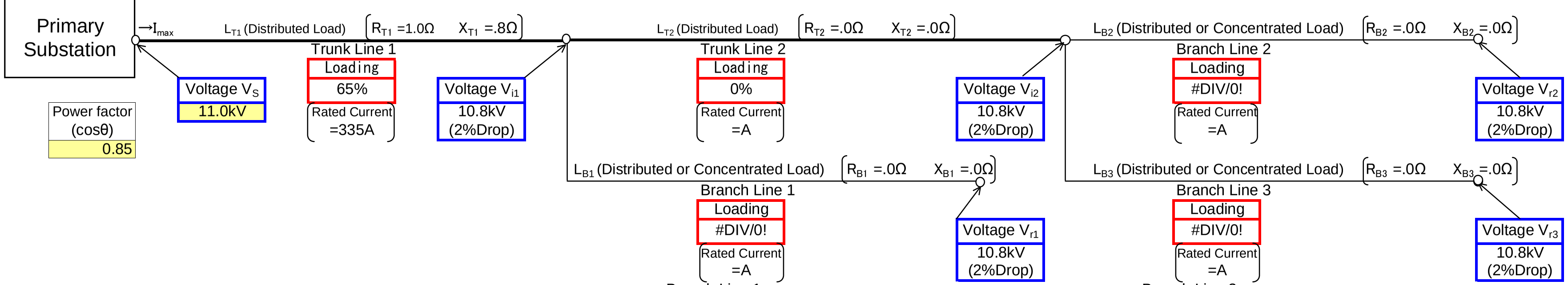
Load L_{T1}	217A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1850kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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}
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 R
Feeder Name	R5

: Input data in colored cells

Type-3

Maximum Current I_{max}: 228.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	228A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1850kVA	

L_{T1} (Distributed Load) (R_{T1} =1.0Ω X_{T1} =.8Ω)

Trunk Line 1: Loading 68%, Rated Current =335A

Voltage V_{i1}: 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R5

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	239A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1850kVA	

<Trank Line 2>

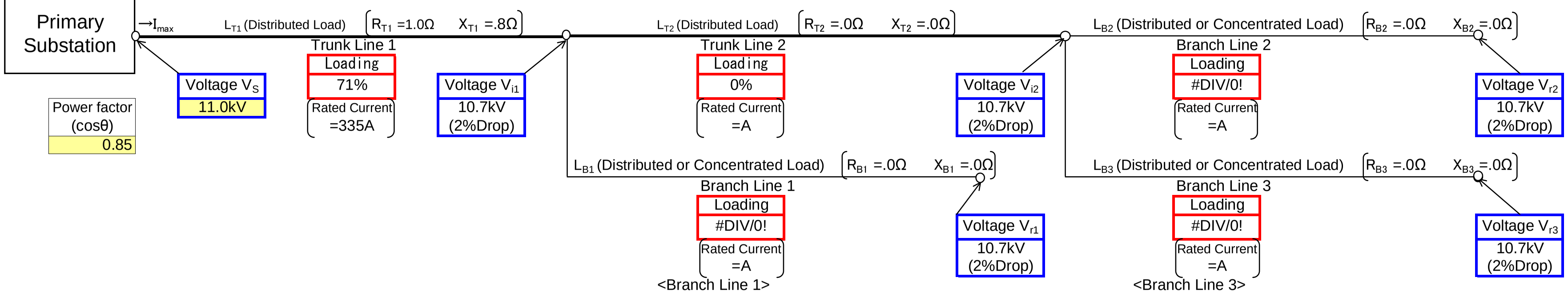
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	239.0A

Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R5

: Input data in colored cells

Type-3

Maximum Current I_{max}
251.0A

<Trank Line 1>

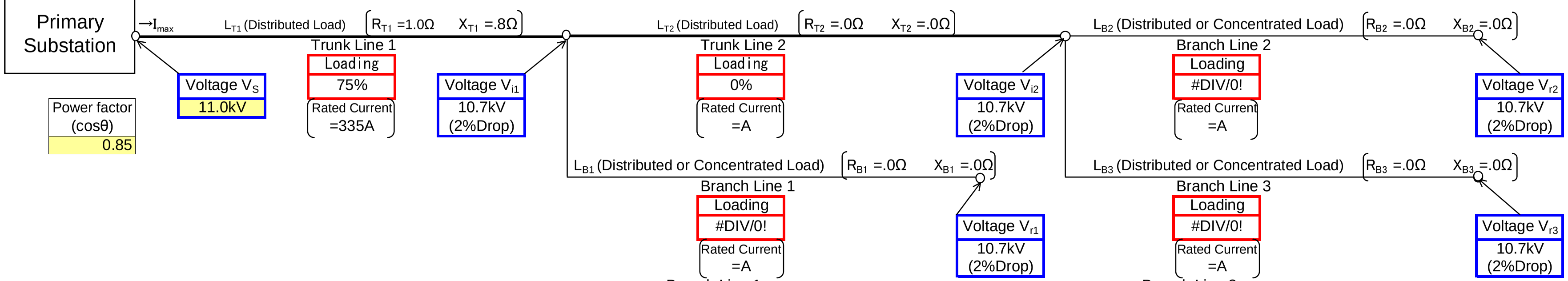
Load L_{T1}	251A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1850kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



Power factor (cosθ)
0.85

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R5

: Input data in colored cells

Type-3

Maximum Current I_{max}
263.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	263A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1850kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =1.0Ω X_{T1} =.8Ω)

Voltage V_S: 11.0kV

Trunk Line 1: Loading 79%; Rated Current =335A

Voltage V_{i1}: 10.7kV (3%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%; Rated Current =A

Voltage V_{i2}: 10.7kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 10.7kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 10.7kV (3%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 10.7kV (3%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R5

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	276A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1850kVA	

<Trank Line 2>

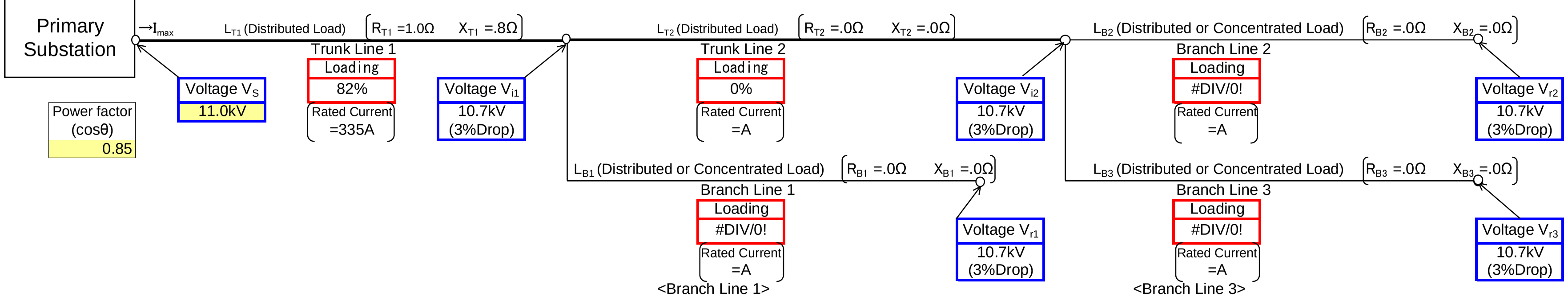
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	276.0A

Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 R
Feeder Name	R5

: Input data in colored cells

Type-3

Maximum Current I_{max}
289.0A

Power factor (cosθ)
0.85

<Trank Line 1>

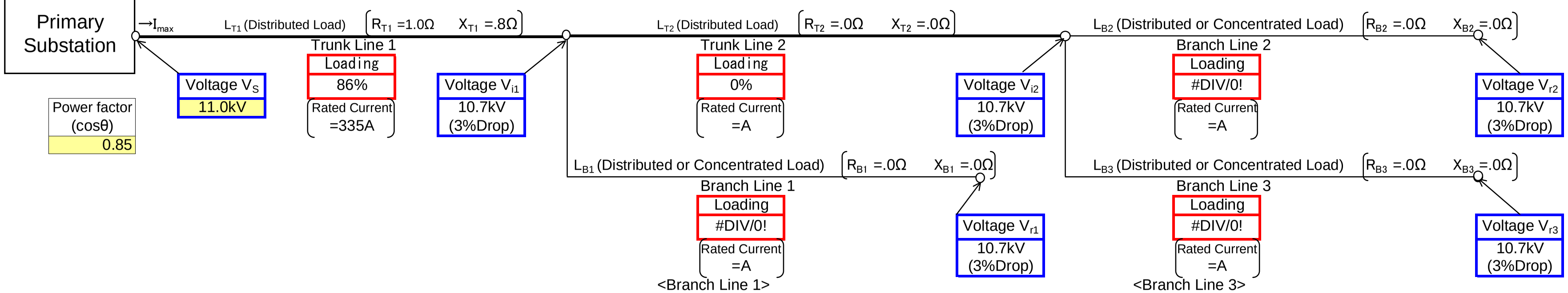
Load L_{T1}	289A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1850kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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},
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 Z
Feeder Name	RADIO

: Input data in colored cells

Type-3

Maximum Current I_{max}
395.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	90A	
Line Type	150ALBARE	No.38
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2725kVA	

<Trank Line 2>

Load L_{T2}	55A	
Line Type	150ALBARE	No.38
Line Legth Len_{T2}	8.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1650kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation

$\rightarrow I_{max}$

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) R_{T1} =2.3Ω X_{T1} =4.0Ω

Trunk Line 1 — Loading: 87% — Rated Current =455A

Voltage V_{i1}: 8.5kV (22%Drop)

L_{T2} (Distributed Load) R_{T2} =1.8Ω X_{T2} =3.0Ω

Trunk Line 2 — Loading: 12% — Rated Current =455A

Voltage V_{i2}: 8.4kV (24%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2 — Loading: #DIV/0! — Rated Current =A

Voltage V_{r2}: 8.4kV (24%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =4.7Ω X_{B1} =8.1Ω

Branch Line 1 — Loading: 55% — Rated Current =455A

Voltage V_{r1}: 6.7kV (39%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3 — Loading: #DIV/0! — Rated Current =A

Voltage V_{r3}: 8.4kV (24%Drop)

<Branch Line 1>

Load L_{B1}	250A	
Line Type	150ALBARE	No.38
Line Length Len_{B1}	23.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	7530kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	RADIO

: Input data in colored cells

Type-3

Maximum Current I_{max}
414.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	95A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2725kVA	

<Trank Line 2>

Load L_{T2}	57A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	8.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1650kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

$\rightarrow I_{max}$

L_{T1} (Distributed Load) R_{T1} =2.9Ω X_{T1} =4.1Ω

Trunk Line 1: Loading 106%, Rated Current =390A

Voltage V_S: 11.0kV

Voltage V_{i1}: 8.1kV (26%Drop)

L_{T2} (Distributed Load) R_{T2} =5.3Ω X_{T2} =3.3Ω

Trunk Line 2: Loading 15%, Rated Current =260A

Voltage V_{i2}: 7.8kV (29%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 7.8kV (29%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =13.7Ω X_{B1} =10.9Ω

Branch Line 1: Loading 111%, Rated Current =236A

Voltage V_{r1}: 4.1kV (62%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 7.8kV (29%Drop)

<Branch Line 1>

Load L_{B1}	262A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	23.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	7530kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	RADIO

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	100A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2725kVA	

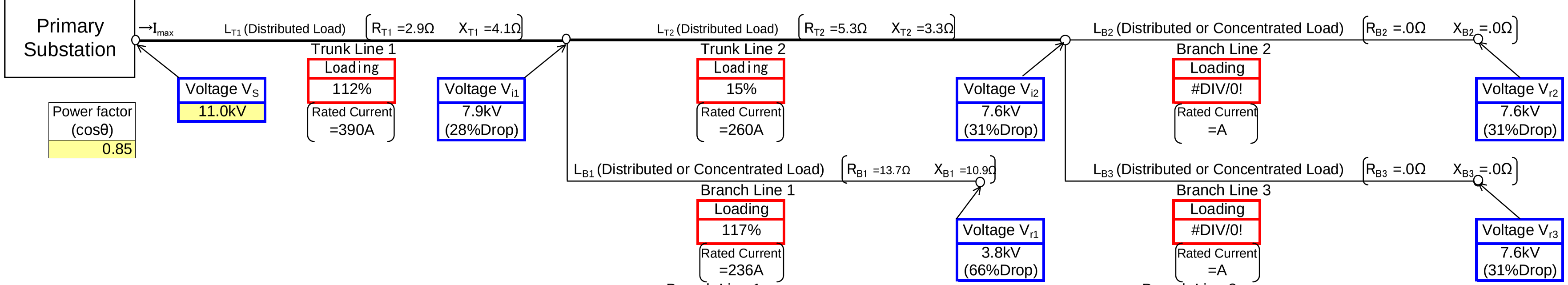
<Trank Line 2>

Load L_{T2}	60A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	8.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1650kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	435.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	275A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	23.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	7530kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 Z
Feeder Name	RADIO

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	104A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2725kVA	

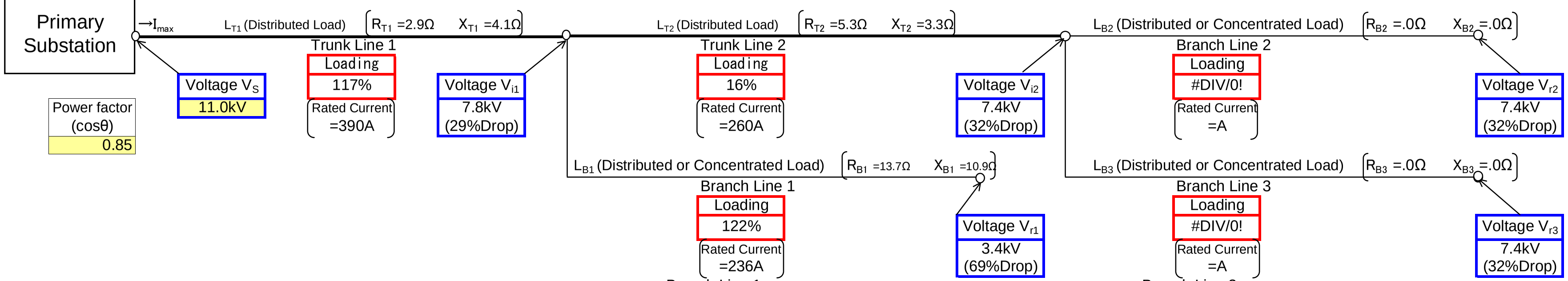
<Trank Line 2>

Load L_{T2}	63A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	8.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1650kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	456.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	288A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	23.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	7530kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	RADIO

: Input data in colored cells

Type-3

Maximum Current I_{max}
478.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	109A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2725kVA	

<Trank Line 2>

Load L_{T2}	66A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	8.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1650kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation →I_{max}

Voltage V_S 11.0kV

L_{T1} (Distributed Load) (R_{T1} =2.9Ω X_{T1} =4.1Ω)

Trunk Line 1: Loading 123%, Rated Current =390A

Voltage V_{i1} 7.6kV (31%Drop)

L_{T2} (Distributed Load) (R_{T2} =5.3Ω X_{T2} =3.3Ω)

Trunk Line 2: Loading 17%, Rated Current =260A

Voltage V_{i2} 7.3kV (34%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2} 7.3kV (34%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =13.7Ω X_{B1} =10.9Ω)

Branch Line 1: Loading 128%, Rated Current =236A

Voltage V_{r1} 3.1kV (72%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3} 7.3kV (34%Drop)

<Branch Line 1>

Load L_{B1}	302A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	23.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	7530kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 Z
Feeder Name	RADIO

: Input data in colored cells

Type-3

Maximum Current I_{max}
502.0A

Power factor (cosθ)
0.85

<Trank Line 1>

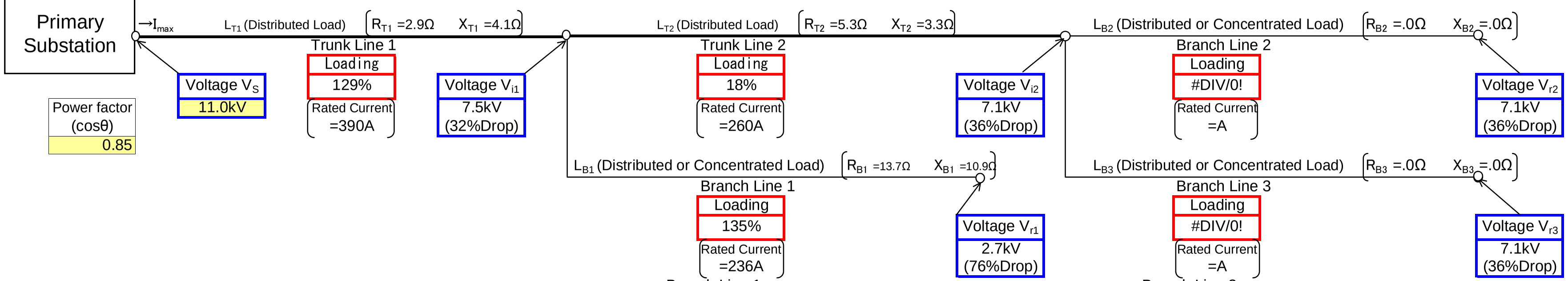
Load L_{T1}	115A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2725kVA	

<Trank Line 2>

Load L_{T2}	70A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	8.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1650kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	318A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	23.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	7530kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	RADIO

: Input data in colored cells

Type-3

Maximum Current I_{max}: 526.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	120A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2725kVA	

L_{T1} (Distributed Load) (R_{T1} =2.9Ω X_{T1} =4.1Ω)

Trunk Line 1 — Loading: 135% — Rated Current =390A

Voltage V_{i1}: 7.3kV (34%Drop)

<Trank Line 2>

Load L_{T2}	73A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	8.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1650kVA	

L_{T2} (Distributed Load) (R_{T2} =5.3Ω X_{T2} =3.3Ω)

Trunk Line 2 — Loading: 19% — Rated Current =260A

Voltage V_{i2}: 6.9kV (37%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading: #DIV/0! — Rated Current =A

Voltage V_{r2}: 6.9kV (37%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =13.7Ω X_{B1} =10.9Ω)

Branch Line 1 — Loading: 141% — Rated Current =236A

Voltage V_{r1}: 2.3kV (79%Drop)

