電　力　系　統　分　析　結　果

（内容はCD内pdfファイルを参照）

Power System Analysis

- Accra West -

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

Substation Name	STATION A
Feeder Name	A120

: Input data in colored cells

Type-3

Maximum Current I_{max}
474.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	474A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4215kVA	

<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 141%, Rated Current =335A

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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

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

Substation Name	STATION A
Feeder Name	A120

: Input data in colored cells

Type-3

Maximum Current I_{max}	501.0A

Power factor (cosθ)	0.85

<Trank Line 1>

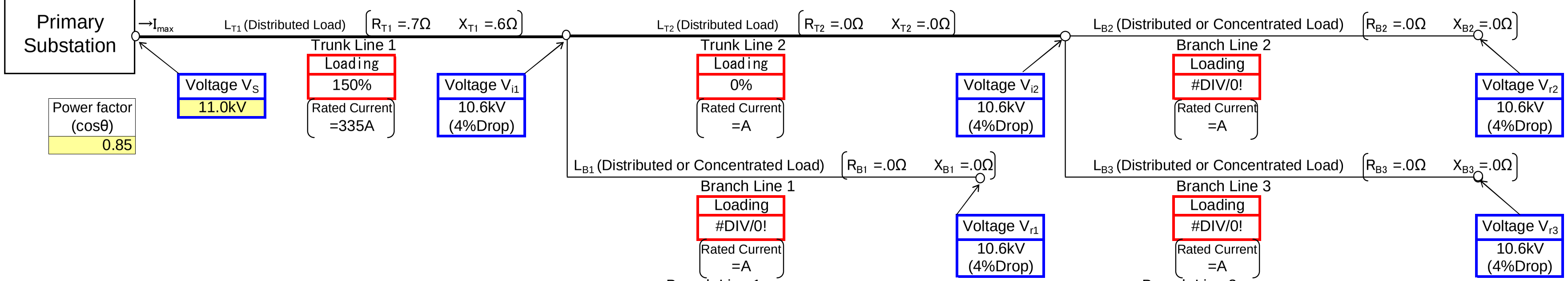
Load L_{T1}	501A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4215kVA	

<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 A
Feeder Name	A120

: Input data in colored cells

Type-3

Maximum Current I_{max}
530.0A

Power factor (cosθ)
0.85

<Trank Line 1>

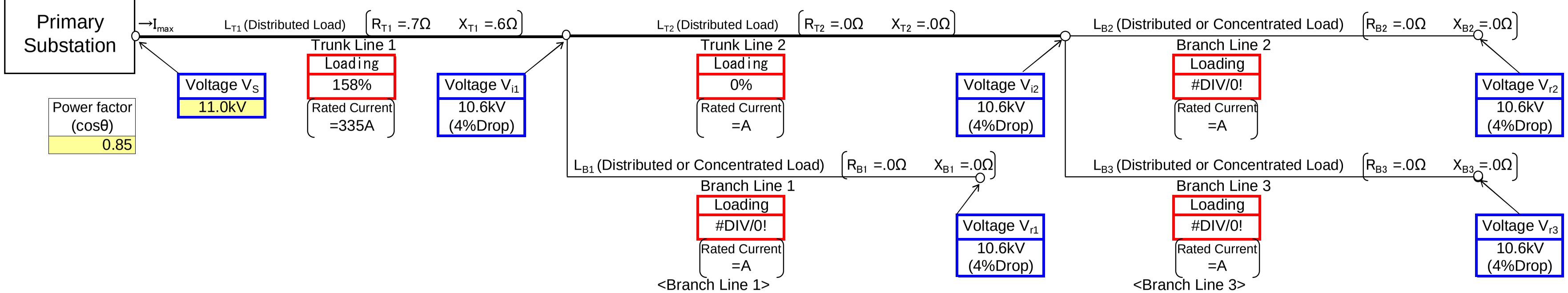
Load L_{T1}	530A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4215kVA	

<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 A
Feeder Name	A120

: Input data in colored cells

Type-3

Maximum Current I_{max}
560.0A

Power factor (cosθ)
0.85

<Trank Line 1>

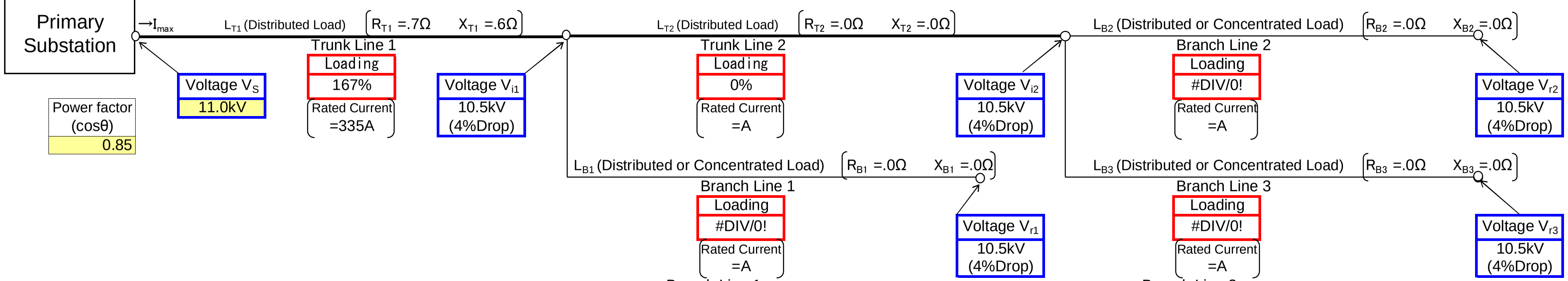
Load L_{T1}	560A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4215kVA	

<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 A
Feeder Name	A120

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	592A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4215kVA	

<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}: 592.0A

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: 177% — Rated Current =335A

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 A
Feeder Name	A120

: Input data in colored cells

Type-3

Maximum Current I_{max}
626.0A

Power factor (cosθ)
0.85

<Trank Line 1>

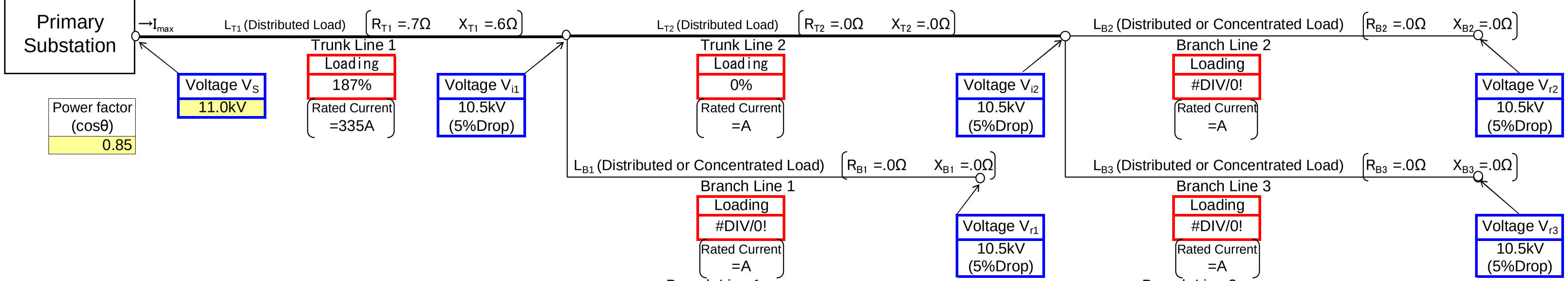
Load L_{T1}	626A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4215kVA	

<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 A
Feeder Name	A120

: Input data in colored cells

Type-3

Maximum Current I_{max}
662.0A

Power factor (cosθ)
0.85

<Trank Line 1>

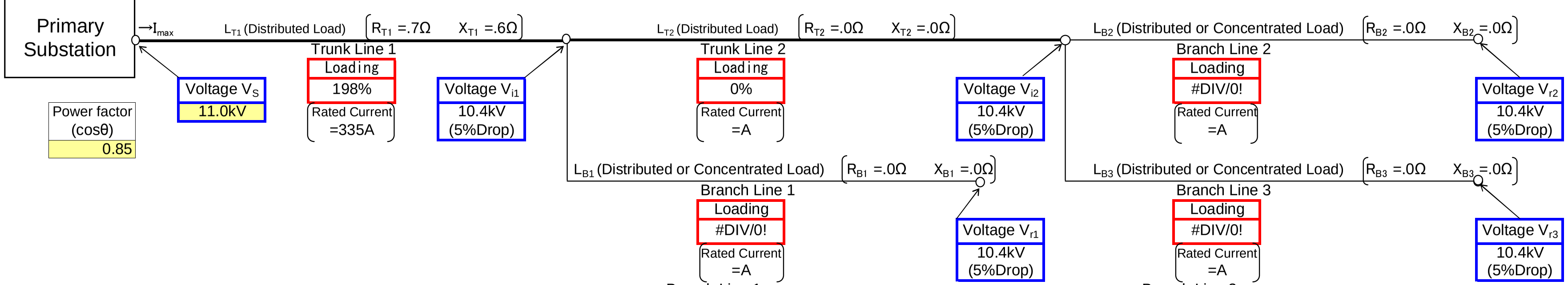
Load L_{T1}	662A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4215kVA	

<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 A
Feeder Name	A120

: Input data in colored cells

Type-3

Maximum Current I_{max}
700.0A

Power factor (cosθ)
0.85

<Trank Line 1>

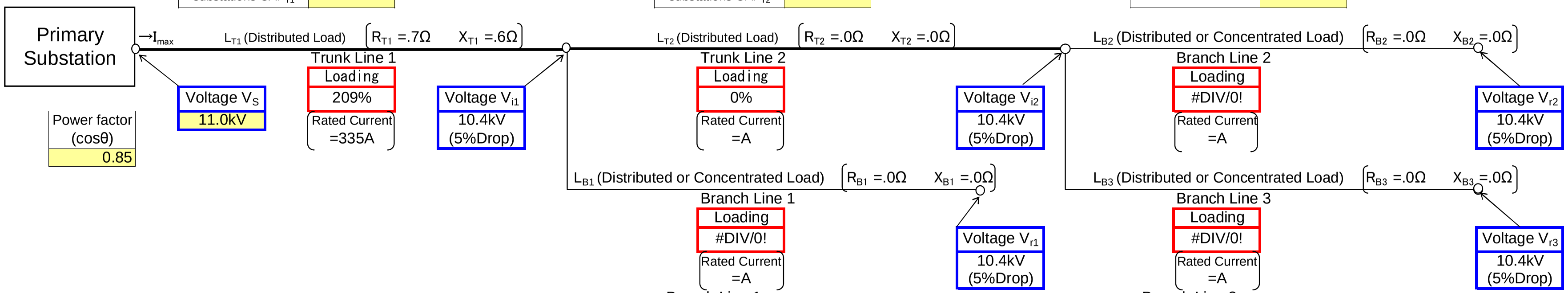
Load L_{T1}	700A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4215kVA	

<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 A
Feeder Name	A120

: Input data in colored cells

Type-3

Maximum Current I_{max}	741.0A

Power factor (cosθ)	0.85

<Trank Line 1>

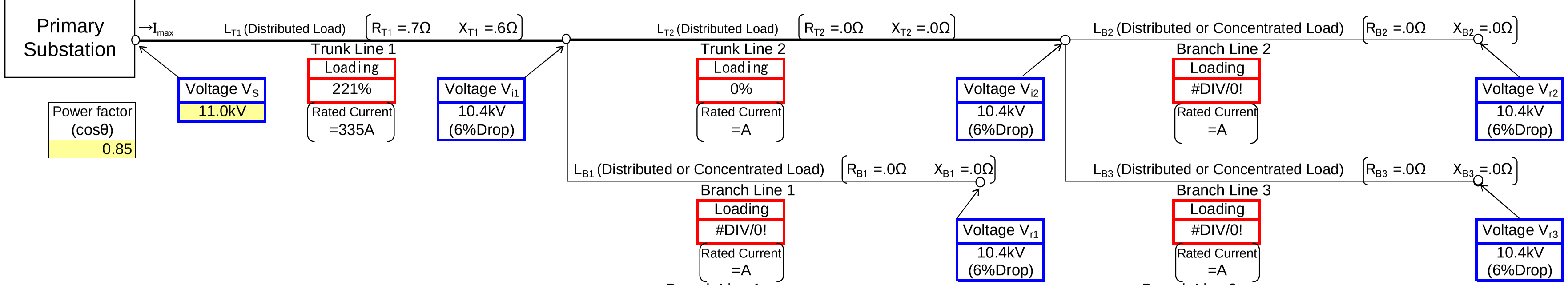
Load L_{T1}	741A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4215kVA	

<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 A
Feeder Name	A120

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	763A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4215kVA	

<Trank Line 2>

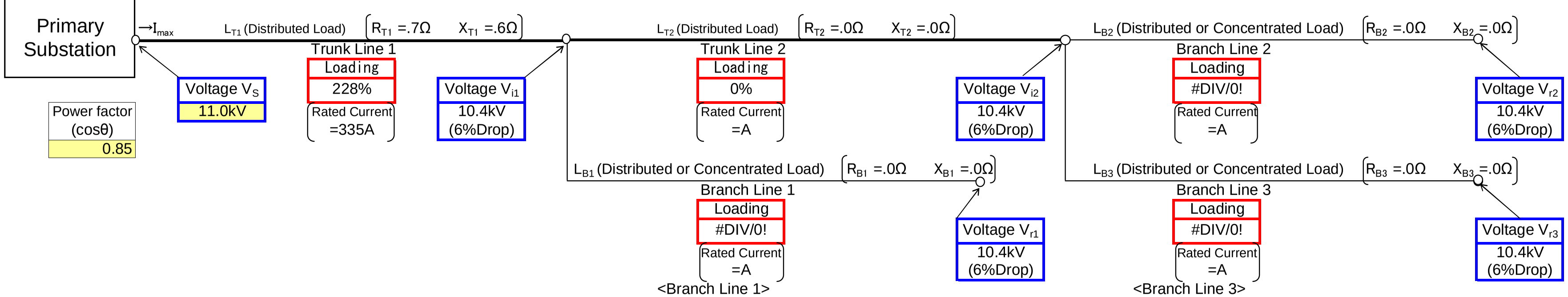
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
763.0A

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 A
Feeder Name	A120

: Input data in colored cells

Type-3

Maximum Current I_{max}	
828.0A	

Power factor (cosθ)
0.85

<Trank Line 1>

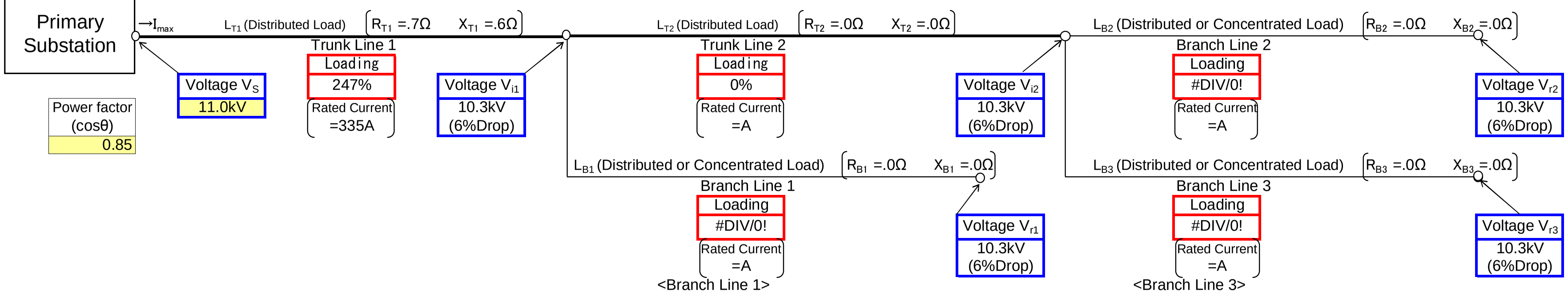
Load L_{T1}	828A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	4215kVA	

<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 A
Feeder Name	A120

: Input data in colored cells

Type-3

Maximum Current I_{max} 876.0A

Power factor (cosθ) 0.85

Primary Substation →I_{max}

Voltage V_s 11.0kV

<Trank Line 1>

Load L_{T1}	876A
Line Type	185ALXPLE(11kV) No.24
Line Legth Len_{T1}	5.0km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T1}	4215kVA

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

Trunk Line 1 Loading 261% Rated Current =335A

Voltage V_{i1} 10.3kV (7%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 (7%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 (7%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 (7%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 (7%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 A
Feeder Name	A13

: Input data in colored cells

Type-3

Maximum Current I_{max}
253.0A

<Trank Line 1>

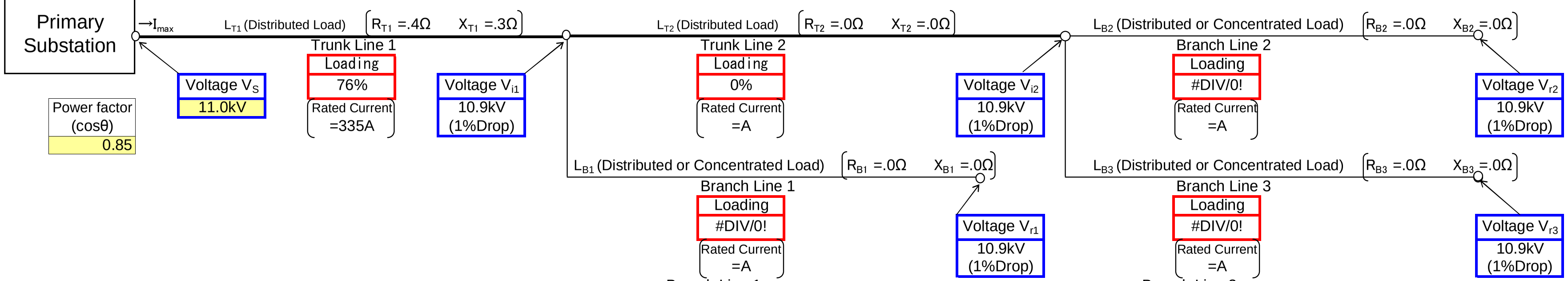
Load L_{T1}	253A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3380kVA	

<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 A
Feeder Name	A13

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	265A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3380kVA	

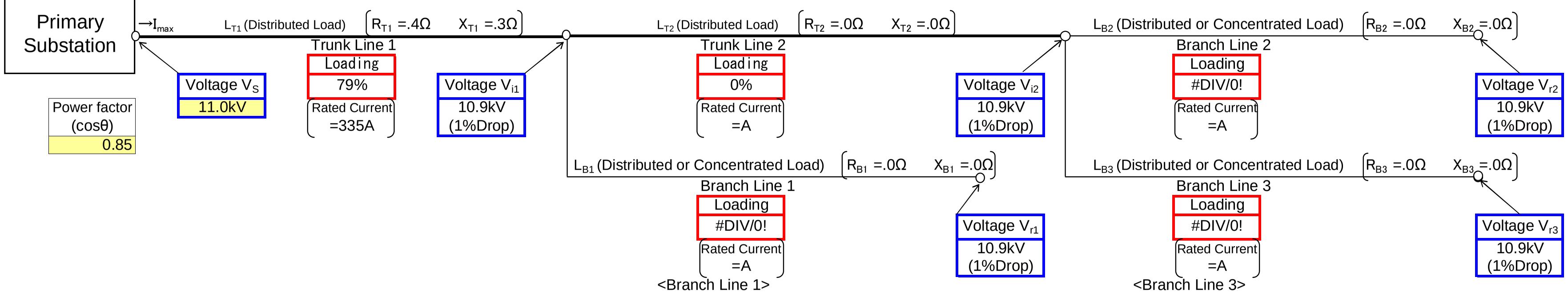
<Trank Line 2>

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 A
Feeder Name	A13

: Input data in colored cells

Type-3

Maximum Current I_{max}
278.0A

Power factor (cosθ)
0.85

<Trank Line 1>

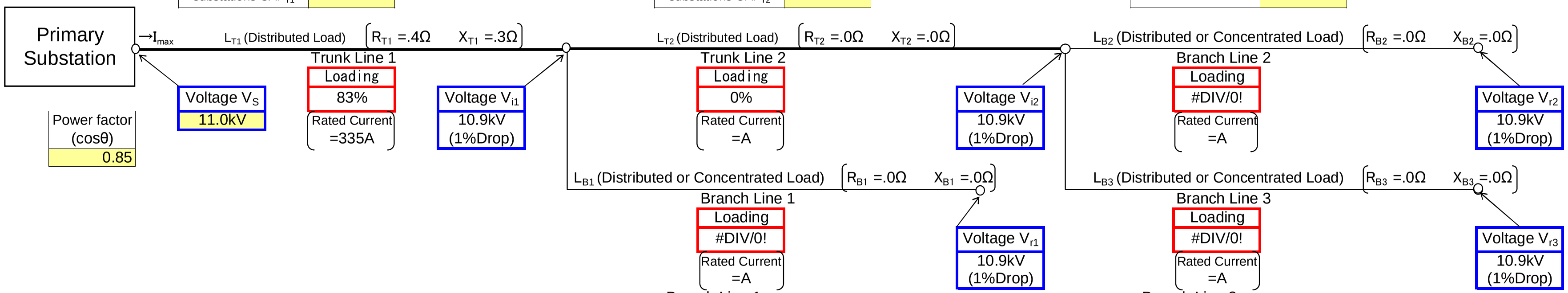
Load L_{T1}	278A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3380kVA	

<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 A
Feeder Name	A13

: 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}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3380kVA	

<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} =.4Ω X_{T1} =.3Ω)

Trunk Line 1

Loading
87%

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 A
Feeder Name	A13

: Input data in colored cells

Type-3

Maximum Current I_{max}	
306.0A	

Power factor (cosθ)	
0.85	

<Trank Line 1>

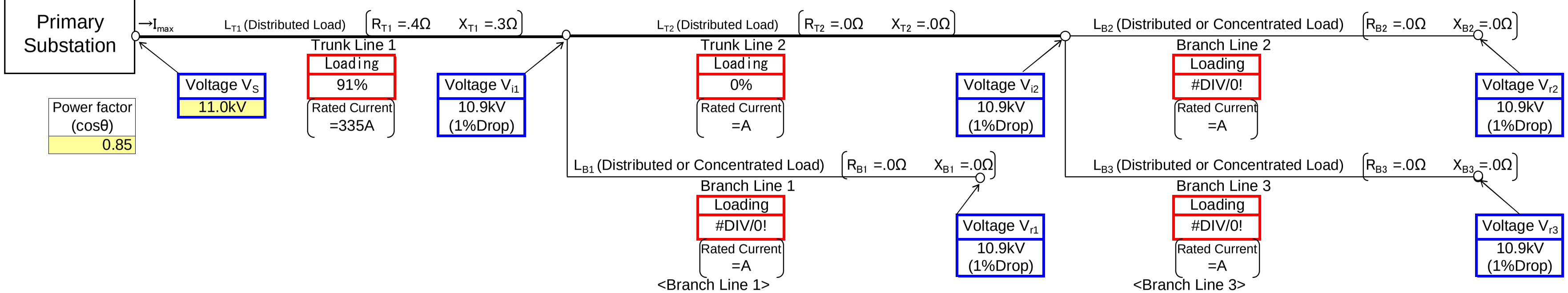
Load L_{T1}	306A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3380kVA	

<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 A
Feeder Name	A13

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	321A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3380kVA	

<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} 321.0A

Primary Substation $\rightarrow I_{max}$

Power factor (cosθ) 0.85

Voltage V_S 11.0kV

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

Trunk Line 1 Loading 96% (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 A
Feeder Name	A13

: Input data in colored cells

Type-3

Maximum Current I_{max}	337.0A
Power factor (cosθ)	0.85

Primary Substation → I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	337A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3380kVA	

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

Trunk Line 1: Loading 101%, 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 A
Feeder Name	A13

: Input data in colored cells

Type-3

Maximum Current I_{max}	354.0A

Power factor (cosθ)	0.85

<Trank Line 1>

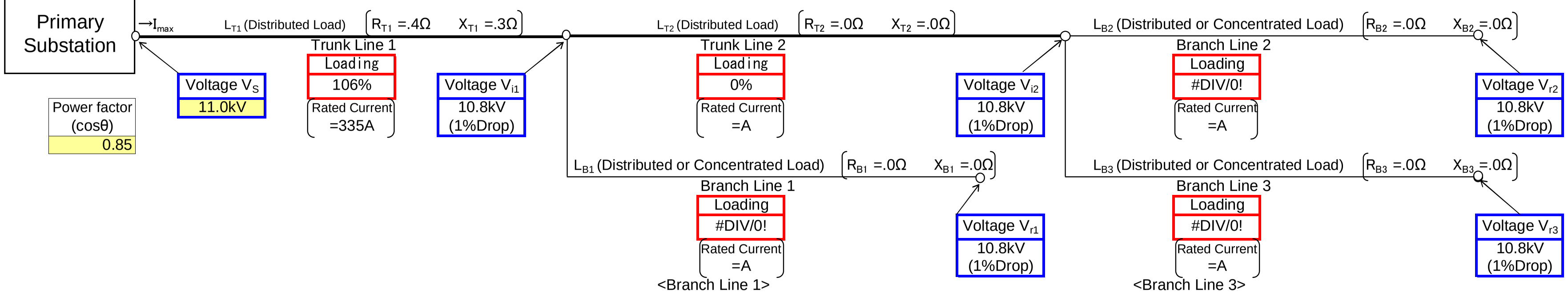
Load L_{T1}	354A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3380kVA	

<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 A
Feeder Name	A13

: Input data in colored cells

Type-3

Maximum Current I_{max}
371.0A

<Trank Line 1>

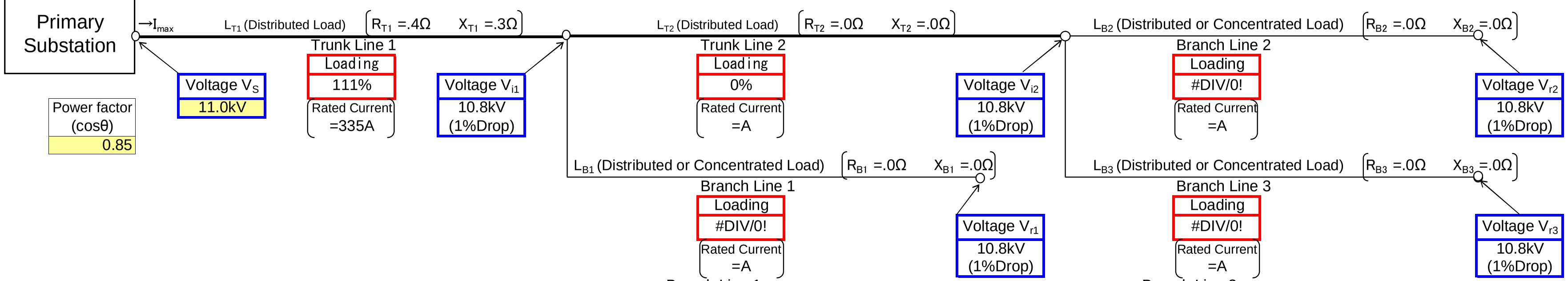
Load L_{T1}	371A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3380kVA	

<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 A
Feeder Name	A13

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	389A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3380kVA	

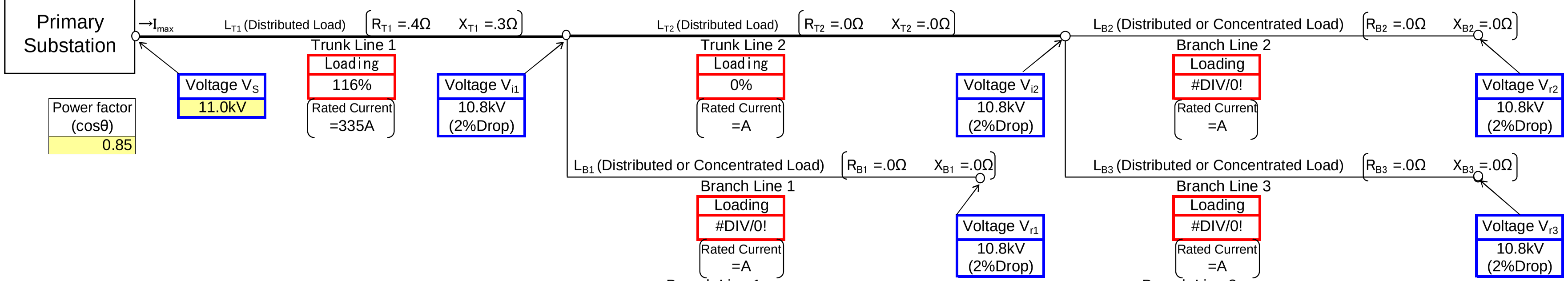
<Trank Line 2>

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}	389.0A
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 A
Feeder Name	A13

: Input data in colored cells

Type-3

Maximum Current I_{max}
408.0A

<Trank Line 1>

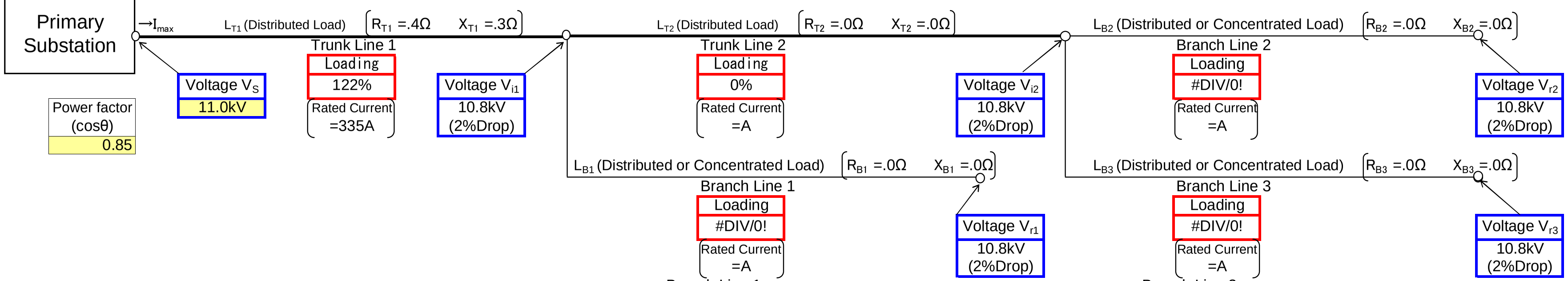
Load L_{T1}	408A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3380kVA	

<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 A
Feeder Name	A13

: Input data in colored cells

Type-3

Maximum Current I_{max}
428.0A

Power factor (cosθ)
0.85

Primary Substation

$\rightarrow I_{max}$

Voltage V_s: 11.0kV

<Trank Line 1>

Load L_{T1}	428A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3380kVA	

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

Trunk Line 1: Loading 128%, (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 A
Feeder Name	A16

: Input data in colored cells

Type-3

Maximum Current I_{max}
156.0A

Power factor (cosθ)
0.85

<Trank Line 1>

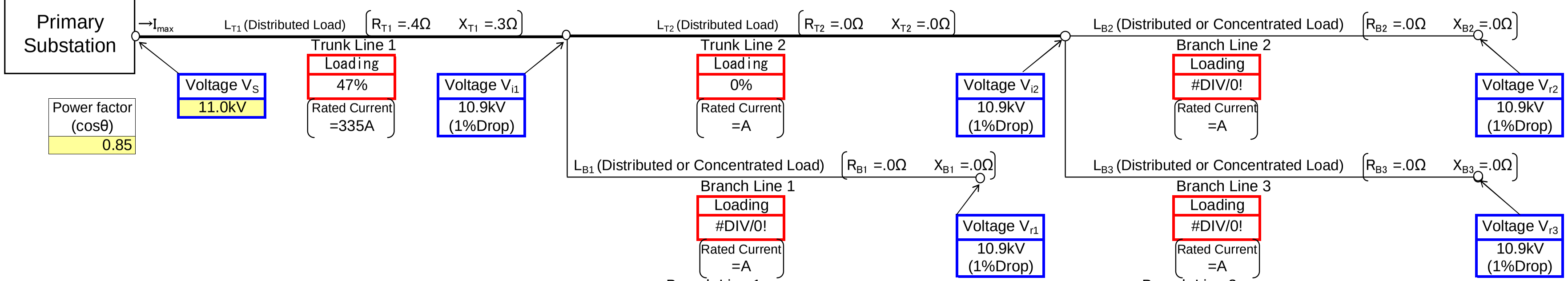
Load L_{T1}	156A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3515kVA	

<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 A
Feeder Name	A16

: Input data in colored cells

Type-3

Maximum Current I_{max}
164.0A

Power factor (cosθ)
0.85

<Trank Line 1>

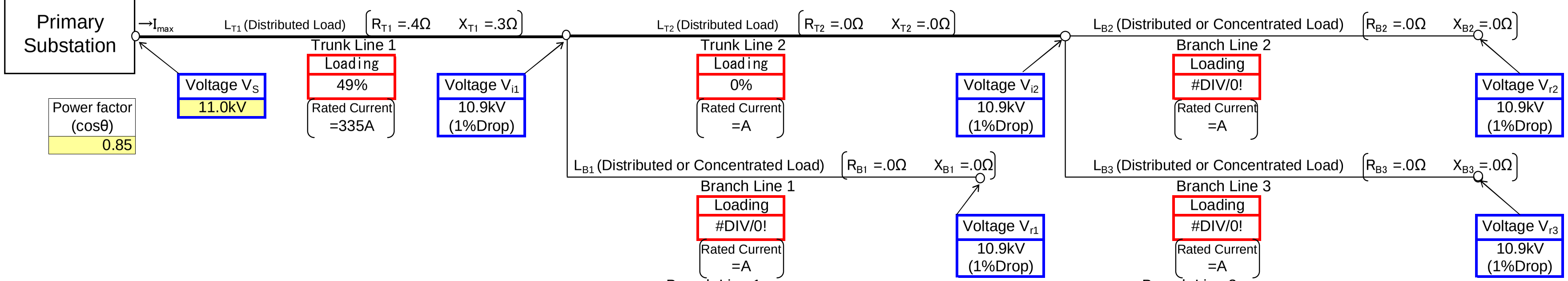
Load L_{T1}	164A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3515kVA	

<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 A
Feeder Name	A16

: Input data in colored cells

Type-3

Maximum Current I_{max}: 172.0A

Power factor (cosθ): 0.85

<Trank Line 1>

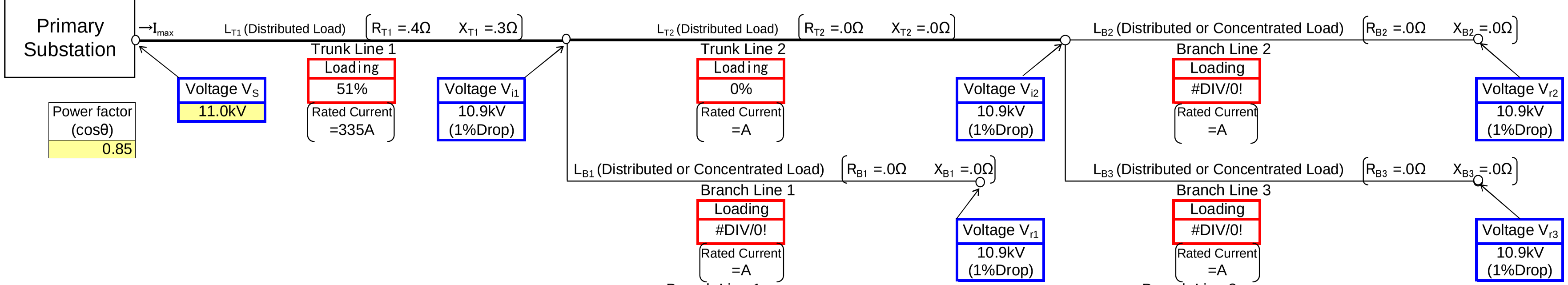
Load L_{T1}	172A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3515kVA	

<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 A
Feeder Name	A16

: Input data in colored cells

Type-3

Maximum Current I_{max}
180.0A

Primary Substation

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

Load L_{T1}	180A	
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}	3515kVA	

<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} =.4Ω X_{T1} =.3Ω

Trunk Line 1: Loading 54%; 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 A
Feeder Name	A16

: Input data in colored cells

Type-3

Maximum Current I_{max}	
189.0A	

Power factor (cosθ)	
0.85	

<Trank Line 1>

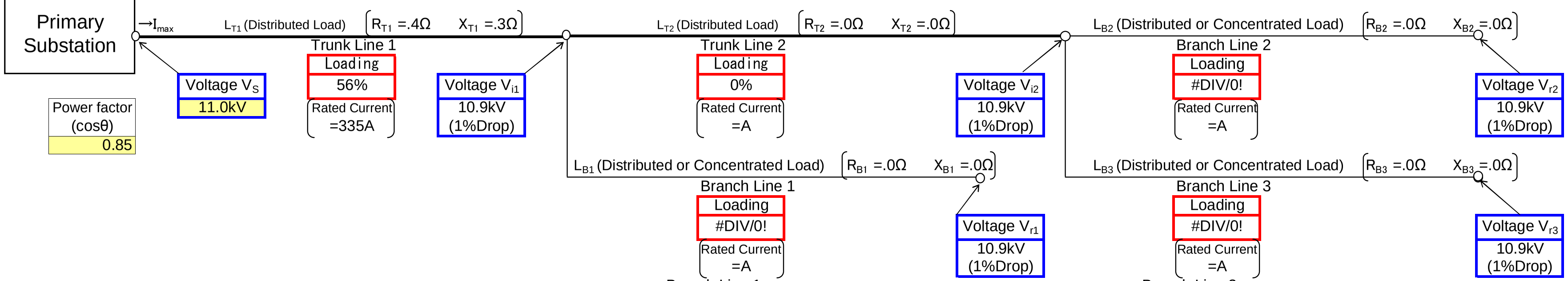
Load L_{T1}	189A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3515kVA	