<Branch Line 1>

Load L_{B1}	333A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	23.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	7530kVA	

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading: #DIV/0! — Rated Current =A

Voltage V_{r3}: 6.9kV (37%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$,
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 Z
Feeder Name	RADIO

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	126A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2725kVA	

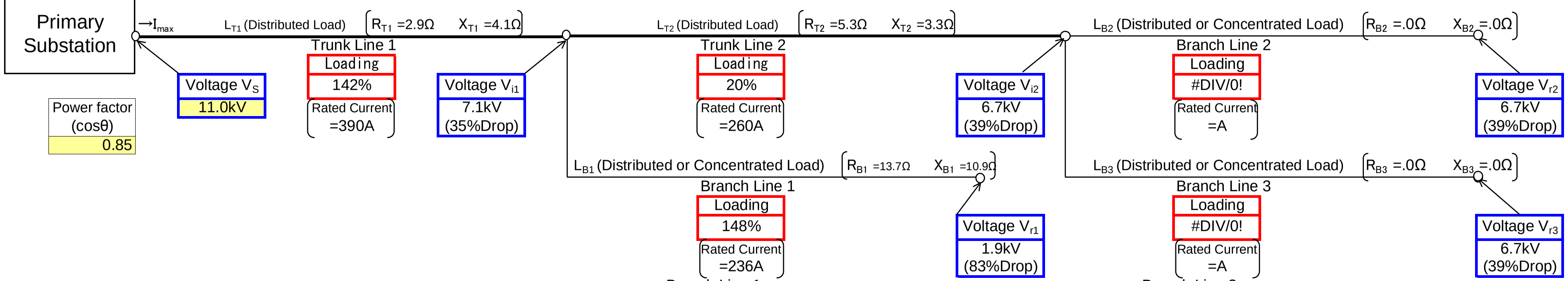
<Trank Line 2>

Load L_{T2}	77A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	8.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1650kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	552.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	349A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	23.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	7530kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	RADIO

: Input data in colored cells

Type-3

Maximum Current I_{max}
579.0A

<Trank Line 1>

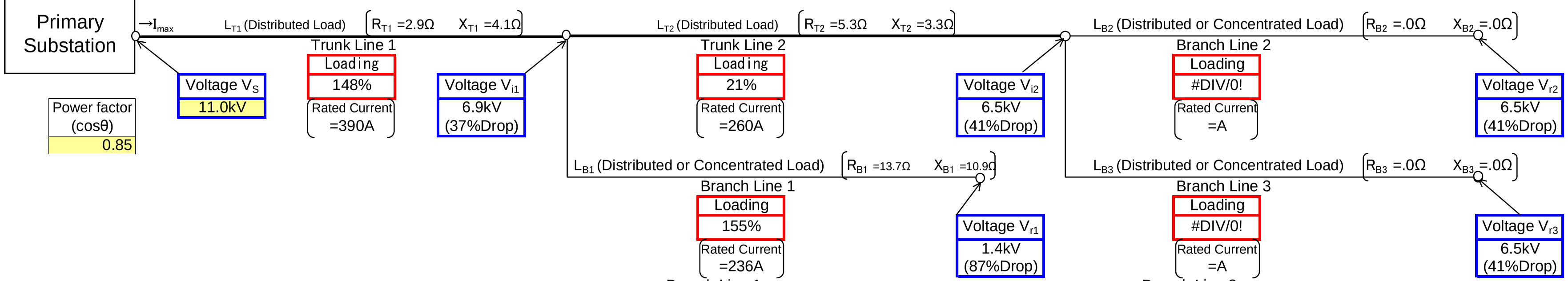
Load L_{T1}	133A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2725kVA	

<Trank Line 2>

Load L_{T2}	80A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	8.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1650kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



Power factor (cosθ)
0.85

<Branch Line 1>

Load L_{B1}	366A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	23.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	7530kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	RADIO

: Input data in colored cells

Type-3

Maximum Current I_{max}
607.0A

Power factor (cosθ)
0.85

<Trank Line 1>

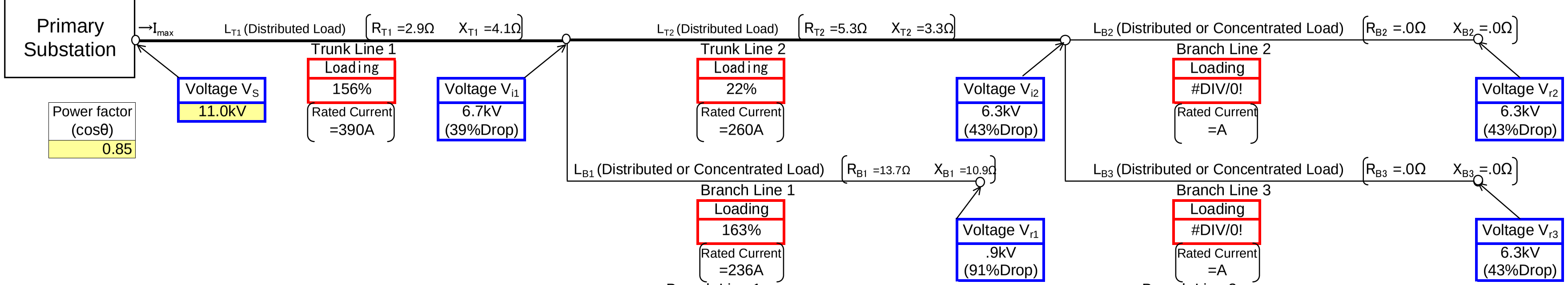
Load L_{T1}	139A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2725kVA	

<Trank Line 2>

Load L_{T2}	84A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	8.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1650kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	384A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	23.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	7530kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	RADIO

: Input data in colored cells

Type-3

Maximum Current I_{max}
637.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	146A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2725kVA	

<Trank Line 2>

Load L_{T2}	88A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	8.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1650kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation →I_{max}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =2.9Ω X_{T1} =4.1Ω)

Trunk Line 1 — Loading 163% — Rated Current =390A

Voltage V_{i1}: 6.5kV (41%Drop)

L_{T2} (Distributed Load) (R_{T2} =5.3Ω X_{T2} =3.3Ω)

Trunk Line 2 — Loading 23% — Rated Current =260A

Voltage V_{i2}: 6.0kV (45%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2}: 6.0kV (45%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =13.7Ω X_{B1} =10.9Ω)

Branch Line 1 — Loading 171% — Rated Current =236A

Voltage V_{r1}: .4kV (96%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3}: 6.0kV (45%Drop)

<Branch Line 1>

Load L_{B1}	403A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	23.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	7530kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	RADIO

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	153A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2725kVA	

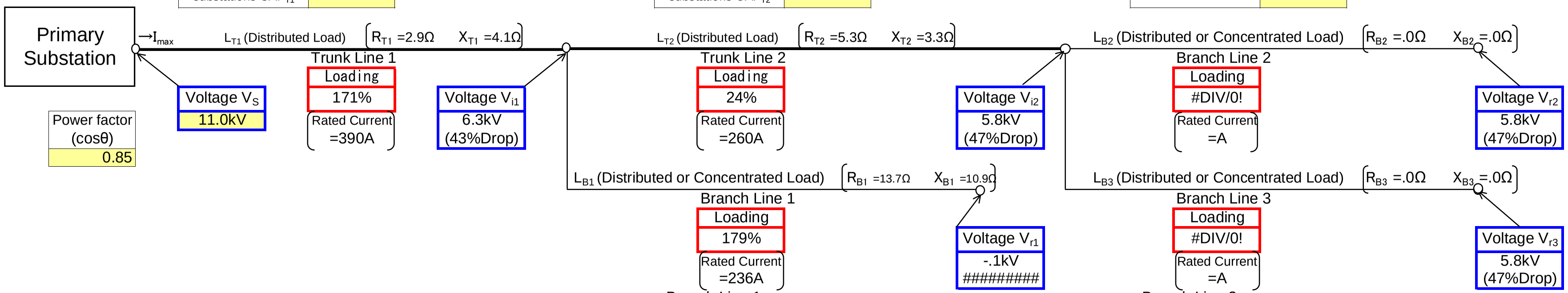
<Trank Line 2>

Load L_{T2}	93A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	8.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1650kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	668.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	423A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	23.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	7530kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S02

: Input data in colored cells

Type-3

Maximum Current I_{max}
205.0A

<Trank Line 1>

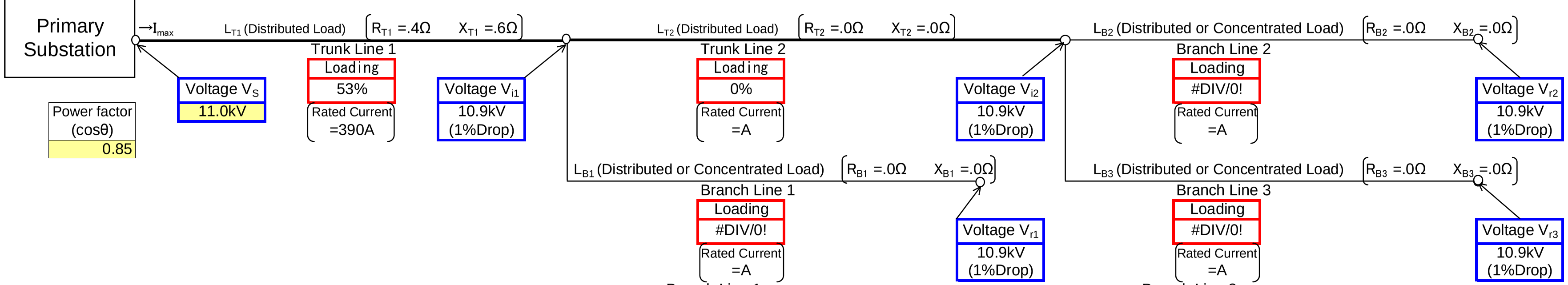
Load L_{T1}	205A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S02

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	215A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2315kVA	

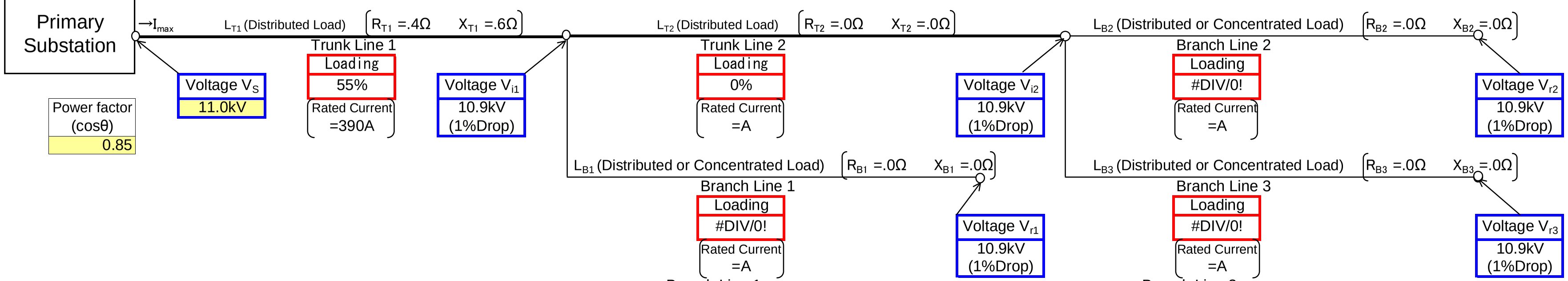
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	
215.0A	
Power factor (cosθ)	
0.85	



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S02

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	226A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2315kVA	

<Trank Line 2>

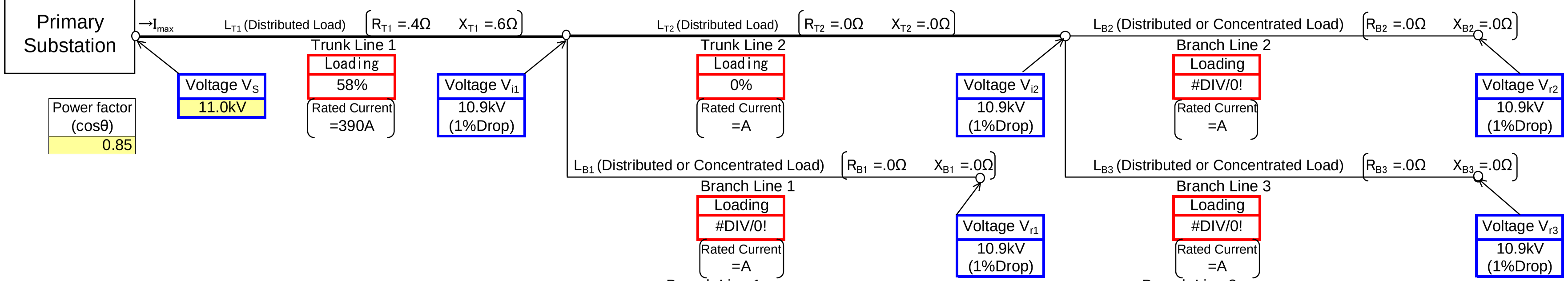
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}
226.0A

Power factor (cosθ)
0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S02

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	237A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}: 237.0A

Power factor (cosθ): 0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_s: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.6Ω)

Trunk Line 1 — Loading 61% — Rated Current =390A

Voltage V_{i1}: 10.9kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 — Loading 0% — Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 — Loading #DIV/0! — Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S02

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	248A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2315kVA	

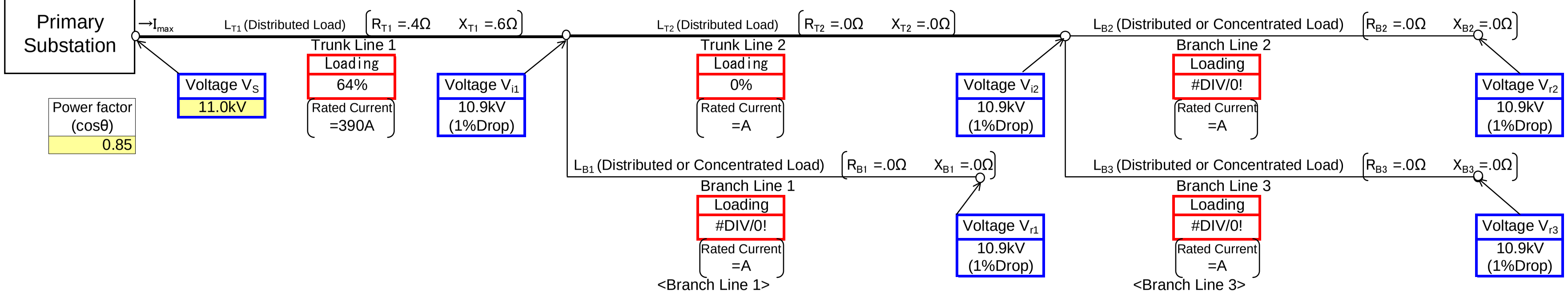
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	248.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S02

: Input data in colored cells

Type-3

Maximum Current I_{max}
260.0A

Power factor (cosθ)
0.85

<Trank Line 1>

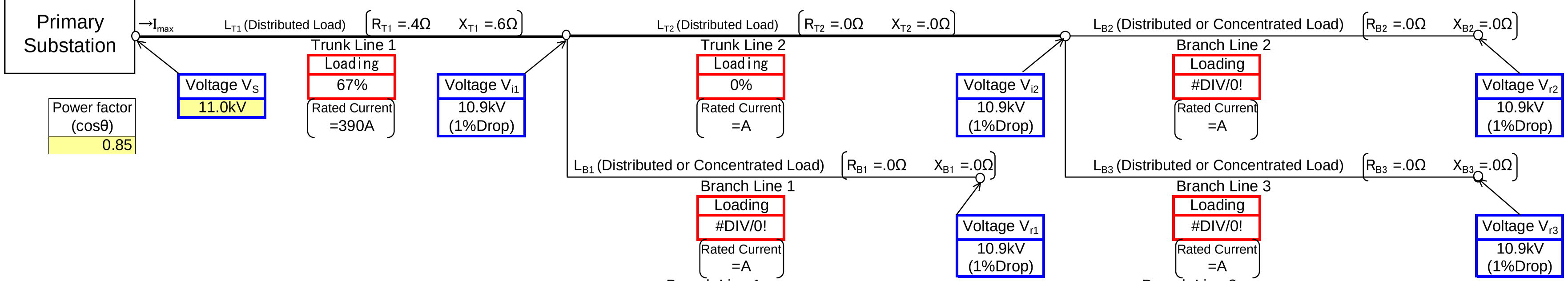
Load L_{T1}	260A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S02

: Input data in colored cells

Type-3

Maximum Current I_{max}	273.0A

Power factor (cosθ)	0.85

Primary Substation →I_{max}

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	273A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2315kVA	

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.6Ω)

Trunk Line 1: Loading 70%, Rated Current =390A

Voltage V_{i1} 10.8kV (1%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2} 10.8kV (1%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2} 10.8kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1} 10.8kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3} 10.8kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S02

: Input data in colored cells

Type-3

Maximum Current I_{max}
287.0A

Power factor (cosθ)
0.85

<Trank Line 1>

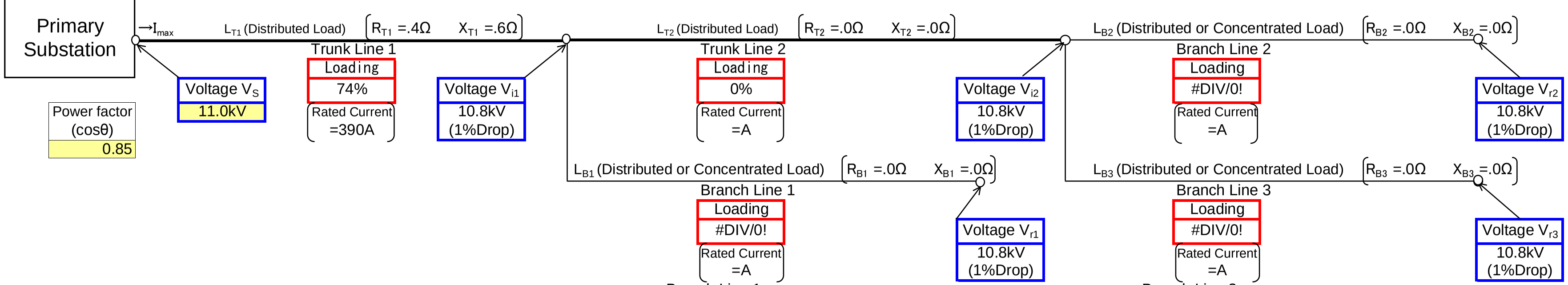
Load L_{T1}	287A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	STATION S
Feeder Name	S02