<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 A
Feeder Name	A16

: Input data in colored cells

Type-3

Maximum Current I_{max}
198.0A

<Trank Line 1>

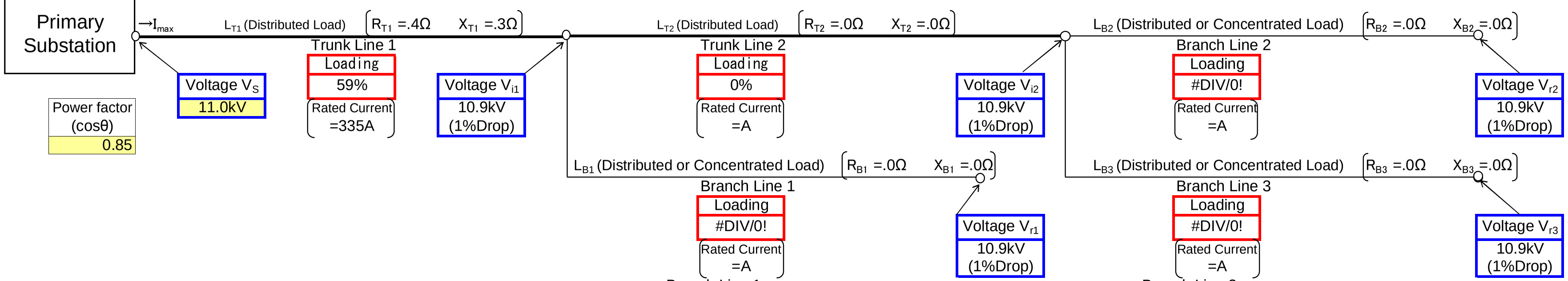
Load L_{T1}	198A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3515kVA	

<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 A
Feeder Name	A16

: Input data in colored cells

Type-3

Maximum Current I_{max}
208.0A

Power factor (cosθ)
0.85

<Trank Line 1>

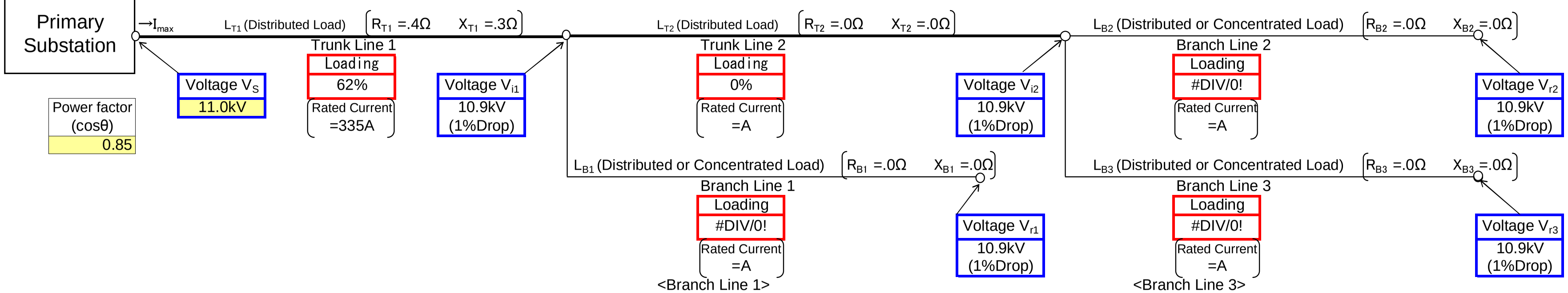
Load L_{T1}	208A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3515kVA	

<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 A
Feeder Name	A16

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	218A	
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}	3515kVA	

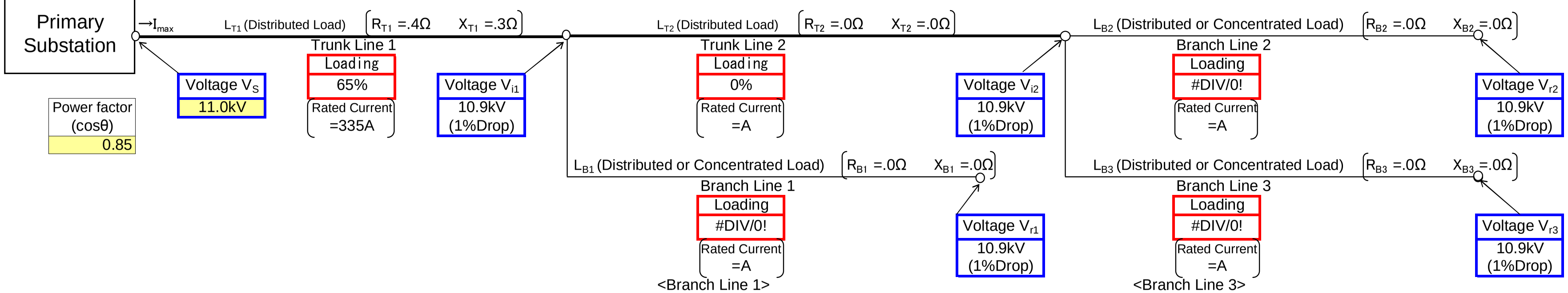
<Trank Line 2>

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}	218.0A
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=====

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

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

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

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

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

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

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

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

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

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

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

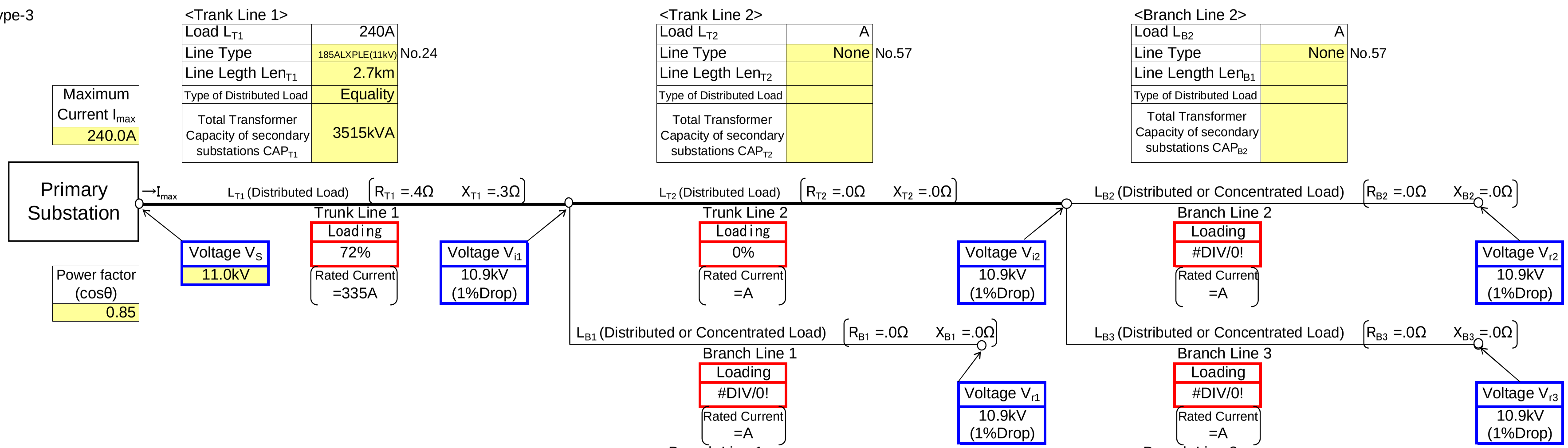
V_s : Supply Voltage	I_{max} : Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal 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 A
Feeder Name	A16

: Input data in colored cells

Type-3



<Branch Line 1>

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

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

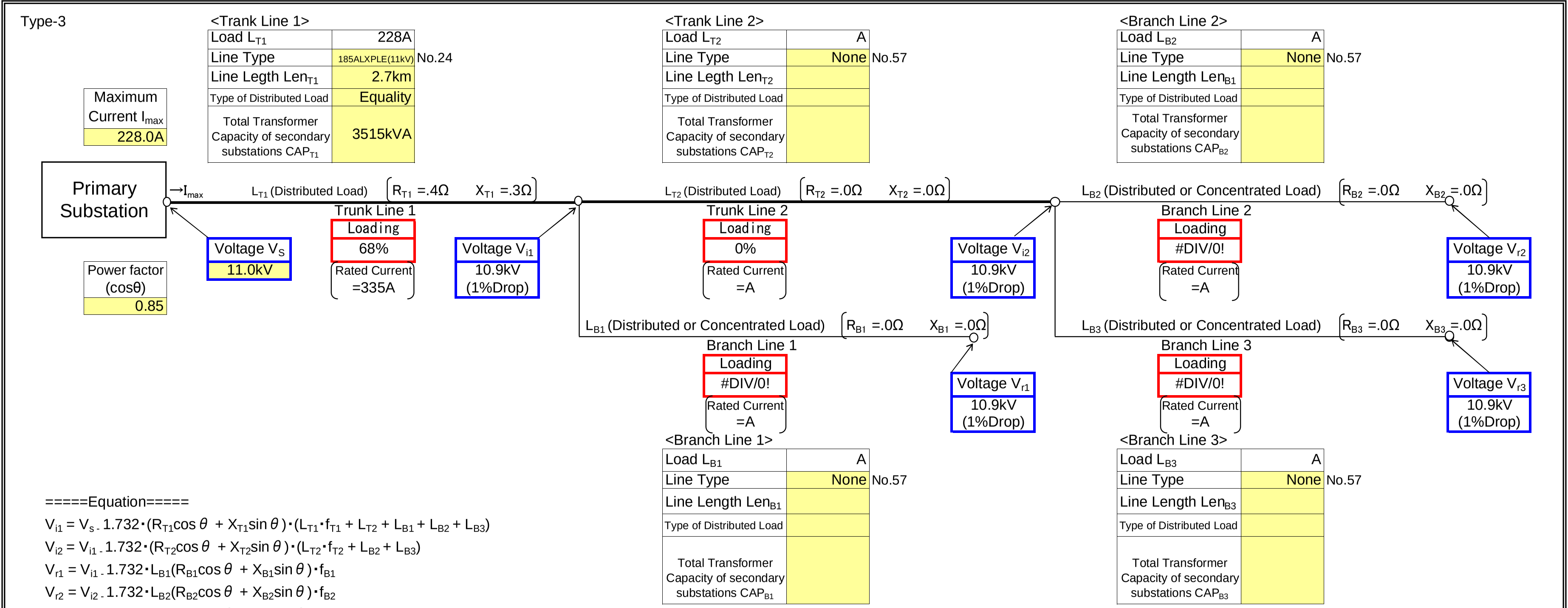
$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

V_s : Supply Voltage	I_{max} : Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: 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 A
Feeder Name	A16

: 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 A
Feeder Name	A16

: Input data in colored cells

Type-3

Maximum Current I_{max}: 252.0A

Power factor (cosθ): 0.85

<Trank Line 1>

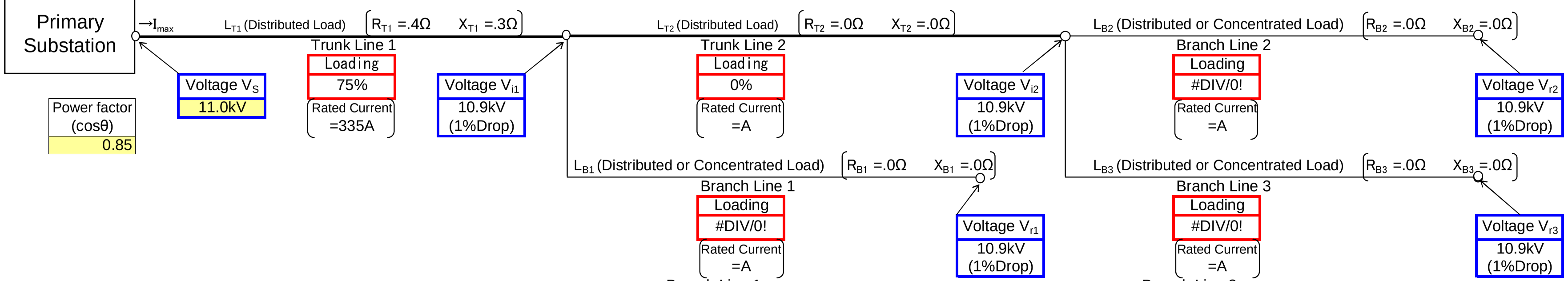
Load L_{T1}	252A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.7km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3515kVA	

<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 A
Feeder Name	A16

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	264A	
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}	3515kVA	

<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}	264.0A
Power factor (cosθ)	0.85

Primary Substation

$\rightarrow I_{max}$

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

Trunk Line 1

Loading 79%

(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 A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}	91.0A

Power factor (cosθ)	0.85

<Trank Line 1>

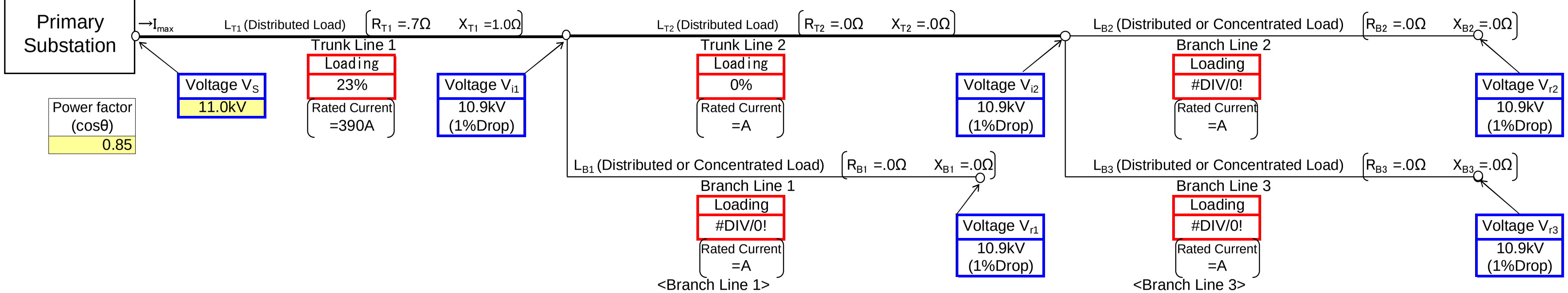
Load L_{T1}	91A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1215kVA	

<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 A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}	95.0A
Power factor ($\cos\theta$)	0.85

<Trank Line 1>

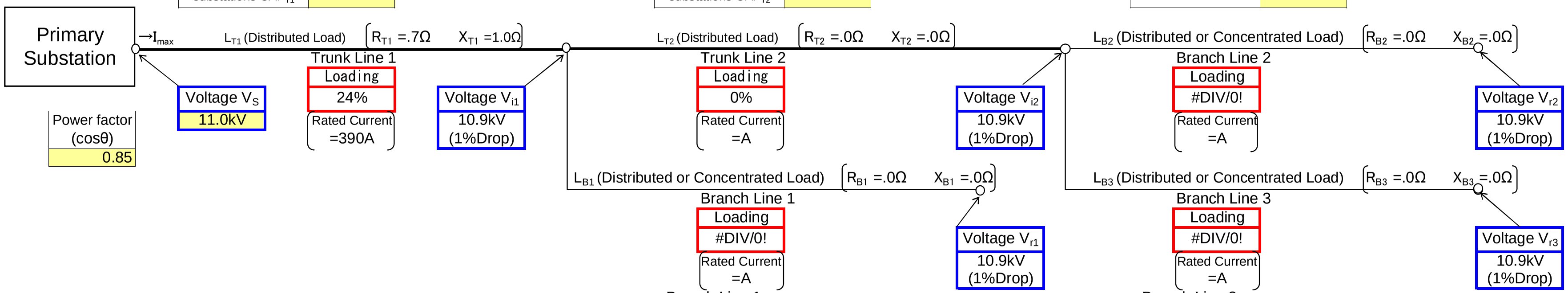
Load L_{T1}	95A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1215kVA	

<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 A
Feeder Name	A18

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	100A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1215kVA	

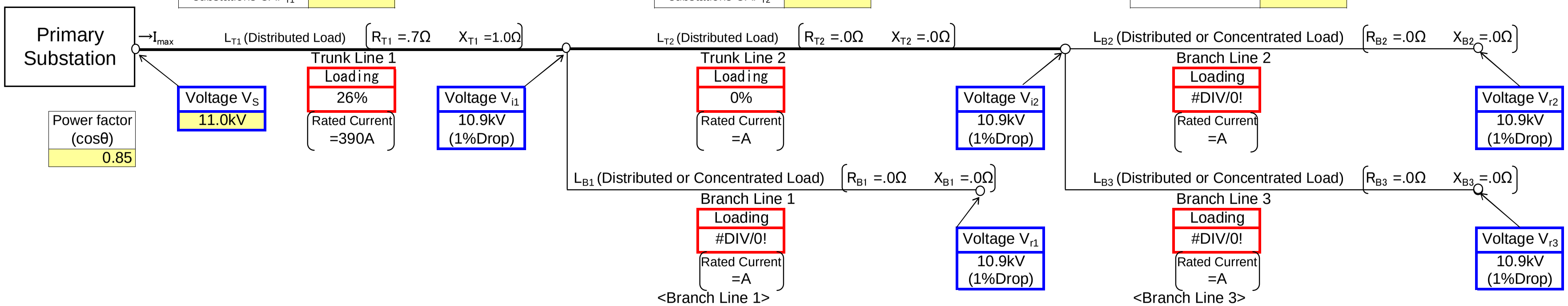
<Trank Line 2>

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}
100.0A



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 A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}
105.0A

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

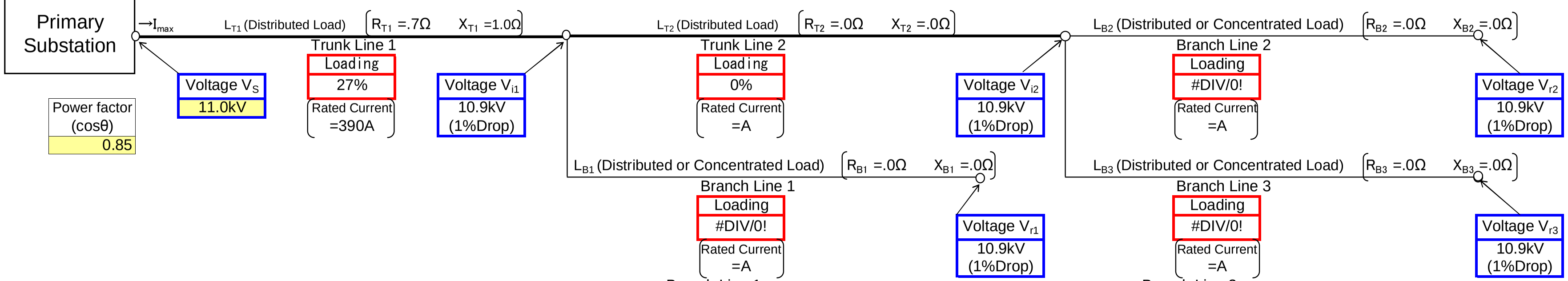
Load L_{T1}	105A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1215kVA	

<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 A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}: 110.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

<Trank Line 1>

Load L_{T1}	110A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1215kVA	

<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}		

L_{T1} (Distributed Load) R_{T1} =.7Ω X_{T1} =1.0Ω

Trunk Line 1: Loading 28%, 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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$, 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 A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}
116.0A

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

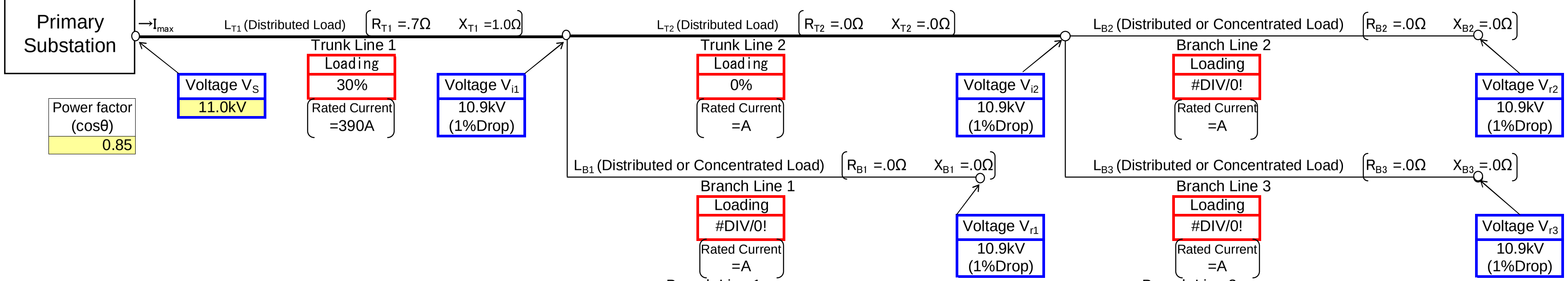
Load L_{T1}	116A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1215kVA	

<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 A
Feeder Name	A18

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	121A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1215kVA	

<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} 121.0A

Primary Substation $\rightarrow I_{max}$

Power factor (cosθ) 0.85

Voltage V_S 11.0kV

L_{T1} (Distributed Load) R_{T1} =.7Ω X_{T1} =1.0Ω

Trunk Line 1 Loading 31% 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 A
Feeder Name	A18

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	127A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1215kVA	

<Trank Line 2>

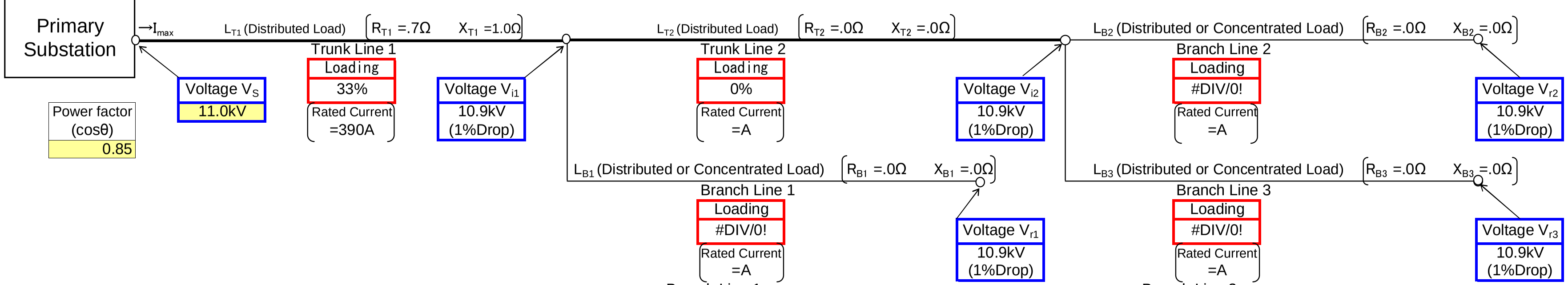
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
127.0A

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 A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}
133.0A

<Trank Line 1>

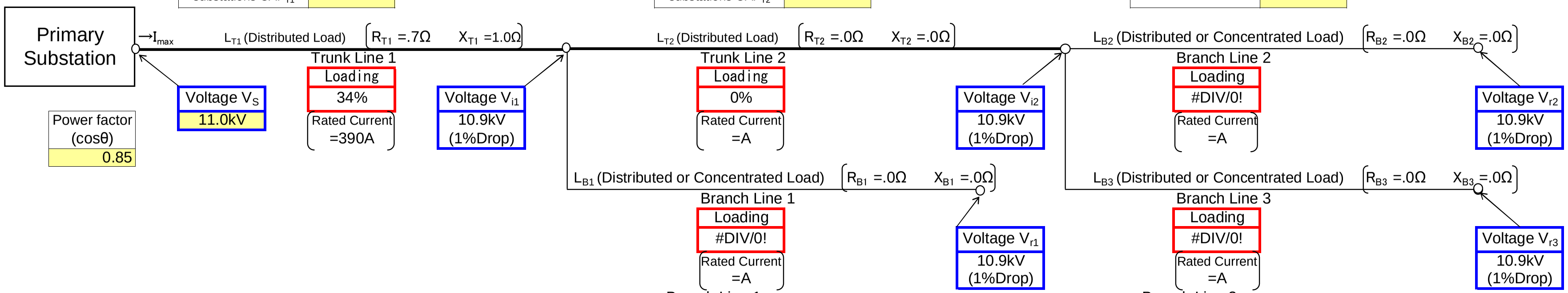
Load L_{T1}	133A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1215kVA	

<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 A
Feeder Name	A18

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	140A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1215kVA	

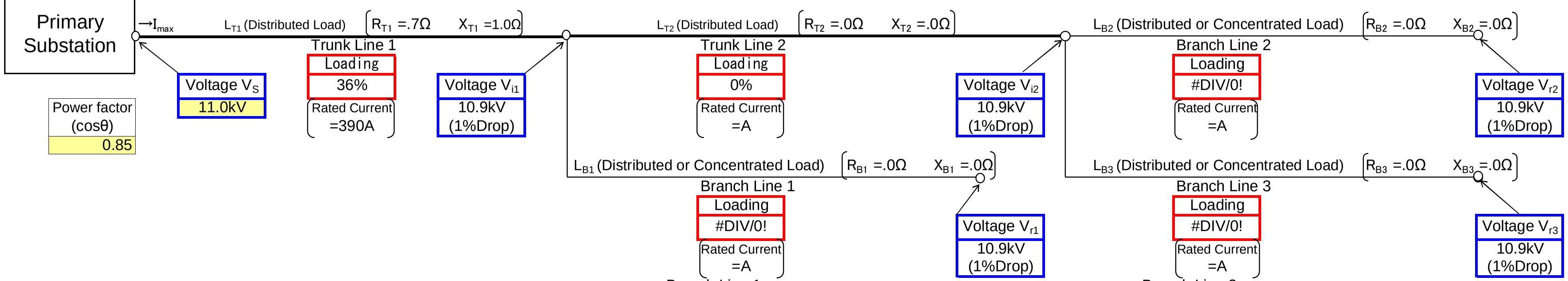
<Trank Line 2>

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}
140.0A



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 A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}
147.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	147A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1215kVA	

<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} =.7Ω X_{T1} =1.0Ω

Trunk Line 1 — Loading 38% — 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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

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

Substation Name	STATION A
Feeder Name	A61

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	154A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	2.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1215kVA	

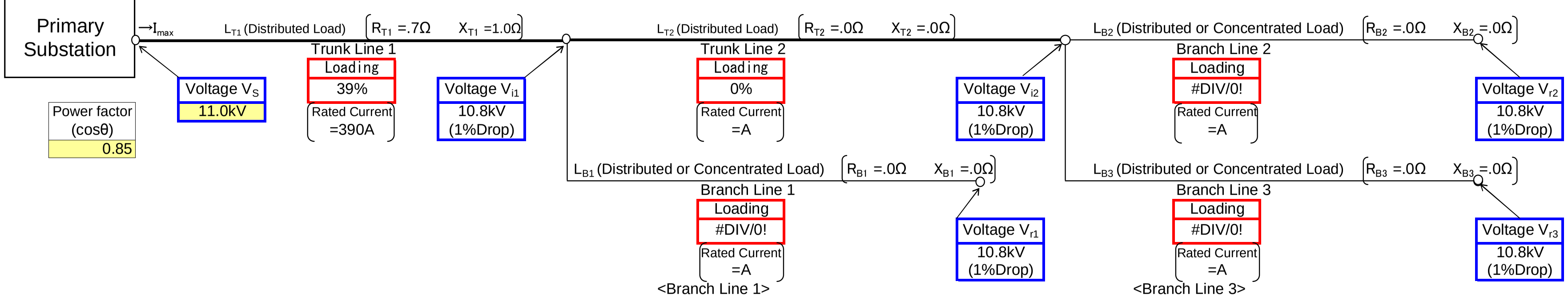
<Trank Line 2>

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}	154.0A
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 A
Feeder Name	A61

: Input data in colored cells

Type-3

Maximum Current I_{max}	
480.0A	

Power factor (cosθ)
0.85

<Trank Line 1>

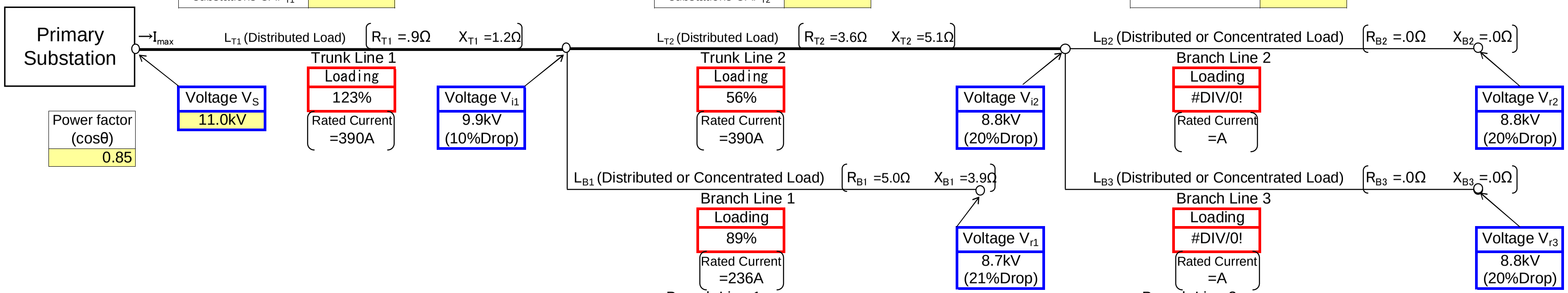
Load L_{T1}	50A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1015kVA	

<Trank Line 2>

Load L_{T2}	220A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	14.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4500kVA	

<Branch Line 2>

Load 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}	210A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	8.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4305kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

V_s : Supply Voltage	I_{max} : Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: 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 A
Feeder Name	A61

: Input data in colored cells

Type-3

Maximum Current I_{max}
489.0A

Power factor (cosθ)
0.85

<Trank Line 1>

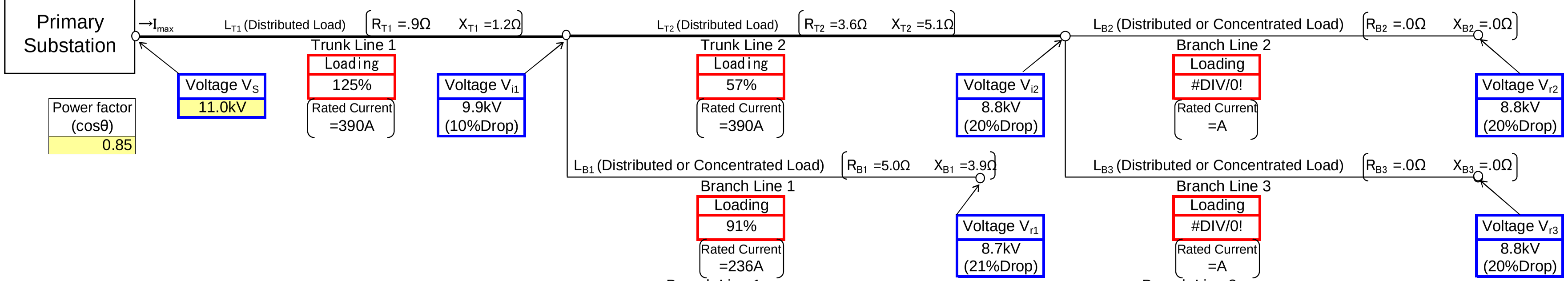
Load L_{T1}	51A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1015kVA	

<Trank Line 2>

Load L_{T2}	224A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	14.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4500kVA	

<Branch Line 2>

Load 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}	214A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	8.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4305kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}
499.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	52A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1015kVA	

<Trank Line 2>

Load L_{T2}	229A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	14.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4500kVA	

<Branch Line 2>

Load 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} =.9Ω X_{T1} =1.2Ω

Trunk Line 1

Loading
128%

Rated Current =390A

Voltage V_S
11.0kV

Voltage V_{i1}
9.8kV (10%Drop)

L_{T2} (Distributed Load) R_{T2} =3.6Ω X_{T2} =5.1Ω

Trunk Line 2

Loading
59%

Rated Current =390A

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} =5.0Ω X_{B1} =3.9Ω

Branch Line 1

Loading
93%

Rated Current =236A

Voltage V_{r1}
8.7kV (21%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}	219A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	8.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4305kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

V_s : Supply Voltage	I_{max} : Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3} : Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3} : Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	f_{T1}, f_{T2}, f_{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 A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}
508.0A

Power factor (cosθ)
0.85

<Trank Line 1>

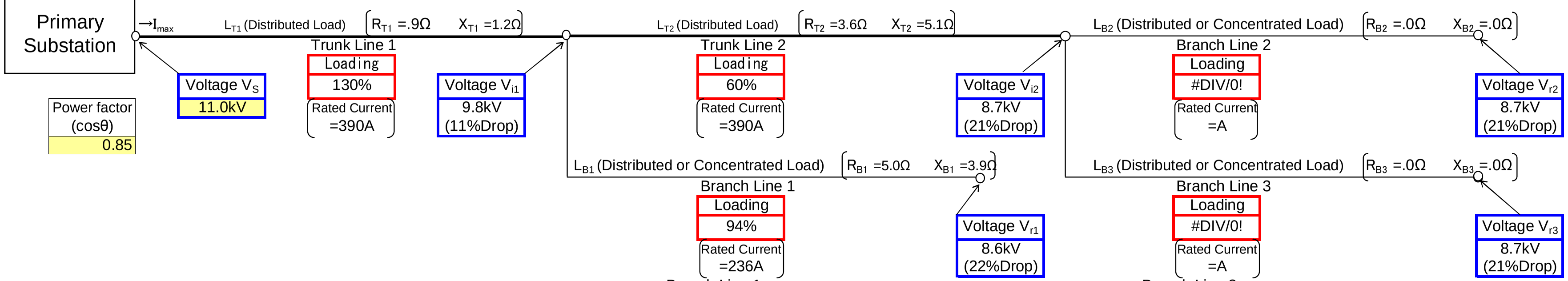
Load L_{T1}	53A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1015kVA	

<Trank Line 2>

Load L_{T2}	233A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	14.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4500kVA	

<Branch Line 2>

Load 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}	223A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	8.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4305kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

(2010)

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

Substation Name	STATION A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}
518.0A

Power factor (cosθ)
0.85

<Trank Line 1>

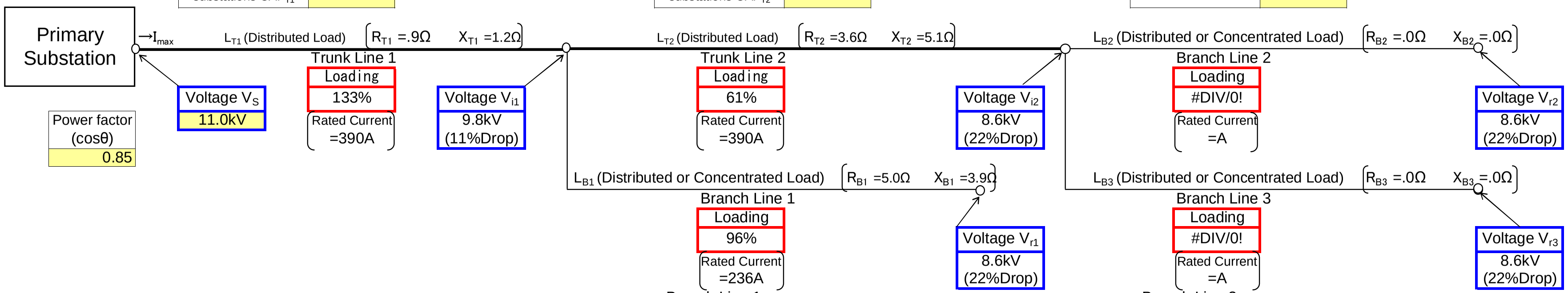
Load L_{T1}	54A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1015kVA	

<Trank Line 2>

Load L_{T2}	237A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	14.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4500kVA	

<Branch Line 2>

Load 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}	227A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	8.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4305kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}: 528.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	55A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1015kVA	

L_{T1} (Distributed Load) (R_{T1} =.9Ω X_{T1} =1.2Ω)

Trunk Line 1: Loading 135% (Rated Current =390A)

Voltage V_{i1}: 9.8kV (11%Drop)

<Trank Line 2>

Load L_{T2}	242A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	14.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4500kVA	

L_{T2} (Distributed Load) (R_{T2} =3.6Ω X_{T2} =5.1Ω)

Trunk Line 2: Loading 62% (Rated Current =390A)

Voltage V_{i2}: 8.6kV (22%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =5.0Ω X_{B1} =3.9Ω)

Branch Line 1: Loading 98% (Rated Current =236A)

Voltage V_{r1}: 8.5kV (23%Drop)

<Branch Line 1>

Load L_{B1}	231A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	8.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4305kVA	

<Branch Line 2>

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

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

Substation Name	STATION A
Feeder Name	A18

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	56A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1015kVA	

<Trank Line 2>

Load L_{T2}	247A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	14.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4500kVA	

<Branch Line 2>

Load 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}	538.0A
Power factor (cosθ)	0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.9Ω X_{T1} =1.2Ω)

Trunk Line 1 — Loading 138% — Rated Current =390A

Voltage V_{i1}: 9.8kV (11%Drop)

L_{T2} (Distributed Load) (R_{T2} =3.6Ω X_{T2} =5.1Ω)

Trunk Line 2 — Loading 63% — Rated Current =390A

Voltage V_{i2}: 8.5kV (22%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}: 8.5kV (22%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =5.0Ω X_{B1} =3.9Ω)