: Input data in colored cells

Type-3

Maximum Current I_{max}: 301.0A

Power factor (cosθ): 0.85

Primary Substation → I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	301A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2315kVA	

L_{T1} (Distributed Load) (R_{T1} =.4Ω X_{T1} =.6Ω)

Trunk Line 1: Loading 77%, Rated Current =390A

Voltage V_{i1}: 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.8kV (2%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S02

: Input data in colored cells

Type-3

Maximum Current I_{max}
315.0A

Power factor (cosθ)
0.85

<Trank Line 1>

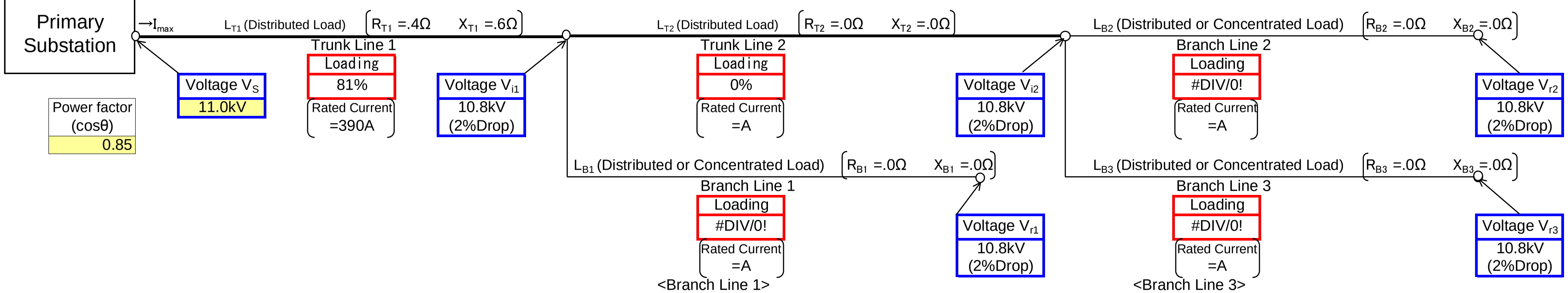
Load L_{T1}	315A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S02

: Input data in colored cells

Type-3

Maximum Current I_{max}
331.0A

Power factor (cosθ)
0.85

<Trank Line 1>

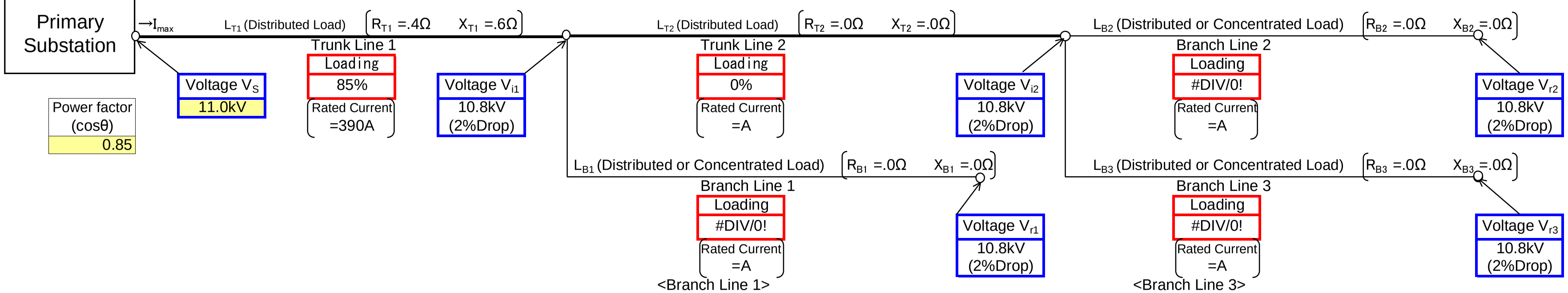
Load L_{T1}	331A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S02

: Input data in colored cells

Type-3

Maximum Current I_{max}	347.0A

Power factor (cosθ)	0.85

<Trank Line 1>

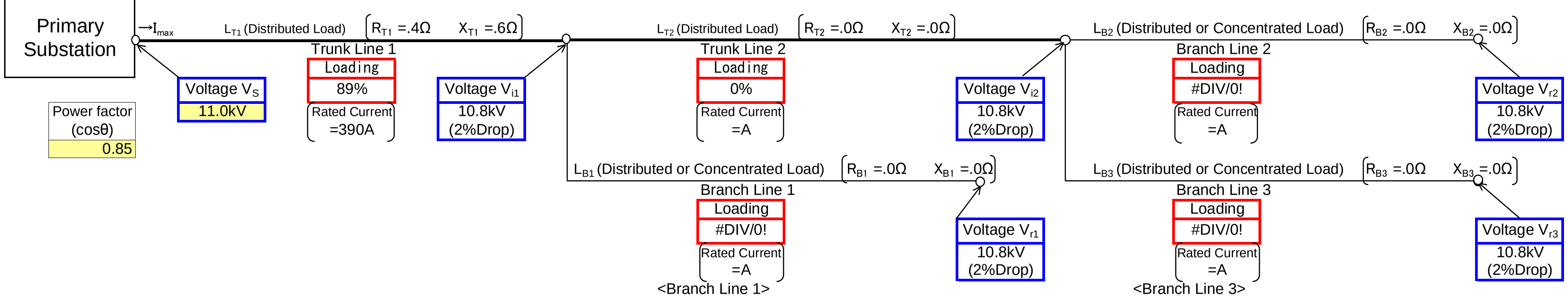
Load L_{T1}	347A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	1.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2315kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S10

: Input data in colored cells

Type-3

Maximum Current I_{max}
410.0A

Primary Substation

Power factor (cosθ)
0.85

Voltage V_S
11.0kV

<Trank Line 1>

Load L_{T1}	290A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	22.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	5660kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =5.7Ω X_{T1} =8.1Ω)

Trunk Line 1

Loading
105%

(Rated Current =390A)

Voltage V_{i1}
7.6kV (31%Drop)

<Trank Line 2>

Load L_{T2}	120A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	7.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2350kVA	

L_{T2} (Distributed Load) (R_{T2} =1.9Ω X_{T2} =2.7Ω)

Trunk Line 2

Loading
31%

(Rated Current =390A)

Voltage V_{i2}
7.2kV (34%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1

Loading
#DIV/0!

(Rated Current =A)

Voltage V_{r1}
7.6kV (31%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2

Loading
#DIV/0!

(Rated Current =A)

Voltage V_{r2}
7.2kV (34%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3

Loading
#DIV/0!

(Rated Current =A)

Voltage V_{r3}
7.2kV (34%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 S
Feeder Name	S10

: Input data in colored cells

Type-3

Maximum Current I_{max}
415.0A

Power factor (cosθ)
0.85

<Trank Line 1>

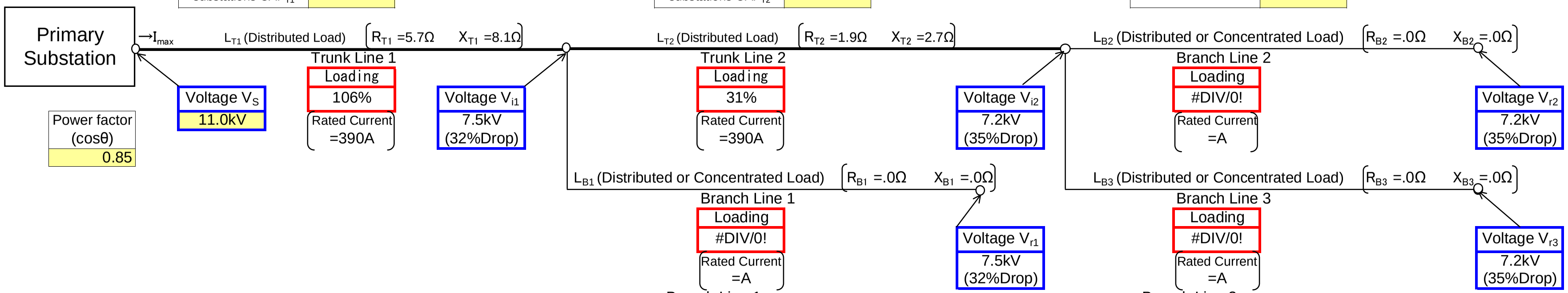
Load L_{T1}	293A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	22.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	5660kVA	

<Trank Line 2>

Load L_{T2}	122A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	7.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2350kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
Line Length Len_{B3}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

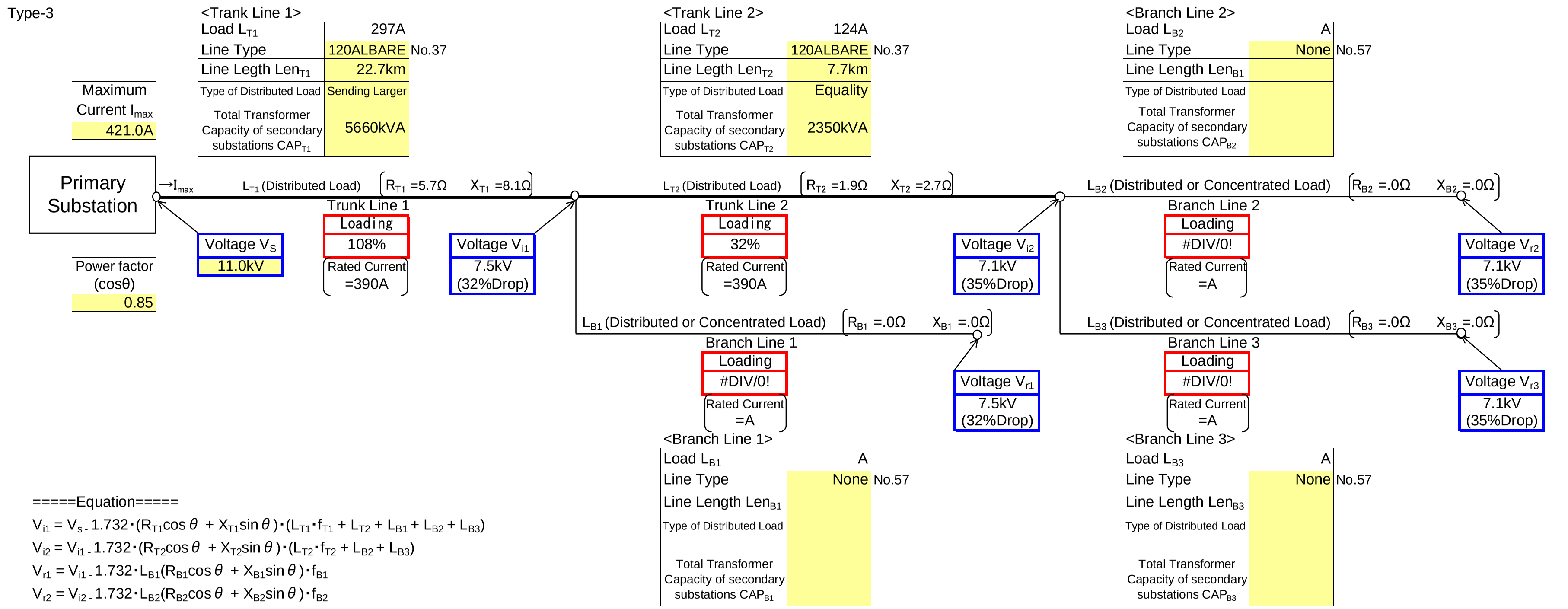
V_s : Supply Voltage	I_{max} : Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal 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 S
Feeder Name	S10

: Input data in colored cells

Type-3



=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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 S
Feeder Name	S10

: Input data in colored cells

Type-3

Maximum Current I_{max}: 426.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_s: 11.0kV

<Trank Line 1>

Load L_{T1}	301A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	22.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	5660kVA	

L_{T1} (Distributed Load) (R_{T1} =5.7Ω X_{T1} =8.1Ω)

Trunk Line 1: Loading 109%, Rated Current =390A

Voltage V_{i1}: 7.4kV (32%Drop)

<Trank Line 2>

Load L_{T2}	125A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	7.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2350kVA	

L_{T2} (Distributed Load) (R_{T2} =1.9Ω X_{T2} =2.7Ω)

Trunk Line 2: Loading 32%, Rated Current =390A

Voltage V_{i2}: 7.1kV (35%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 7.4kV (32%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 7.1kV (35%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 7.1kV (35%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$,
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 S
Feeder Name	S10

: Input data in colored cells

Type-3

Maximum Current I_{max}
432.0A

Primary Substation

Power factor (cosθ)
0.85

Voltage V_S
11.0kV

<Trank Line 1>

Load L_{T1}	305A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	22.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	5660kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) $(R_{T1}=5.7\Omega \quad X_{T1}=8.1\Omega)$

Trunk Line 1

Loading
111%

(Rated Current =390A)

Voltage V_{i1}
7.4kV (33%Drop)

<Trank Line 2>

Load L_{T2}	127A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	7.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2350kVA	

L_{T2} (Distributed Load) $(R_{T2}=1.9\Omega \quad X_{T2}=2.7\Omega)$

Trunk Line 2

Loading
32%

(Rated Current =390A)

Voltage V_{i2}
7.0kV (36%Drop)

L_{B1} (Distributed or Concentrated Load) $(R_{B1}=.0\Omega \quad X_{B1}=.0\Omega)$

Branch Line 1

Loading
#DIV/0!

(Rated Current =A)

Voltage V_{r1}
7.4kV (33%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) $(R_{B2}=.0\Omega \quad X_{B2}=.0\Omega)$

Branch Line 2

Loading
#DIV/0!

(Rated Current =A)

Voltage V_{r2}
7.0kV (36%Drop)

L_{B3} (Distributed or Concentrated Load) $(R_{B3}=.0\Omega \quad X_{B3}=.0\Omega)$

Branch Line 3

Loading
#DIV/0!

(Rated Current =A)

Voltage V_{r3}
7.0kV (36%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S10

: Input data in colored cells

Type-3

Maximum Current I_{max}
438.0A

Power factor (cosθ)
0.85

<Trank Line 1>

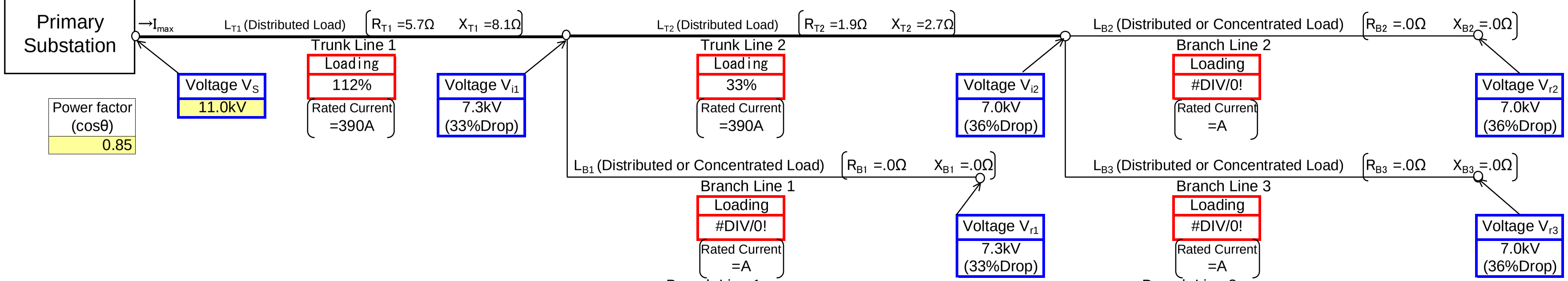
Load L_{T1}	309A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	22.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	5660kVA	

<Trank Line 2>

Load L_{T2}	129A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	7.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2350kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 S
Feeder Name	S10

: Input data in colored cells

Type-3

Maximum Current I_{max}
444.0A

Power factor (cosθ)
0.85

<Trank Line 1>

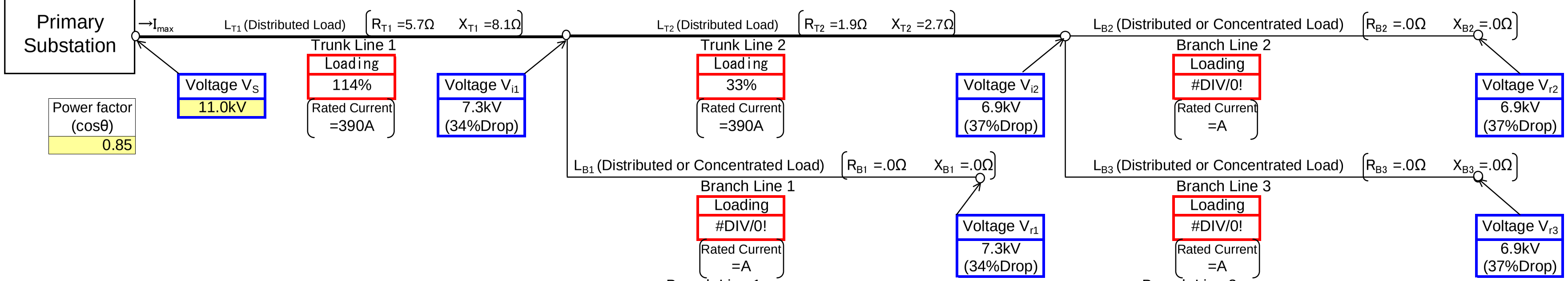
Load L_{T1}	314A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	22.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	5660kVA	

<Trank Line 2>

Load L_{T2}	130A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	7.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2350kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S10