Branch Line 1 — Loading 100% — Rated Current =236A

Voltage V_{r1}: 8.5kV (23%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}: 8.5kV (22%Drop)

<Branch Line 1>

Load L_{B1}	236A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	8.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4305kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}
549.0A

<Trank Line 1>

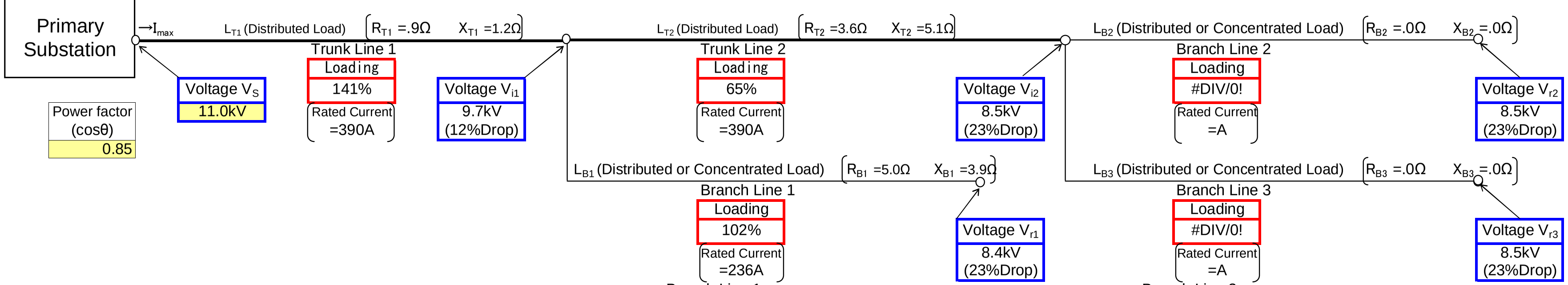
Load L_{T1}	57A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1015kVA	

<Trank Line 2>

Load L_{T2}	252A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	14.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4500kVA	

<Branch Line 2>

Load 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}	241A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	8.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4305kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}
559.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	58A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1015kVA	

<Trank Line 2>

Load L_{T2}	256A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	14.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4500kVA	

<Branch Line 2>

Load 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} =.9Ω X_{T1} =1.2Ω

Trunk Line 1: Loading 143%, Rated Current =390A

Voltage V_S: 11.0kV

Voltage V_{i1}: 9.7kV (12%Drop)

L_{T2} (Distributed Load) R_{T2} =3.6Ω X_{T2} =5.1Ω

Trunk Line 2: Loading 66%, Rated Current =390A

Voltage V_{i2}: 8.4kV (23%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 (23%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =5.0Ω X_{B1} =3.9Ω

Branch Line 1: Loading 104%, Rated Current =236A

Voltage V_{r1}: 8.4kV (24%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 (23%Drop)

<Branch Line 1>

Load L_{B1}	245A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	8.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4305kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}
570.0A

Power factor (cosθ)
0.85

Primary Substation

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	59A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1015kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) R_{T1} =.9Ω X_{T1} =1.2Ω

Trunk Line 1: Loading 146%, Rated Current =390A

Voltage V_{i1}: 9.7kV (12%Drop)

<Trank Line 2>

Load L_{T2}	261A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	14.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4500kVA	

L_{T2} (Distributed Load) R_{T2} =3.6Ω X_{T2} =5.1Ω

Trunk Line 2: Loading 67%, Rated Current =390A

Voltage V_{i2}: 8.4kV (24%Drop)

L_{B1} (Distributed or Concentrated Load) R_{B1} =5.0Ω X_{B1} =3.9Ω

Branch Line 1: Loading 106%, Rated Current =236A

Voltage V_{r1}: 8.3kV (24%Drop)

<Branch Line 1>

Load L_{B1}	250A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	8.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4305kVA	

<Branch Line 2>

Load 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}: 8.4kV (24%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 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}
581.0A

Power factor (cosθ)
0.85

Primary Substation

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	60A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1015kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.9Ω X_{T1} =1.2Ω)

Trunk Line 1 — Loading: 149% (Rated Current =390A)

Voltage V_{i1}: 9.7kV (12%Drop)

<Trank Line 2>

Load L_{T2}	266A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	14.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4500kVA	

L_{T2} (Distributed Load) (R_{T2} =3.6Ω X_{T2} =5.1Ω)

Trunk Line 2 — Loading: 68% (Rated Current =390A)

Voltage V_{i2}: 8.3kV (24%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}: 8.3kV (24%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =5.0Ω X_{B1} =3.9Ω)

Branch Line 1 — Loading: 108% (Rated Current =236A)

Voltage V_{r1}: 8.3kV (25%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}: 8.3kV (24%Drop)

<Branch Line 1>

Load L_{B1}	255A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	8.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4305kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION A
Feeder Name	A18

: Input data in colored cells

Type-3

Maximum Current I_{max}	592.0A
Power factor (cosθ)	0.85

<Trank Line 1>

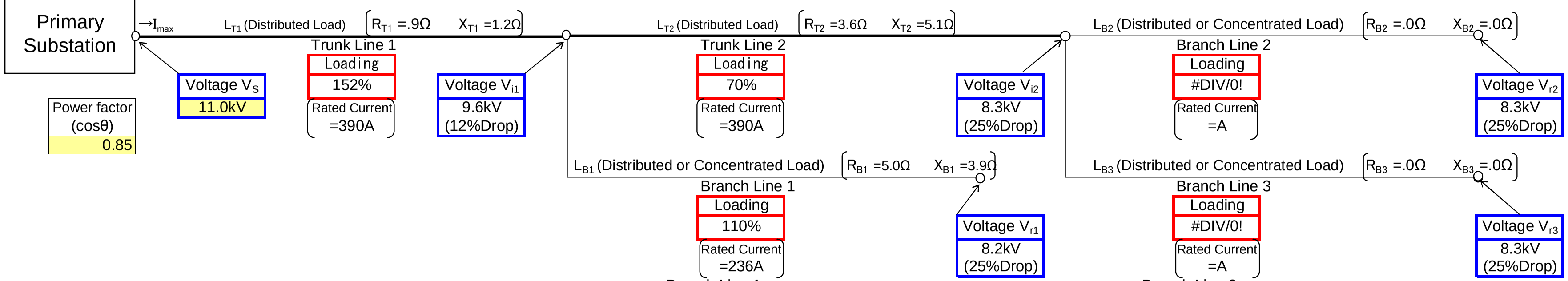
Load L_{T1}	61A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1015kVA	

<Trank Line 2>

Load L_{T2}	271A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	14.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	4500kVA	

<Branch Line 2>

Load 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}	260A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	8.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4305kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}
340.0A

Power factor (cosθ)
0.85

<Trank Line 1>

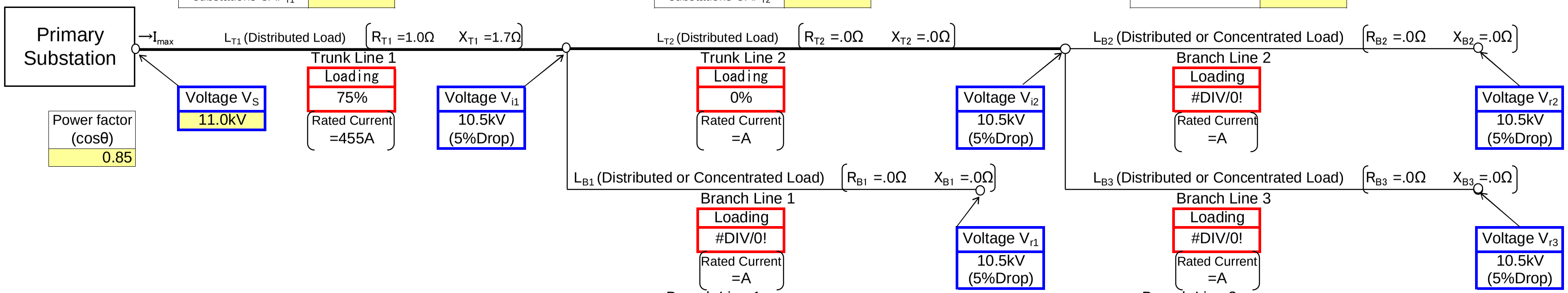
Load L_{T1}	340A	
Line Type	150ALBARE	No.38
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}	372.0A
Power factor (cosθ)	0.85

<Trank Line 1>

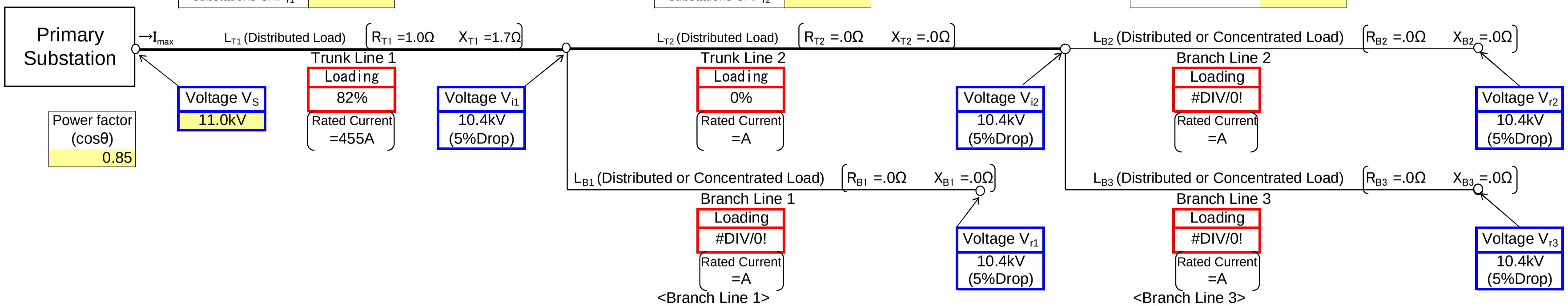
Load L_{T1}	372A	
Line Type	150ALBARE	No.38
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	393A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<Trank Line 2>

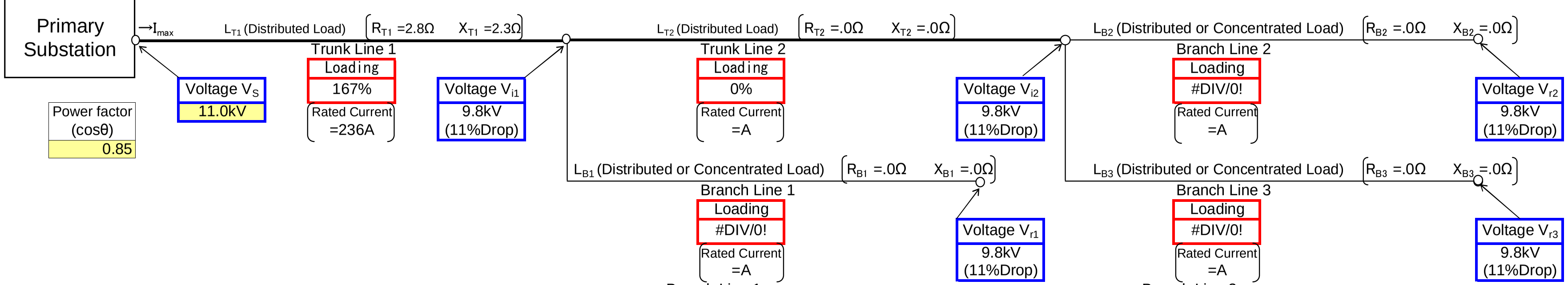
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
393.0A

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=====

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

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

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

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

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

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

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

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

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

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

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

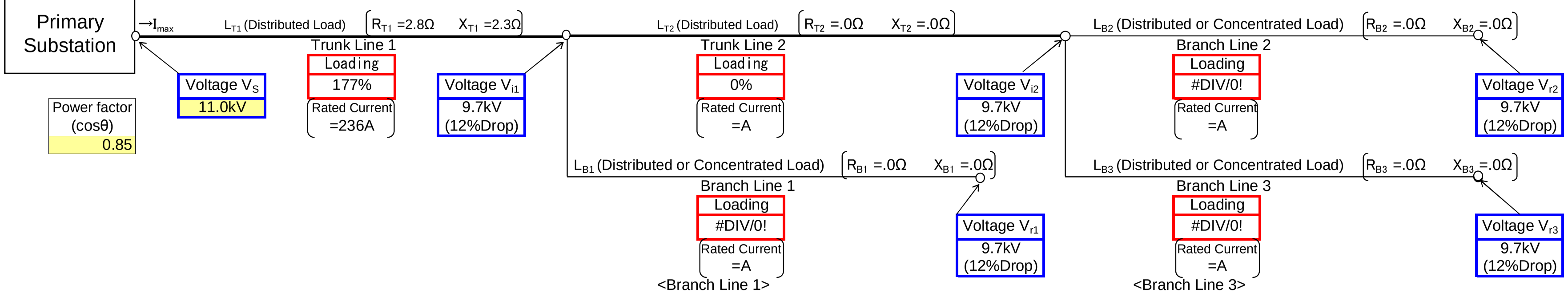
V_s : Supply Voltage	I_{max} : Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal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

: Input data in colored cells

Type-3



<Trank Line 1>

Load L_{T1}	417A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}	441.0A
Power factor (cosθ)	0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	441A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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} =2.8Ω X_{T1} =2.3Ω)

Trunk Line 1: Loading 187%; Rated Current =236A

Voltage V_S: 11.0kV

Voltage V_{i1}: 9.6kV (13%Drop)

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

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

Voltage V_{i2}: 9.6kV (13%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}: 9.6kV (13%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}: 9.6kV (13%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}: 9.6kV (13%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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}	467.0A
Power factor (cosθ)	0.85

<Trank Line 1>

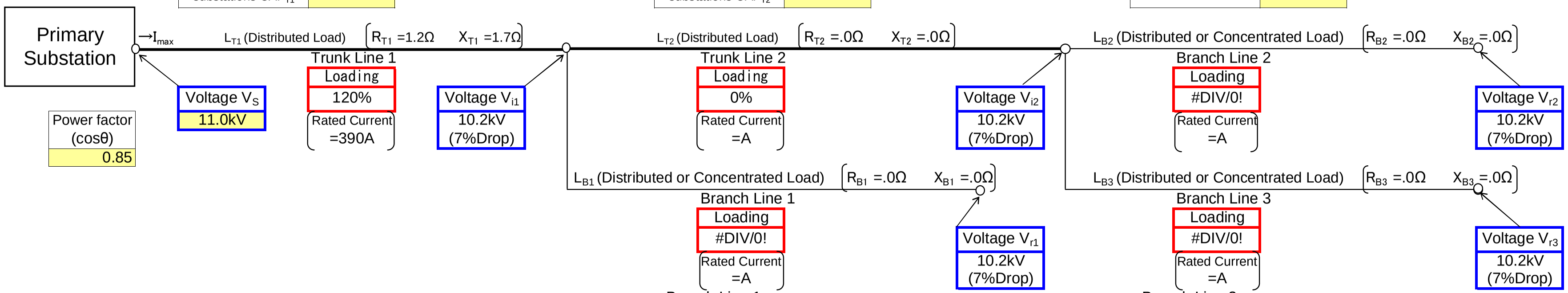
Load L_{T1}	467A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}
494.0A

Power factor (cosθ)
0.85

<Trank Line 1>

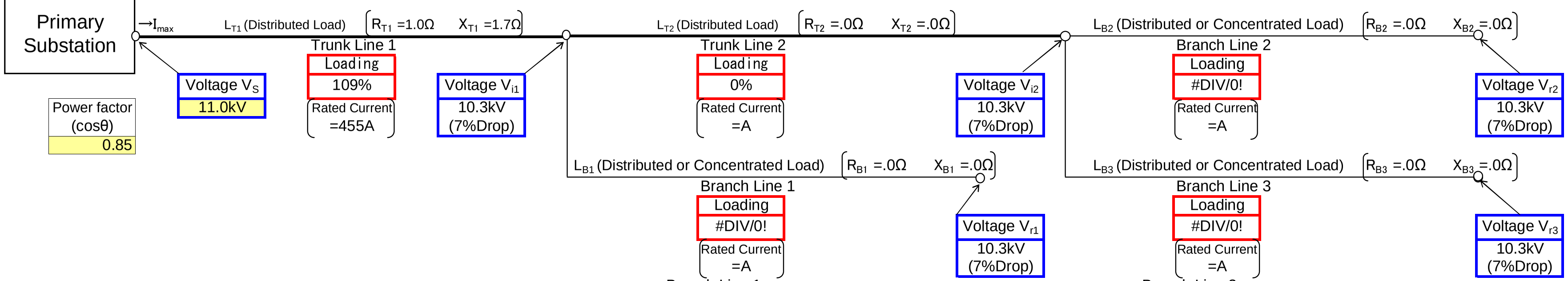
Load L_{T1}	494A	
Line Type	150ALBARE	No.38
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}
523.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	523A	
Line Type	150ALBARE	No.38
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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} =1.7Ω)

Trunk Line 1: Loading 115%; (Rated Current =455A)

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.2kV (7%Drop)

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

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

Voltage V_{i2}: 10.2kV (7%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}: 10.2kV (7%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}: 10.2kV (7%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}: 10.2kV (7%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	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}
554.0A

Power factor (cosθ)
0.85

<Trank Line 1>

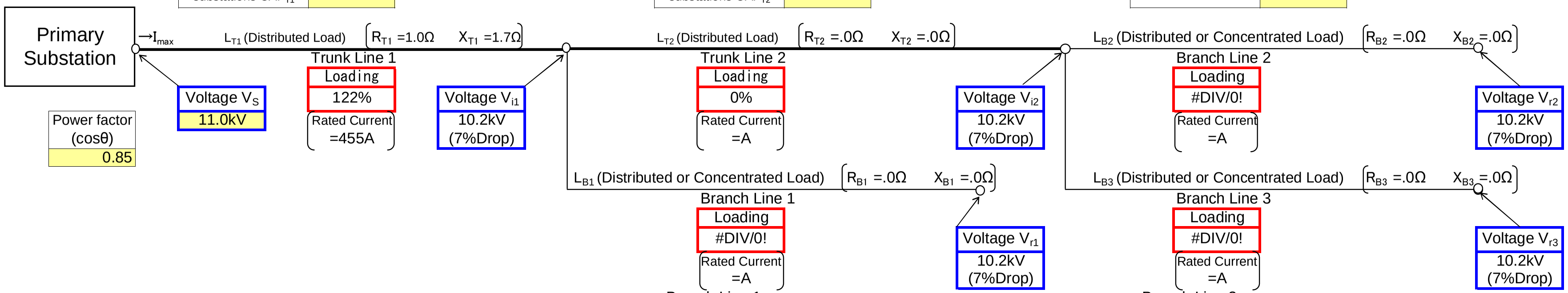
Load L_{T1}	554A	
Line Type	150ALBARE	No.38
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	587A	
Line Type	150ALBARE	No.38
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<Trank Line 2>

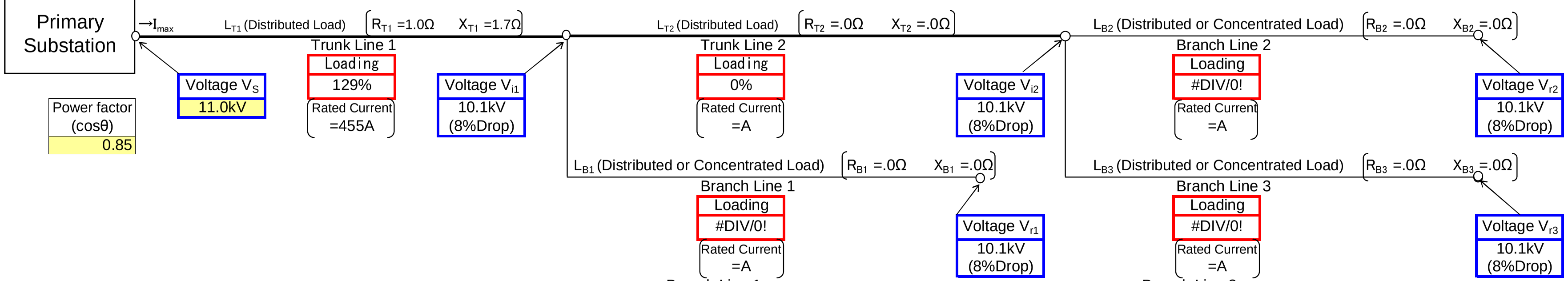
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
587.0A

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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}
621.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	621A	
Line Type	150ALBARE	No.38
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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} =1.7Ω

Trunk Line 1: Loading 136%, Rated Current =455A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.1kV (8%Drop)

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

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

Voltage V_{i2}: 10.1kV (8%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}: 10.1kV (8%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}: 10.1kV (8%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}: 10.1kV (8%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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	658A	
Line Type	150ALBARE	No.38
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<Trank Line 2>

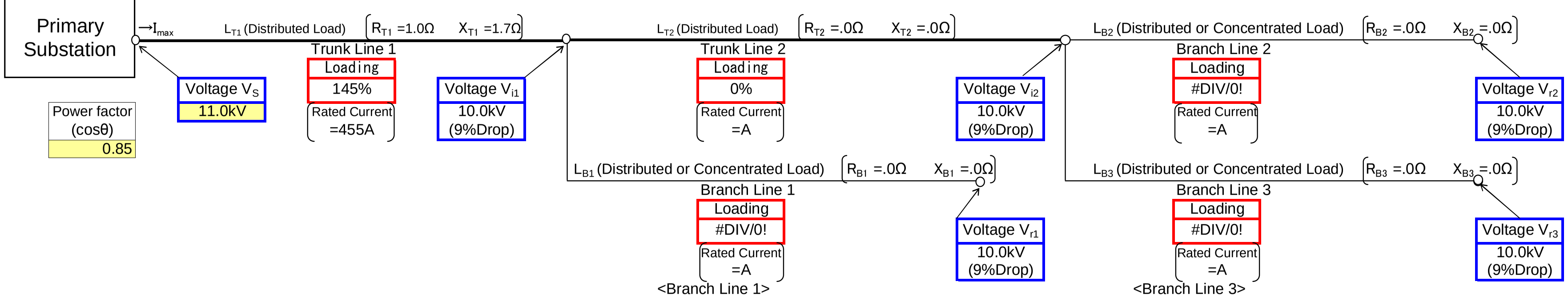
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
658.0A

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 E
Feeder Name	ABL

: Input data in colored cells

Type-3

Maximum Current I_{max}: 100.0A

Power factor (cosθ): 0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	100A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	.5km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	750kVA	

<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} =.1Ω X_{T1} =.1Ω)

Trunk Line 1: Loading 30%; Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 11.0kV (0%Drop)

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)

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)

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 1>

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

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

: Input data in colored cells

Type-3

Maximum Current I_{max}
105.0A

Power factor (cosθ)
0.85

<Trank Line 1>

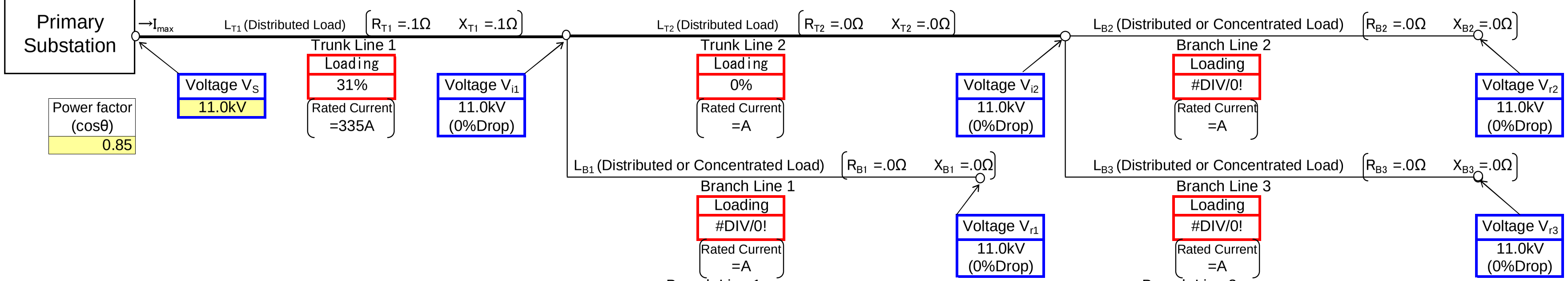
Load L_{T1}	105A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	.5km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	750kVA	

<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	ABL

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	110A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	.5km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	750kVA	

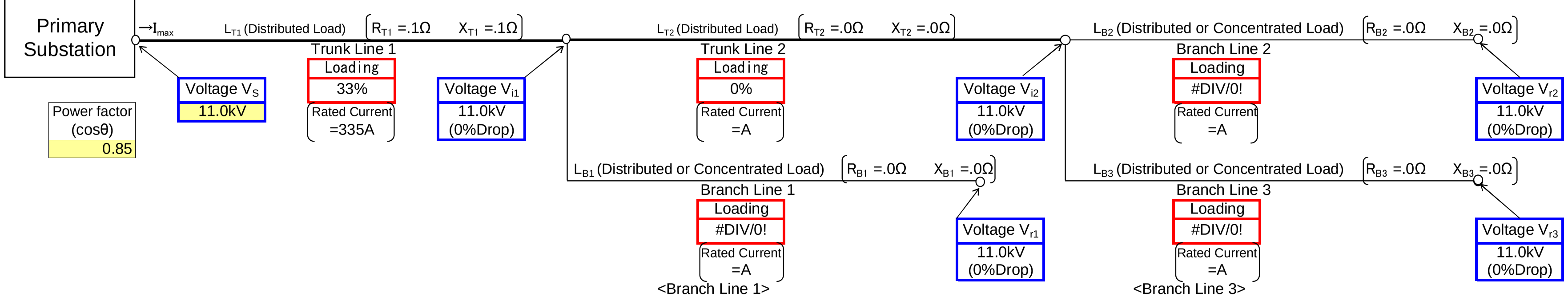
<Trank Line 2>

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}	110.0A
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	ABL

: Input data in colored cells

Type-3

Maximum Current I_{max}	115.0A
Power factor (cosθ)	0.85

<Trank Line 1>

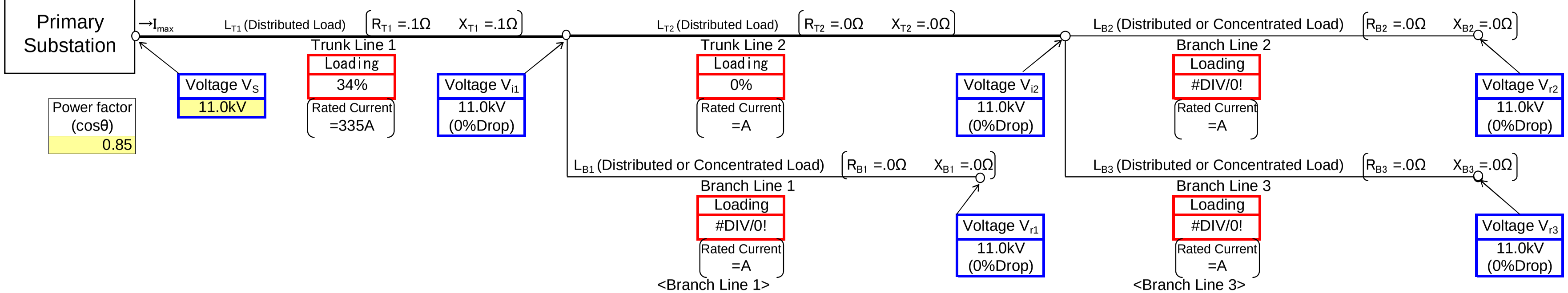
Load L_{T1}	115A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	.5km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	750kVA	

<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 C
Feeder Name	ABL

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	121A
Line Type	185ALXPLE(11kV) No.24
Line Legth Len_{T1}	.5km
Type of Distributed Load	Sending Larger
Total Transformer Capacity of secondary substations CAP_{T1}	750kVA

<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}	121.0A
Power factor (cosθ)	0.85

Primary Substation →I_{max}

Voltage V_S 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.1Ω X_{T1} =.1Ω)

Trunk Line 1: Loading 36%, Rated Current =335A

Voltage V_{i1} 11.0kV (0%Drop)

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)

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)

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 1>

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

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

: Input data in colored cells

Type-3

Maximum Current I_{max}
127.0A

Power factor (cosθ)
0.85

<Trank Line 1>

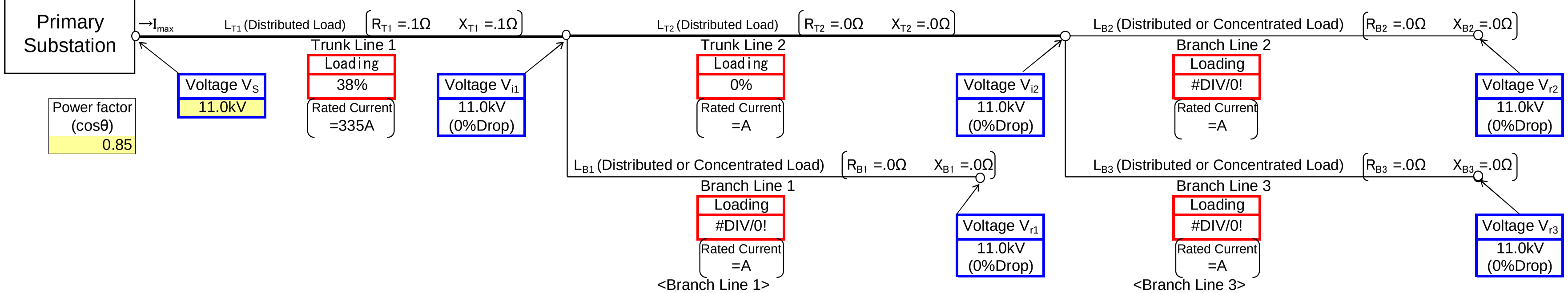
Load L_{T1}	127A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	.5km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	750kVA	

<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	ABL

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	133A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	.5km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

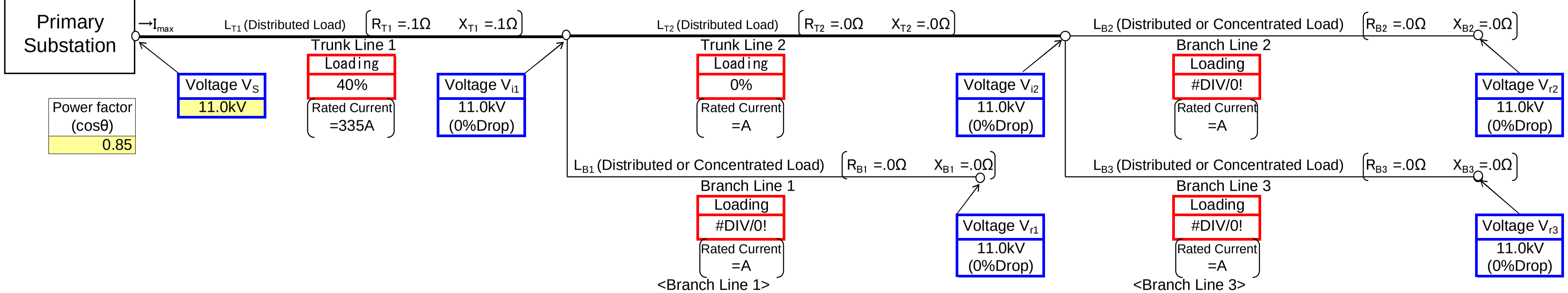
<Trank Line 2>

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}	133.0A
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=====

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

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

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

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

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

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

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

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

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

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

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

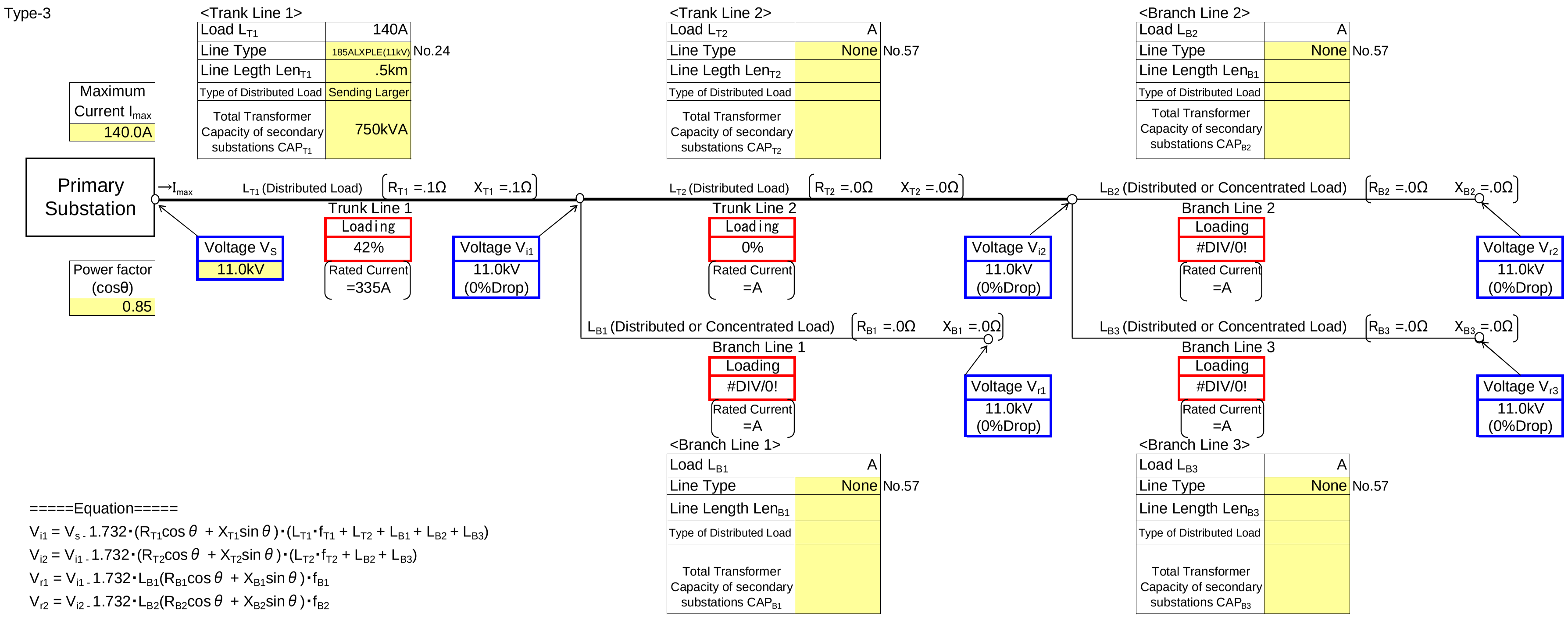
V_s : Supply Voltage	I_{max} : Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$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

: 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	ABL

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	147A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	.5km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	750kVA	

<Trank Line 2>

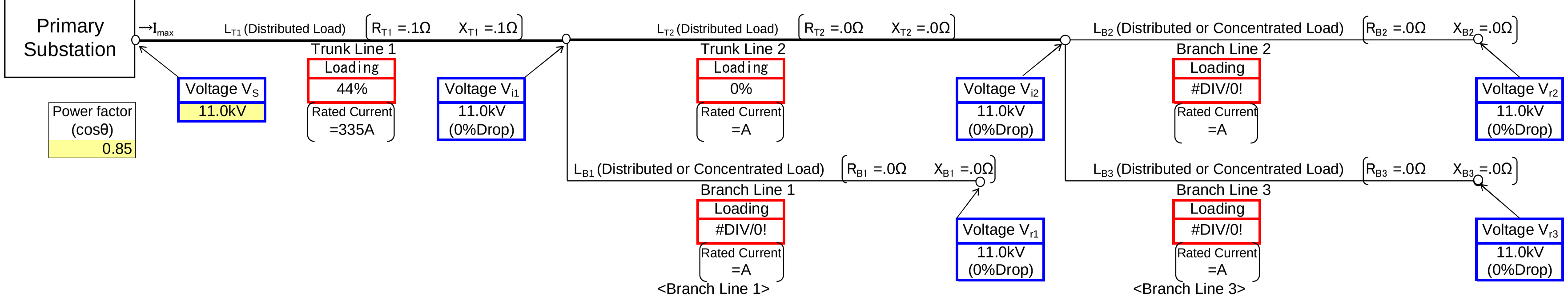
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
147.0A

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 E
Feeder Name	ABL

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	154A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	.5km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	750kVA	

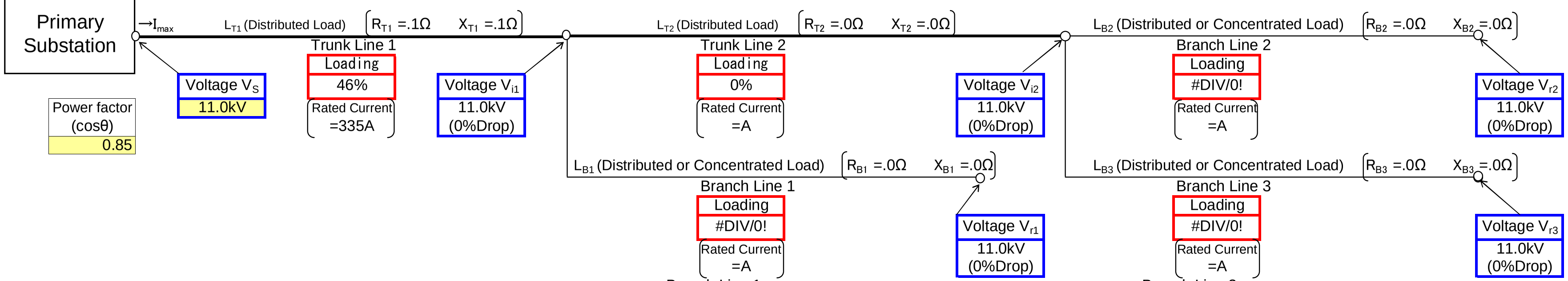
<Trank Line 2>

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}	154.0A
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	ABL

: Input data in colored cells

Type-3

Maximum Current I_{max}
164.0A

Power factor (cosθ)
0.85

<Trank Line 1>

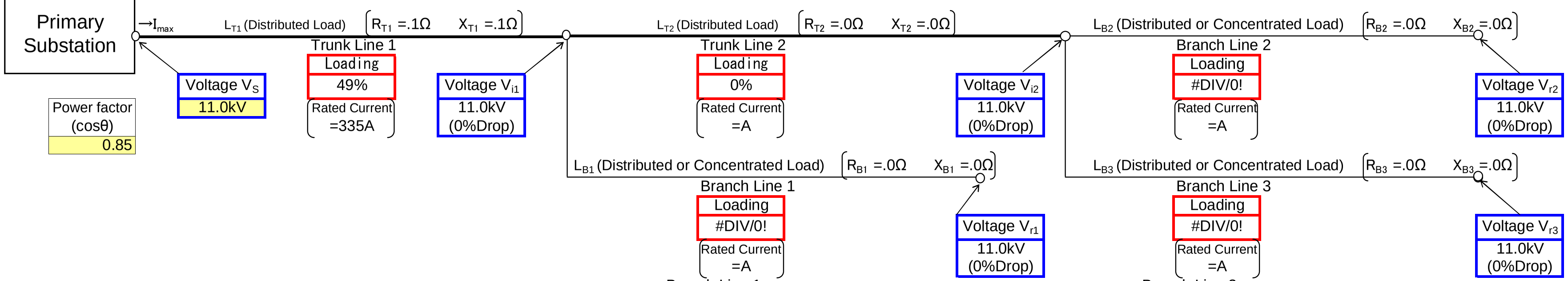
Load L_{T1}	164A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	.5km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	750kVA	

<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	ABL

: Input data in colored cells

Type-3

Maximum Current I_{max}
169.0A

Power factor (cosθ)
0.85

Primary Substation

Voltage V_s 11.0kV

<Trank Line 1>

Load L_{T1}	169A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	.5km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	750kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.1Ω X_{T1} =.1Ω)

Trunk Line 1: Loading 50% (Rated Current =335A)

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)

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}		

<Branch Line 2>

Load 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_{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	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch 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	ABL1

: Input data in colored cells

Type-3

Maximum Current I_{max}
340.0A

Power factor (cosθ)
0.85

<Trank Line 1>

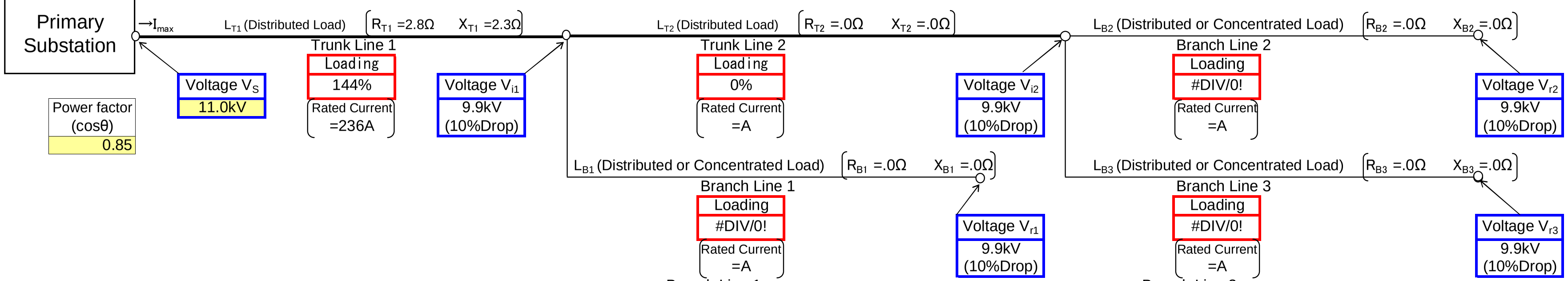
Load L_{T1}	340A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	372A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

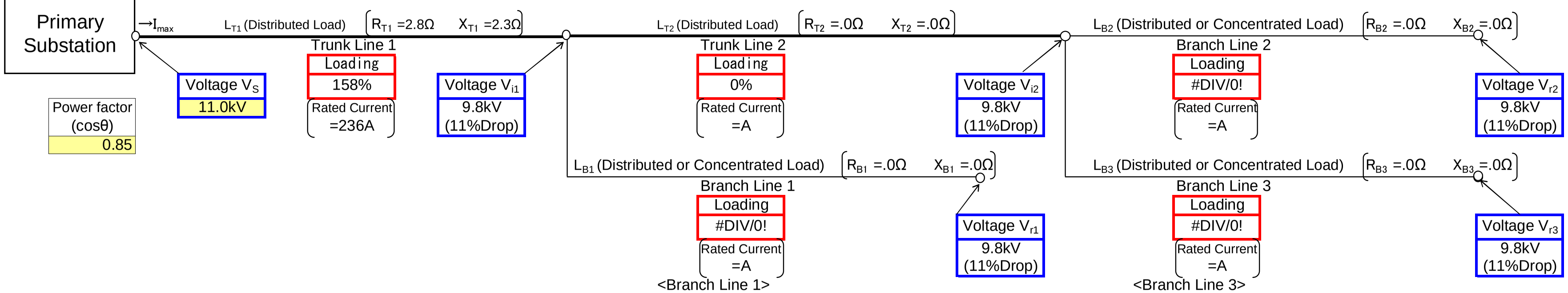
<Trank Line 2>

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}	372.0A
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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}: 393.0A

Power factor (cosθ): 0.85

<Trank Line 1>

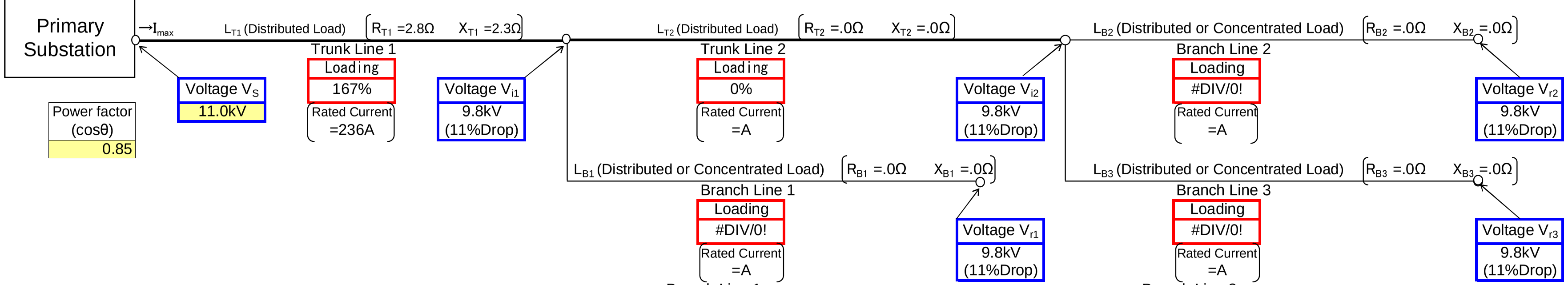
Load L_{T1}	393A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Primary Substation

Maximum Current I_{max}	417.0A
Power factor (cosθ)	0.85

Voltage V_s: 11.0kV

<Trank Line 1>

Load L_{T1}	417A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =2.8Ω X_{T1} =2.3Ω)

Trunk Line 1: Loading 177%, Rated Current =236A

Voltage V_{i1}: 9.7kV (12%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}: 9.7kV (12%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}: 9.7kV (12%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}: 9.7kV (12%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}: 9.7kV (12%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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}	441.0A

Power factor (cosθ)	0.85

<Trank Line 1>

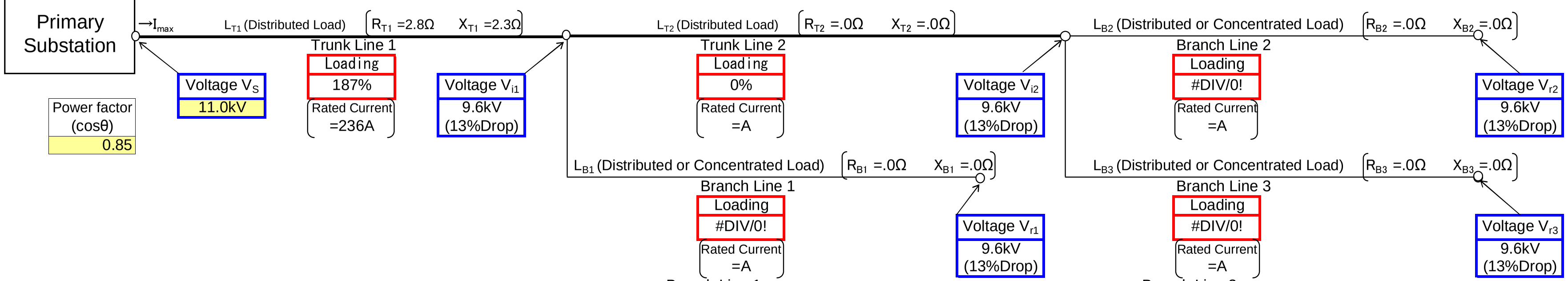
Load L_{T1}	441A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}
467.0A

Power factor (cosθ)
0.85

<Trank Line 1>

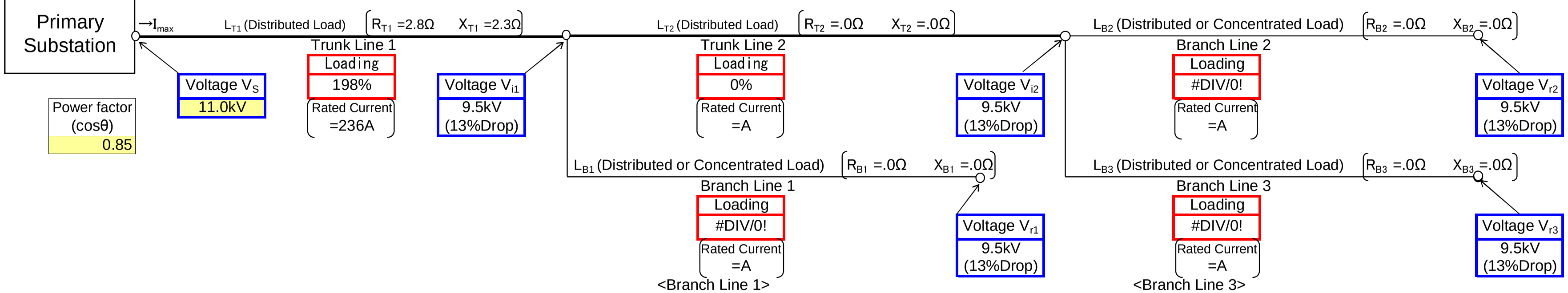
Load L_{T1}	467A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}
494.0A

Power factor (cosθ)
0.85

<Trank Line 1>

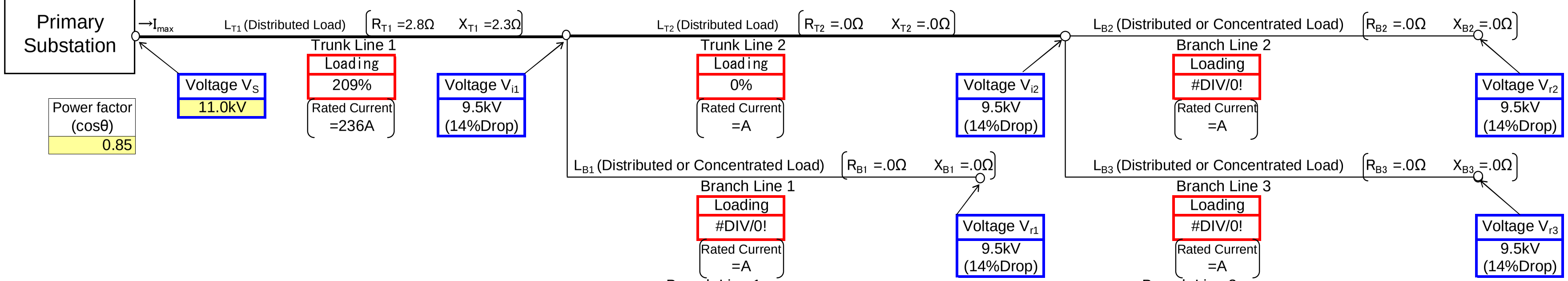
Load L_{T1}	494A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}
523.0A

<Trank Line 1>

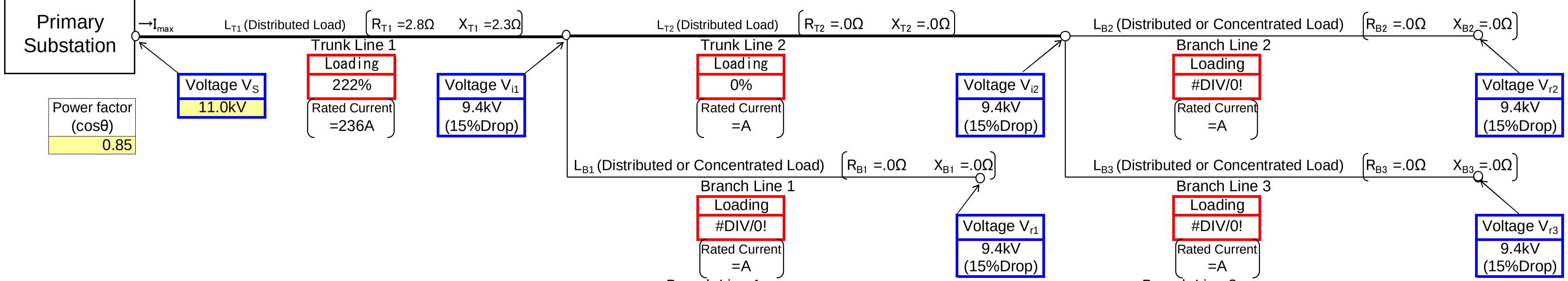
Load L_{T1}	523A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}
554.0A

<Trank Line 1>

Load L_{T1}	554A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

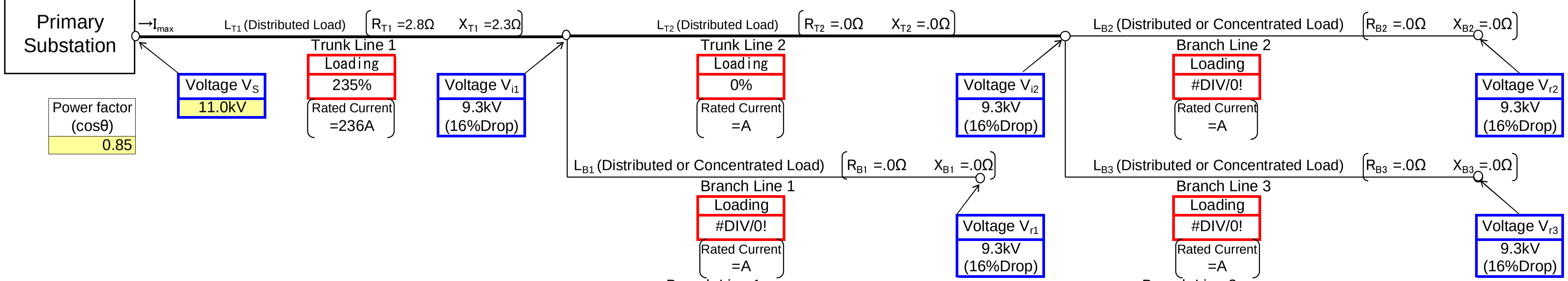
<Trank Line 2>

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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}
587.0A

Power factor (cosθ)
0.85

<Trank Line 1>

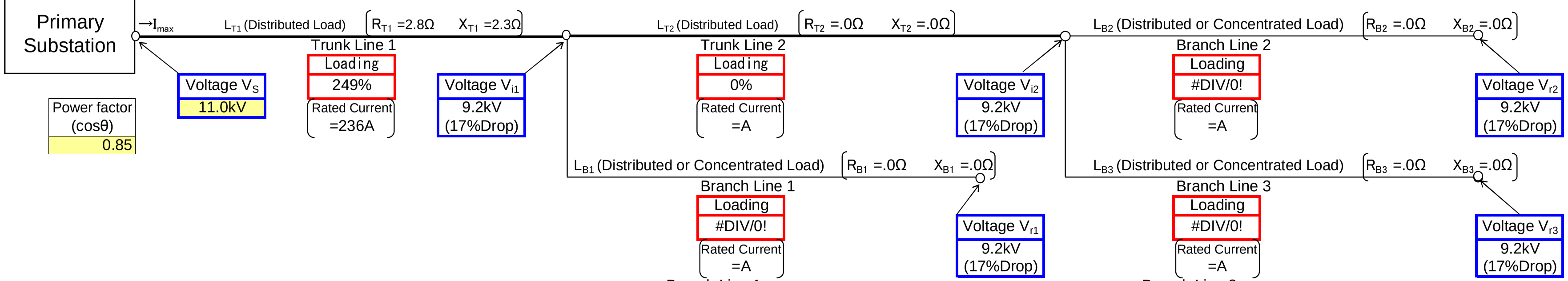
Load L_{T1}	587A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}
621.0A

Power factor (cosθ)
0.85

<Trank Line 1>

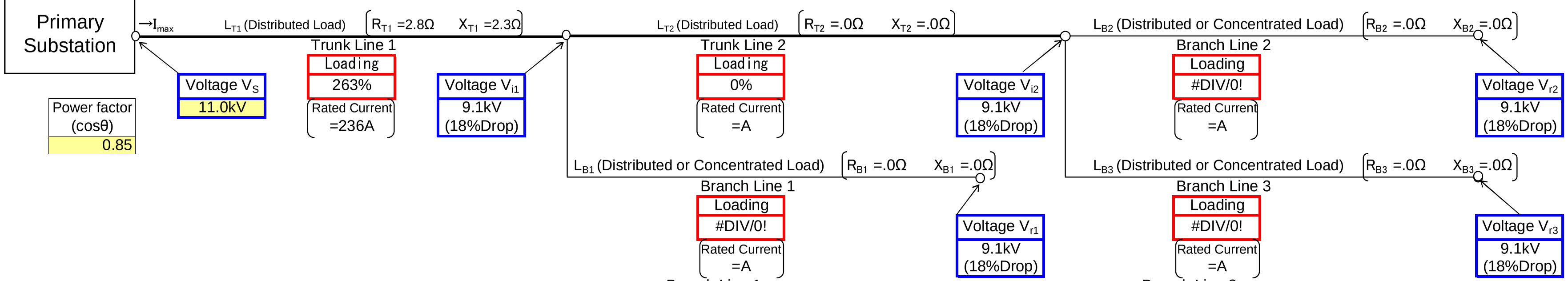
Load L_{T1}	621A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 C
Feeder Name	ABC

: Input data in colored cells

Type-3

Maximum Current I_{max}
658.0A

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

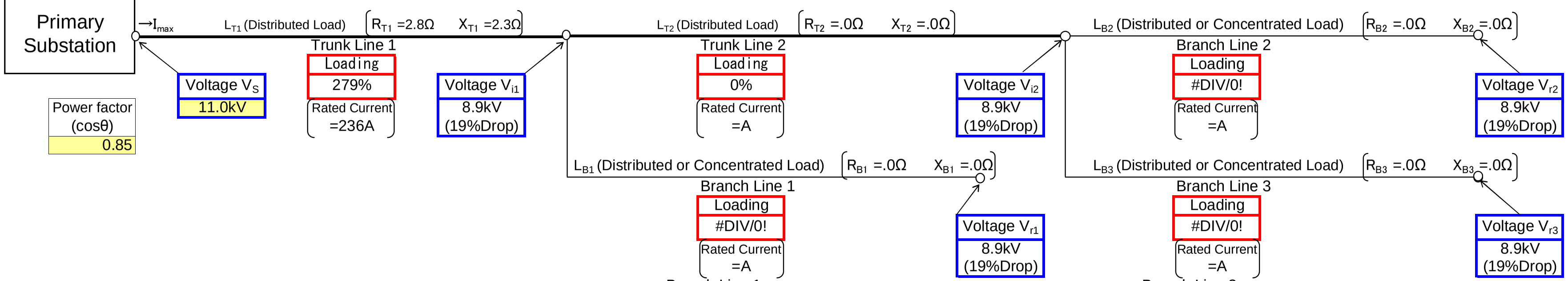
Load L_{T1}	658A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	4.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1315kVA	

<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 A
Feeder Name	A01

: Input data in colored cells

Type-3

Maximum Current I_{max}	480.0A

<Trank Line 1>

Load L_{T1}	480A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	16.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5220kVA	

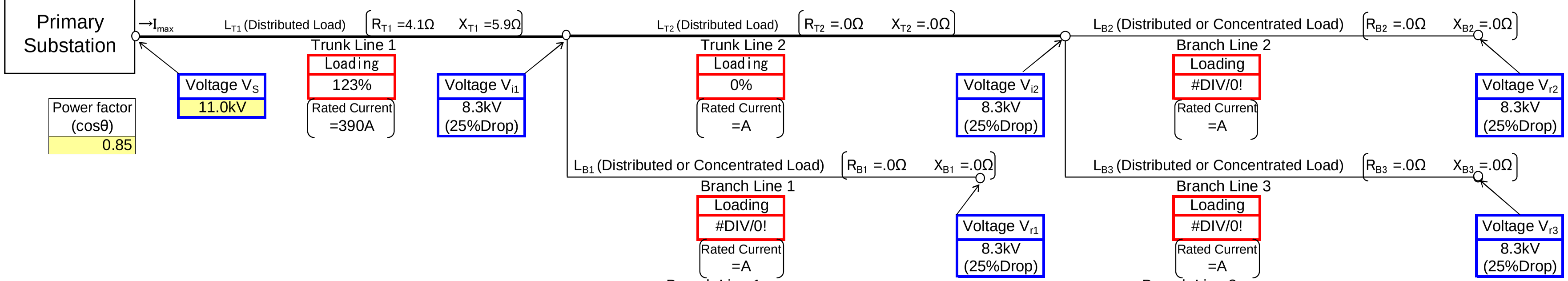
<Trank Line 2>

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 A
Feeder Name	A01

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	498A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	16.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5220kVA	

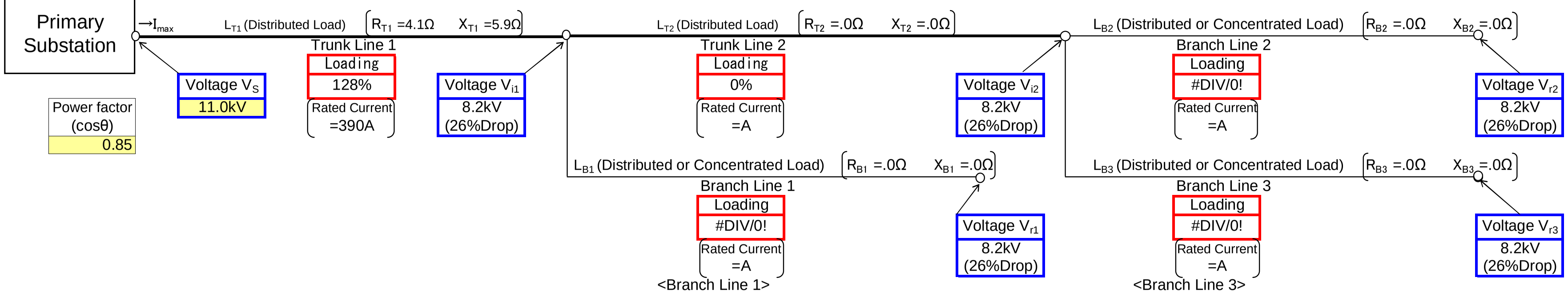
<Trank Line 2>

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}	498.0A
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 A
Feeder Name	A01

: Input data in colored cells

Type-3

Maximum Current I_{max}: 516.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

<Trank Line 1>

Load L_{T1}	516A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	16.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5220kVA	

L_{T1} (Distributed Load) (R_{T1} =4.1Ω X_{T1} =5.9Ω)

Voltage V_S: 11.0kV

Trunk Line 1 Loading: 132% (Rated Current =390A)

Voltage V_{i1}: 8.1kV (27%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}: 8.1kV (27%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}: 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}: 8.1kV (27%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}: 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 A
Feeder Name	A01

: Input data in colored cells

Type-3

Maximum Current I_{max}: 535.0A

Power factor (cosθ): 0.85

<Trank Line 1>

Load L_{T1}	535A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	16.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5220kVA	

<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} =4.1Ω X_{T1} =5.9Ω)

Trunk Line 1: Loading 137%; Rated Current =390A

Voltage V_{i1}: 7.9kV (28%Drop)

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

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

Voltage V_{i2}: 7.9kV (28%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}: 7.9kV (28%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}: 7.9kV (28%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}: 7.9kV (28%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 A
Feeder Name	A01

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	555A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	16.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5220kVA	

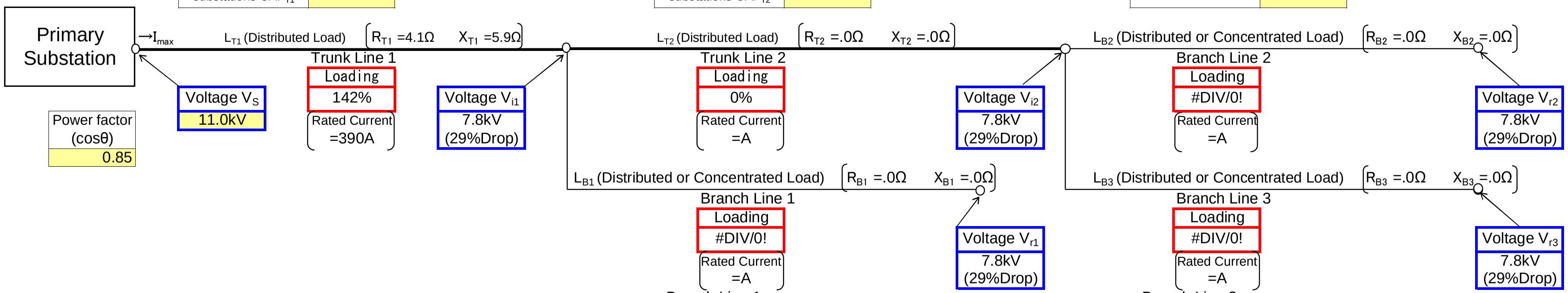
<Trank Line 2>

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}	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 A
Feeder Name	A01

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	576A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	16.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5220kVA	

<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}
576.0A

Primary Substation

$\rightarrow I_{max}$

Power factor ($\cos\theta$)
0.85

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =4.1Ω X_{T1} =5.9Ω)

Trunk Line 1: Loading 148% (Rated Current =390A)

Voltage V_{i1}: 7.7kV (30%Drop)

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

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

Voltage V_{i2}: 7.7kV (30%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}: 7.7kV (30%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}: 7.7kV (30%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}: 7.7kV (30%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 A
Feeder Name	A01

: Input data in colored cells

Type-3

Maximum Current I_{max}
597.0A

Power factor (cosθ)
0.85

<Trank Line 1>

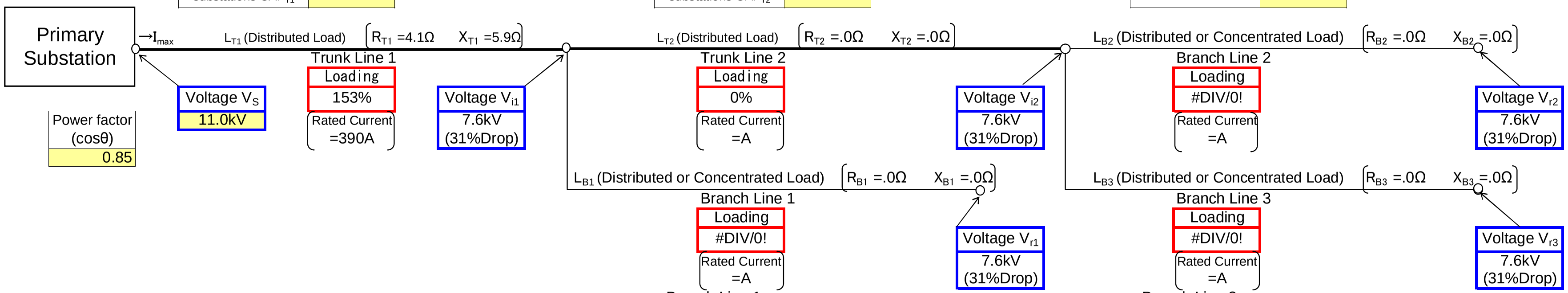
Load L_{T1}	597A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	16.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5220kVA	

<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 A
Feeder Name	A01

: Input data in colored cells

Type-3

Maximum Current I_{max}
619.0A

Power factor (cosθ)
0.85

<Trank Line 1>

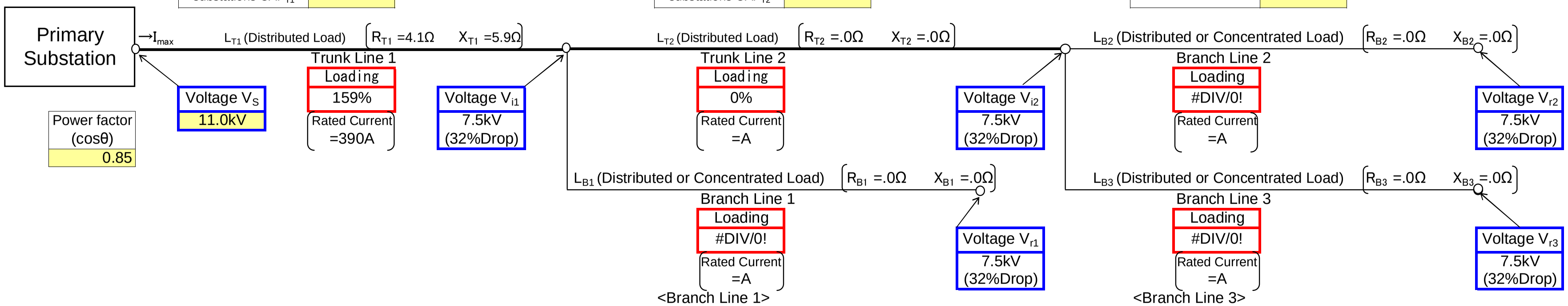
Load L_{T1}	619A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	16.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5220kVA	

<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 A
Feeder Name	A01

: Input data in colored cells

Type-3

Maximum Current I_{max}
642.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	642A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	16.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5220kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =4.1Ω X_{T1} =5.9Ω)

Voltage V_S: 11.0kV

Trunk Line 1 — Loading: 165% (Rated Current =390A)

Voltage V_{i1}: 7.3kV (33%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}: 7.3kV (33%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}: 7.3kV (33%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}: 7.3kV (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}		

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 (33%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 A
Feeder Name	A01

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	666A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	16.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5220kVA	

<Trank Line 2>

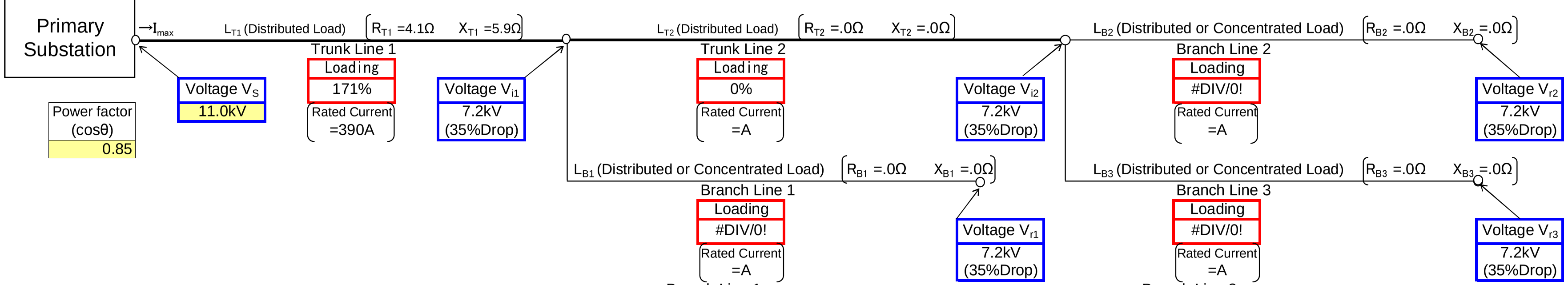
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
666.0A

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 A
Feeder Name	A01

: Input data in colored cells

Type-3

Maximum Current I_{max}
621.0A

Power factor (cosθ)
0.85

<Trank Line 1>

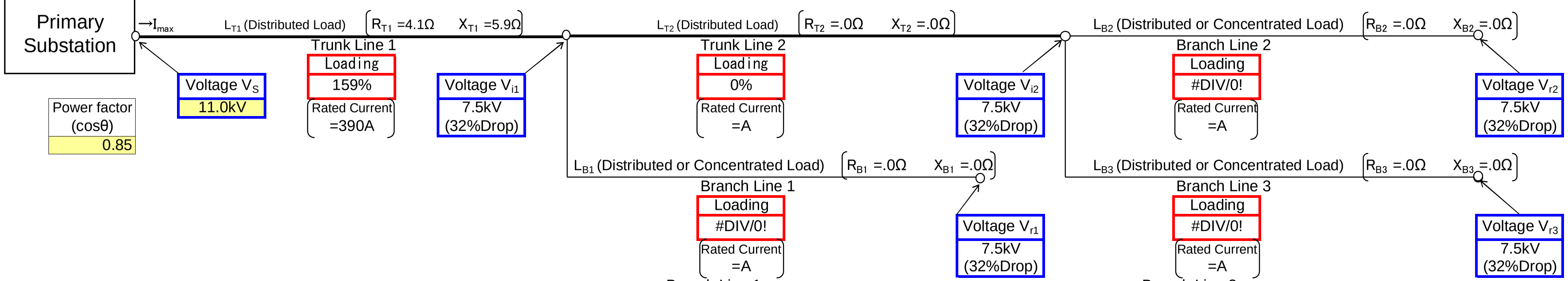
Load L_{T1}	621A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	16.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5220kVA	

<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 A
Feeder Name	A01

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	717A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	16.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5220kVA	

<Trank Line 2>

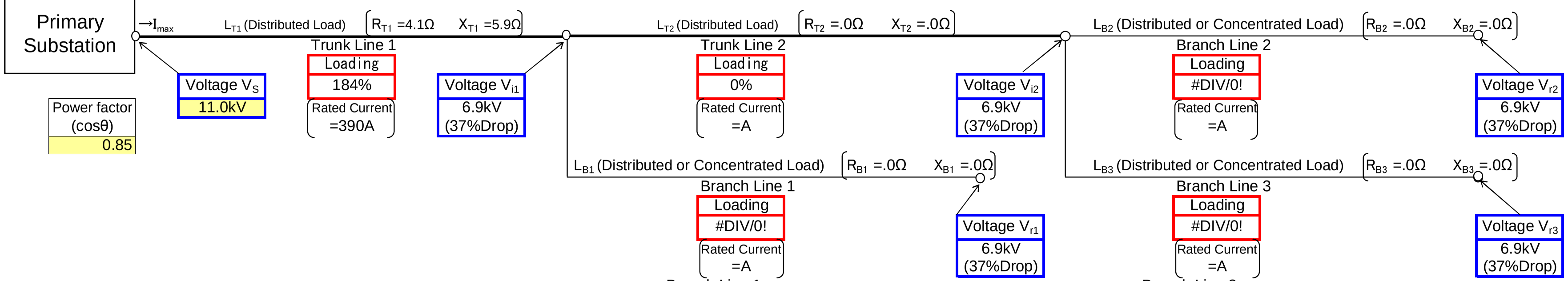
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
717.0A

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 B
Feeder Name	B15

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	340A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5930kVA	

<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}	340.0A
Power factor (cosθ)	0.85

Primary Substation

$\rightarrow I_{max}$

Voltage V_S 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)

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 B
Feeder Name	B15

: Input data in colored cells

Type-3

Maximum Current I_{max}
355.0A

Power factor ($\cos\theta$)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	355A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5930kVA	

<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
106%

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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION B
Feeder Name	B15

: Input data in colored cells

Type-3

Maximum Current I_{max}
370.0A

Power factor (cosθ)
0.85

<Trank Line 1>

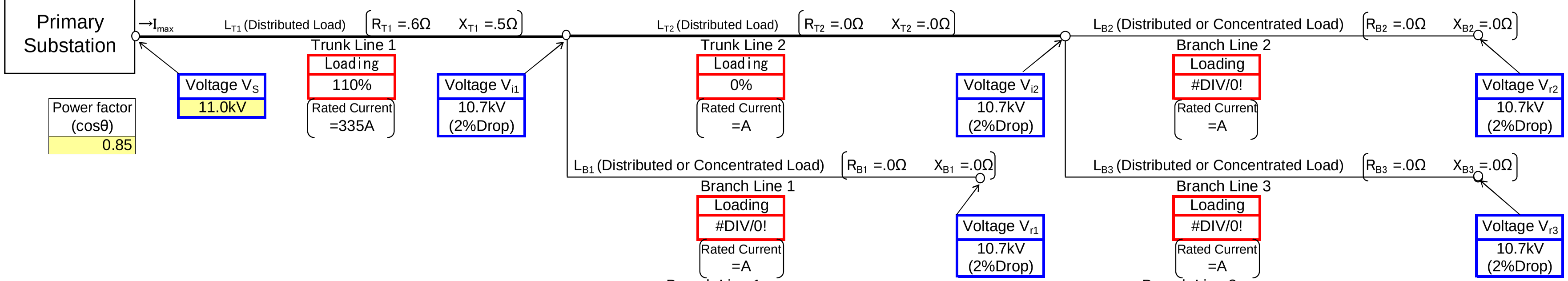
Load L_{T1}	370A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5930kVA	