: Input data in colored cells

Type-3

Maximum Current I_{max}
449.0A

Power factor (cosθ)
0.85

<Trank Line 1>

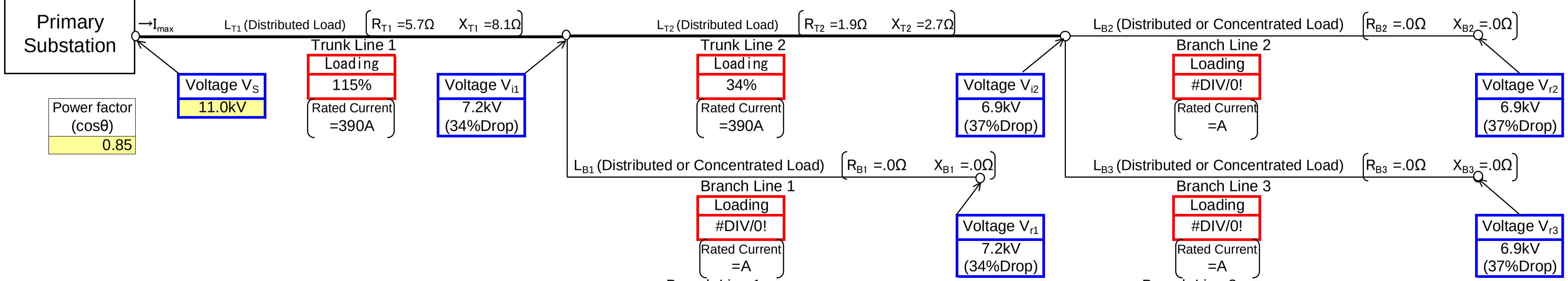
Load L_{T1}	317A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	22.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	5660kVA	

<Trank Line 2>

Load L_{T2}	132A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	7.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2350kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S10

: Input data in colored cells

Type-3

Maximum Current I_{max}
455.0A

<Trank Line 1>

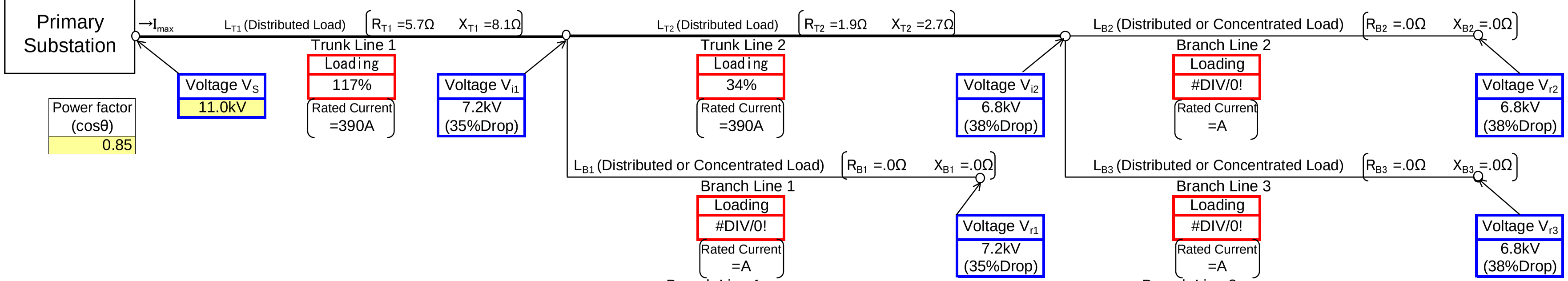
Load L_{T1}	322A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	22.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	5660kVA	

<Trank Line 2>

Load L_{T2}	133A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	7.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2350kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S10

: Input data in colored cells

Type-3

Maximum Current I_{max}
461.0A

<Trank Line 1>

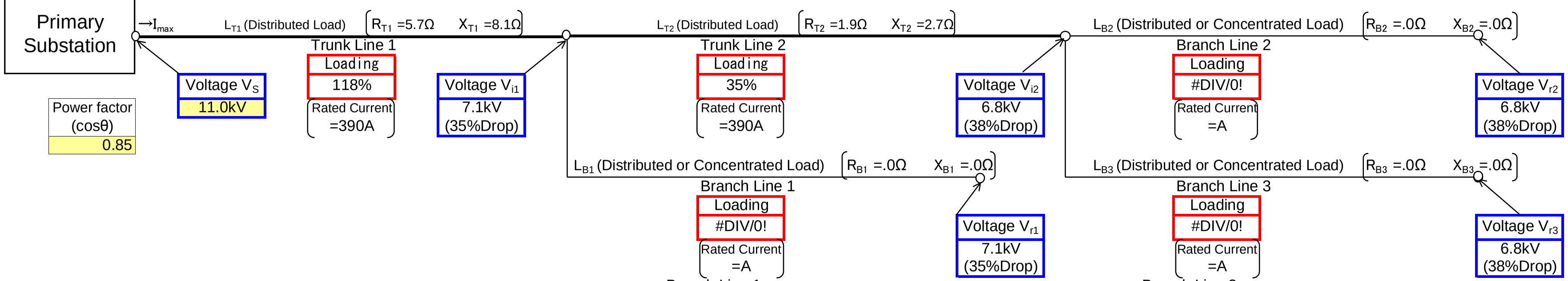
Load L_{T1}	326A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	22.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	5660kVA	

<Trank Line 2>

Load L_{T2}	135A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	7.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2350kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S10

: Input data in colored cells

Type-3

Maximum Current I_{max}
467.0A

Power factor (cosθ)
0.85

<Trank Line 1>

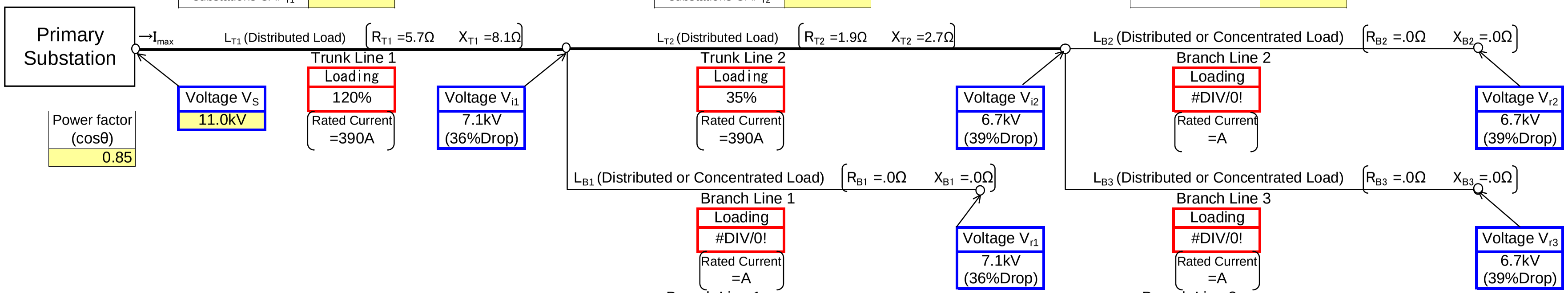
Load L_{T1}	330A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	22.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	5660kVA	

<Trank Line 2>

Load L_{T2}	137A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	7.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2350kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S10

: Input data in colored cells

Type-3

Maximum Current I_{max}	
474.0A	

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	335A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	22.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	5660kVA	

L_{T1} (Distributed Load) (R_{T1} =5.7Ω X_{T1} =8.1Ω)

Trunk Line 1: Loading 122% (Rated Current =390A)

Voltage V_{i1}: 7.0kV (36%Drop)

<Trank Line 2>

Load L_{T2}	139A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	7.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	2350kVA	

L_{T2} (Distributed Load) (R_{T2} =1.9Ω X_{T2} =2.7Ω)

Trunk Line 2: Loading 36% (Rated Current =390A)

Voltage V_{i2}: 6.7kV (39%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0! (Rated Current =A)

Voltage V_{r2}: 6.7kV (39%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0! (Rated Current =A)

Voltage V_{r1}: 7.0kV (36%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0! (Rated Current =A)

Voltage V_{r3}: 6.7kV (39%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S11

: Input data in colored cells

Type-3

Maximum Current I_{max}
165.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	99A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7220kVA	

<Trank Line 2>

Load L_{T2}	66A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	1.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4850kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

→I_{max}

L_{T1} (Distributed Load) [R_{T1} =.5Ω X_{T1} =.7Ω]

Trunk Line 1: Loading 42% (Rated Current =390A)

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.8kV (1%Drop)

L_{T2} (Distributed Load) [R_{T2} =.4Ω X_{T2} =.5Ω]

Trunk Line 2: Loading 17% (Rated Current =390A)

Voltage V_{i2}: 10.8kV (2%Drop)

L_{B2} (Distributed or Concentrated Load) [R_{B2} =.0Ω X_{B2} =.0Ω]

Branch Line 2: Loading #DIV/0! (Rated Current =A)

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) [R_{B1} =.0Ω X_{B1} =.0Ω]

Branch Line 1: Loading #DIV/0! (Rated Current =A)

Voltage V_{r1}: 10.8kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) [R_{B3} =.0Ω X_{B3} =.0Ω]

Branch Line 3: Loading #DIV/0! (Rated Current =A)

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S11

: Input data in colored cells

Type-3

Maximum Current I_{max}
173.0A

Power factor (cosθ)
0.85

<Trank Line 1>

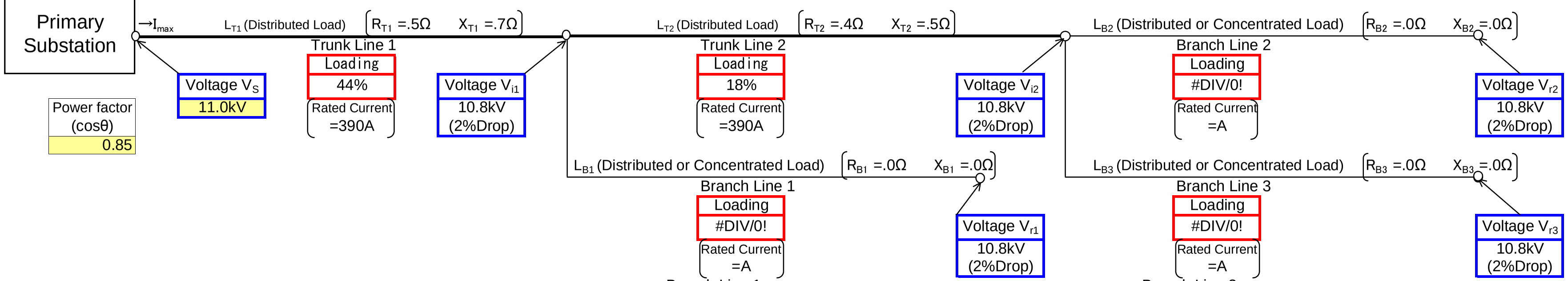
Load L_{T1}	103A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7220kVA	

<Trank Line 2>

Load L_{T2}	70A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	1.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4850kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S11

: Input data in colored cells

Type-3

Maximum Current I_{max}
182.0A

<Trank Line 1>

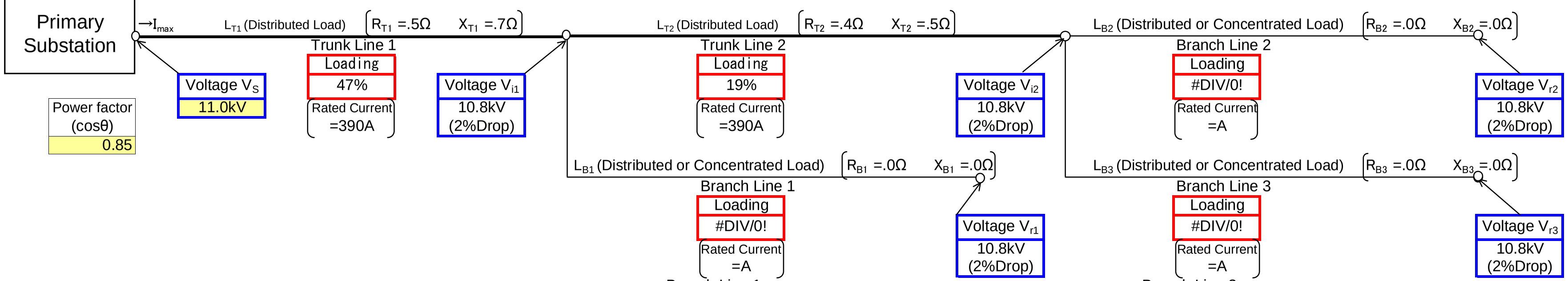
Load L_{T1}	109A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7220kVA	

<Trank Line 2>

Load L_{T2}	73A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	1.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4850kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S11

: Input data in colored cells

Type-3

Maximum Current I_{max}: 191.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	114A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7220kVA	

L_{T1} (Distributed Load) (R_{T1} =.5Ω X_{T1} =.7Ω)

Trunk Line 1: Loading 49% (Rated Current =390A)

Voltage V_{i1}: 10.8kV (2%Drop)

<Trank Line 2>

Load L_{T2}	77A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	1.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4850kVA	

L_{T2} (Distributed Load) (R_{T2} =.4Ω X_{T2} =.5Ω)

Trunk Line 2: Loading 20% (Rated Current =390A)

Voltage V_{i2}: 10.8kV (2%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0! (Rated Current =A)

Voltage V_{r2}: 10.8kV (2%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0! (Rated Current =A)

Voltage V_{r1}: 10.8kV (2%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0! (Rated Current =A)

Voltage V_{r3}: 10.8kV (2%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S11

: Input data in colored cells

Type-3

Maximum Current I_{max}
200.0A

<Trank Line 1>

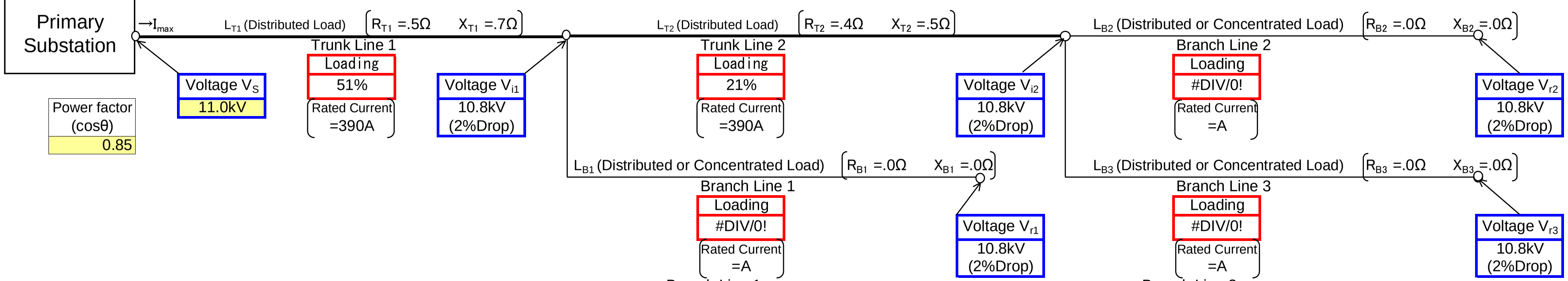
Load L_{T1}	120A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7220kVA	

<Trank Line 2>

Load L_{T2}	80A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	1.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4850kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S11

: Input data in colored cells

Type-3

Maximum Current I_{max}
210.0A

Power factor (cosθ)
0.85

<Trank Line 1>

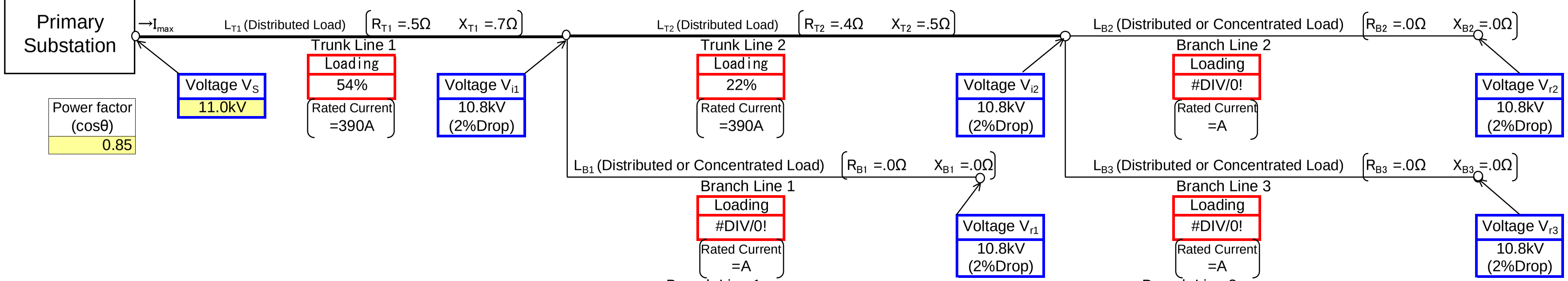
Load L_{T1}	126A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7220kVA	

<Trank Line 2>

Load L_{T2}	84A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	1.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4850kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S11

: Input data in colored cells

Type-3

Maximum Current I_{max}	
220.0A	

Power factor (cosθ)
0.85

<Trank Line 1>

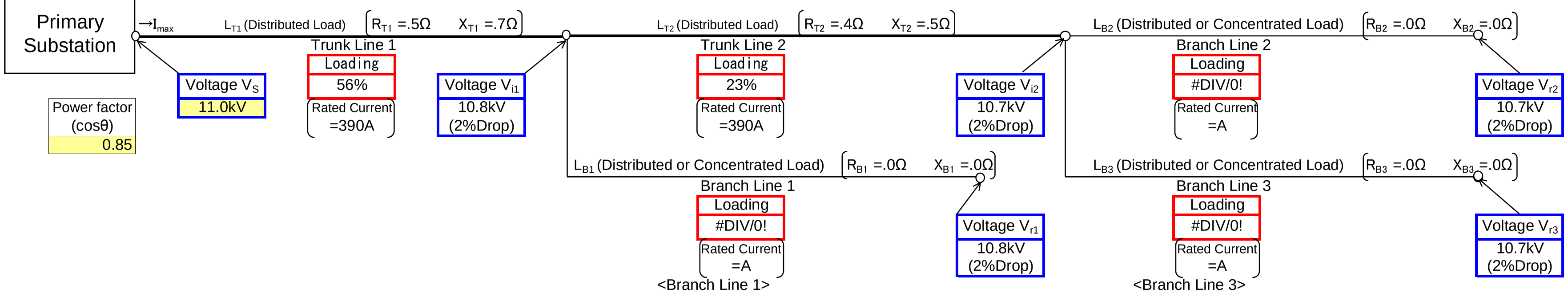
Load L_{T1}	132A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7220kVA	

<Trank Line 2>

Load L_{T2}	88A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	1.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4850kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S11