<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 B
Feeder Name	B15

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	386A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5930kVA	

<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}	386.0A
Power factor (cosθ)	0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) R_{T1} =.6Ω X_{T1} =.5Ω

Trunk Line 1 — Loading 115% — 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 B
Feeder Name	B15

: Input data in colored cells

Type-3

Maximum Current I_{max}
403.0A

<Trank Line 1>

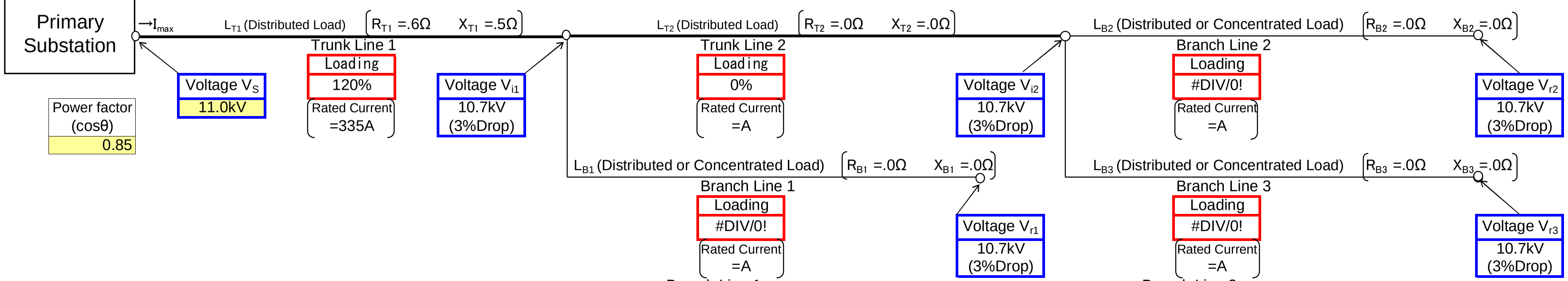
Load L_{T1}	403A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5930kVA	

<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 B
Feeder Name	B15

: Input data in colored cells

Type-3

Maximum Current I_{max}
421.0A

Power factor (cosθ)
0.85

<Trank Line 1>

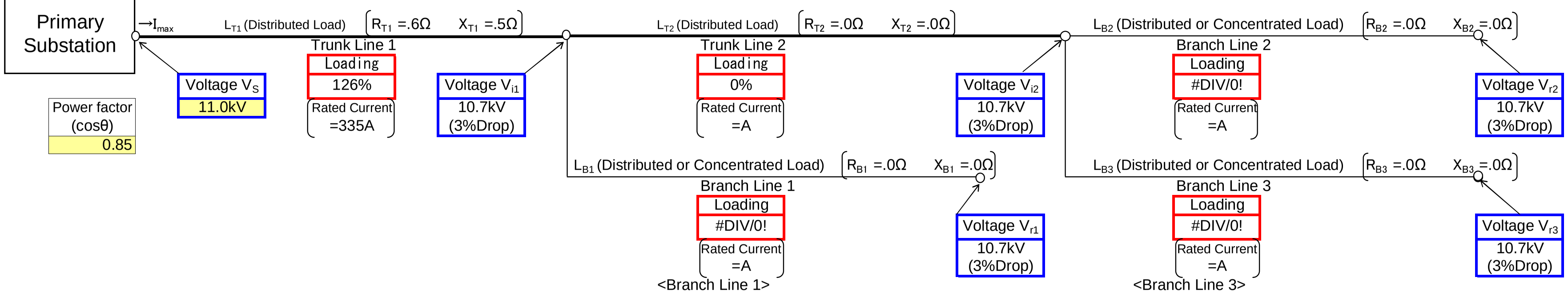
Load L_{T1}	421A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5930kVA	

<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 B
Feeder Name	B15

: Input data in colored cells

Type-3

Primary Substation

Maximum Current I_{max}
439.0A

Power factor (cosθ)
0.85

Voltage V_S
11.0kV

<Trank Line 1>

Load L_{T1}	439A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5930kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)

Trunk Line 1: Loading 131%, (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 B
Feeder Name	B15

: Input data in colored cells

Type-3

Maximum Current I_{max}
458.0A

Power factor (cosθ)
0.85

<Trank Line 1>

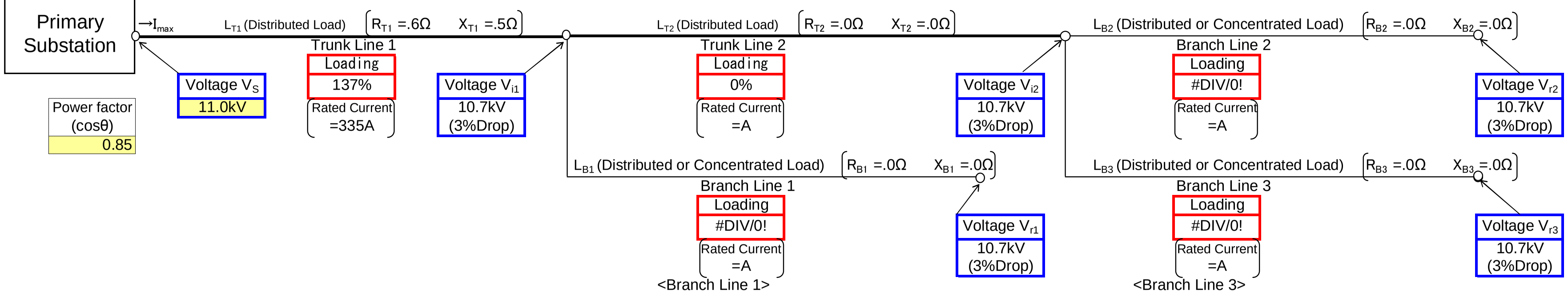
Load L_{T1}	458A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5930kVA	

<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 B
Feeder Name	B15

: Input data in colored cells

Type-3

Maximum Current I_{max}
478.0A

Power factor (cosθ)
0.85

<Trank Line 1>

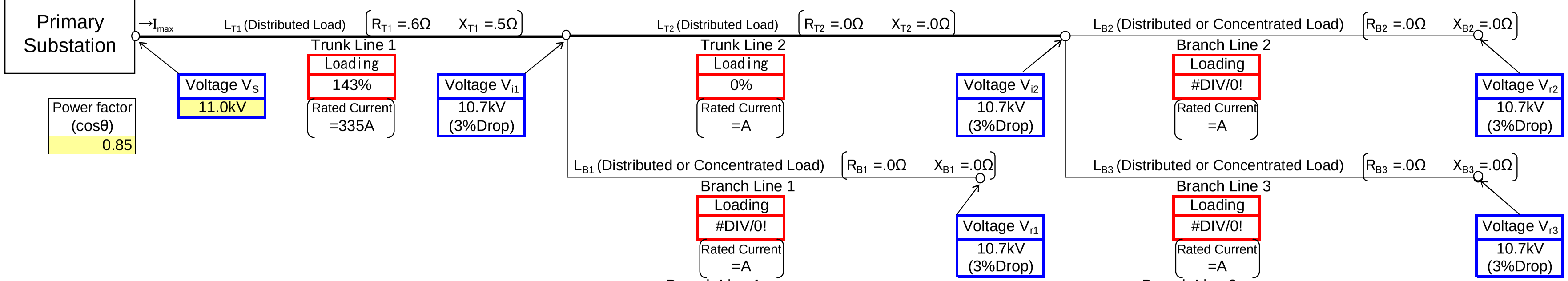
Load L_{T1}	478A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5930kVA	

<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 B
Feeder Name	B15

: Input data in colored cells

Type-3

Maximum Current I_{max}
499.0A

Power factor ($\cos\theta$)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	499A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5930kVA	

<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 149%; Rated Current =335A

Voltage V_S: 11.0kV

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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION B
Feeder Name	B15

: Input data in colored cells

Type-3

Maximum Current I_{max}
520.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	520A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5930kVA	

<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} =.6Ω X_{T1} =.5Ω)

Trunk Line 1 Loading 155% (Rated Current =335A)

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 B
Feeder Name	B15

: Input data in colored cells

Type-3

Maximum Current I_{max}
543.0A

Power factor (cosθ)
0.85

<Trank Line 1>

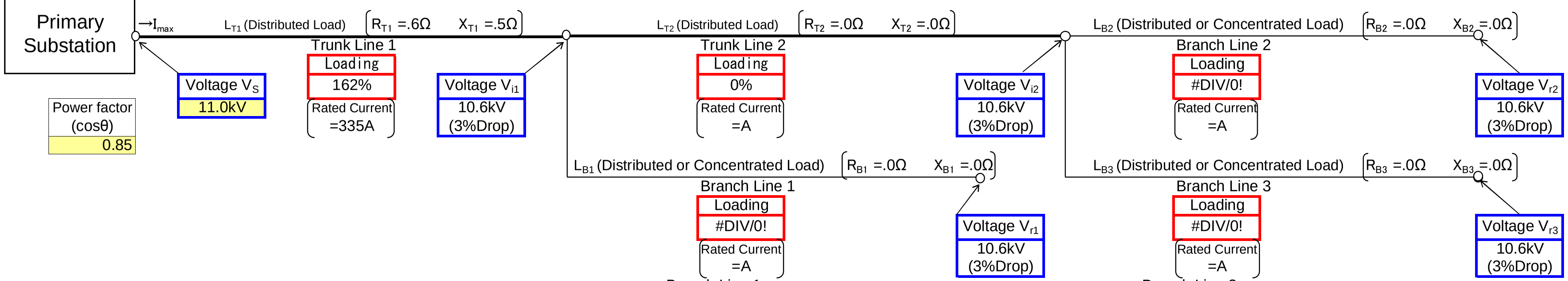
Load L_{T1}	543A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.1km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5930kVA	

<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 B
Feeder Name	B19

: Input data in colored cells

Type-3

Maximum Current I_{max}
340.0A

Power factor (cosθ)
0.85

Primary Substation

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	340A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.3Ω X_{T1} =.2Ω)

Trunk Line 1 — Loading 101% (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)	cosθ : Power Factor

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

Substation Name	STATION B
Feeder Name	B19

: Input data in colored cells

Type-3

Maximum Current I_{max}
350.0A

Power factor (cosθ)
0.85

<Trank Line 1>

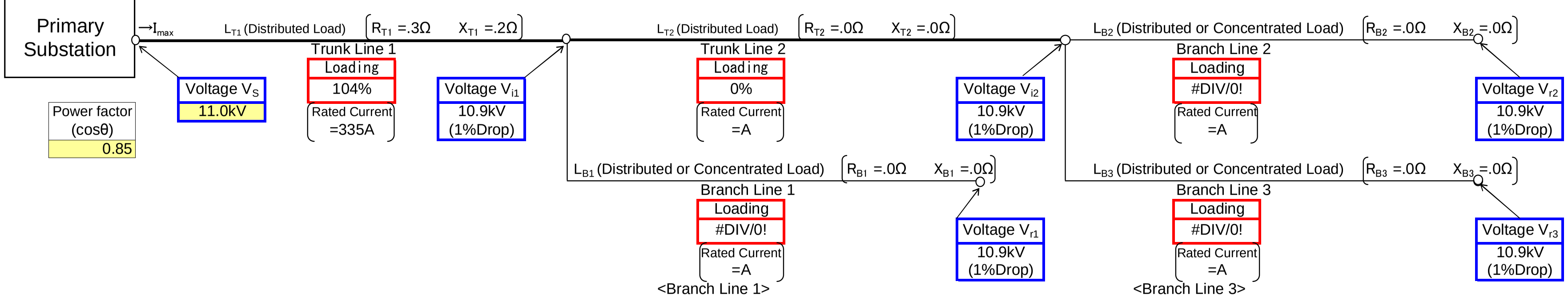
Load L_{T1}	350A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<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 B
Feeder Name	B19

: Input data in colored cells

Type-3

Maximum Current I_{max}
362.0A

Power factor (cosθ)
0.85

<Trank Line 1>

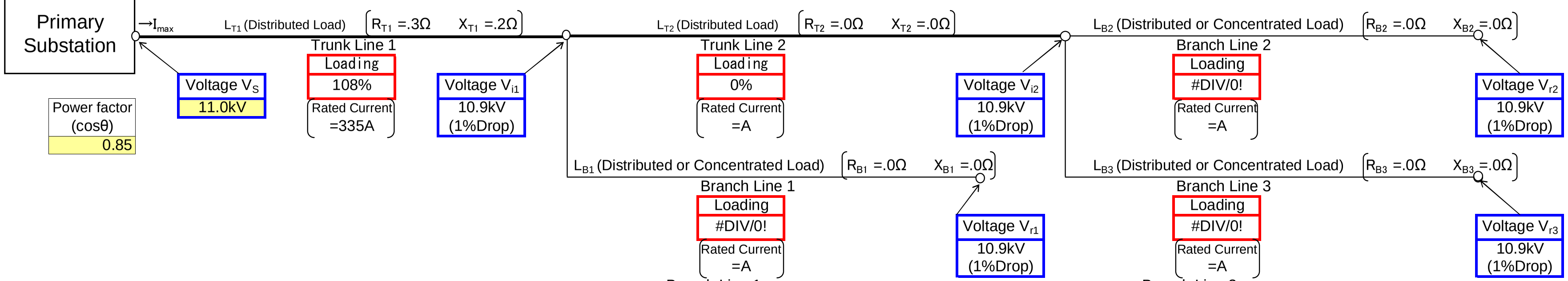
Load L_{T1}	362A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<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 B
Feeder Name	B19

: Input data in colored cells

Type-3

Maximum Current I_{max}	371.0A
Power factor (cosθ)	0.85

Primary Substation $\rightarrow I_{max}$

<Trank Line 1>

Load L_{T1}	371A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

L_{T1} (Distributed Load) (R_{T1} =.3Ω X_{T1} =.2Ω)

Voltage V_S: 11.0kV

Trunk Line 1: Loading 111%; 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 B
Feeder Name	B19

: Input data in colored cells

Type-3

Maximum Current I_{max}
383.0A

Power factor (cosθ)
0.85

<Trank Line 1>

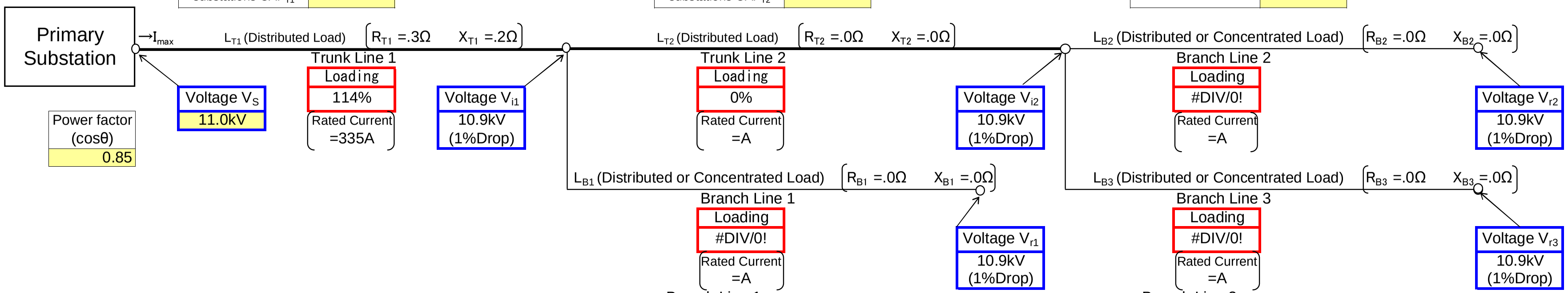
Load L_{T1}	383A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<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 B
Feeder Name	B19

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	394A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<Trank Line 2>

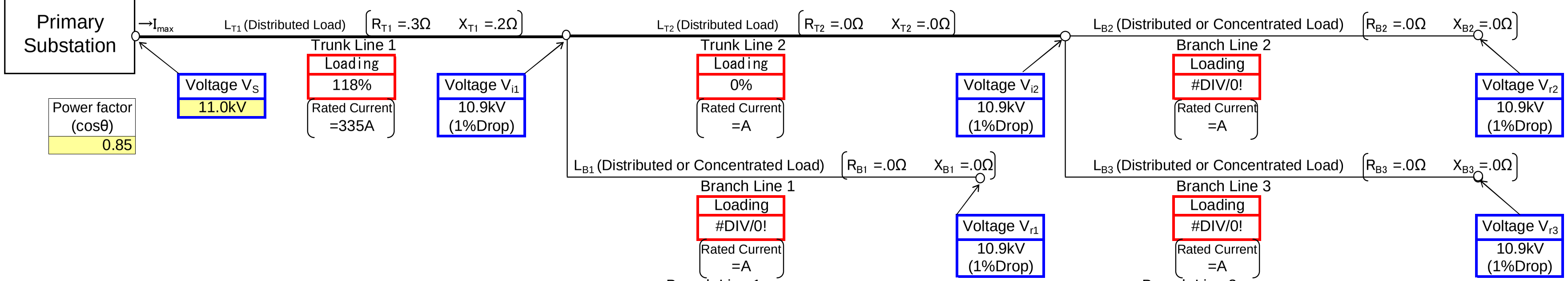
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
394.0A

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 B
Feeder Name	B19

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	406A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<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

Primary Substation $\rightarrow I_{max}$

Voltage V_S
11.0kV

L_{T1} (Distributed Load) R_{T1} =.3Ω X_{T1} =.2Ω

Trunk Line 1

Loading
121%

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 B
Feeder Name	B19

: Input data in colored cells

Type-3

Maximum Current I_{max}
418.0A

Power factor ($\cos\theta$)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	418A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<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) $(R_{T1} = .3\Omega \quad X_{T1} = .2\Omega)$

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

Voltage V_S: 11.0kV

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

L_{T2} (Distributed Load) $(R_{T2} = .0\Omega \quad X_{T2} = .0\Omega)$

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

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

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}: 10.9kV (1%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}: 10.9kV (1%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}: 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 B
Feeder Name	B19

: Input data in colored cells

Type-3

Maximum Current I_{max}	431.0A

Power factor (cosθ)	0.85

<Trank Line 1>

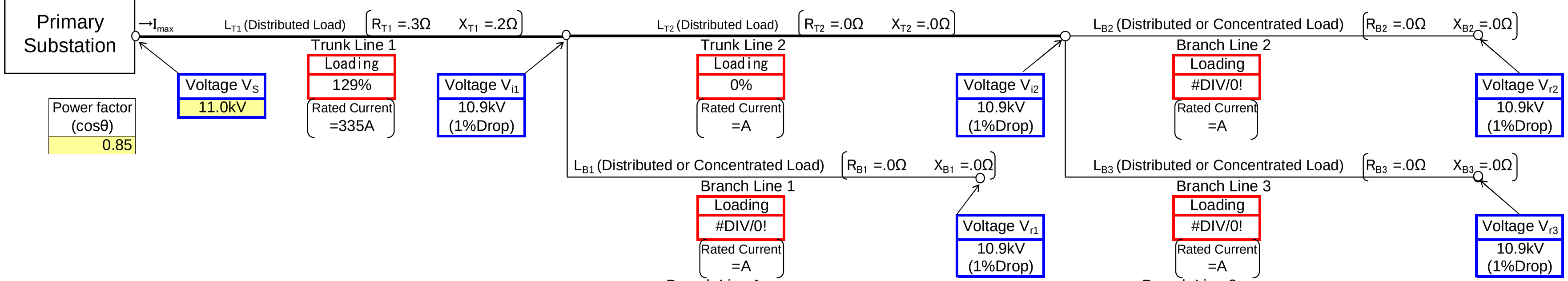
Load L_{T1}	431A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<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 B
Feeder Name	B19

: Input data in colored cells

Type-3

Maximum Current I_{max}
444.0A

Power factor (cosθ)
0.85

<Trank Line 1>

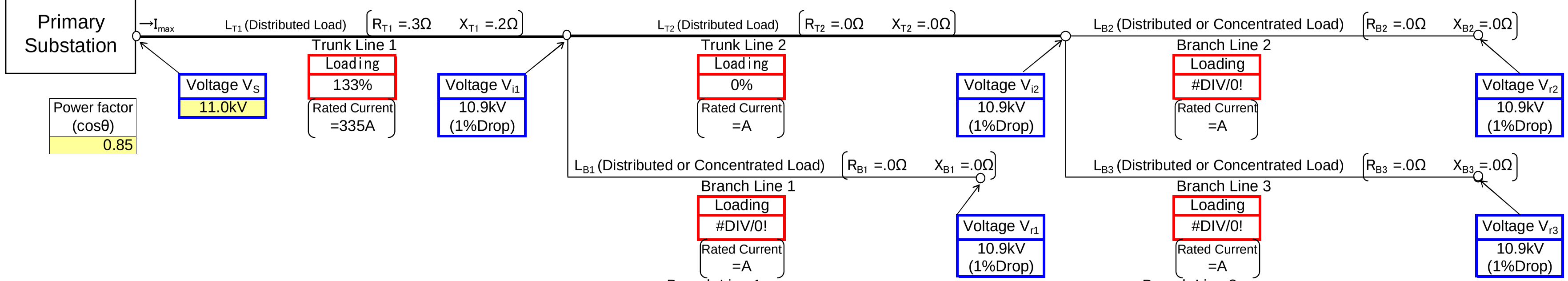
Load L_{T1}	444A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<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 B
Feeder Name	B19

: Input data in colored cells

Type-3

Maximum Current I_{max}
457.0A

Power factor (cosθ)
0.85

<Trank Line 1>

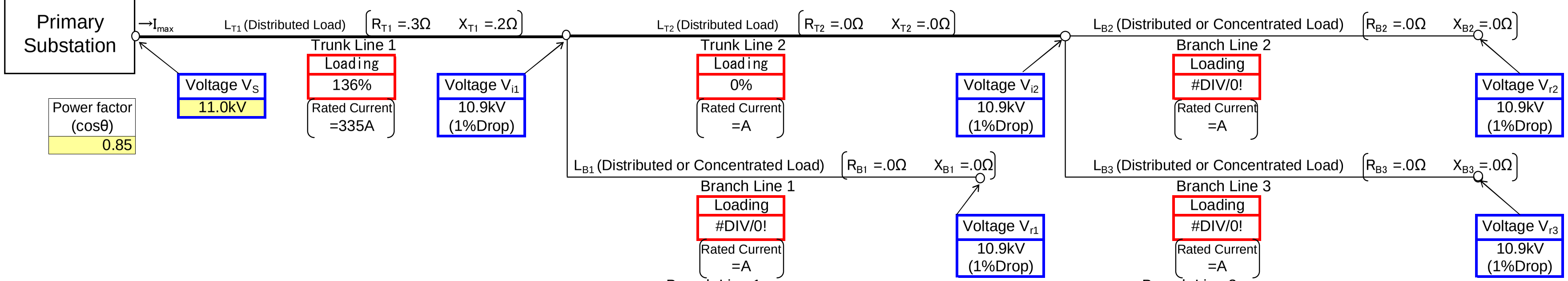
Load L_{T1}	457A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<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 B
Feeder Name	B19

: Input data in colored cells

Type-3

Maximum Current I_{max}
470.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	470A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.8km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<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} =.2Ω)

Trunk Line 1: Loading 140%, 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 B
Feeder Name	B20

: Input data in colored cells

Type-3

Maximum Current I_{max}
205.0A

Power factor (cosθ)
0.85

Primary Substation

→I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	205A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6000kVA	

L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)

Trunk Line 1: Loading 61%, (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 B
Feeder Name	B20

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	215A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6000kVA	

<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

Primary Substation

$\rightarrow I_{max}$

L_{T1} (Distributed Load) R_{T1} =.6Ω X_{T1} =.5Ω

Trunk Line 1: Loading 64%; 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 B
Feeder Name	B20

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	226A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6000kVA	

<Trank Line 2>

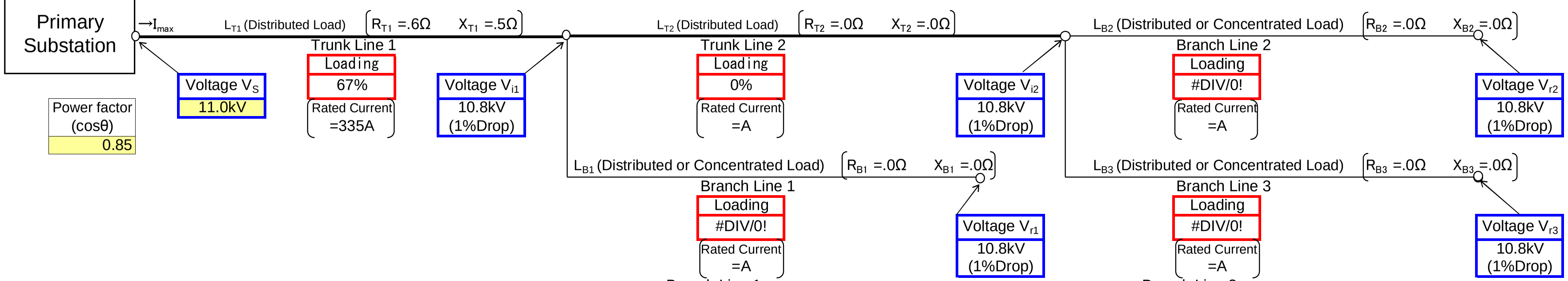
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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=====

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

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

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

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

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

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

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

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

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

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

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

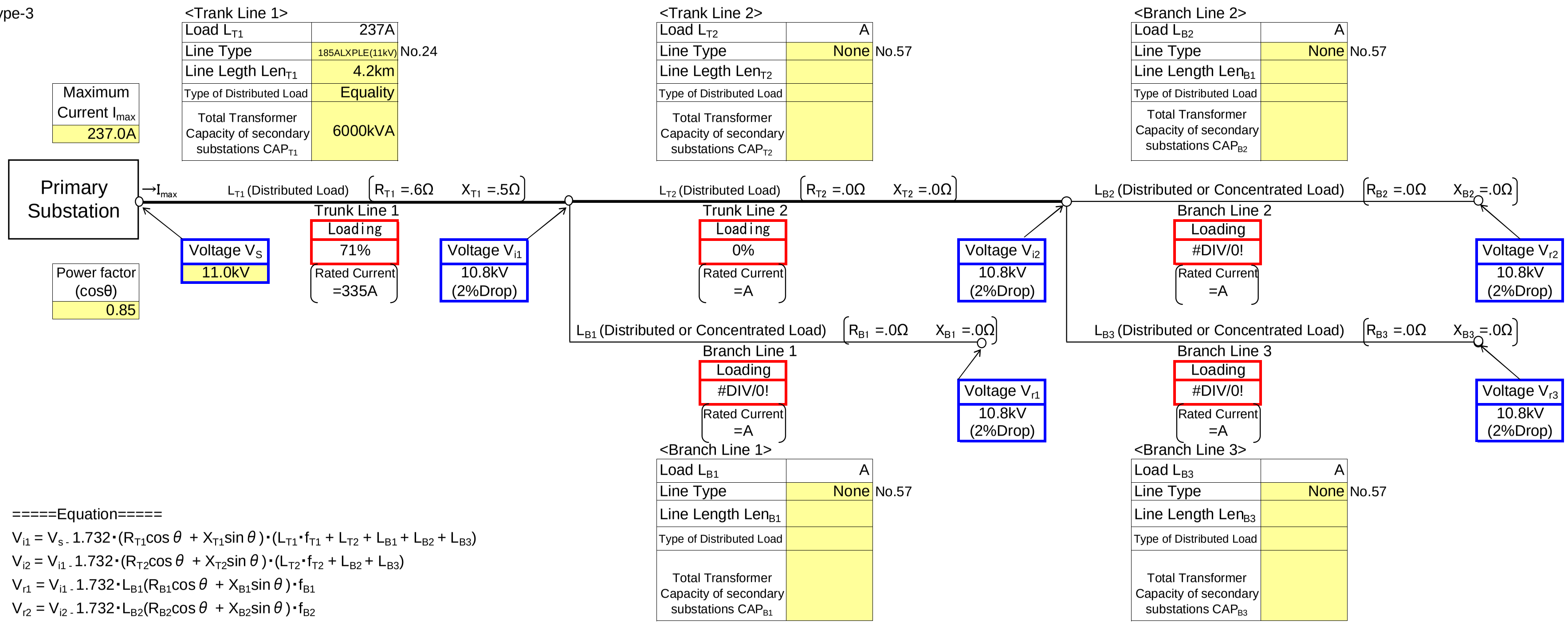
V_s : Supply Voltage	I_{max} : Maximum Current	R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}	: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}	: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}	: Dispersal 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 B
Feeder Name	B20

: 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 B
Feeder Name	B20

: Input data in colored cells

Type-3

Maximum Current I_{max}
246.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	246A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6000kVA	

<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} =.6Ω X_{T1} =.5Ω)

Trunk Line 1: Loading 73%; 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 B
Feeder Name	B20

: 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	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6000kVA	

<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: 78% — 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
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 B
Feeder Name	B20

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	273A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6000kVA	

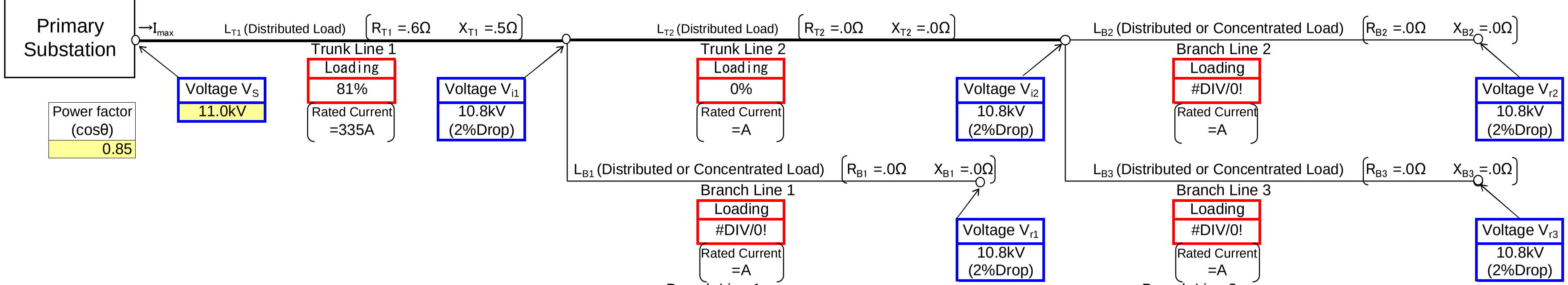
<Trank Line 2>

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}	273.0A
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 B
Feeder Name	B20

: Input data in colored cells

Type-3

Maximum Current I_{max}
287.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	287A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6000kVA	

<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 86%, 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 B
Feeder Name	B20

: 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	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6000kVA	

L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)

Trunk Line 1: Loading 90%; 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
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 B
Feeder Name	B20

: Input data in colored cells

Type-3

Maximum Current I_{max}	315.0A

Primary Substation

Power factor (cosθ)	0.85

<Trank Line 1>		
Load L_{T1}	315A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6000kVA	

<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} =.6Ω X_{T1} =.5Ω)

Trunk Line 1: Loading 94%, 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 B
Feeder Name	B20

: Input data in colored cells

Type-3

Maximum Current I_{max}
331.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_S
11.0kV

<Trank Line 1>

Load L_{T1}	331A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6000kVA	

L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)

Trunk Line 1

Loading
99%
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=====

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

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

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

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

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

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

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

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

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

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

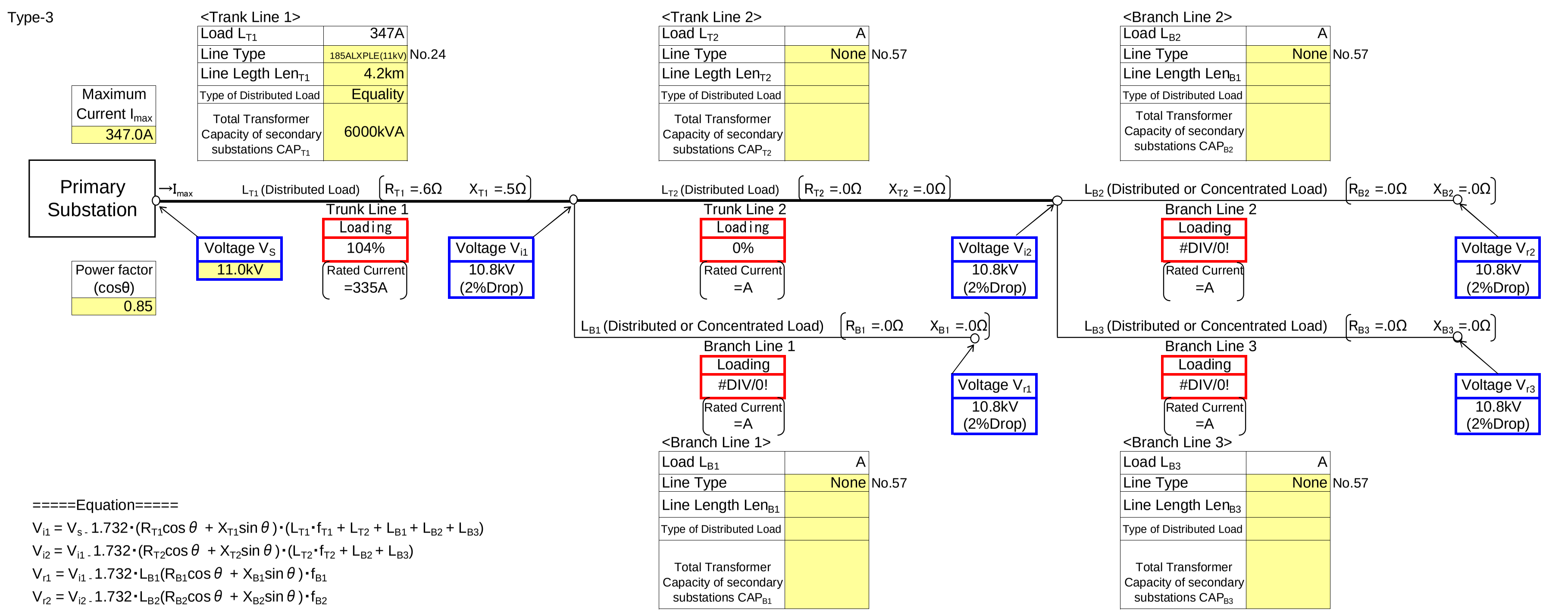
$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

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 B
Feeder Name	B20

: 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 B
Feeder Name	B25

: Input data in colored cells

Type-3

Maximum Current I_{max}	260.0A

Power factor (cosθ)	0.85

<Trank Line 1>

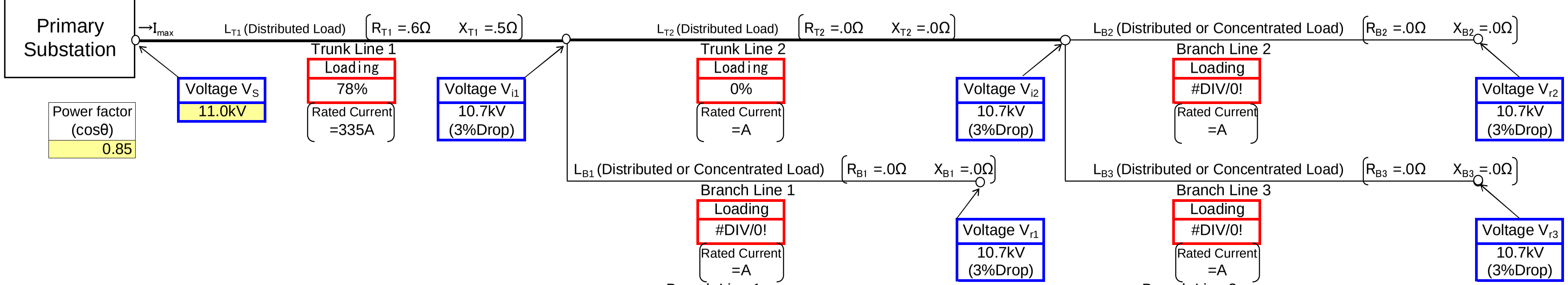
Load L_{T1}	260A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	5450kVA	

<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 B
Feeder Name	B25

: 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	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	5450kVA	

L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)

Trunk Line 1: Loading 81%, 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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
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 B
Feeder Name	B25

: Input data in colored cells

Type-3

Maximum Current I_{max}
286.0A

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

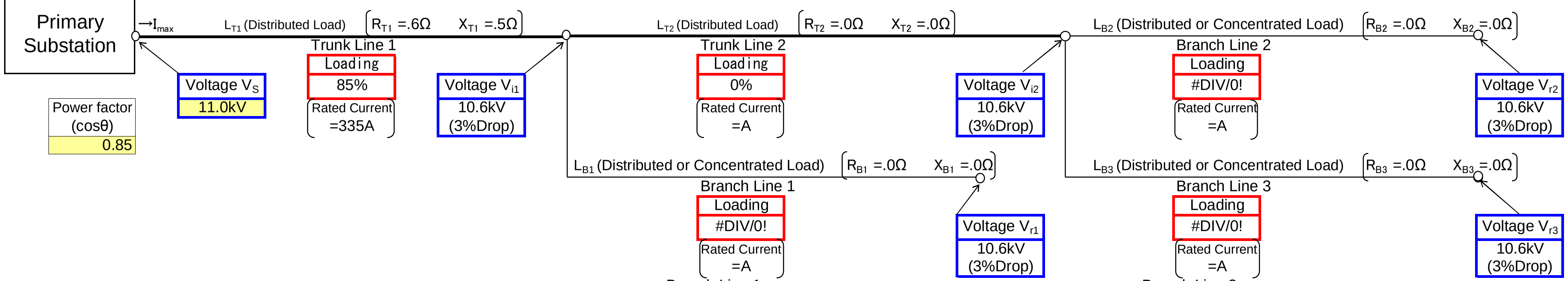
Load L_{T1}	286A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	5450kVA	

<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 B
Feeder Name	B25

: Input data in colored cells

Type-3

Maximum Current I_{max}
300.0A

Power factor (cosθ)
0.85

<Trank Line 1>

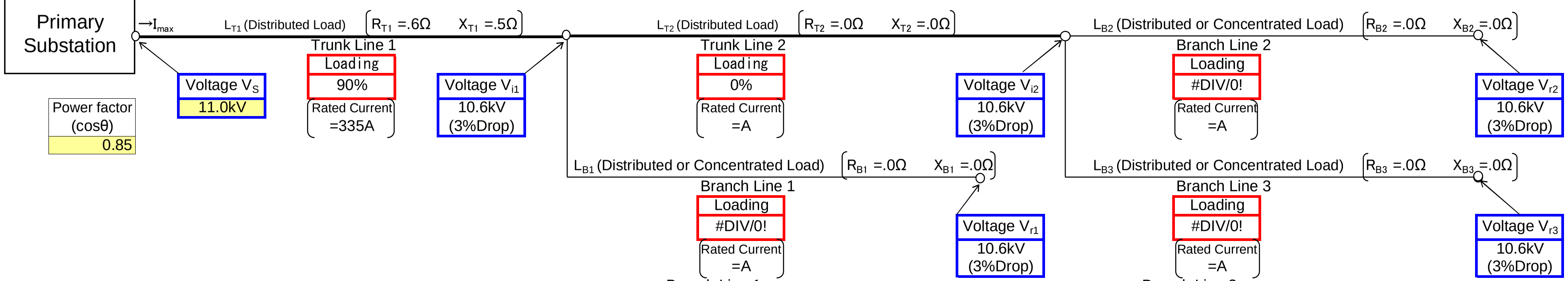
Load L_{T1}	300A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	5450kVA	

<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 B
Feeder Name	B25

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	315A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	5450kVA	

<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}
315.0A

Primary Substation

$\rightarrow I_{max}$

Power factor (cosθ)
0.85

Voltage V_S
11.0kV

L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)

Trunk Line 1

Loading
94%

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 B
Feeder Name	B25

: Input data in colored cells

Type-3

Maximum Current I_{max}: 330.0A

Power factor (cosθ): 0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	330A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	5450kVA	

<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}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)

Trunk Line 1 — Loading 99% — 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}, 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 B
Feeder Name	B25

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	346A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	5450kVA	

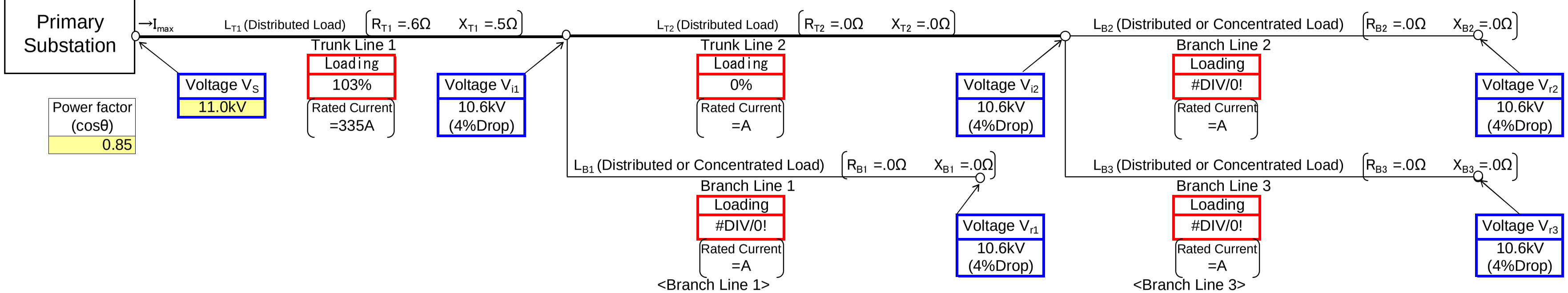
<Trank Line 2>

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}	346.0A
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 B
Feeder Name	B25

: Input data in colored cells

Type-3

Maximum Current I_{max}
363.0A

Power factor (cosθ)
0.85

<Trank Line 1>

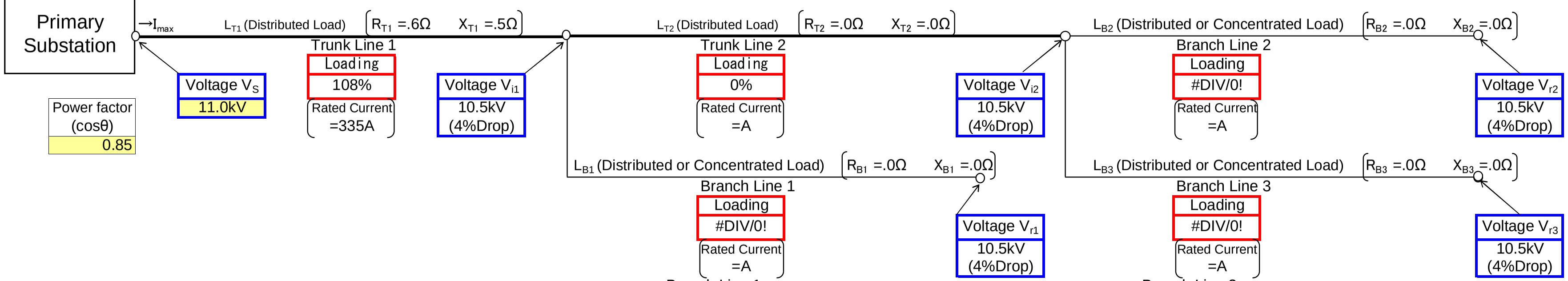
Load L_{T1}	363A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	5450kVA	

<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 B
Feeder Name	B25

: Input data in colored cells

Type-3

Maximum Current I_{max}
381.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_s
11.0kV

<Trank Line 1>

Load L_{T1}	381A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	5450kVA	

L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)

Trunk Line 1

Loading
114%

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 B
Feeder Name	B25

: Input data in colored cells

Type-3

Maximum Current I_{max}	400.0A

Power factor (cosθ)	0.85

<Trank Line 1>

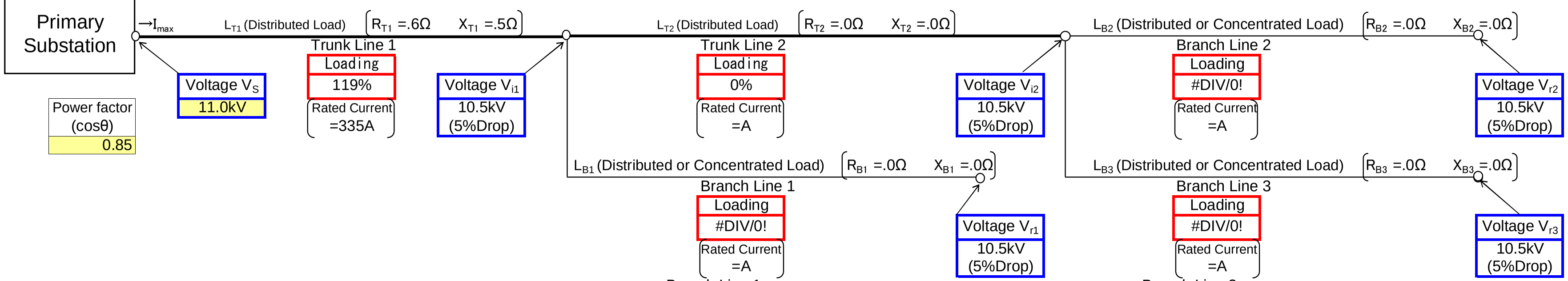
Load L_{T1}	400A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	5450kVA	

<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 B
Feeder Name	B25

: Input data in colored cells

Type-3

Maximum Current I_{max}	419.0A
Power factor (cosθ)	0.85

<Trank Line 1>

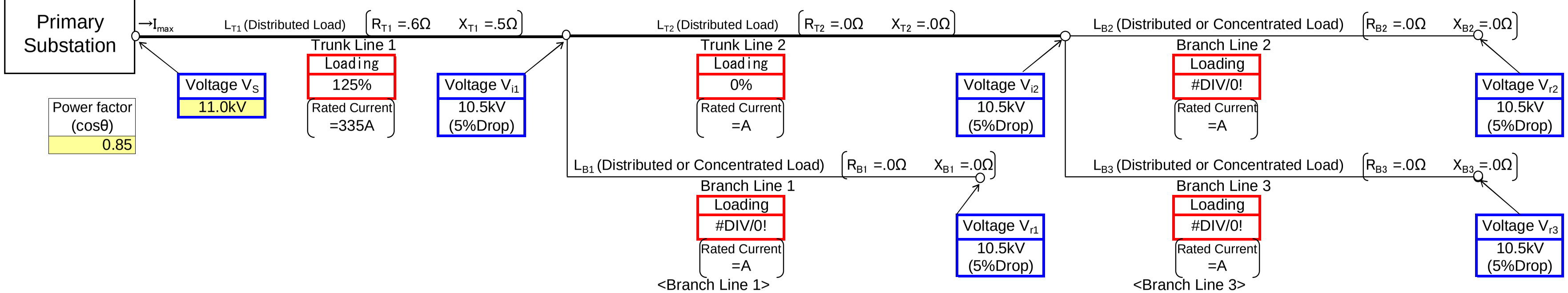
Load L_{T1}	419A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	5450kVA	

<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 B
Feeder Name	B25

: Input data in colored cells

Type-3

Maximum Current I_{max}
440.0A

Primary Substation

Power factor ($\cos\theta$)
0.85

Voltage V_s
11.0kV

<Trank Line 1>

Load L_{T1}	440A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.8km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	5450kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)

Trunk Line 1

Loading
131%

(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)

<Branch Line 2>

Load 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_{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}		

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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION B
Feeder Name	B27

: Input data in colored cells

Type-3

Maximum Current I_{max}
330.0A

Power factor (cosθ)
0.85

<Trank Line 1>

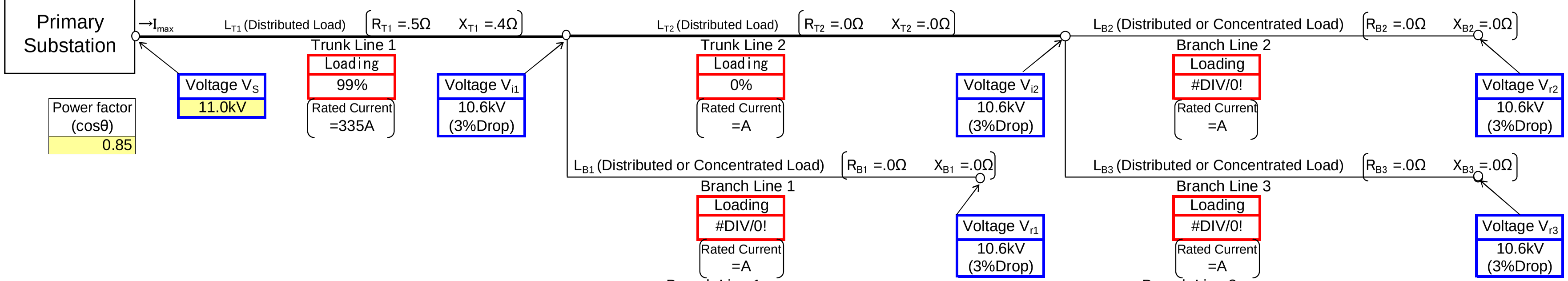
Load L_{T1}	330A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	4665kVA	

<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 B
Feeder Name	B27

: Input data in colored cells

Type-3

Maximum Current I_{max}
356.0A

Power factor (cosθ)
0.85

<Trank Line 1>

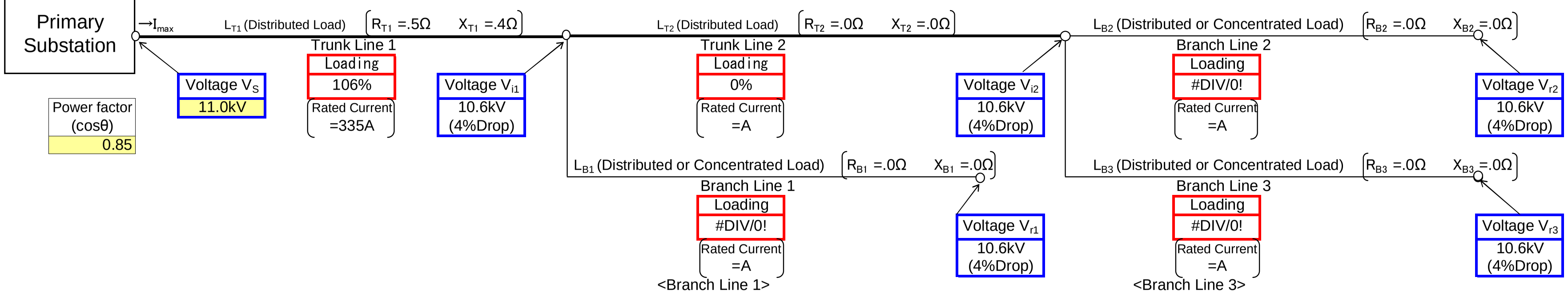
Load L_{T1}	356A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	4665kVA	

<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 B
Feeder Name	B27

: Input data in colored cells

Type-3

Maximum Current I_{max}
384.0A

Power factor (cosθ)
0.85

<Trank Line 1>

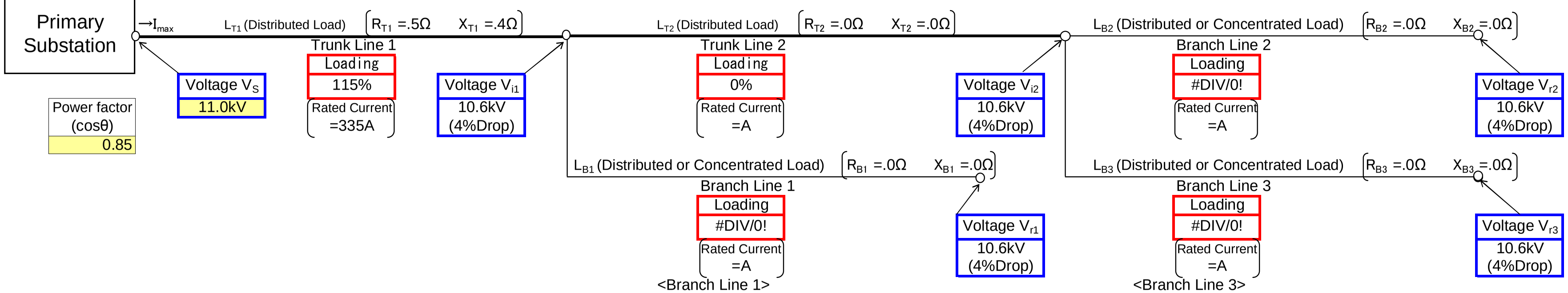
Load L_{T1}	384A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	4665kVA	

<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 B
Feeder Name	B27

: Input data in colored cells

Type-3

Maximum Current I_{max}	415.0A
Power factor (cosθ)	0.85

<Trank Line 1>

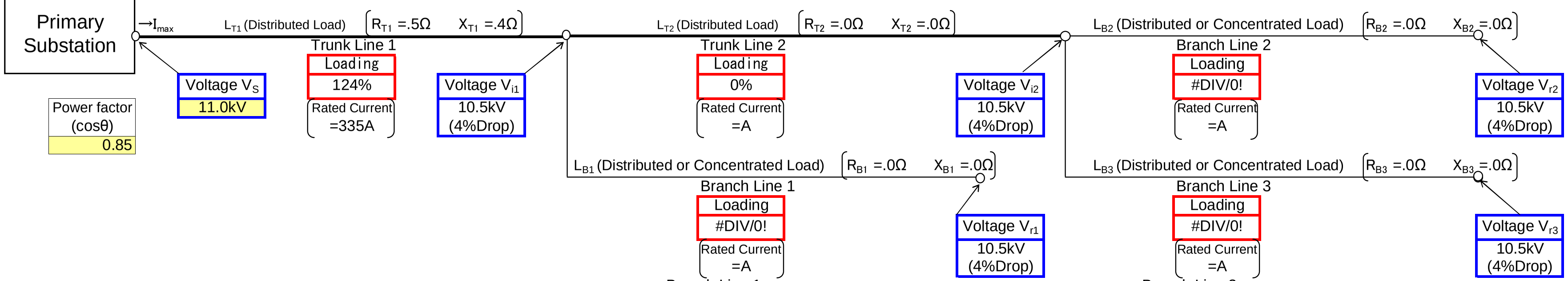
Load L_{T1}	415A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	4665kVA	

<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 B
Feeder Name	B27

: Input data in colored cells

Type-3

Maximum Current I_{max}
447.0A

<Trank Line 1>

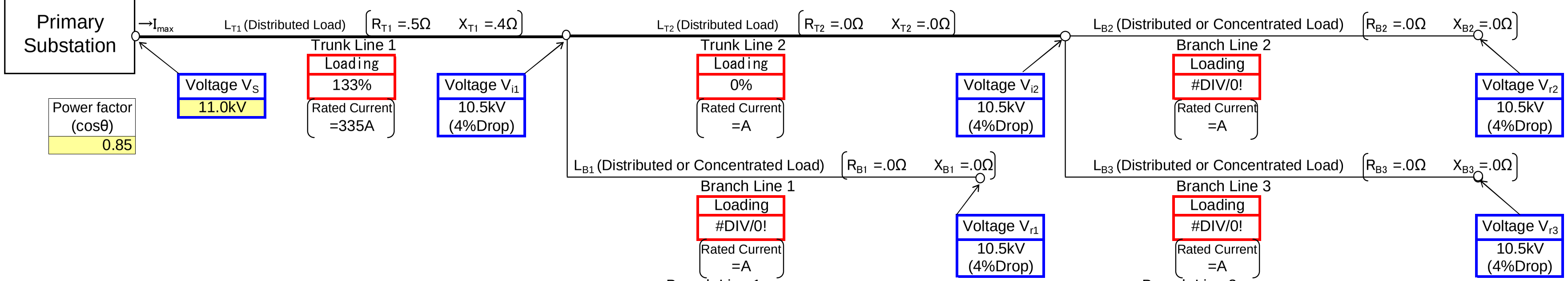
Load L_{T1}	447A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	4665kVA	

<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 B
Feeder Name	B27

: Input data in colored cells

Type-3

Maximum Current I_{max}: 463.0A

Power factor (cosθ): 0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	463A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	4665kVA	

<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} =.5Ω X_{T1} =.4Ω)

Trunk Line 1: Loading 138%, Rated Current =335A

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)	cosθ : Power Factor

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

Substation Name	STATION B
Feeder Name	B27

: Input data in colored cells

Type-3

Maximum Current I_{max}
521.0A

Power factor (cosθ)
0.85

<Trank Line 1>

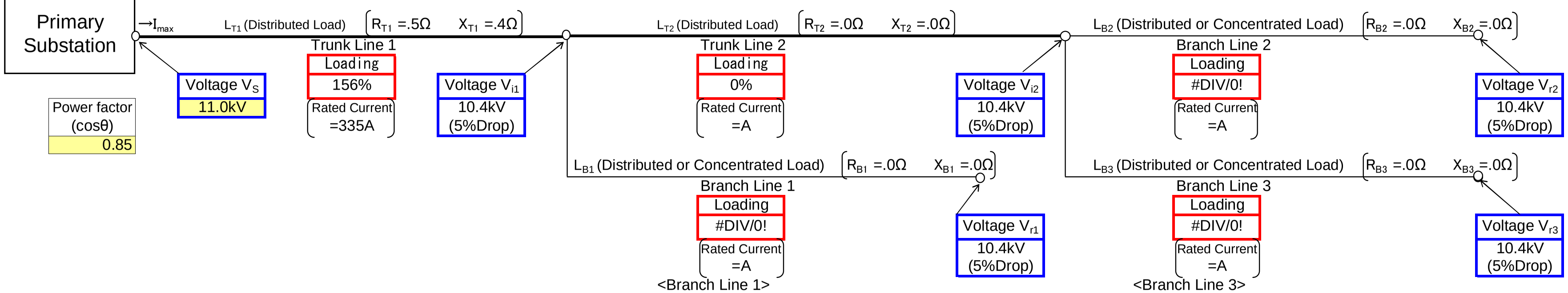
Load L_{T1}	521A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	4665kVA	

<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 B
Feeder Name	B27

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	562A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	4665kVA	

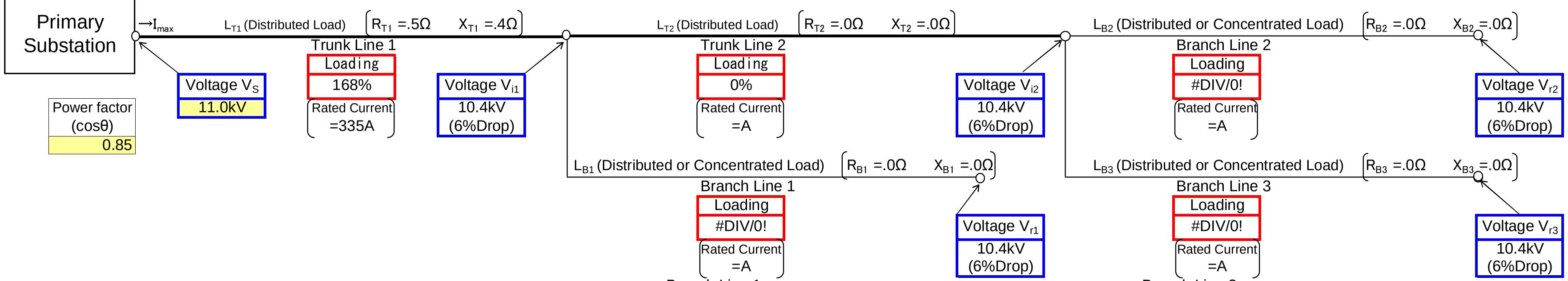
<Trank Line 2>

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}	562.0A
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 B
Feeder Name	B27

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	607A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	4665kVA	

<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}
607.0A

Power factor (cosθ)
0.85

Primary Substation

$\rightarrow I_{max}$

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

Trunk Line 1: Loading 181%; Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.3kV (6%Drop)

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)

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)

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 B
Feeder Name	B27

: Input data in colored cells

Type-3

Maximum Current I_{max}
655.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_s
11.0kV

<Trank Line 1>

Load L_{T1}	655A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	4665kVA	

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

Trunk Line 1

Loading
196%

(Rated Current =335A)

Voltage V_{i1}
10.3kV (7%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 (7%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 (7%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}
10.3kV (7%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 (7%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 B
Feeder Name	B27

: Input data in colored cells

Type-3

Maximum Current I_{max}
707.0A

Power factor (cosθ)
0.85

<Trank Line 1>

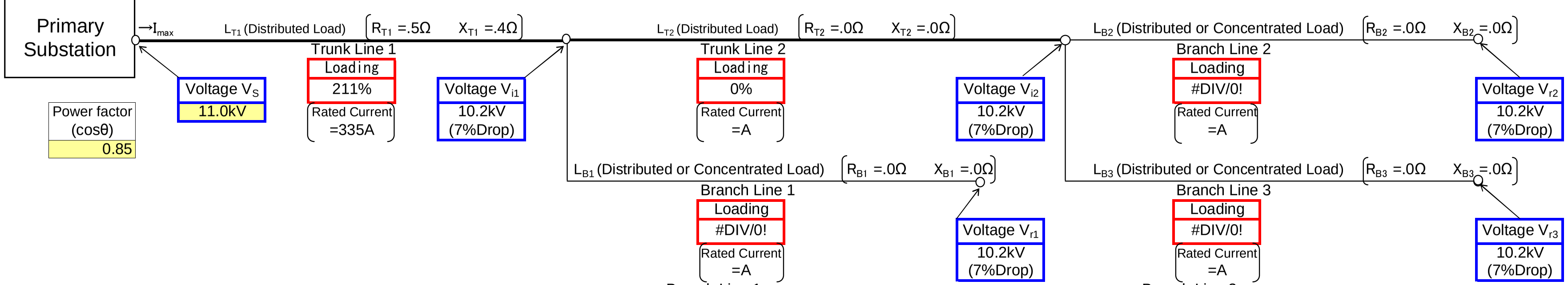
Load L_{T1}	707A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	4665kVA	

<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 B
Feeder Name	B27

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	762A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	4665kVA	

<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}	762.0A
Power factor (cosθ)	0.85

Primary Substation

$\rightarrow I_{max}$

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

Trunk Line 1: Loading 227%, Rated Current =335A

Voltage V_S 11.0kV

Voltage V_{i1} 10.2kV (8%Drop)

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

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

Voltage V_{i2} 10.2kV (8%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} 10.2kV (8%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} 10.2kV (8%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} 10.2kV (8%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 B
Feeder Name	B28

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	341A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5000kVA	

<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

Primary Substation →I_{max}

Voltage V_S 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.5Ω X_{T1} =.4Ω)
Trunk Line 1: Loading 102%, 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 B
Feeder Name	B28

: Input data in colored cells

Type-3

Maximum Current I_{max}
361.0A

Power factor (cosθ)
0.85

<Trank Line 1>

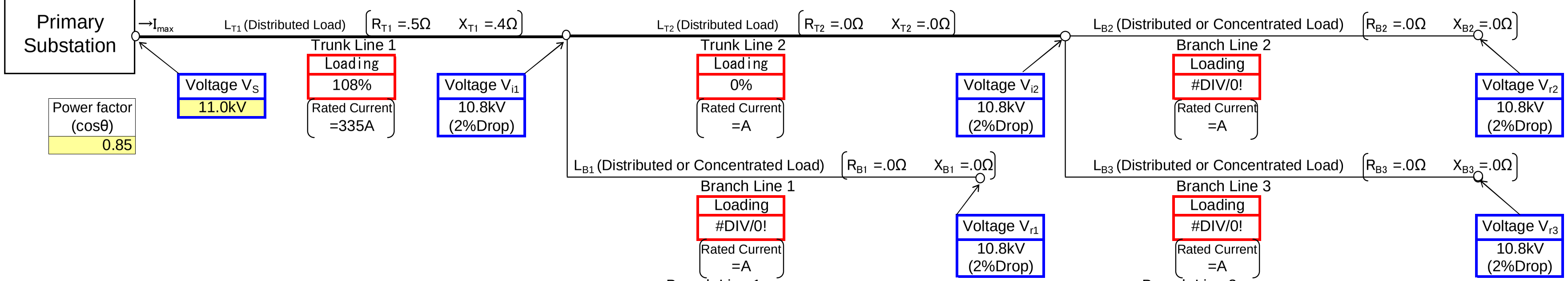
Load L_{T1}	361A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5000kVA	

<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 B
Feeder Name	B28

: Input data in colored cells

Type-3

Maximum Current I_{max}	366.0A
Power factor (cosθ)	0.85

<Trank Line 1>

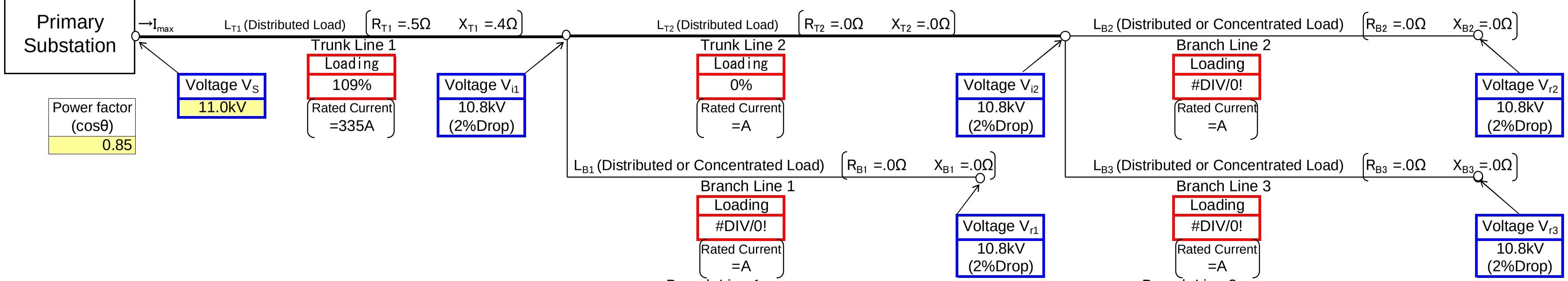
Load L_{T1}	366A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5000kVA	

<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 B
Feeder Name	B28

: Input data in colored cells

Type-3

Maximum Current I_{max}
410.0A

Power factor (cosθ)
0.85

<Trank Line 1>

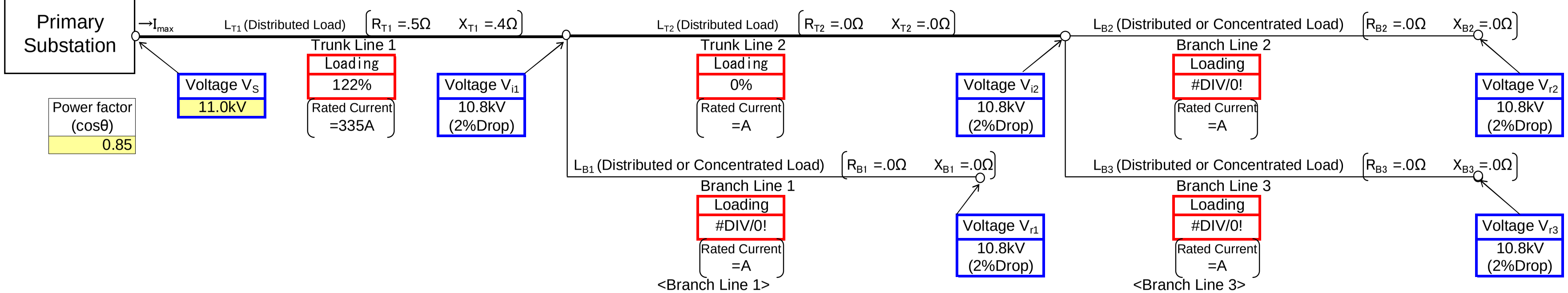
Load L_{T1}	410A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5000kVA	

<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 B
Feeder Name	B28

: Input data in colored cells

Type-3

Maximum Current I_{max}
437.0A

<Trank Line 1>

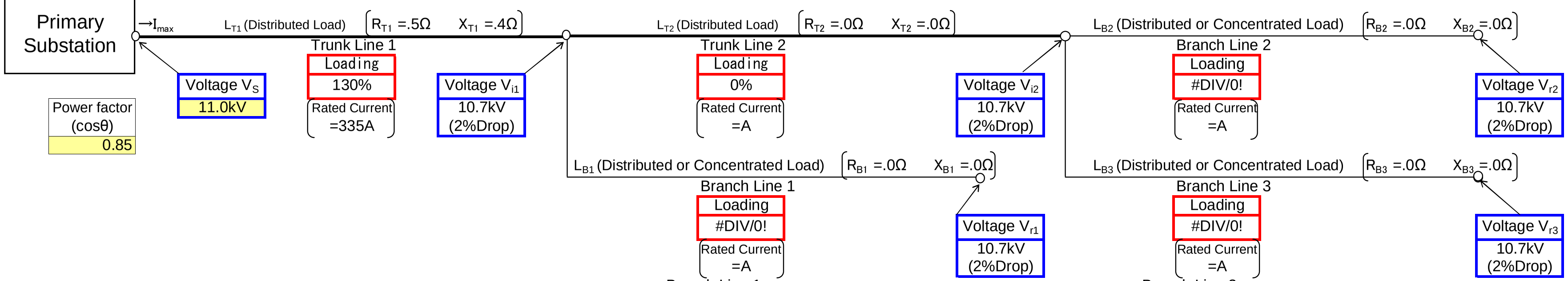
Load L_{T1}	437A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5000kVA	

<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 B
Feeder Name	B28

: Input data in colored cells

Type-3

Primary Substation

Maximum Current I_{max}	464.0A
Power factor (cosθ)	0.85

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	464A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5000kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.5Ω X_{T1} =.4Ω)

Trunk Line 1 Loading 139% (Rated Current =335A)

Voltage V_{i1} 10.7kV (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} 10.7kV (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)

<Branch Line 1>

Load L_{B1}	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 (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 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION B
Feeder Name	B28

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	494A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5000kVA	

<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}	494.0A
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 147% (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 B
Feeder Name	B28

: Input data in colored cells

Type-3

Maximum Current I_{max}: 494.0A

Power factor (cosθ): 0.85

<Trank Line 1>

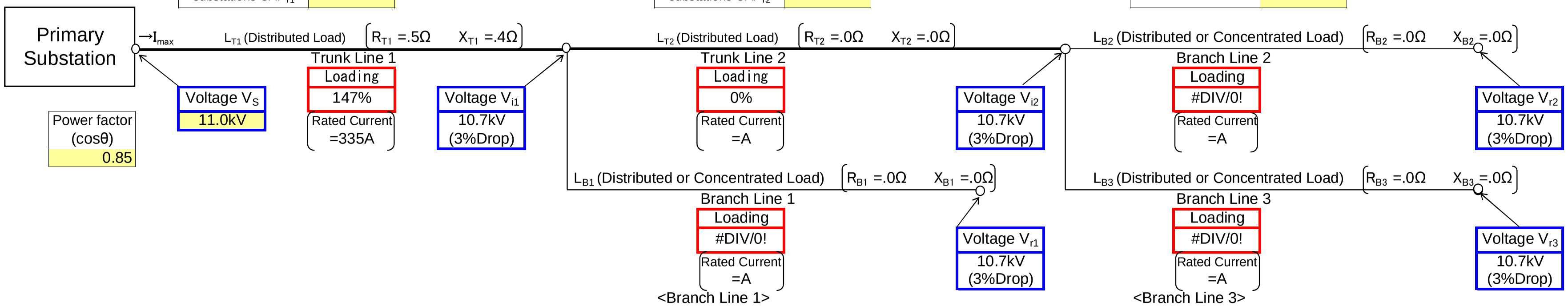
Load L_{T1}	494A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5000kVA	

<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 B
Feeder Name	B28

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	525A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5000kVA	

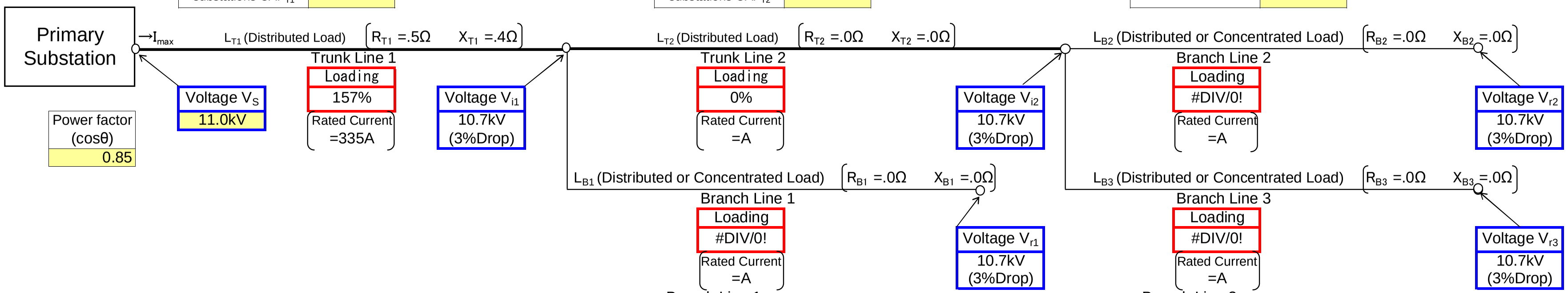
<Trank Line 2>

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}	525.0A
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 B
Feeder Name	B28

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	559A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5000kVA	

<Trank Line 2>

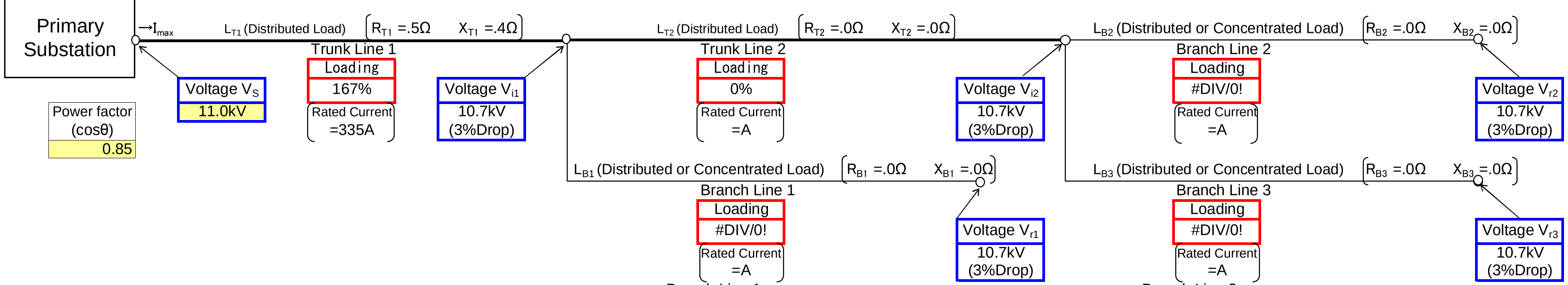
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
559.0A