: Input data in colored cells

Type-3

Maximum Current I_{max}
231.0A

<Trank Line 1>

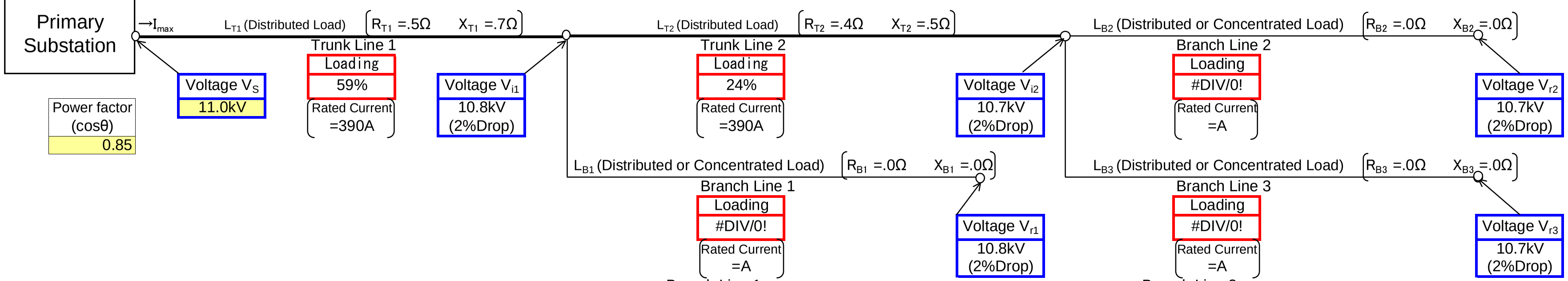
Load L_{T1}	138A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7220kVA	

<Trank Line 2>

Load L_{T2}	93A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	1.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4850kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S11

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	145A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7220kVA	

<Trank Line 2>

Load L_{T2}	97A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	1.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4850kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	242.0A
Power factor (cosθ)	0.85

Primary Substation

$\rightarrow I_{max}$

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) $\{R_{T1}$ =.5Ω X_{T1} =.7Ω$\}$

Trunk Line 1: Loading 62%, Rated Current =390A

Voltage V_{i1}: 10.8kV (2%Drop)

L_{T2} (Distributed Load) $\{R_{T2}$ =.4Ω X_{T2} =.5Ω$\}$

Trunk Line 2: Loading 25%, Rated Current =390A

Voltage V_{i2}: 10.7kV (3%Drop)

L_{B2} (Distributed or Concentrated Load) $\{R_{B2}$ =.0Ω X_{B2} =.0Ω$\}$

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.7kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) $\{R_{B1}$ =.0Ω X_{B1} =.0Ω$\}$

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.8kV (2%Drop)

L_{B3} (Distributed or Concentrated Load) $\{R_{B3}$ =.0Ω X_{B3} =.0Ω$\}$

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.7kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S11

: Input data in colored cells

Type-3

Maximum Current I_{max}
254.0A

Power factor (cosθ)
0.85

<Trank Line 1>

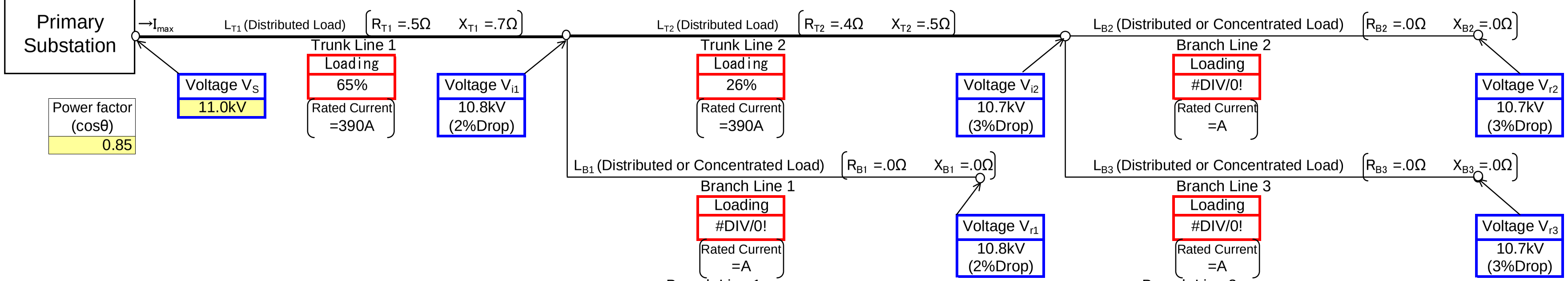
Load L_{T1}	152A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7220kVA	

<Trank Line 2>

Load L_{T2}	102A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	1.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4850kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 S
Feeder Name	S11

: Input data in colored cells

Type-3

Maximum Current I_{max}
266.0A

Power factor (cosθ)
0.85

<Trank Line 1>

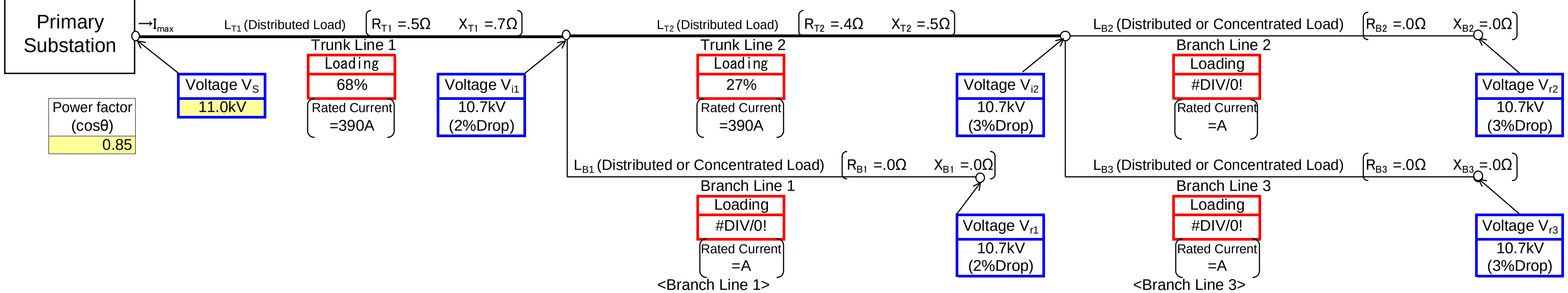
Load L_{T1}	159A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7220kVA	

<Trank Line 2>

Load L_{T2}	107A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	1.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4850kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 S
Feeder Name	S11

: Input data in colored cells

Type-3

Maximum Current I_{max}
279.0A

<Trank Line 1>

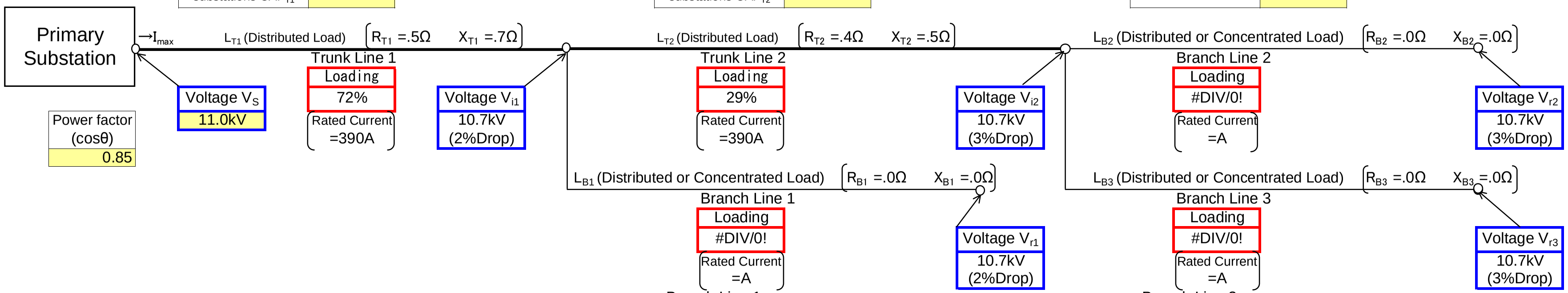
Load L_{T1}	167A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	7220kVA	

<Trank Line 2>

Load L_{T2}	112A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	1.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4850kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	TUBA

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	59A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	9.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1120kVA	

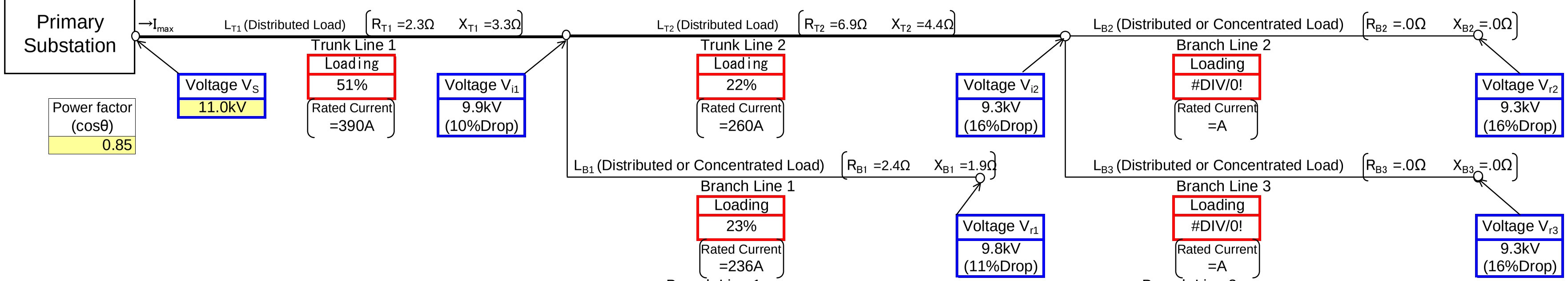
<Trank Line 2>

Load L_{T2}	87A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1660kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	200.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	54A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1030kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 Z
Feeder Name	TUBA

: Input data in colored cells

Type-3

Maximum Current I_{max}
210.0A

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

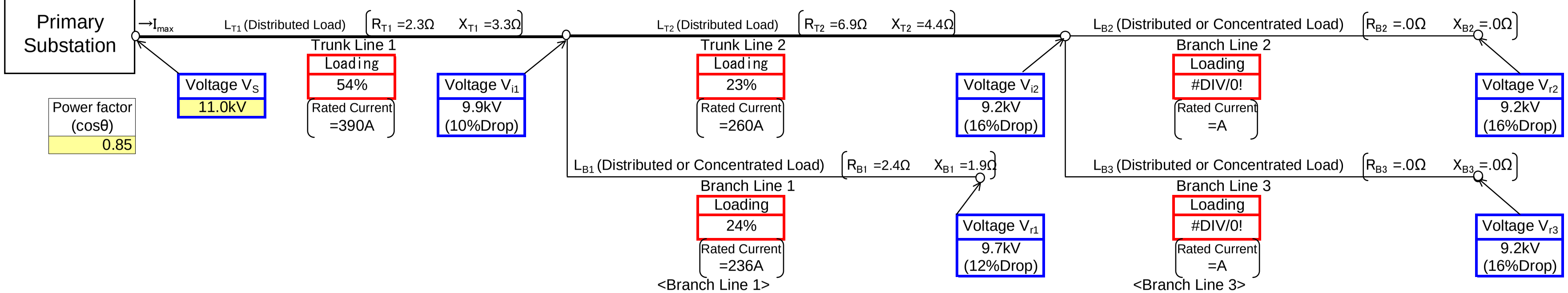
Load L_{T1}	62A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	9.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1120kVA	

<Trank Line 2>

Load L_{T2}	91A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1660kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	57A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1030kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION Z
Feeder Name	TUBA

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	65A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	9.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1120kVA	

<Trank Line 2>

Load L_{T2}	96A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1660kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}
220.0A

Power factor (cosθ)
0.85

Primary Substation $\rightarrow I_{max}$

L_{T1} (Distributed Load) R_{T1} =2.3Ω X_{T1} =3.3Ω

Trunk Line 1: Loading 56%, Rated Current =390A

Voltage V_S: 11.0kV

Voltage V_{i1}: 9.8kV (11%Drop)

L_{T2} (Distributed Load) R_{T2} =6.9Ω X_{T2} =4.4Ω

Trunk Line 2: Loading 25%, Rated Current =260A

Voltage V_{i2}: 9.1kV (17%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 9.1kV (17%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =2.4Ω X_{B1} =1.9Ω

Branch Line 1: Loading 25%, Rated Current =236A

Voltage V_{r1}: 9.6kV (12%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 9.1kV (17%Drop)

<Branch Line 1>

Load L_{B1}	59A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1030kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 Z
Feeder Name	TUBA

: Input data in colored cells

Type-3

Maximum Current I_{max}
231.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_s
11.0kV

<Trank Line 1>

Load L_{T1}	68A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	9.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1120kVA	

L_{T1} (Distributed Load) (R_{T1} =2.3Ω X_{T1} =3.3Ω)

Trunk Line 1

Loading
59%

(Rated Current =390A)

Voltage V_{i1}
9.7kV (11%Drop)

<Trank Line 2>

Load L_{T2}	101A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1660kVA	

L_{T2} (Distributed Load) (R_{T2} =6.9Ω X_{T2} =4.4Ω)

Trunk Line 2

Loading
26%

(Rated Current =260A)

Voltage V_{i2}
9.0kV (18%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2

Loading
#DIV/0!

(Rated Current =A)

Voltage V_{r2}
9.0kV (18%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =2.4Ω X_{B1} =1.9Ω)

Branch Line 1

Loading
26%

(Rated Current =236A)

Voltage V_{r1}
9.6kV (13%Drop)

<Branch Line 1>

Load L_{B1}	62A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1030kVA	

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3

Loading
#DIV/0!

(Rated Current =A)

Voltage V_{r3}
9.0kV (18%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	TUBA

: Input data in colored cells

Type-3

Maximum Current I_{max}	
242.0A	

Power factor (cosθ)	
0.85	

<Trank Line 1>

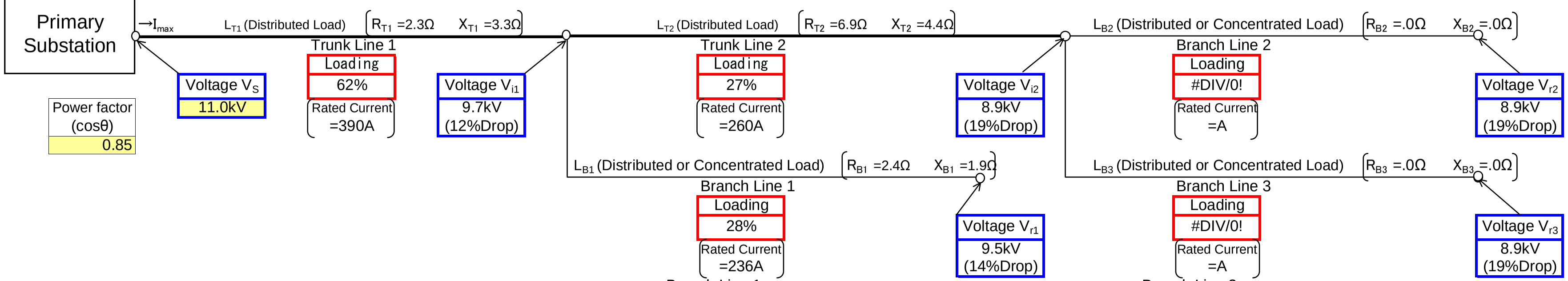
Load L_{T1}	71A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	9.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1120kVA	

<Trank Line 2>

Load L_{T2}	105A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1660kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	65A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1030kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	TUBA

: Input data in colored cells

Type-3

Maximum Current I_{max}	254.0A
Power factor (cosθ)	0.85

<Trank Line 1>

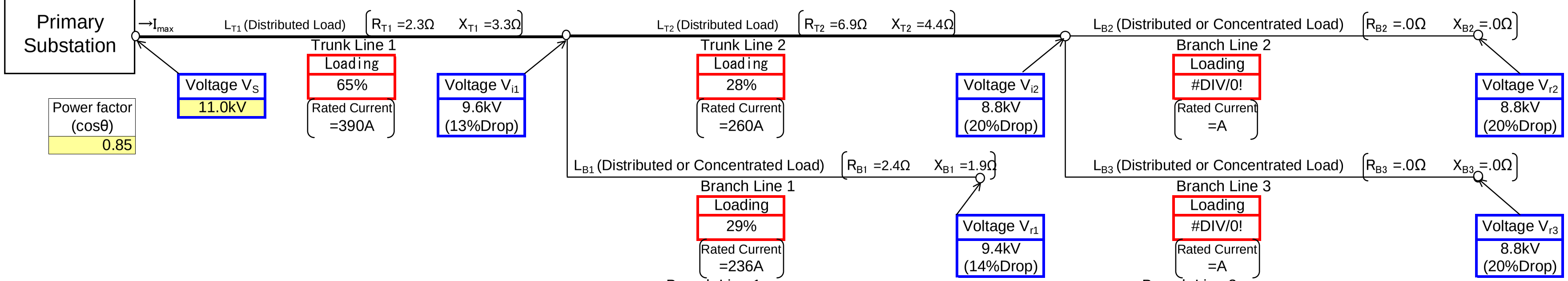
Load L_{T1}	75A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	9.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1120kVA	

<Trank Line 2>

Load L_{T2}	111A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1660kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	69A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1030kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	TUBA

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	78A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	9.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1120kVA	

<Trank Line 2>

Load L_{T2}	116A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1660kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	266.0A
Power factor (cosθ)	0.85

Primary Substation

$\rightarrow I_{max}$

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =2.3Ω X_{T1} =3.3Ω)
Trunk Line 1 — Loading 68% — Rated Current =390A

Voltage V_{i1}: 9.5kV (13%Drop)

L_{T2} (Distributed Load) (R_{T2} =6.9Ω X_{T2} =4.4Ω)
Trunk Line 2 — Loading 30% — Rated Current =260A

Voltage V_{i2}: 8.7kV (21%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)
Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2}: 8.7kV (21%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =2.4Ω X_{B1} =1.9Ω)
Branch Line 1 — Loading 30% — Rated Current =236A

Voltage V_{r1}: 9.4kV (15%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)
Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3}: 8.7kV (21%Drop)

<Branch Line 1>

Load L_{B1}	72A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1030kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
Line Length Len_{B3}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B3}		