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 B
Feeder Name	B28

: Input data in colored cells

Type-3

Maximum Current I_{max}
594.0A

Power factor (cosθ)
0.85

<Trank Line 1>

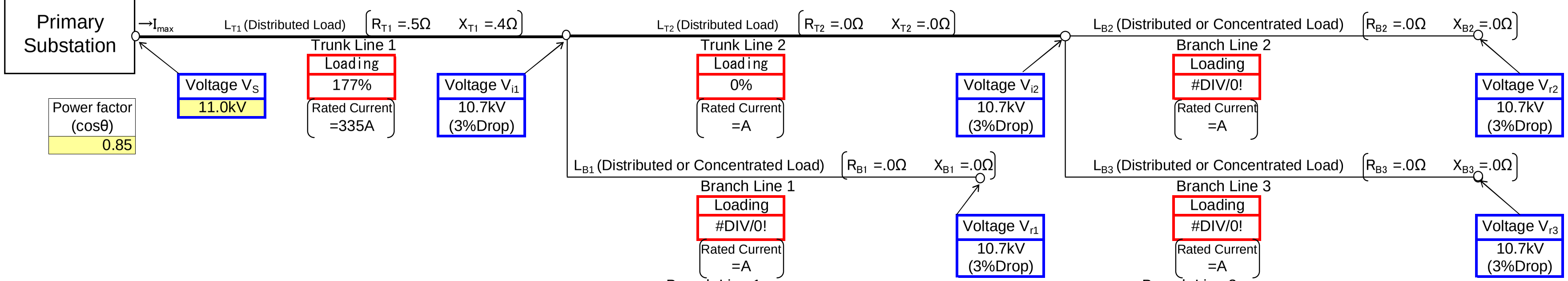
Load L_{T1}	594A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5000kVA	

<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 B
Feeder Name	B28

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	632A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5000kVA	

<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}
632.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_S 11.0kV

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

Trunk Line 1 Loading 189% (Rated Current =335A)

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 B
Feeder Name	B28

: Input data in colored cells

Type-3

Maximum Current I_{max}
673.0A

Power factor (cosθ)
0.85

<Trank Line 1>

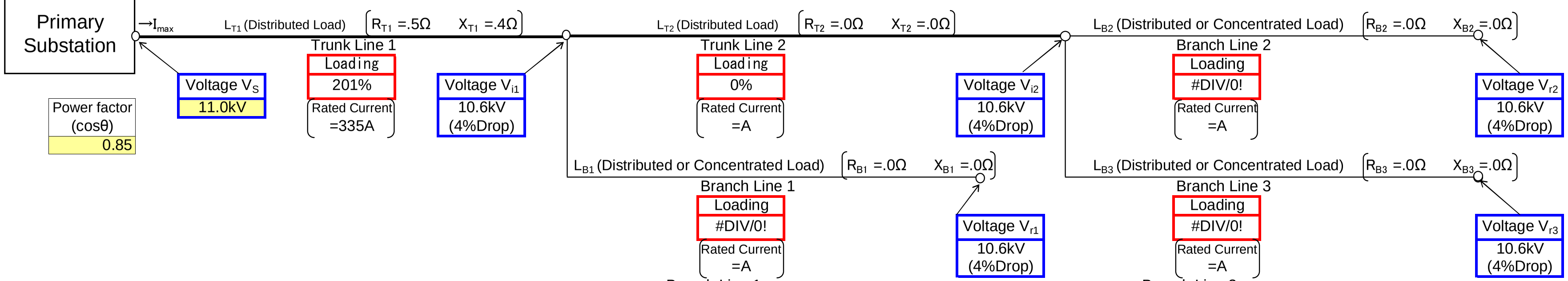
Load L_{T1}	673A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	5000kVA	

<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 B
Feeder Name	B35

: Input data in colored cells

Type-3

Maximum Current I_{max}
200.0A

Power factor (cosθ)
0.85

<Trank Line 1>

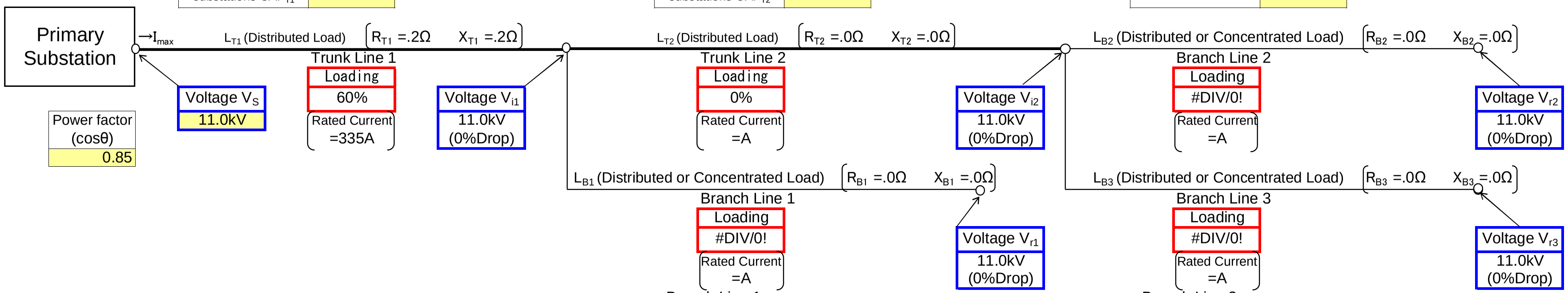
Load L_{T1}	200A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1800kVA	

<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 B
Feeder Name	B35

: Input data in colored cells

Type-3

Maximum Current I_{max}
210.0A

<Trank Line 1>

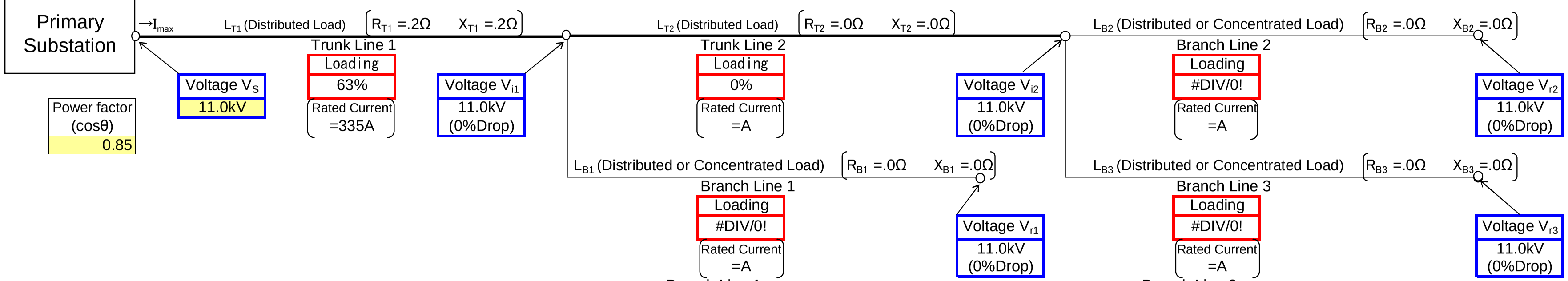
Load L_{T1}	210A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1800kVA	

<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 B
Feeder Name	B35

: Input data in colored cells

Type-3

Maximum Current I_{max}
220.0A

Power factor (cosθ)
0.85

<Trank Line 1>

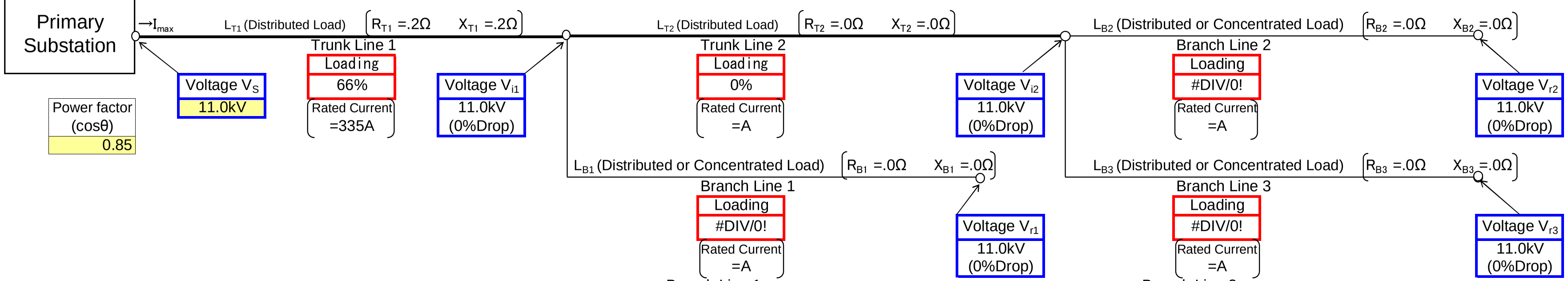
Load L_{T1}	220A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1800kVA	

<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 B
Feeder Name	B35

: 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}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1800kVA	

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

Trunk Line 1: Loading 69%, Rated Current =335A

Voltage V_{i1}: 10.9kV (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}: 10.9kV (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}: 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)

<Branch Line 1>

Load 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 (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	I_{max} : Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: 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 B
Feeder Name	B35

: Input data in colored cells

Type-3

Maximum Current I_{max}: 242.0A

Power factor (cosθ): 0.85

<Trank Line 1>

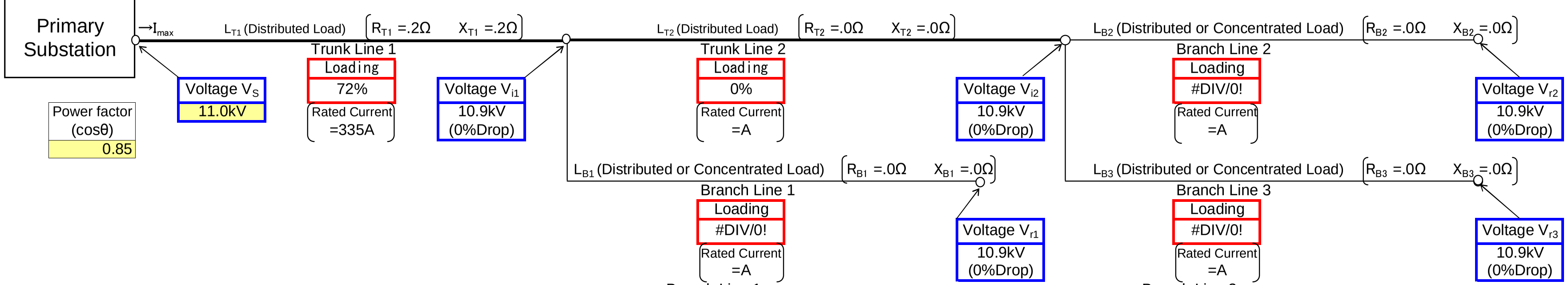
Load L_{T1}	242A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1800kVA	

<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 B
Feeder Name	B35

: Input data in colored cells

Type-3

Maximum Current I_{max}
254.0A

Power factor (cosθ)
0.85

<Trank Line 1>

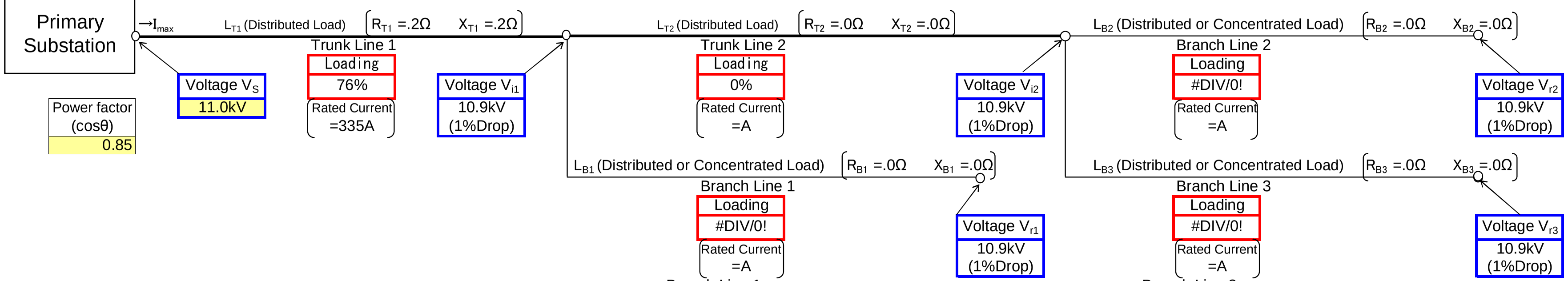
Load L_{T1}	254A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1800kVA	

<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 B
Feeder Name	B35

: Input data in colored cells

Type-3

Maximum Current I_{max}	266.0A

Power factor (cosθ)	0.85

<Trank Line 1>

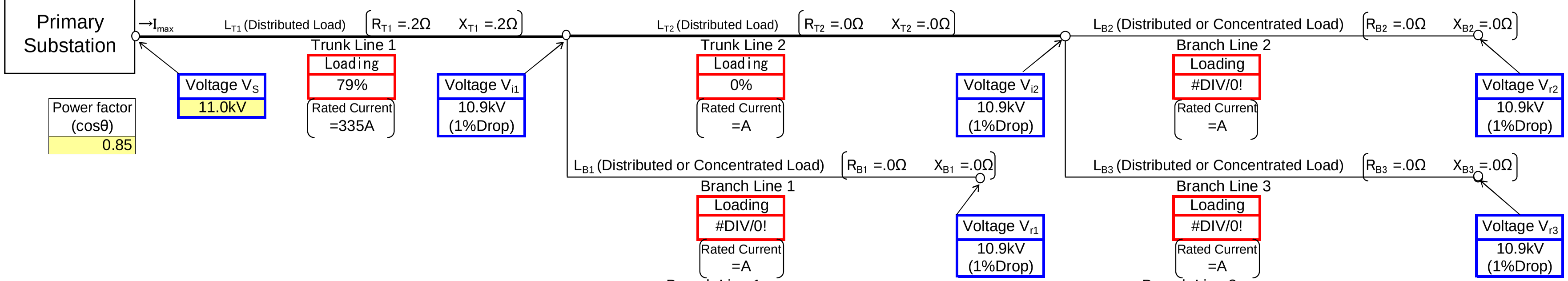
Load L_{T1}	266A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1800kVA	

<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 B
Feeder Name	B35

: Input data in colored cells

Type-3

Maximum Current I_{max}: 280.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	280A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1800kVA	

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

Trunk Line 1 Loading 84% (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 B
Feeder Name	B35

: Input data in colored cells

Type-3

Maximum Current I_{max}
293.0A

Power factor (cosθ)
0.85

<Trank Line 1>

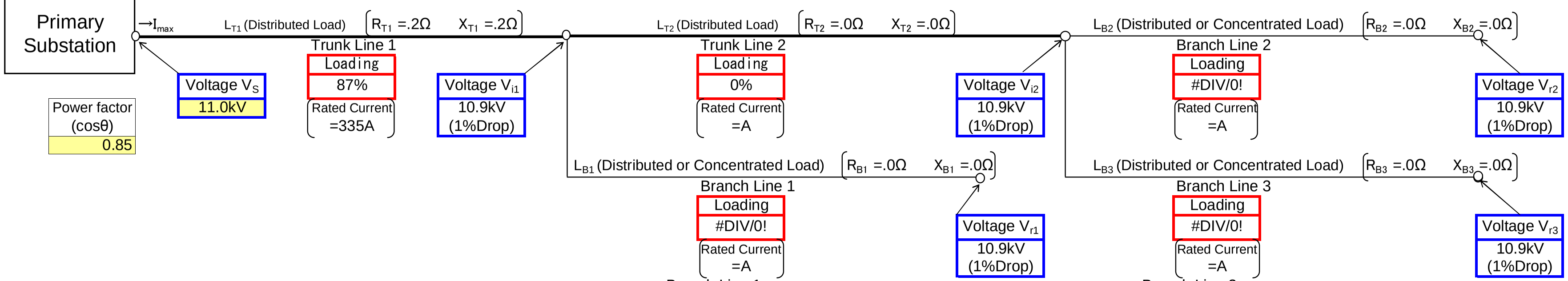
Load L_{T1}	293A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1800kVA	

<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 B
Feeder Name	B35

: 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}	308A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1800kVA	

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

Trunk Line 1 Loading 92%, 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=====

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

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

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

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

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

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

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

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

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

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

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

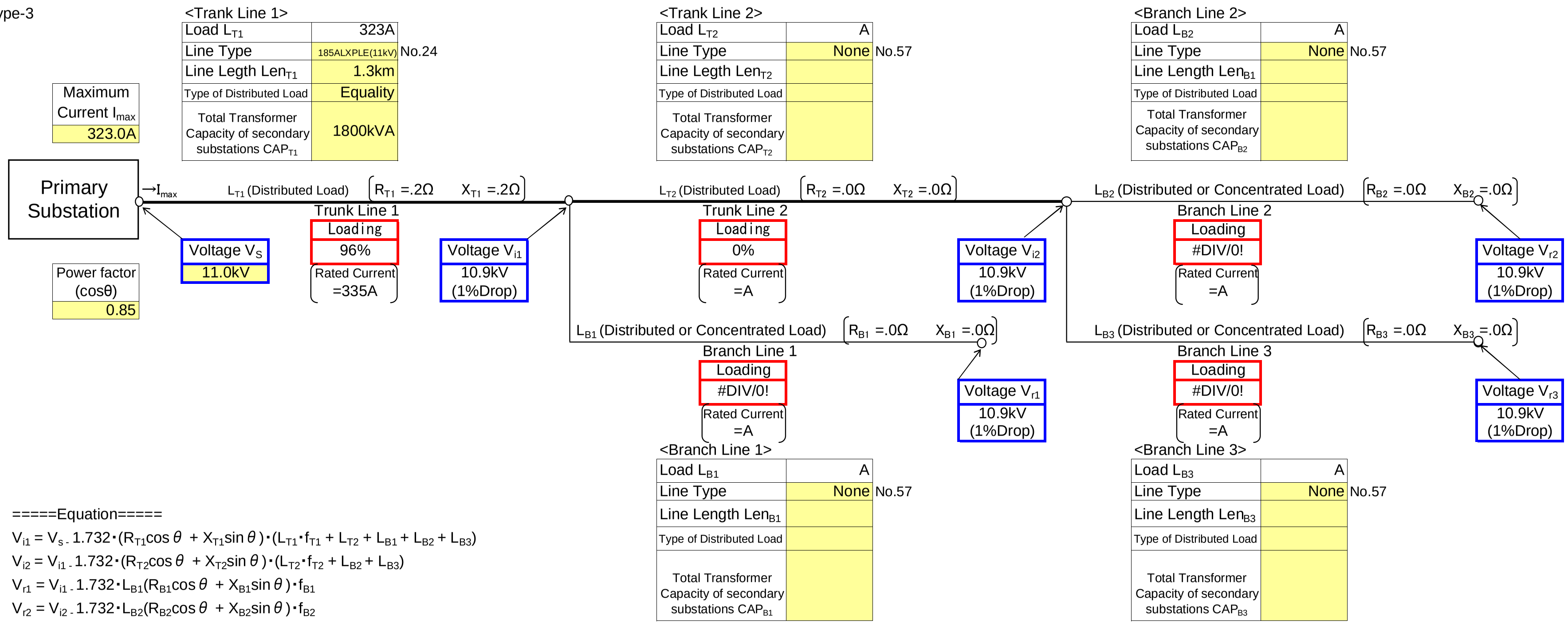
V_s : Supply Voltage	I_{max} : Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: Dispersal Load Factor
V_{r1} : Received Voltage	L_{B1} : Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$,
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 B
Feeder Name	B35

: 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 B
Feeder Name	B35

: 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}	1.3km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1800kVA	

<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} =.2Ω X_{T1} =.2Ω)

Trunk Line 1 — Loading: 101% — 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 B
Feeder Name	B42

: Input data in colored cells

Type-3

Maximum Current I_{max}: 274.0A

Power factor (cosθ): 0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	274A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6580kVA	

<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 82%, 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 B
Feeder Name	B42

: Input data in colored cells

Type-3

Maximum Current I_{max}
287.0A

Power factor (cosθ)
0.85

<Trank Line 1>

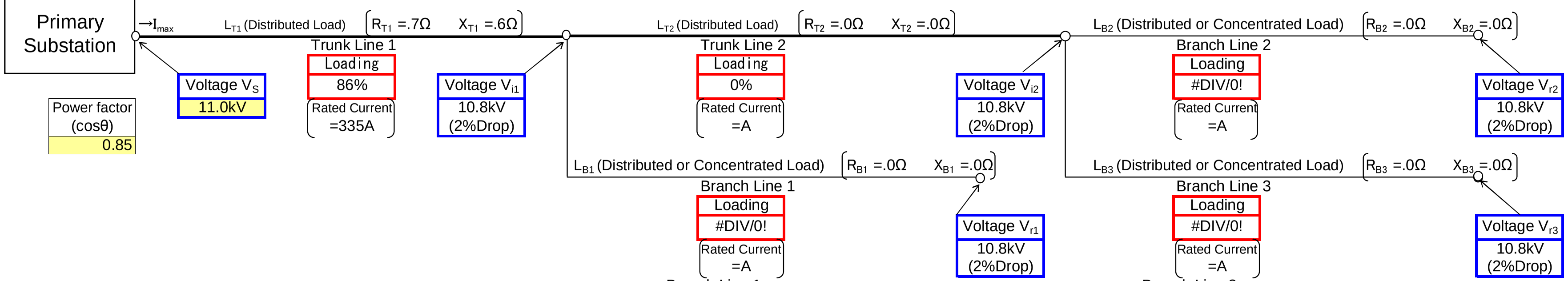
Load L_{T1}	287A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6580kVA	

<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 B
Feeder Name	B42

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	300A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6580kVA	

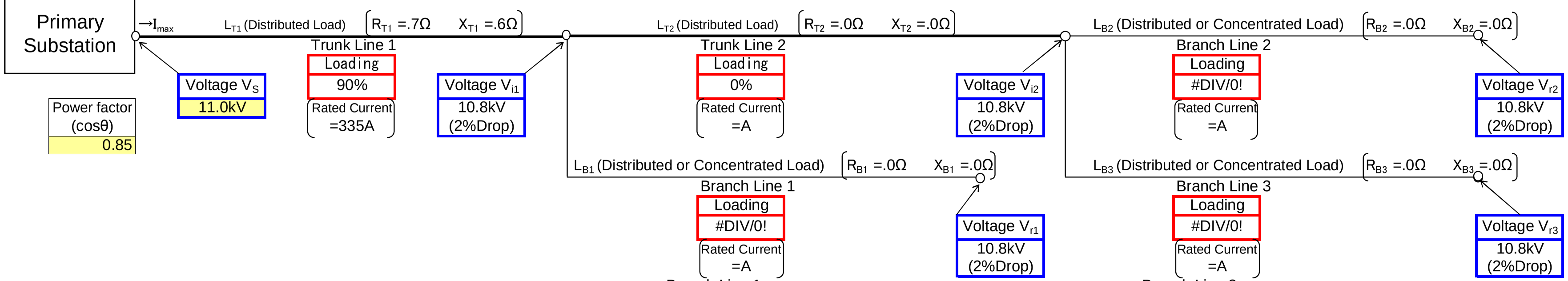
<Trank Line 2>

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}	300.0A
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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
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 B
Feeder Name	B42

: Input data in colored cells

Type-3

Maximum Current I_{max}
314.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	314A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6580kVA	

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

Trunk Line 1 Loading 94% 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 B
Feeder Name	B42

: Input data in colored cells

Type-3

Maximum Current I_{max}	329.0A

Power factor (cosθ)	0.85

<Trank Line 1>

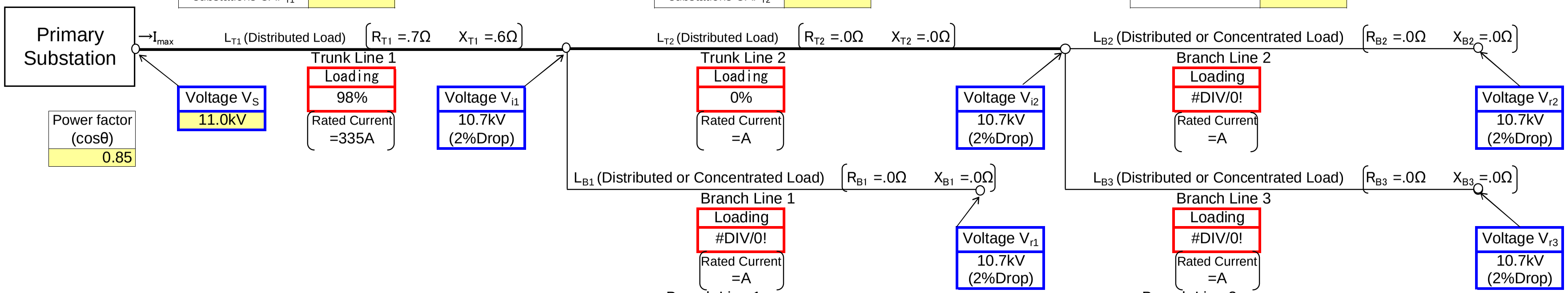
Load L_{T1}	329A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6580kVA	

<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 B
Feeder Name	B42

: Input data in colored cells

Type-3

Maximum Current I_{max}
344.0A

Power factor (cosθ)
0.85

<Trank Line 1>

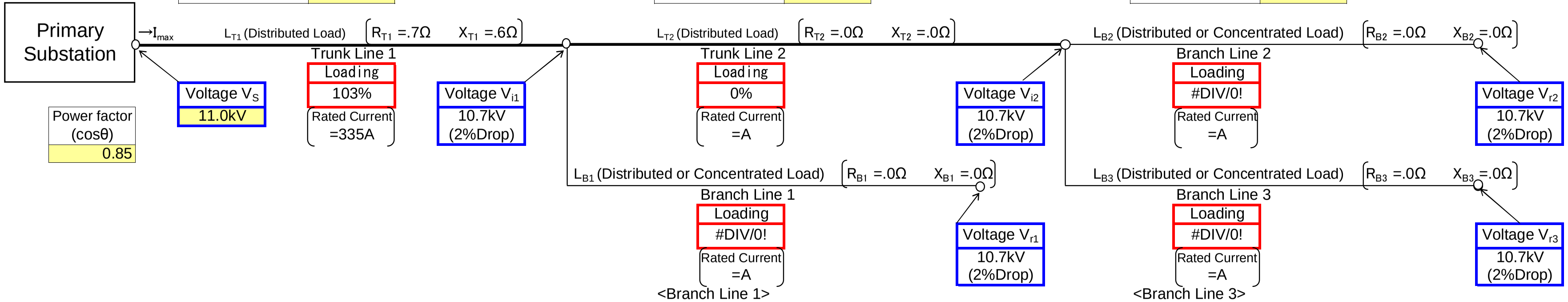
Load L_{T1}	344A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6580kVA	

<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 B
Feeder Name	B42

: Input data in colored cells

Type-3

Maximum Current I_{max}
361.0A

Power factor ($\cos\theta$)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	361A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6580kVA	

$\rightarrow I_{max}$

Voltage V_S: 11.0kV

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

Trunk Line 1 — Loading 108% — 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)

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)	$\cos\theta$: Power Factor

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

Substation Name	STATION B
Feeder Name	B42

: Input data in colored cells

Type-3

Maximum Current I_{max}
378.0A

Power factor (cosθ)
0.85

<Trank Line 1>

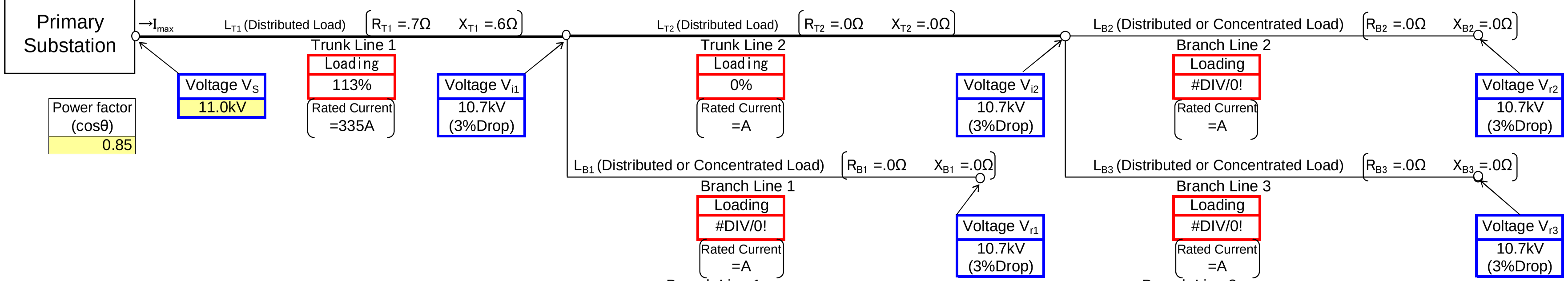
Load L_{T1}	378A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6580kVA	

<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 B
Feeder Name	B42

: Input data in colored cells

Type-3

Maximum Current I_{max}	
395.0A	

Power factor (cosθ)	
0.85	

<Trank Line 1>

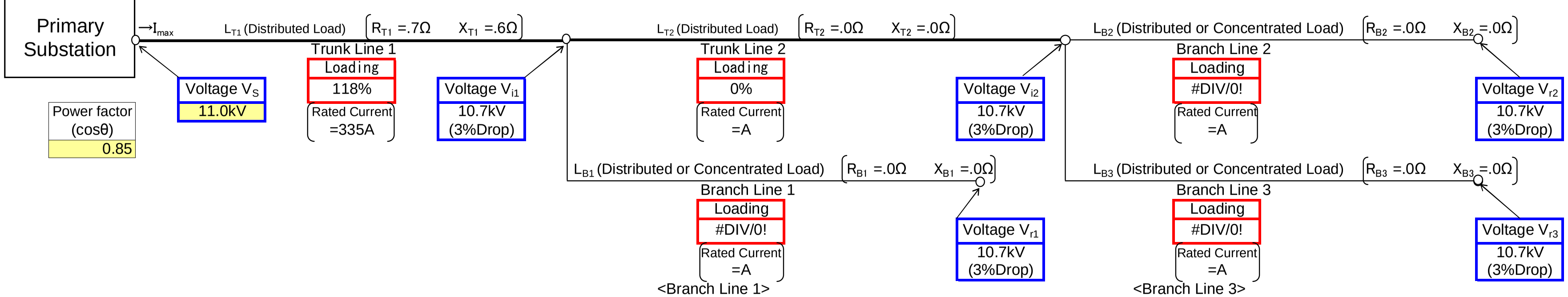
Load L_{T1}	395A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6580kVA	

<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 B
Feeder Name	B42

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	414A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6580kVA	

<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}	414.0A

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 124%, 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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$
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 B
Feeder Name	B42

: Input data in colored cells

Type-3

Maximum Current I_{max}
433.0A

Power factor (cosθ)
0.85

<Trank Line 1>

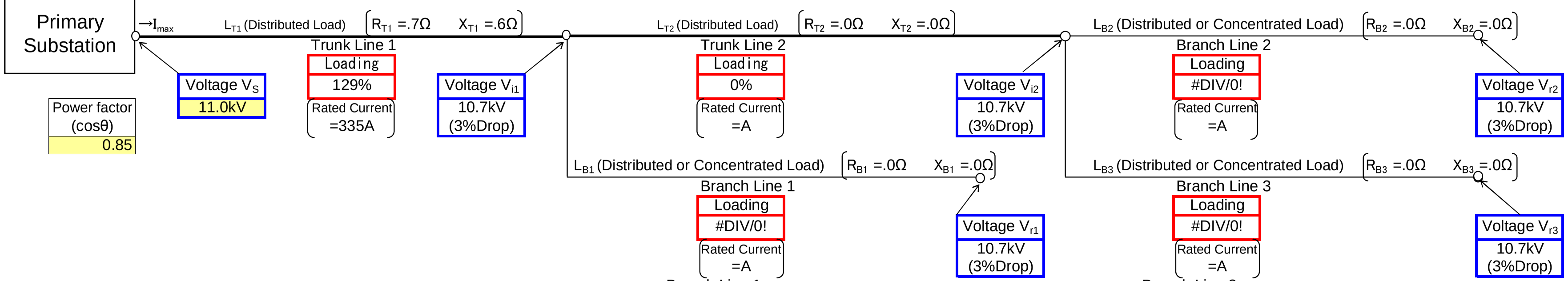
Load L_{T1}	433A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	6580kVA	

<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 B
Feeder Name	B42

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	433A
Line Type	185ALXPLE(11kV) No.24
Line Legth Len_{T1}	4.6km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T1}	6580kVA

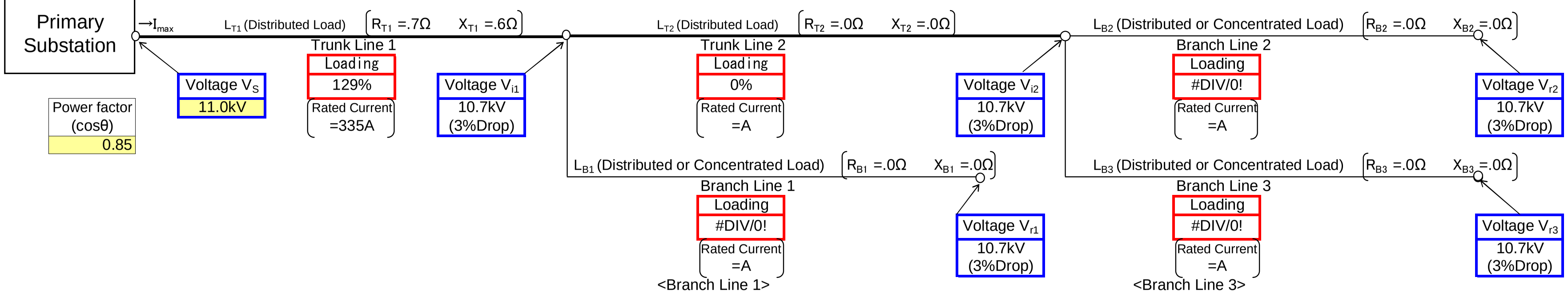
<Trank Line 2>

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}	433.0A
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 C
Feeder Name	C13

: Input data in colored cells

Type-3

Maximum Current I_{max}
355.0A

Power factor (cosθ)
0.85

<Trank Line 1>

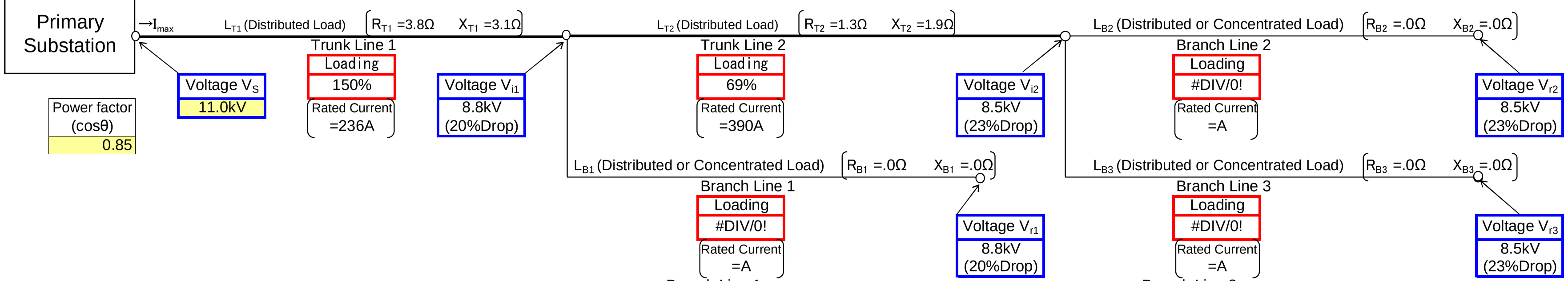
Load L_{T1}	193A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1230kVA	

<Trank Line 2>

Load L_{T2}	162A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1030kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C13

: Input data in colored cells

Type-3

Maximum Current I_{max}
360.0A

Power factor (cosθ)
0.85

<Trank Line 1>

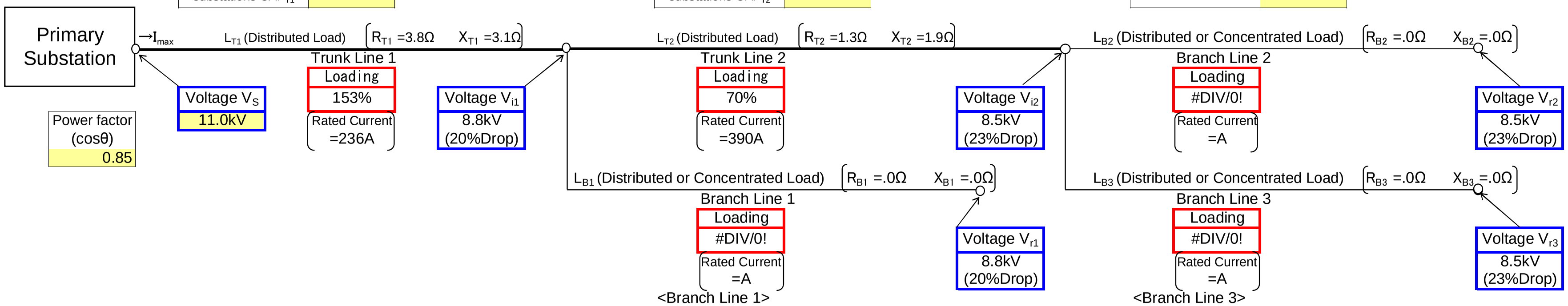
Load L_{T1}	196A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1230kVA	

<Trank Line 2>

Load L_{T2}	164A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1030kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C13