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

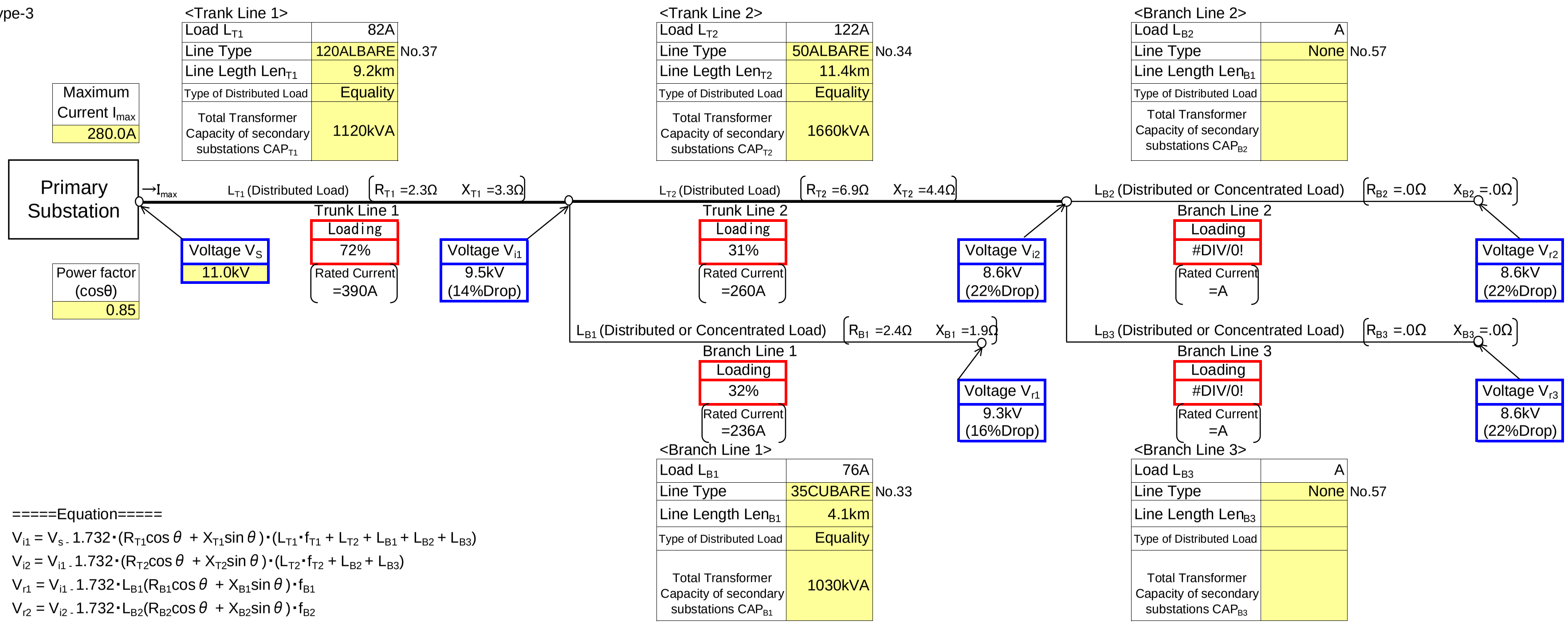
V_s	: Supply Voltage	I_{max}	: Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal 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 Z
Feeder Name	TUBA

: Input data in colored cells

Type-3



=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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 Z
Feeder Name	TUBA

: Input data in colored cells

Type-3

Maximum Current I_{max}
293.0A

Power factor (cosθ)
0.85

<Trank Line 1>

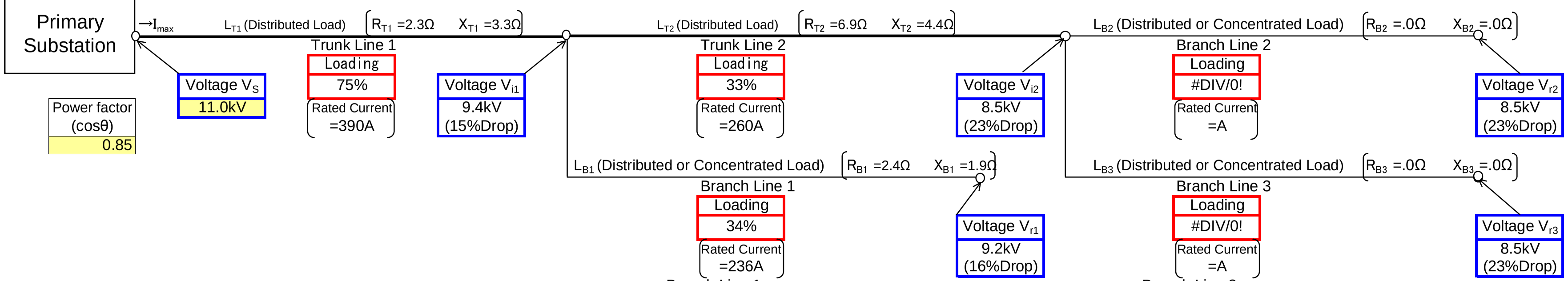
Load L_{T1}	86A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	9.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1120kVA	

<Trank Line 2>

Load L_{T2}	128A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1660kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	79A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1030kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	TUBA

: Input data in colored cells

Type-3

Maximum Current I_{max}	308.0A
Power factor (cosθ)	0.85

<Trank Line 1>

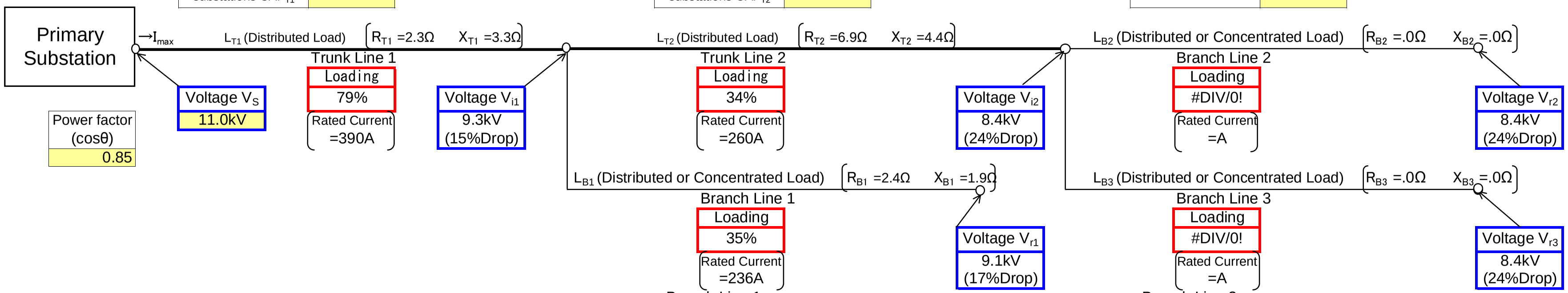
Load L_{T1}	91A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	9.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1120kVA	

<Trank Line 2>

Load L_{T2}	134A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1660kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	83A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1030kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	TUBA

: Input data in colored cells

Type-3

Maximum Current I_{max}: 323.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

<Trank Line 1>

Load L_{T1}	95A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	9.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1120kVA	

<Trank Line 2>

Load L_{T2}	141A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1660kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{T1} (Distributed Load) R_{T1} =2.3Ω X_{T1} =3.3Ω

Trunk Line 1: Loading 83%, Rated Current =390A

Voltage V_S: 11.0kV

Voltage V_{i1}: 9.2kV (16%Drop)

L_{T2} (Distributed Load) R_{T2} =6.9Ω X_{T2} =4.4Ω

Trunk Line 2: Loading 36%, Rated Current =260A

Voltage V_{i2}: 8.2kV (25%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 8.2kV (25%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =2.4Ω X_{B1} =1.9Ω

Branch Line 1: Loading 37%, Rated Current =236A

Voltage V_{r1}: 9.0kV (18%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 8.2kV (25%Drop)

<Branch Line 1>

Load L_{B1}	87A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1030kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 Z
Feeder Name	TUBA

: Input data in colored cells

Type-3

Maximum Current I_{max}: 338.0A

Power factor (cosθ): 0.85

<Trank Line 1>

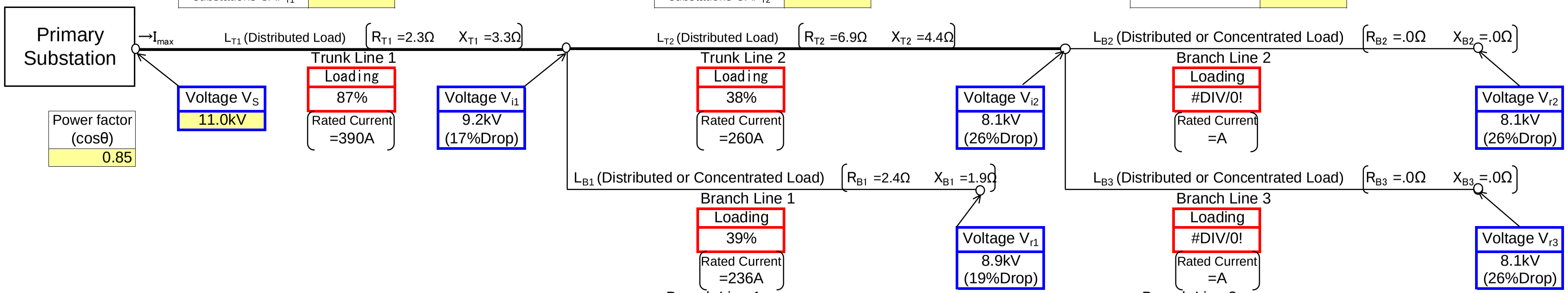
Load L_{T1}	99A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	9.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1120kVA	

<Trank Line 2>

Load L_{T2}	147A	
Line Type	50ALBARE	No.34
Line Legth Len_{T2}	11.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1660kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	91A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	1030kVA	

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V02

: Input data in colored cells

Type-3

Maximum Current I_{max}
277.0A

Primary Substation

Power factor (cosθ)
0.85

Voltage V_S
11.0kV

<Trank Line 1>

Load L_{T1}	277A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	2000kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.2Ω X_{T1} =.2Ω)

Trunk Line 1: Loading 71%, Rated Current =390A

Voltage V_{i1}
11.0kV (0%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}
11.0kV (0%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}
11.0kV (0%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}
11.0kV (0%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}
11.0kV (0%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 V
Feeder Name	V02

: Input data in colored cells

Type-3

Maximum Current I_{max}
291.0A

Power factor (cosθ)
0.85

<Trank Line 1>

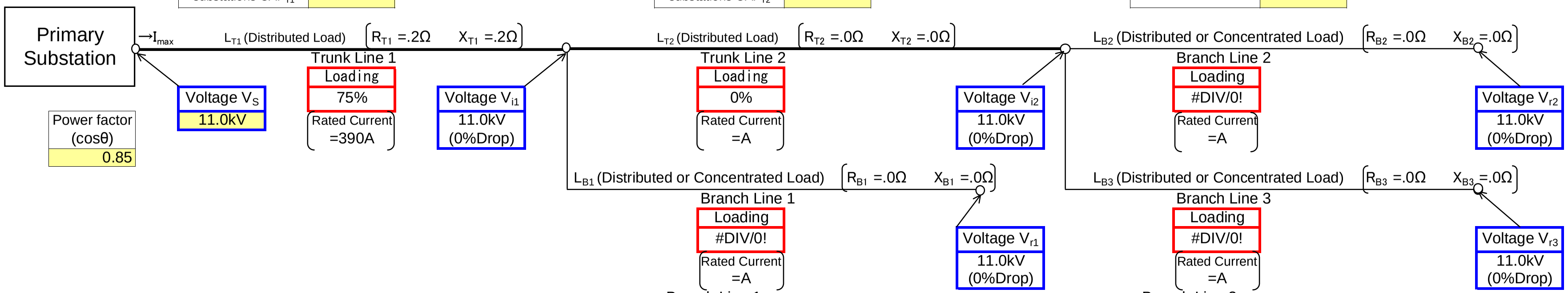
Load L_{T1}	291A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	2000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V02

: Input data in colored cells

Type-3

Maximum Current I_{max}
305.0A

Power factor (cosθ)
0.85

<Trank Line 1>

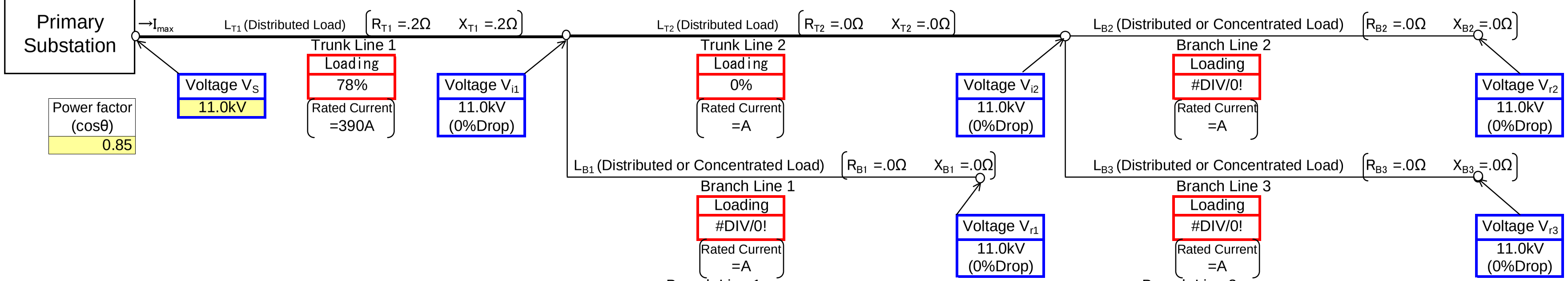
Load L_{T1}	305A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	2000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V02

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	320A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	2000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}
320.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_S 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.2Ω X_{T1} =.2Ω)

Trunk Line 1 — Loading 82% — Rated Current =390A

Voltage V_{i1} 10.9kV (0%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 — Loading 0% — Rated Current =A

Voltage V_{i2} 10.9kV (0%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2} 10.9kV (0%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 — Loading #DIV/0! — Rated Current =A

Voltage V_{r1} 10.9kV (0%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3} 10.9kV (0%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V02

: Input data in colored cells

Type-3

Maximum Current I_{max}
335.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	335A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	2000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.2Ω X_{T1} =.2Ω)

Trunk Line 1: Loading 86%, Rated Current =390A

Voltage V_S 11.0kV

Voltage V_{i1} 10.9kV (0%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2} 10.9kV (0%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2} 10.9kV (0%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1} 10.9kV (0%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3} 10.9kV (0%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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	STATION V
Feeder Name	V02

: Input data in colored cells

Type-3

Maximum Current I_{max}
352.0A

Power factor (cosθ)
0.85

<Trank Line 1>

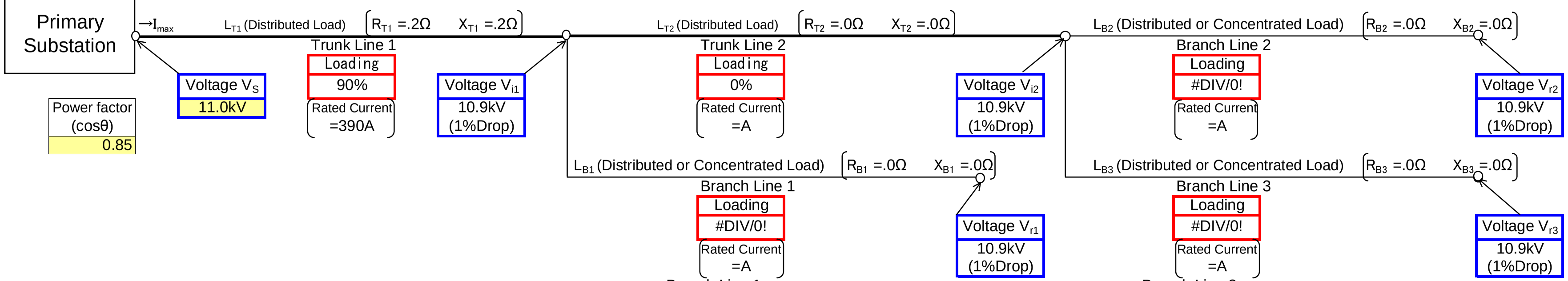
Load L_{T1}	352A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	2000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V02

: Input data in colored cells

Type-3

Maximum Current I_{max}: 369.0A

Power factor (cosθ): 0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	369A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	2000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

$\rightarrow I_{max}$

L_{T1} (Distributed Load) (R_{T1} =.2Ω X_{T1} =.2Ω)

Trunk Line 1: Loading 95%, Rated Current =390A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.9kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$,
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 V
Feeder Name	V02

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	387A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	2000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	387.0A
Power factor (cosθ)	0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.2Ω X_{T1} =.2Ω)
Trunk Line 1 — Loading 99% — Rated Current =390A

Voltage V_{i1}: 10.9kV (1%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)
Trunk Line 2 — Loading 0% — Rated Current =A

Voltage V_{i2}: 10.9kV (1%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)
Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2}: 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)
Branch Line 1 — Loading #DIV/0! — Rated Current =A

Voltage V_{r1}: 10.9kV (1%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)
Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3}: 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V02

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	406A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	2000kVA	

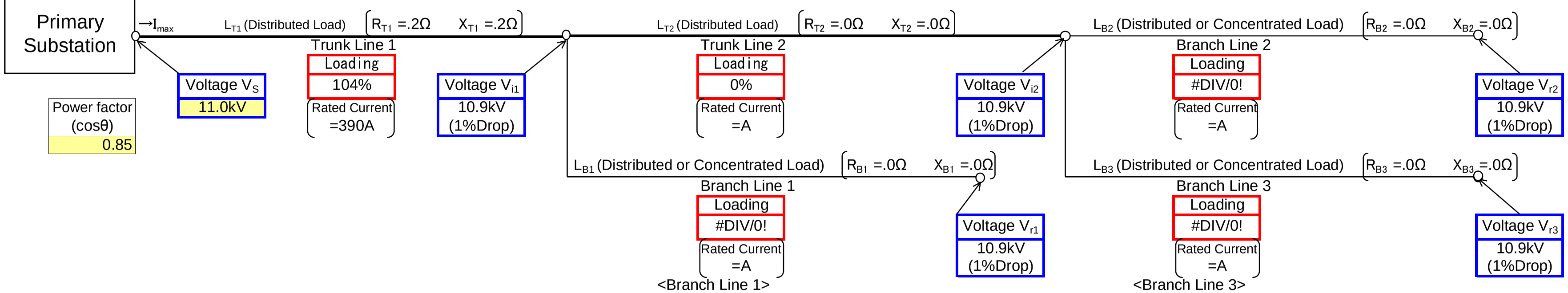
<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	406.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V02

: Input data in colored cells

Type-3

Maximum Current I_{max}
426.0A

Power factor (cosθ)
0.85

<Trank Line 1>

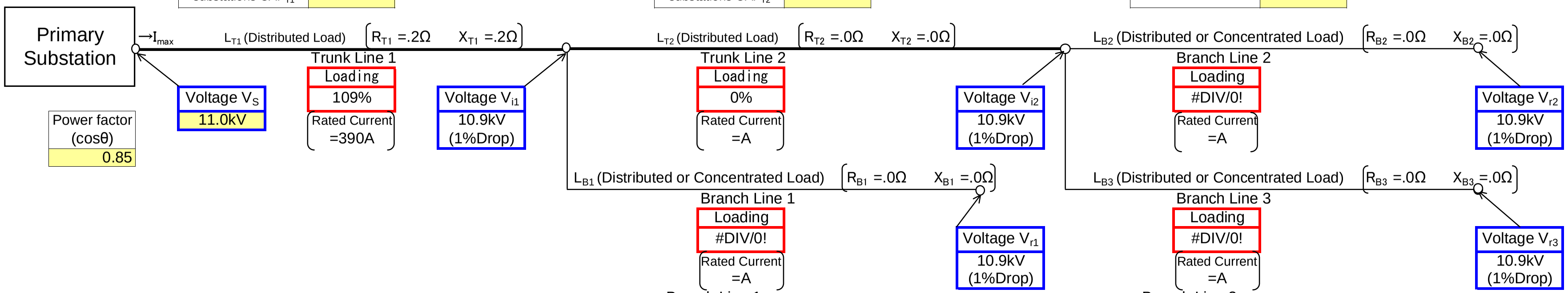
Load L_{T1}	426A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	2000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$,
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 V
Feeder Name	V02

: Input data in colored cells

Type-3

Maximum Current I_{max}
447.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	447A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	2000kVA	

L_{T1} (Distributed Load) (R_{T1} =.2Ω X_{T1} =.2Ω)

Trunk Line 1: Loading 115%, Rated Current =390A

Voltage V_{i1} 10.9kV (1%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2} 10.9kV (1%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2} 10.9kV (1%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1} 10.9kV (1%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3} 10.9kV (1%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V02

: Input data in colored cells

Type-3

Maximum Current I_{max}
469.0A

Power factor (cosθ)
0.85

<Trank Line 1>

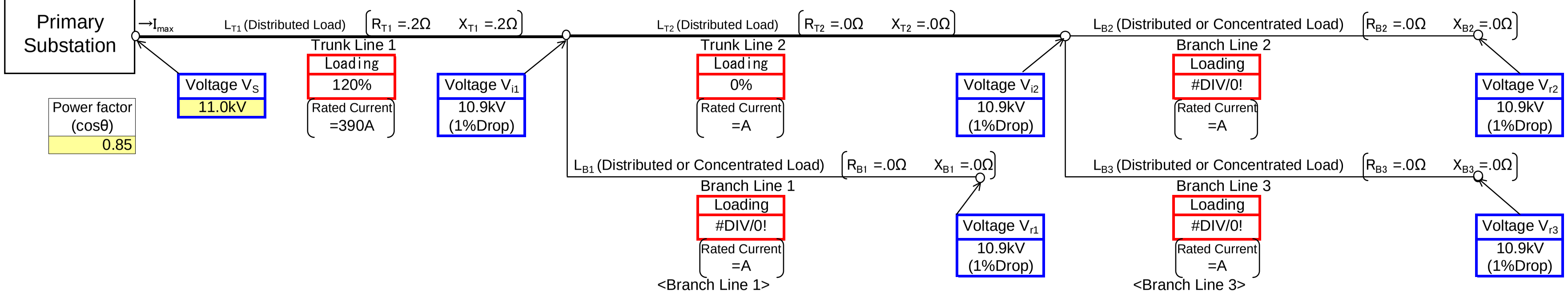
Load L_{T1}	469A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	2000kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V10

: Input data in colored cells

Type-3

Maximum Current I_{max}	453.0A

Power factor (cosθ)	0.85

<Trank Line 1>

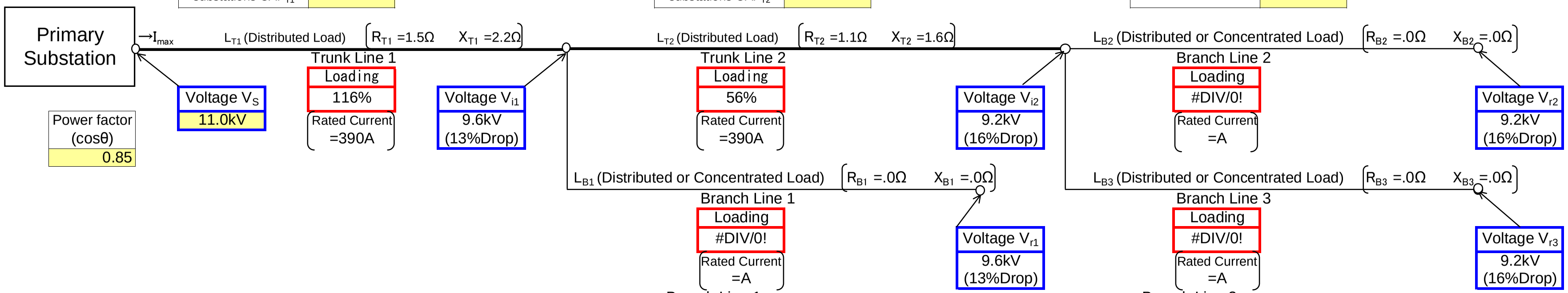
Load L_{T1}	235A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3465kVA	

<Trank Line 2>

Load L_{T2}	218A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3215kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 V
Feeder Name	V10

: Input data in colored cells

Type-3

Maximum Current I_{max}
477.0A

Power factor (cosθ)
0.85

<Trank Line 1>

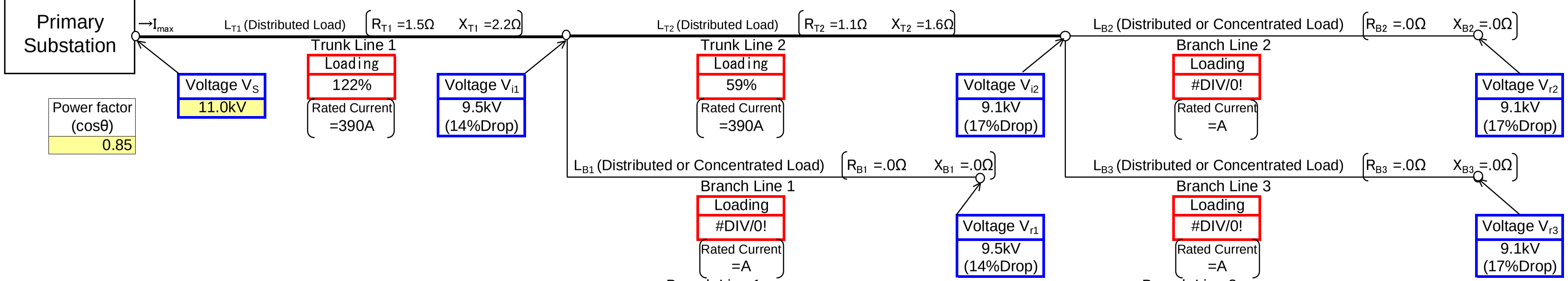
Load L_{T1}	247A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3465kVA	

<Trank Line 2>

Load L_{T2}	230A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3215kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V10

: Input data in colored cells

Type-3

Maximum Current I_{max}: 501.0A

Power factor (cosθ): 0.85

Primary Substation → I_{max}

Voltage V_s: 11.0kV

<Trank Line 1>

Load L_{T1}	260A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3465kVA	

L_{T1} (Distributed Load) (R_{T1} =1.5Ω X_{T1} =2.2Ω)

Trunk Line 1: Loading 128%; Rated Current =390A

Voltage V_{i1}: 9.4kV (14%Drop)

<Trank Line 2>

Load L_{T2}	241A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3215kVA	

L_{T2} (Distributed Load) (R_{T2} =1.1Ω X_{T2} =1.6Ω)

Trunk Line 2: Loading 62%; Rated Current =390A

Voltage V_{i2}: 9.1kV (18%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}: 9.1kV (18%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}: 9.4kV (14%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}: 9.1kV (18%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V10

: Input data in colored cells

Type-3

Maximum Current I_{max}
527.0A

Power factor (cosθ)
0.85

<Trank Line 1>

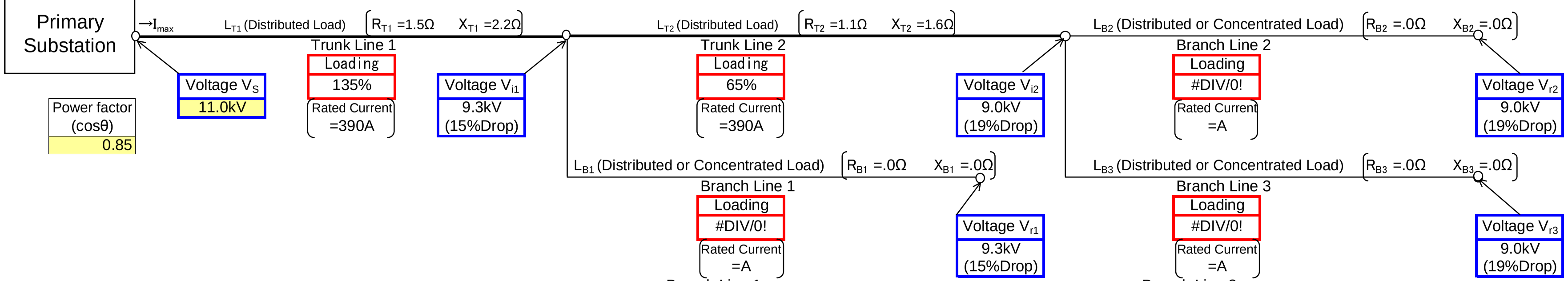
Load L_{T1}	273A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3465kVA	

<Trank Line 2>

Load L_{T2}	254A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3215kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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 V
Feeder Name	V10

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	288A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3465kVA	

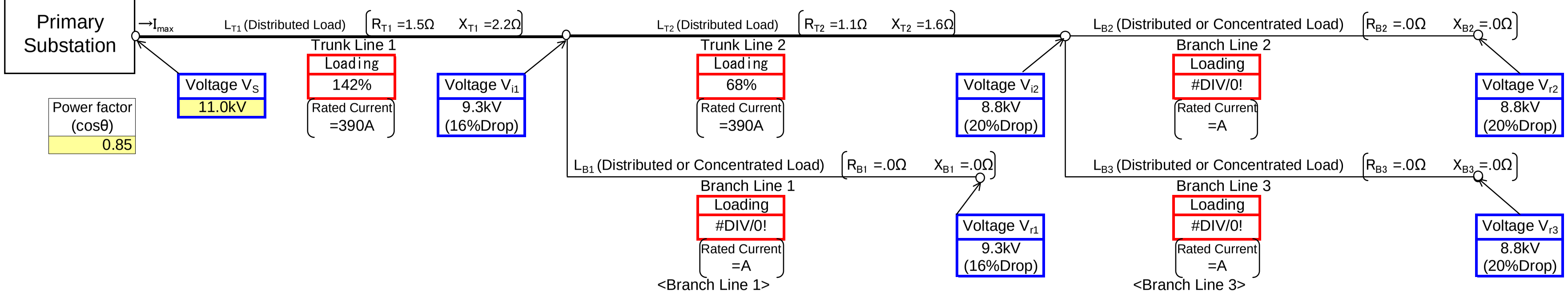
<Trank Line 2>

Load L_{T2}	267A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3215kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	555.0A
Power factor (cosθ)	0.85



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V10

: Input data in colored cells

Type-3

Maximum Current I_{max}
584.0A

Power factor (cosθ)
0.85

<Trank Line 1>

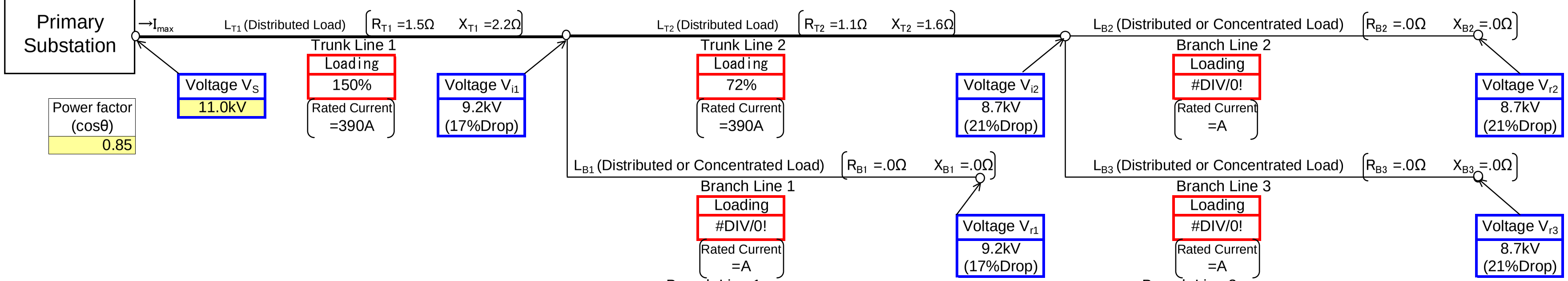
Load L_{T1}	303A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3465kVA	

<Trank Line 2>

Load L_{T2}	281A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3215kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V10

: Input data in colored cells

Type-3

Maximum Current I_{max}	614.0A
Power factor (cosθ)	0.85

Primary Substation →I_{max}

Voltage V_S
11.0kV

<Trank Line 1>

Load L_{T1}	318A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3465kVA	

L_{T1} (Distributed Load) (R_{T1} =1.5Ω X_{T1} =2.2Ω)

Trunk Line 1: Loading 157%; Rated Current =390A

Voltage V_{i1}
9.1kV (18%Drop)

<Trank Line 2>

Load L_{T2}	296A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3215kVA	

L_{T2} (Distributed Load) (R_{T2} =1.1Ω X_{T2} =1.6Ω)

Trunk Line 2: Loading 76%; Rated Current =390A

Voltage V_{i2}
8.6kV (22%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!; Rated Current =A

Voltage V_{r1}
9.1kV (18%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!; Rated Current =A

Voltage V_{r2}
8.6kV (22%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!; Rated Current =A

Voltage V_{r3}
8.6kV (22%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 V
Feeder Name	V10

: Input data in colored cells

Type-3

Maximum Current I_{max}: 646.0A

Power factor (cosθ): 0.85

<Trank Line 1>

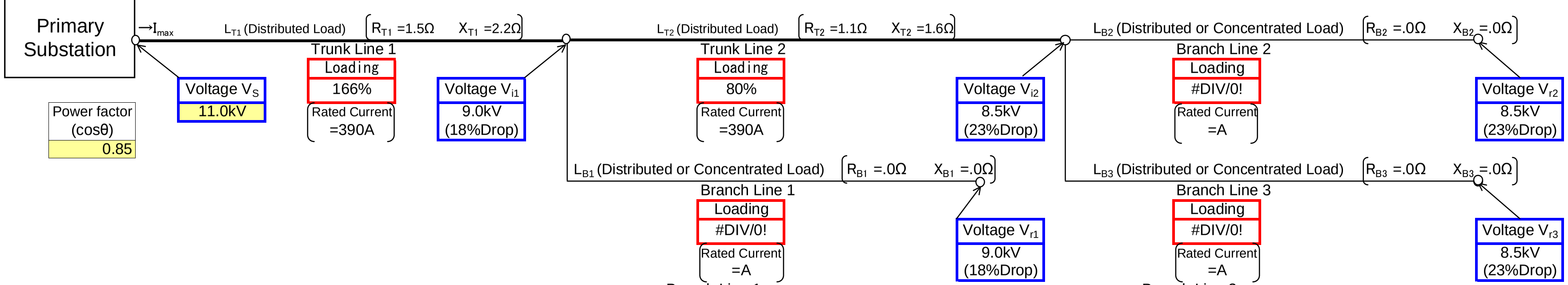
Load L_{T1}	335A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3465kVA	

<Trank Line 2>

Load L_{T2}	311A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3215kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V10

: Input data in colored cells

Type-3

Maximum Current I_{max}
679.0A

Power factor (cosθ)
0.85

<Trank Line 1>

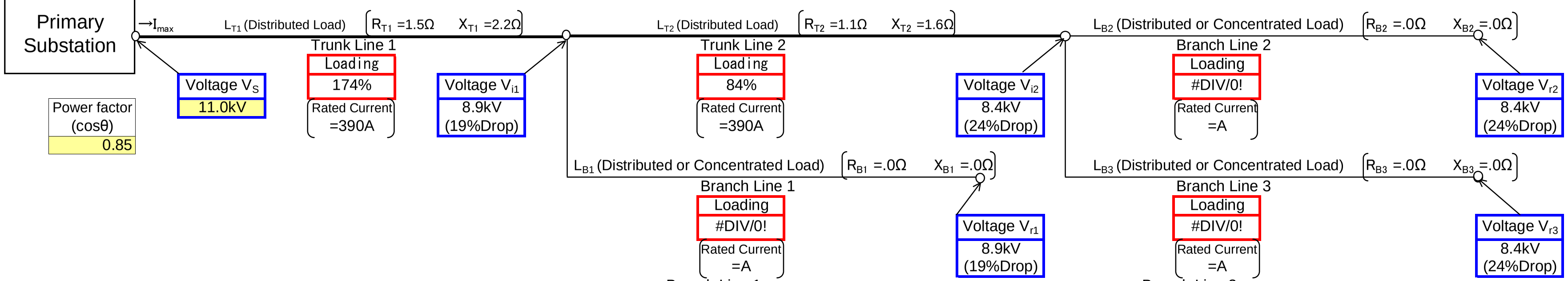
Load L_{T1}	352A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3465kVA	

<Trank Line 2>

Load L_{T2}	327A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3215kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V10

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	371A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3465kVA	

<Trank Line 2>

Load L_{T2}	344A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3215kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}
715.0A

Primary Substation

Power factor (cosθ)
0.85

$\rightarrow I_{max}$

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =1.5Ω X_{T1} =2.2Ω)

Trunk Line 1: Loading 183%, Rated Current =390A

Voltage V_{i1}: 8.7kV (20%Drop)

L_{T2} (Distributed Load) (R_{T2} =1.1Ω X_{T2} =1.6Ω)

Trunk Line 2: Loading 88%, Rated Current =390A

Voltage V_{i2}: 8.2kV (25%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 8.2kV (25%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 8.7kV (20%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 8.2kV (25%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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 V
Feeder Name	V10

: Input data in colored cells

Type-3

Maximum Current I_{max}: 752.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_s: 11.0kV

<Trank Line 1>

Load L_{T1}	390A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3465kVA	

L_{T1} (Distributed Load) (R_{T1} =1.5Ω X_{T1} =2.2Ω)

Trunk Line 1: Loading 193% (Rated Current =390A)

Voltage V_{i1}: 8.6kV (22%Drop)

<Trank Line 2>

Load L_{T2}	362A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3215kVA	

L_{T2} (Distributed Load) (R_{T2} =1.1Ω X_{T2} =1.6Ω)

Trunk Line 2: Loading 93% (Rated Current =390A)

Voltage V_{i2}: 8.1kV (27%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0! (Rated Current =A)

Voltage V_{r1}: 8.6kV (22%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
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.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0! (Rated Current =A)

Voltage V_{r2}: 8.1kV (27%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0! (Rated Current =A)

Voltage V_{r3}: 8.1kV (27%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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 V
Feeder Name	V10

: Input data in colored cells

Type-3

Maximum Current I_{max}: 791.0A

Power factor ($\cos\theta$): 0.85

<Trank Line 1>

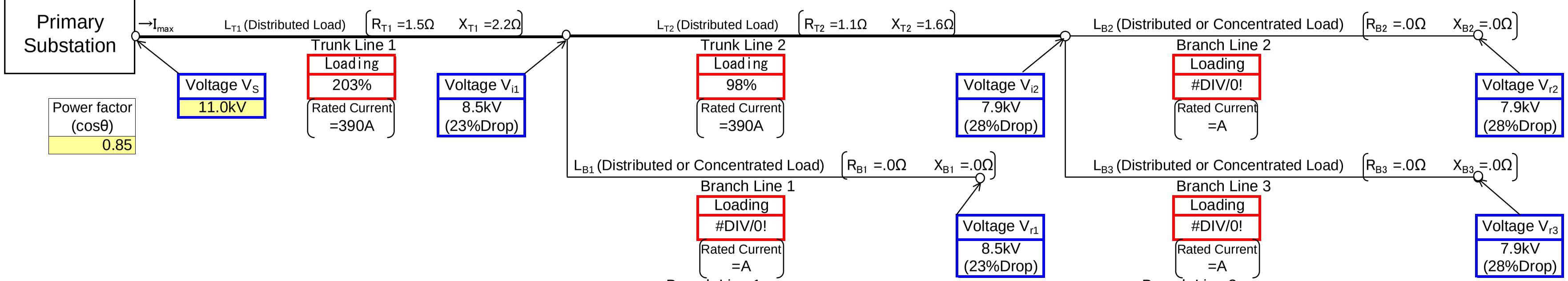
Load L_{T1}	410A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	6.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3465kVA	

<Trank Line 2>

Load L_{T2}	381A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3215kVA	

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$,
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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
Feeder Name	V11

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	262A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4015kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max} 262.0A

Power factor (cosθ) 0.85

Primary Substation →I_{max}

Voltage V_S 11.0kV

L_{T1} (Distributed Load) (R_{T1} =1.0Ω X_{T1} =1.4Ω)
Trunk Line 1 — Loading 67% — Rated Current =390A

Voltage V_{i1} 10.6kV (3%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)
Trunk Line 2 — Loading 0% — Rated Current =A

Voltage V_{i2} 10.6kV (3%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)
Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2} 10.6kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)
Branch Line 1 — Loading #DIV/0! — Rated Current =A

Voltage V_{r1} 10.6kV (3%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)
Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3} 10.6kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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
Feeder Name	V11

: Input data in colored cells

Type-3

Maximum Current I_{max}	275.0A

Primary Substation

Power factor (cosθ)	0.85

<Trank Line 1>

Load L_{T1}	275A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4015kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

→I_{max}

L_{T1} (Distributed Load) (R_{T1} =1.0Ω X_{T1} =1.4Ω)

Trunk Line 1: Loading 71%, Rated Current =390A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.6kV (3%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.6kV (3%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.6kV (3%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.6kV (3%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.6kV (3%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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
Feeder Name	V11

: Input data in colored cells

Type-3

Maximum Current I_{max}
288.0A

Power factor (cosθ)
0.85

<Trank Line 1>

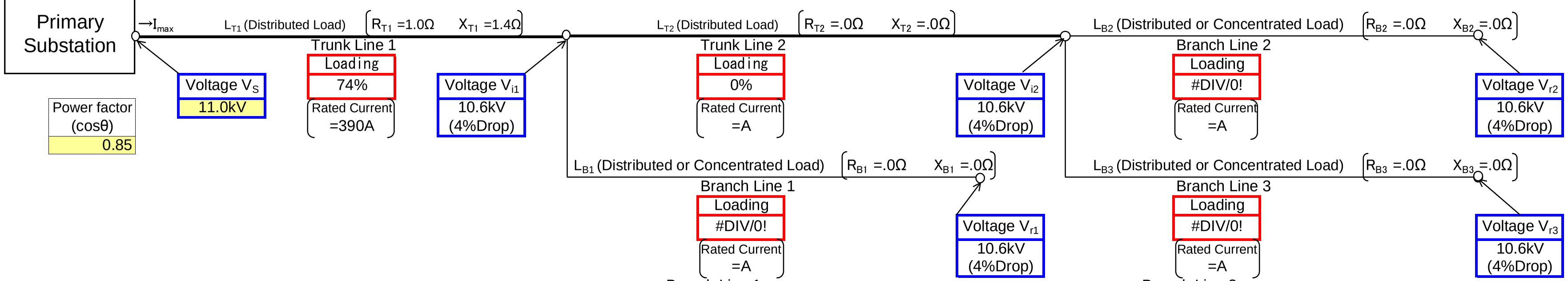
Load L_{T1}	288A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4015kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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
Feeder Name	V11

: Input data in colored cells

Type-3

Maximum Current I_{max}	302.0A
Power factor (cosθ)	0.85

<Trank Line 1>

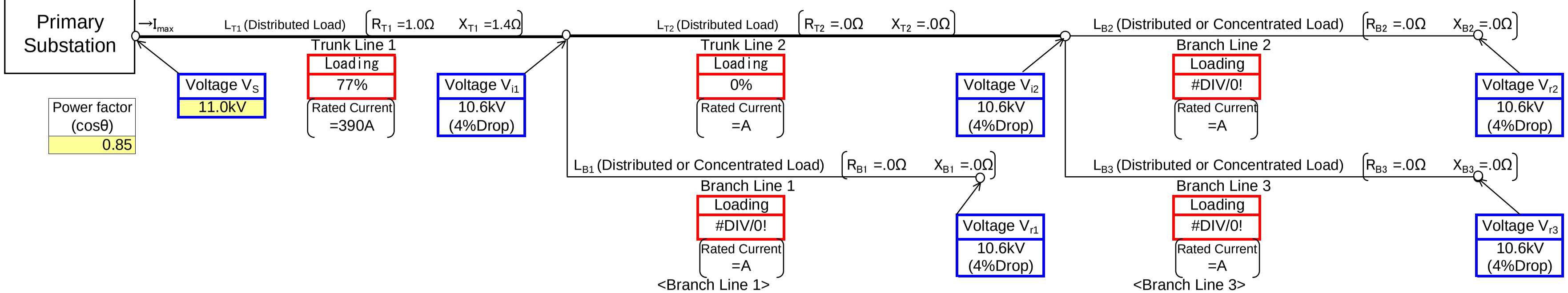
Load L_{T1}	302A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4015kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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
Feeder Name	V11

: Input data in colored cells

Type-3

Maximum Current I_{max}
317.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	317A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4015kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation

$\rightarrow I_{max}$

L_{T1} (Distributed Load) (R_{T1} =1.0Ω X_{T1} =1.4Ω)

Trunk Line 1: Loading 81% (Rated Current =390A)

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.6kV (4%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0% (Rated Current =A)

Voltage V_{i2}: 10.6kV (4%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2: Loading #DIV/0! (Rated Current =A)

Voltage V_{r2}: 10.6kV (4%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1: Loading #DIV/0! (Rated Current =A)

Voltage V_{r1}: 10.6kV (4%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3: Loading #DIV/0! (Rated Current =A)

Voltage V_{r3}: 10.6kV (4%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
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
Feeder Name	V11

: Input data in colored cells

Type-3

Maximum Current I_{max}
333.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	333A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4015kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Primary Substation →I_{max}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =1.0Ω X_{T1} =1.4Ω)

Trunk Line 1 — Loading 85% — Rated Current =390A

Voltage V_{i1}: 10.5kV (4%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 — Loading 0% — Rated Current =A

Voltage V_{i2}: 10.5kV (4%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2}: 10.5kV (4%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 — Loading #DIV/0! — Rated Current =A

Voltage V_{r1}: 10.5kV (4%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3}: 10.5kV (4%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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
Feeder Name	V11

: Input data in colored cells

Type-3

Maximum Current I_{max}	349.0A

<Trank Line 1>

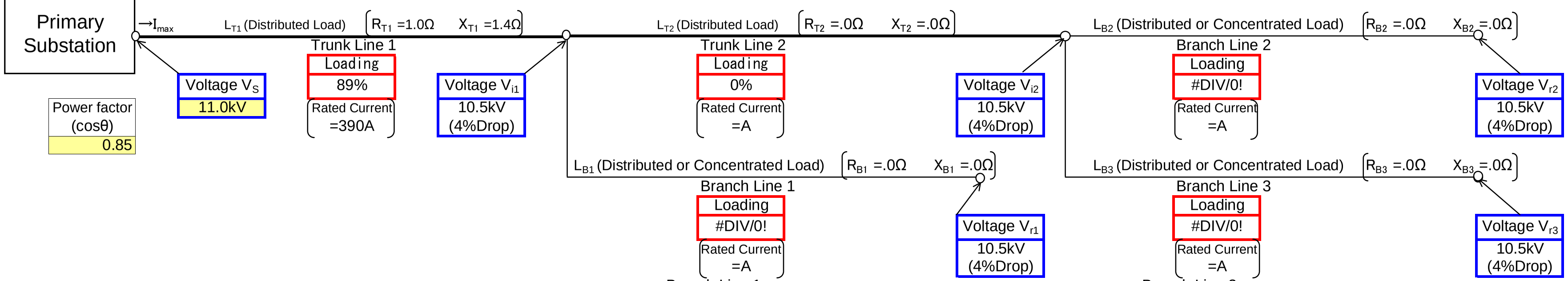
Load L_{T1}	349A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4015kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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
Feeder Name	V11

: Input data in colored cells

Type-3

Maximum Current I_{max}
366.0A

Power factor (cosθ)
0.85

Primary Substation

$\rightarrow I_{max}$

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	366A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4015kVA	

L_{T1} (Distributed Load) (R_{T1} =1.0Ω X_{T1} =1.4Ω)

Trunk Line 1 — Loading: 94% — (Rated Current =390A)

Voltage V_{i1}: 10.5kV (5%Drop)

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2 — Loading: 0% — (Rated Current =A)

Voltage V_{i2}: 10.5kV (5%Drop)

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)

Branch Line 2 — Loading: #DIV/0! — (Rated Current =A)

Voltage V_{r2}: 10.5kV (5%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)

Branch Line 1 — Loading: #DIV/0! — (Rated Current =A)

Voltage V_{r1}: 10.5kV (5%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)

Branch Line 3 — Loading: #DIV/0! — (Rated Current =A)

Voltage V_{r3}: 10.5kV (5%Drop)

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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
Feeder Name	V11

: Input data in colored cells

Type-3

Maximum Current I_{max}
384.0A

Primary Substation

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

Load L_{T1}	384A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4015kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

$\rightarrow I_{max}$

L_{T1} (Distributed Load) R_{T1} =1.0Ω X_{T1} =1.4Ω

Trunk Line 1: Loading 98%, Rated Current =390A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.5kV (5%Drop)

L_{T2} (Distributed Load) R_{T2} =.0Ω X_{T2} =.0Ω

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.5kV (5%Drop)

L_{B2} (Distributed or Concentrated Load) R_{B2} =.0Ω X_{B2} =.0Ω

Branch Line 2: Loading #DIV/0!, Rated Current =A

Voltage V_{r2}: 10.5kV (5%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =.0Ω X_{B1} =.0Ω

Branch Line 1: Loading #DIV/0!, Rated Current =A

Voltage V_{r1}: 10.5kV (5%Drop)

L_{B3} (Distributed or Concentrated Load) R_{B3} =.0Ω X_{B3} =.0Ω

Branch Line 3: Loading #DIV/0!, Rated Current =A

Voltage V_{r3}: 10.5kV (5%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3} : Total Transformer Capacity of secondary substations
V_{r3} : Received Voltage	L_{B3} : Load (Branch Line 3)	$\cos\theta$: Power Factor

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

Substation Name	STATION
Feeder Name	V11

: Input data in colored cells

Type-3

Maximum Current I_{max}
403.0A

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

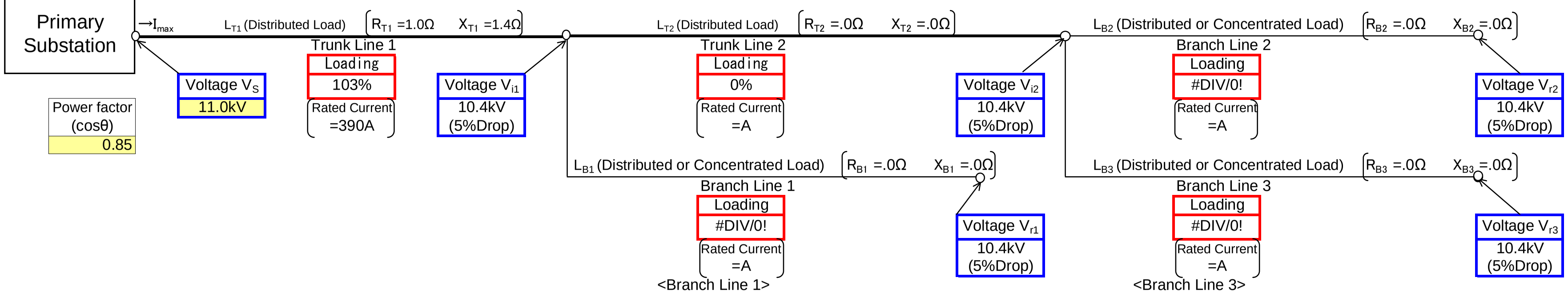
Load L_{T1}	403A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4015kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION
Feeder Name	V11

: Input data in colored cells

Type-3

Maximum Current I_{max}
423.0A

Power factor (cosθ)
0.85

<Trank Line 1>

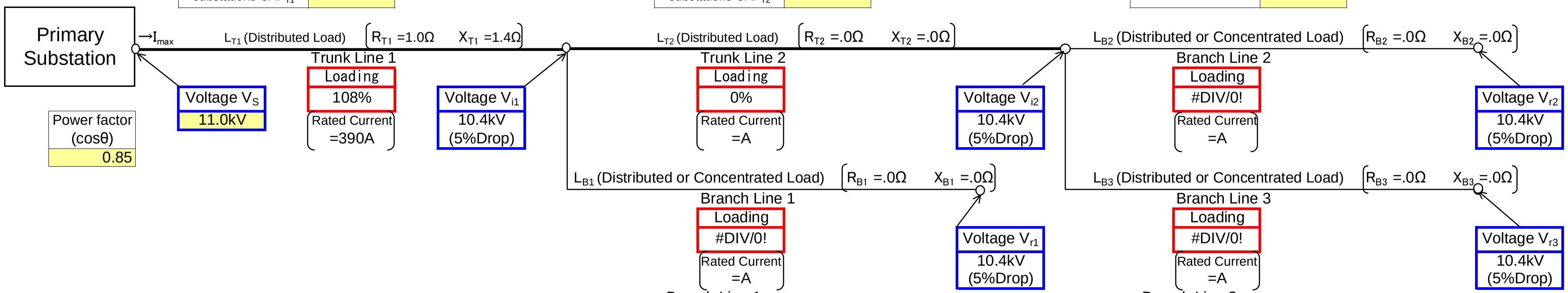
Load L_{T1}	423A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4015kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		



<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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
Feeder Name	V11

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	443A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4015kVA	

<Trank Line 2>

Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<Branch Line 2>

Load L_{B2}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B2}		

Maximum Current I_{max}	443.0A
Power factor (cosθ)	0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =1.0Ω X_{T1} =1.4Ω)
Trunk Line 1 — Loading 114% — Rated Current =390A

Voltage V_{i1}: 10.4kV (6%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)
Trunk Line 2 — Loading 0% — Rated Current =A

Voltage V_{i2}: 10.4kV (6%Drop)

L_{B2} (Distributed or Concentrated Load) (R_{B2} =.0Ω X_{B2} =.0Ω)
Branch Line 2 — Loading #DIV/0! — Rated Current =A

Voltage V_{r2}: 10.4kV (6%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =.0Ω X_{B1} =.0Ω)
Branch Line 1 — Loading #DIV/0! — Rated Current =A

Voltage V_{r1}: 10.4kV (6%Drop)

L_{B3} (Distributed or Concentrated Load) (R_{B3} =.0Ω X_{B3} =.0Ω)
Branch Line 3 — Loading #DIV/0! — Rated Current =A

Voltage V_{r3}: 10.4kV (6%Drop)

<Branch Line 1>

Load L_{B1}	A	
Line Type	None	No.57
Line Length Len_{B1}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{B1}		

<Branch Line 3>

Load L_{B3}	A	
Line Type	None	No.57
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	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