: Input data in colored cells

Type-3

Maximum Current I_{max}
365.0A

Power factor (cosθ)
0.85

<Trank Line 1>

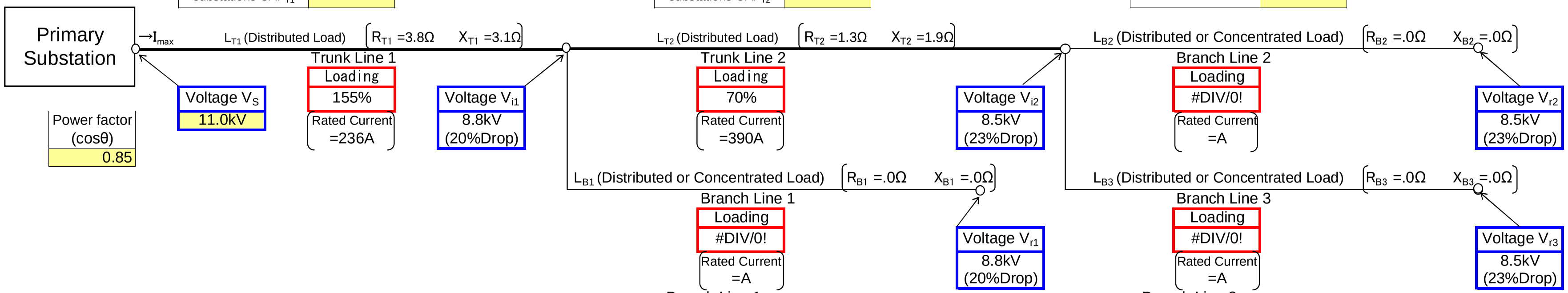
Load L_{T1}	199A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1230kVA	

<Trank Line 2>

Load L_{T2}	166A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1030kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C13

: Input data in colored cells

Type-3

Maximum Current I_{max}
371.0A

<Trank Line 1>

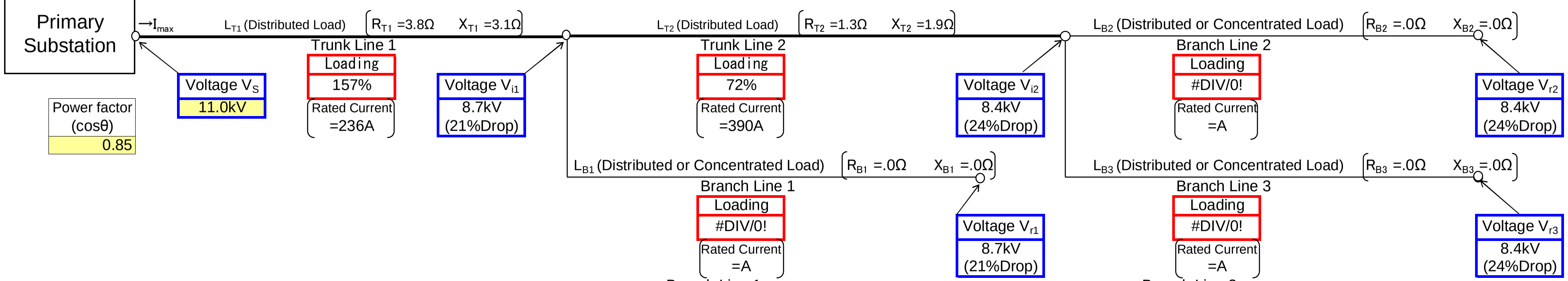
Load L_{T1}	202A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1230kVA	

<Trank Line 2>

Load L_{T2}	169A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1030kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C13

: Input data in colored cells

Type-3

Maximum Current I_{max}
376.0A

Power factor (cosθ)
0.85

<Trank Line 1>

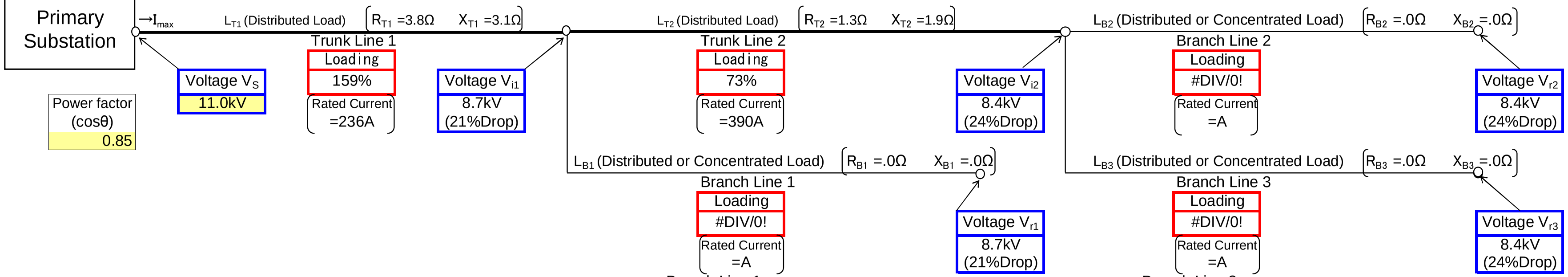
Load L_{T1}	205A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1230kVA	

<Trank Line 2>

Load L_{T2}	171A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1030kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C13

: Input data in colored cells

Type-3

Maximum Current I_{max}
381.0A

<Trank Line 1>

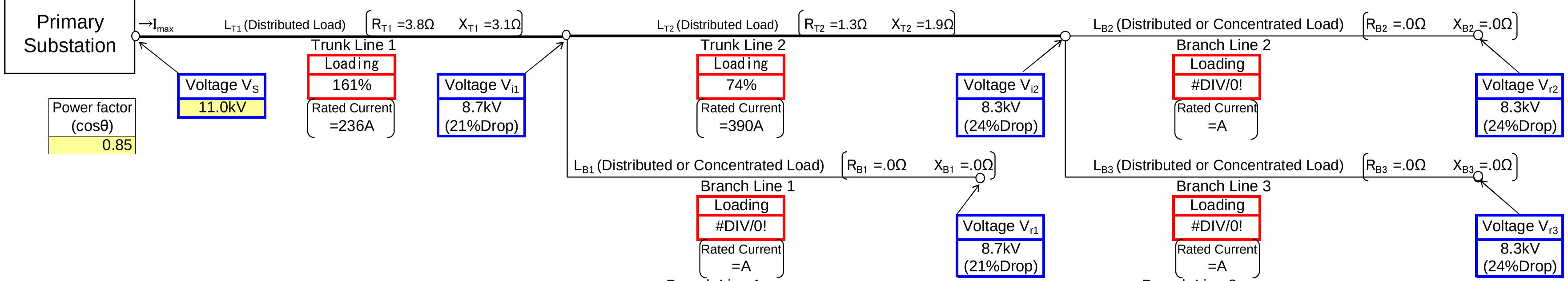
Load L_{T1}	207A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1230kVA	

<Trank Line 2>

Load L_{T2}	174A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1030kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C13

: 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}	211A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1230kVA	

L_{T1} (Distributed Load) (R_{T1} =3.8Ω X_{T1} =3.1Ω)

Trunk Line 1

Loading
164%

Rated Current =236A

Voltage V_{i1}
8.6kV (22%Drop)

<Trank Line 2>

Load L_{T2}	176A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1030kVA	

L_{T2} (Distributed Load) (R_{T2} =1.3Ω X_{T2} =1.9Ω)

Trunk Line 2

Loading
75%

Rated Current =390A

Voltage V_{i2}
8.3kV (25%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}
8.3kV (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}
8.6kV (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}		

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

Branch Line 3

Loading
#DIV/0!

Rated Current =A

Voltage V_{r3}
8.3kV (25%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 C
Feeder Name	C13

: Input data in colored cells

Type-3

Maximum Current I_{max}
392.0A

<Trank Line 1>

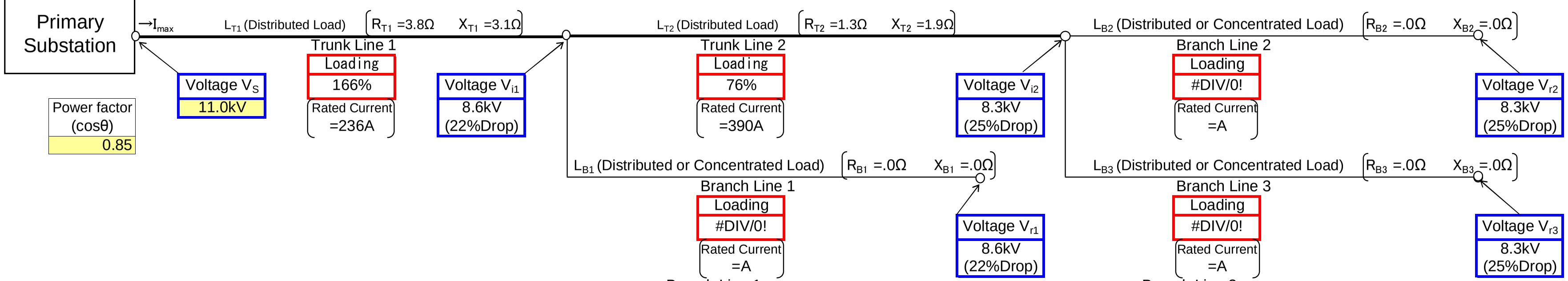
Load L_{T1}	213A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1230kVA	

<Trank Line 2>

Load L_{T2}	179A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1030kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C13

: Input data in colored cells

Type-3

Maximum Current I_{max}
398.0A

Power factor (cosθ)
0.85

<Trank Line 1>

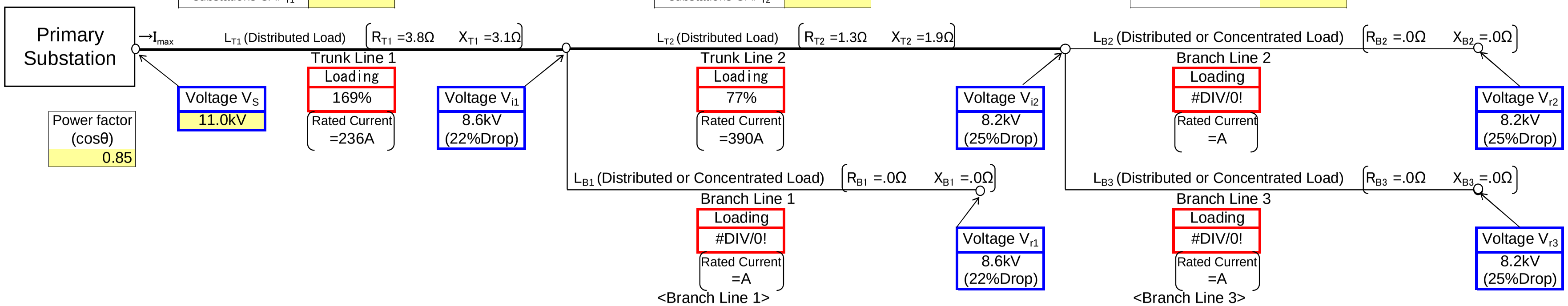
Load L_{T1}	217A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1230kVA	

<Trank Line 2>

Load L_{T2}	181A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1030kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C13

: Input data in colored cells

Type-3

Maximum Current I_{max}
404.0A

Power factor (cosθ)
0.85

<Trank Line 1>

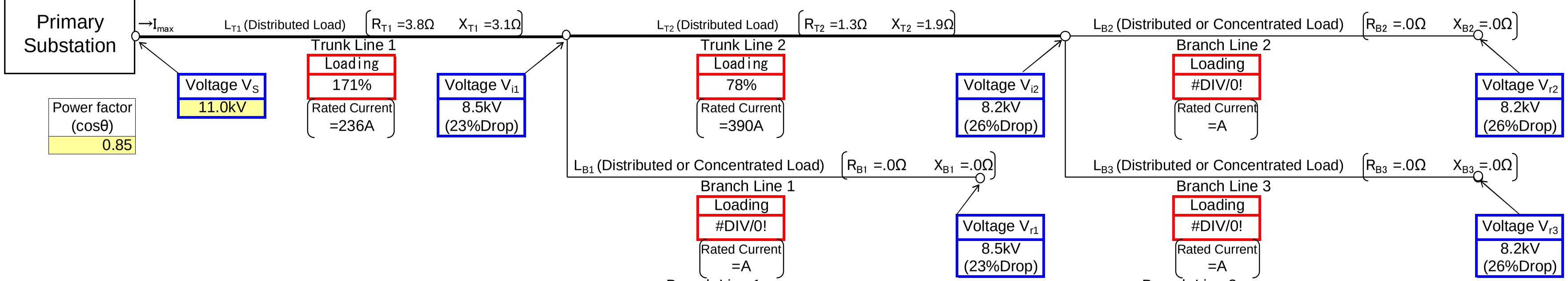
Load L_{T1}	220A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1230kVA	

<Trank Line 2>

Load L_{T2}	184A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1030kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C13

: Input data in colored cells

Type-3

Maximum Current I_{max}: 410.0A

Power factor (cosθ): 0.85

<Trank Line 1>

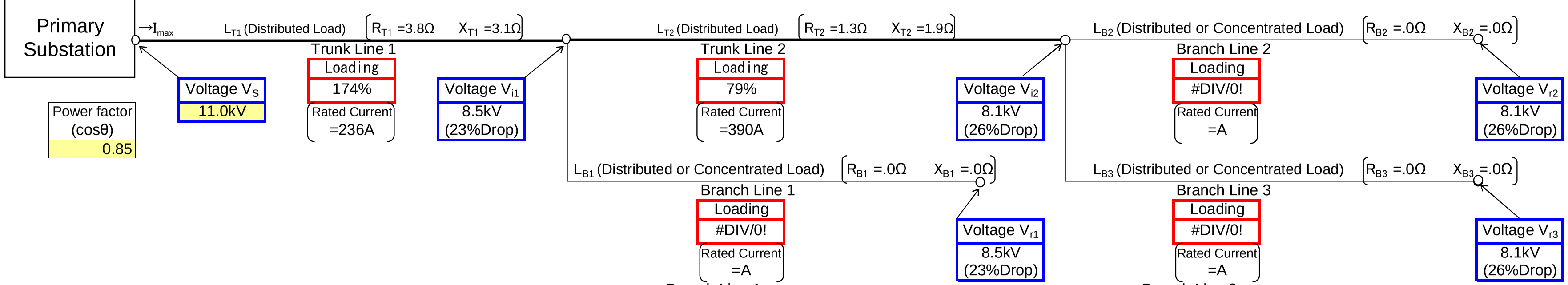
Load L_{T1}	223A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1230kVA	

<Trank Line 2>

Load L_{T2}	187A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1030kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C13

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	226A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	6.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	1230kVA	

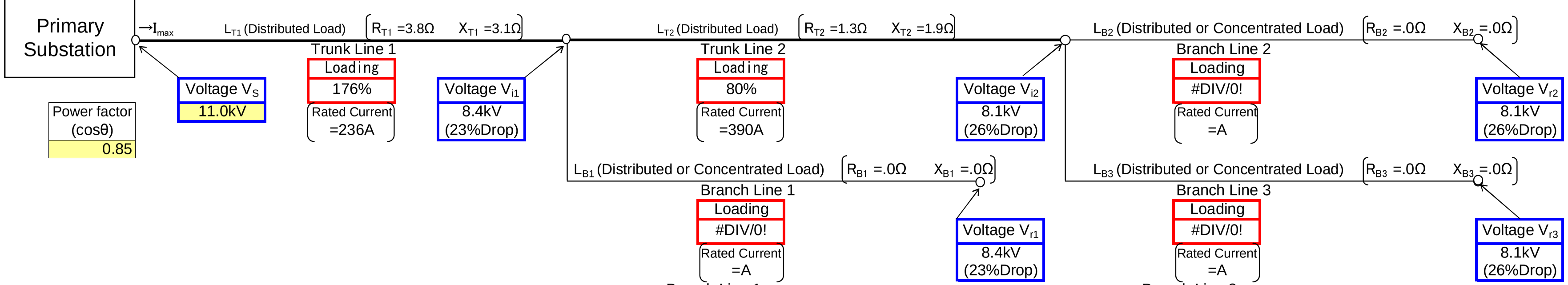
<Trank Line 2>

Load L_{T2}	189A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	1030kVA	

<Branch Line 2>

Load 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}	
415.0A	
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 C
Feeder Name	C14

: Input data in colored cells

Type-3

Maximum Current I_{max}: 356.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	356A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3215kVA	

L_{T1} (Distributed Load) (R_{T1} =1.8Ω X_{T1} =1.4Ω)

Trunk Line 1: Loading 151%, Rated Current =236A

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}	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch Line 3)	cosθ	: Power Factor

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

Substation Name	STATION C
Feeder Name	C14

: Input data in colored cells

Type-3

Maximum Current I_{max}: 371.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_s: 11.0kV

<Trank Line 1>

Load L_{T1}	371A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3215kVA	

L_{T1} (Distributed Load) (R_{T1} =1.8Ω X_{T1} =1.4Ω)

Trunk Line 1: Loading 157%; Rated Current =236A

Voltage V_{i1}: 10.3kV (7%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 (7%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 (7%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 (7%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 (7%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 C
Feeder Name	C14

: Input data in colored cells

Type-3

Maximum Current I_{max}
387.0A

Power factor (cosθ)
0.85

<Trank Line 1>

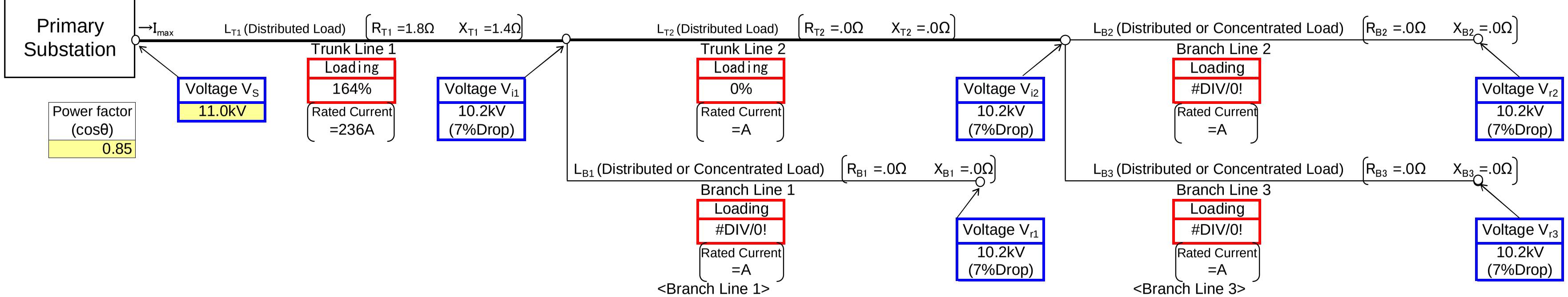
Load L_{T1}	387A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3215kVA	

<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 C
Feeder Name	C14

: Input data in colored cells

Type-3

Maximum Current I_{max} 404.0A

Power factor (cosθ) 0.85

Primary Substation →I_{max}

<Trank Line 1>

Load L_{T1}	404A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3215kVA	

L_{T1} (Distributed Load) (R_{T1} =1.8Ω X_{T1} =1.4Ω)

Voltage V_S 11.0kV

Trunk Line 1 Loading 171% Rated Current =236A

Voltage V_{i1} 10.2kV (7%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} 10.2kV (7%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} 10.2kV (7%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} 10.2kV (7%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} 10.2kV (7%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 C
Feeder Name	C14

: Input data in colored cells

Type-3

Maximum Current I_{max}
421.0A

Primary Substation

Power factor (cosθ)
0.85

Voltage V_s
11.0kV

<Trank Line 1>

Load L_{T1}	421A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3215kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =1.8Ω X_{T1} =1.4Ω)

Trunk Line 1

Loading
178%

Rated Current =236A

Voltage V_{i1}
10.2kV (7%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}
10.2kV (7%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}
10.2kV (7%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}
10.2kV (7%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}
10.2kV (7%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 C
Feeder Name	C14

: Input data in colored cells

Type-3

Maximum Current I_{max}
439.0A

Power factor (cosθ)
0.85

<Trank Line 1>

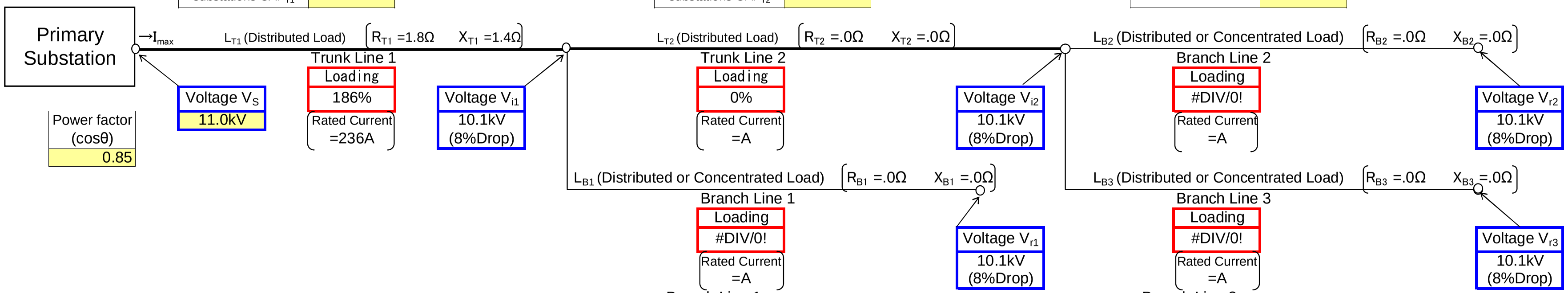
Load L_{T1}	439A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3215kVA	

<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 C
Feeder Name	C14

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	458A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3215kVA	

<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}	458.0A
Power factor (cosθ)	0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S 11.0kV

L_{T1} (Distributed Load) (R_{T1} =1.8Ω X_{T1} =1.4Ω)

Trunk Line 1 Loading 194% (Rated Current =236A)

Voltage V_{i1} 10.1kV (8%Drop)

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

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

Voltage V_{i2} 10.1kV (8%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} 10.1kV (8%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} 10.1kV (8%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} 10.1kV (8%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 C
Feeder Name	C14

: Input data in colored cells

Type-3

Maximum Current I_{max}
478.0A

<Trank Line 1>

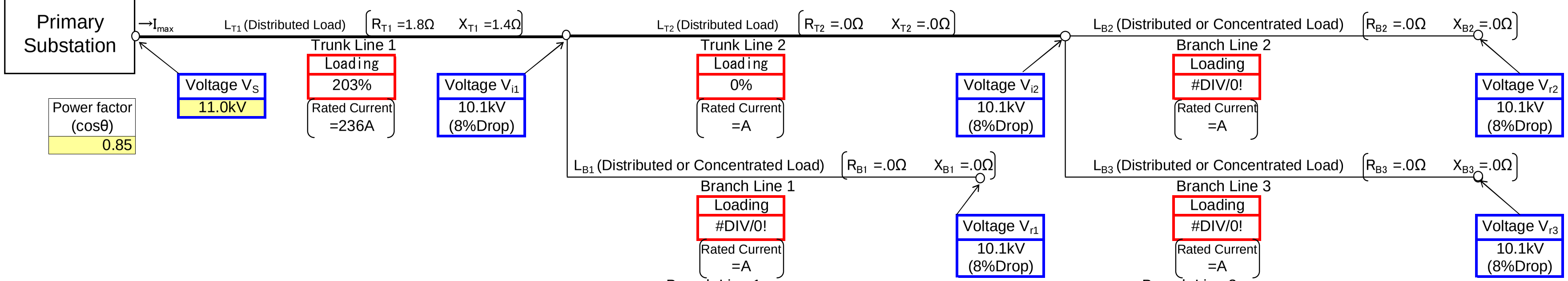
Load L_{T1}	478A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3215kVA	

<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 C
Feeder Name	C14

: Input data in colored cells

Type-3

Maximum Current I_{max}
498.0A

<Trank Line 1>

Load L_{T1}	498A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3215kVA	

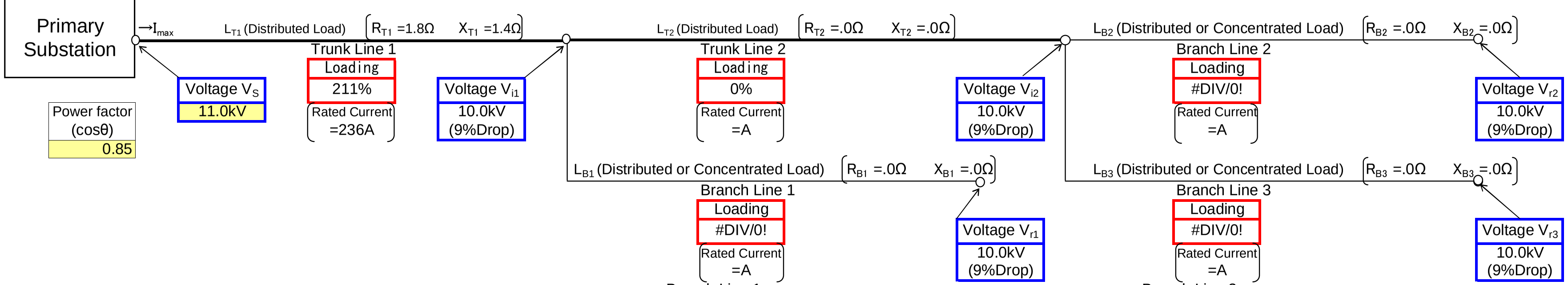
<Trank Line 2>

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 C
Feeder Name	C14

: Input data in colored cells

Type-3

Maximum Current I_{max}: 520.0A

Power factor (cosθ): 0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	520A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3215kVA	

<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} =1.8Ω X_{T1} =1.4Ω)

Trunk Line 1: Loading 220%, Rated Current =236A

Voltage V_S: 11.0kV

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

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_{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_{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)

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 1>

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

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION C
Feeder Name	C14

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	542A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3215kVA	

<Trank Line 2>

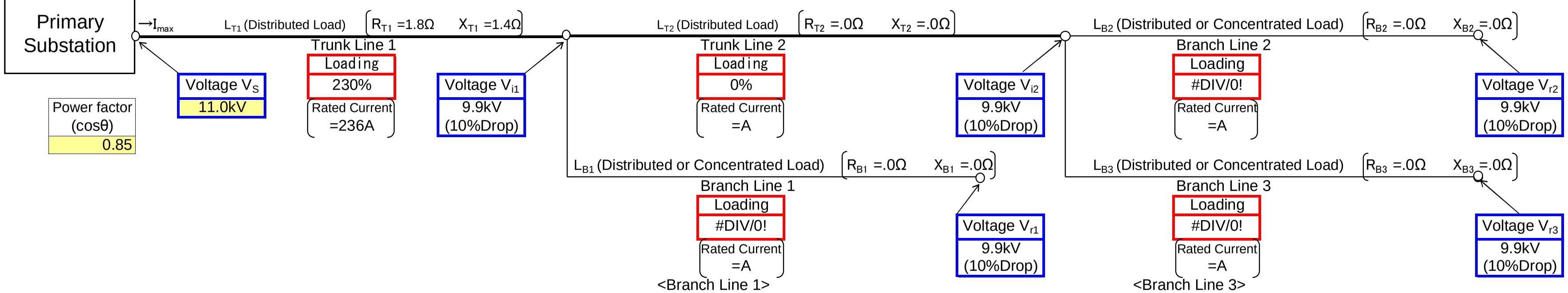
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
542.0A

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 C
Feeder Name	C14

: Input data in colored cells

Type-3

Maximum Current I_{max}
565.0A

Power factor (cosθ)
0.85

<Trank Line 1>

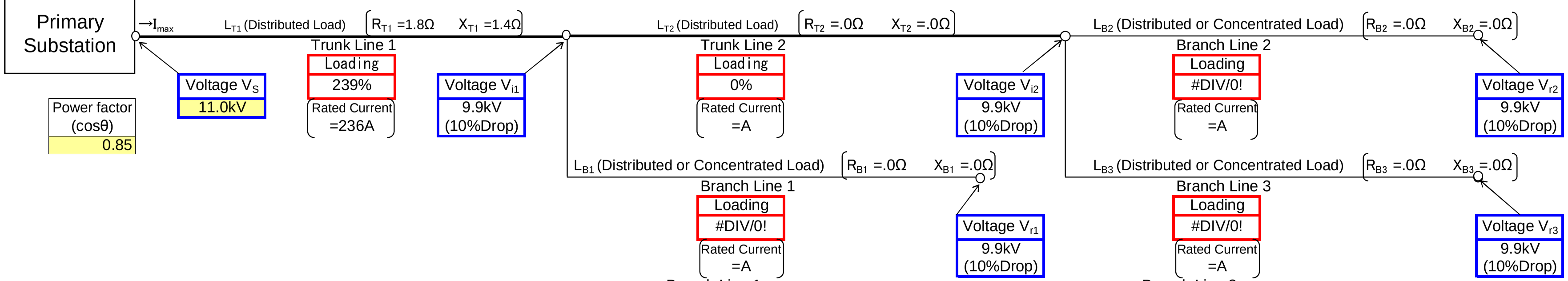
Load L_{T1}	565A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	3.0km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3215kVA	

<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 C
Feeder Name	C20

: Input data in colored cells

Type-3

Maximum Current I_{max}
331.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	143A
Line Type	150ALBARE No.38
Line Legth Len_{T1}	4.9km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA

<Trank Line 2>

Load L_{T2}	188A
Line Type	185ALXPLE(11kV) No.24
Line Legth Len_{T2}	6.4km
Type of Distributed Load	Equality
Total Transformer Capacity of secondary substations CAP_{T2}	3445kVA

<Branch Line 2>

Load 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} =1.7Ω

Trunk Line 1: Loading 73%, Rated Current =455A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.2kV (7%Drop)

L_{T2} (Distributed Load) R_{T2} =1.0Ω X_{T2} =.8Ω

Trunk Line 2: Loading 41%, Rated Current =335A

Voltage V_{i2}: 10.0kV (9%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}: 10.0kV (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}: 10.2kV (7%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 1>

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

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION C
Feeder Name	C20

: Input data in colored cells

Type-3

Maximum Current I_{max}: 352.0A

Power factor (cosθ): 0.85

Primary Substation

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	152A	
Line Type	150ALBARE	No.38
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =1.0Ω X_{T1} =1.7Ω)

Trunk Line 1: Loading 77%, Rated Current =455A

Voltage V_{i1}: 10.2kV (8%Drop)

<Trank Line 2>

Load L_{T2}	200A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3445kVA	

L_{T2} (Distributed Load) (R_{T2} =1.0Ω X_{T2} =.8Ω)

Trunk Line 2: Loading 44%, Rated Current =335A

Voltage V_{i2}: 9.9kV (10%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}: 10.2kV (8%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}: 9.9kV (10%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}: 9.9kV (10%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 C
Feeder Name	C20

: Input data in colored cells

Type-3

Maximum Current I_{max}
374.0A

Power factor (cosθ)
0.85

<Trank Line 1>

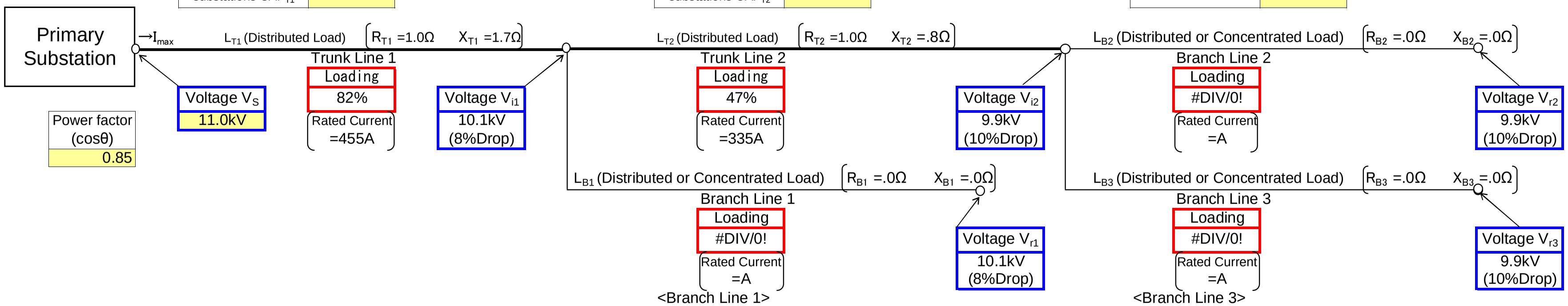
Load L_{T1}	162A	
Line Type	150ALBARE	No.38
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<Trank Line 2>

Load L_{T2}	212A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3445kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C20

: Input data in colored cells

Type-3

Maximum Current I_{max}
397.0A

Power factor (cosθ)
0.85

<Trank Line 1>

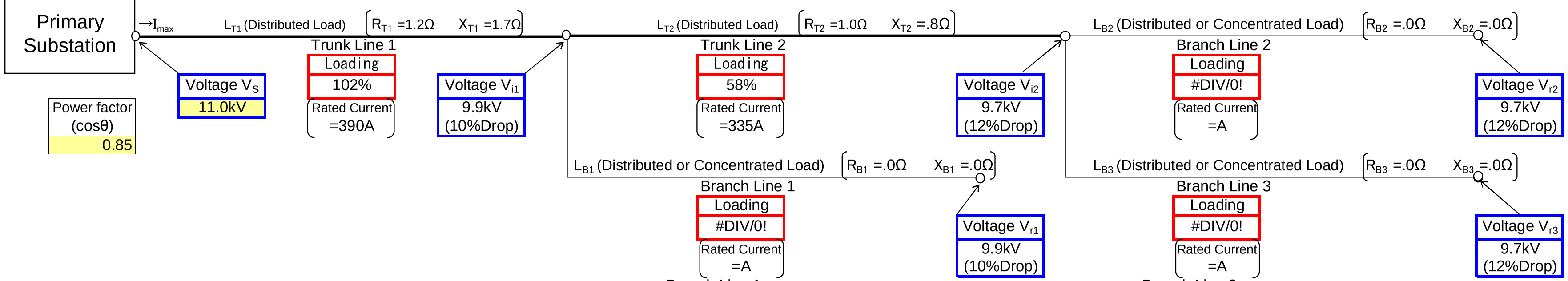
Load L_{T1}	172A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<Trank Line 2>

Load L_{T2}	225A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3445kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C20

: Input data in colored cells

Type-3

Maximum Current I_{max}: 422.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	183A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

L_{T1} (Distributed Load) (R_{T1} =1.2Ω X_{T1} =1.7Ω)

Trunk Line 1: Loading 108%, Rated Current =390A

Voltage V_{i1}: 9.9kV (10%Drop)

<Trank Line 2>

Load L_{T2}	239A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3445kVA	

L_{T2} (Distributed Load) (R_{T2} =1.0Ω X_{T2} =.8Ω)

Trunk Line 2: Loading 61%, Rated Current =335A

Voltage V_{i2}: 9.6kV (13%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}: 9.6kV (13%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}: 9.9kV (10%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}: 9.6kV (13%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 C
Feeder Name	C20

: Input data in colored cells

Type-3

Maximum Current I_{max}
449.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	194A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<Trank Line 2>

Load L_{T2}	255A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3445kVA	

<Branch Line 2>

Load 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} =1.2Ω X_{T1} =1.7Ω)

Trunk Line 1: Loading 115%, (Rated Current =390A)

Voltage V_S: 11.0kV

Voltage V_{i1}: 9.8kV (11%Drop)

L_{T2} (Distributed Load) (R_{T2} =1.0Ω X_{T2} =.8Ω)

Trunk Line 2: Loading 65%, (Rated Current =335A)

Voltage V_{i2}: 9.5kV (13%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}: 9.5kV (13%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}: 9.8kV (11%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}: 9.5kV (13%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 C
Feeder Name	C20

: Input data in colored cells

Type-3

Maximum Current I_{max}
477.0A

Power factor (cosθ)
0.85

<Trank Line 1>

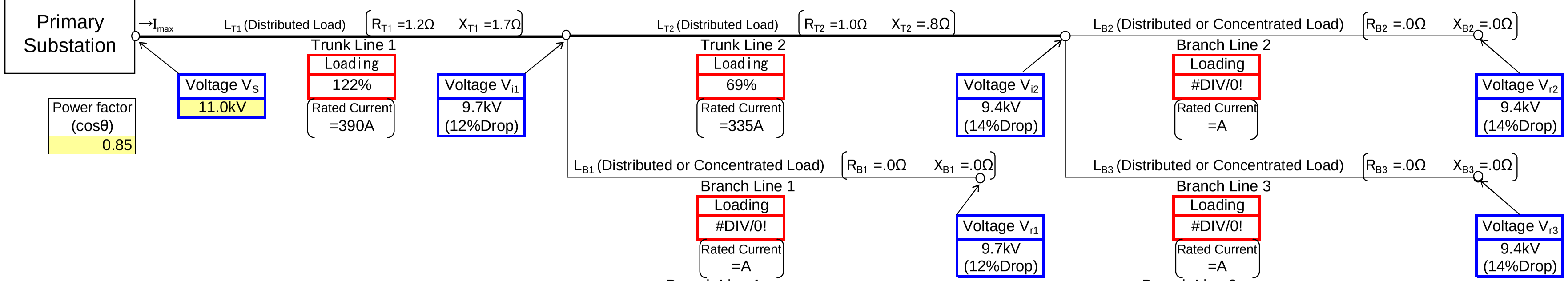
Load L_{T1}	207A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<Trank Line 2>

Load L_{T2}	270A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3445kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C20

: Input data in colored cells

Type-3

Maximum Current I_{max}
507.0A

Power factor (cosθ)
0.85

Primary Substation

$\rightarrow I_{max}$

Voltage V_S
11.0kV

<Trank Line 1>

Load L_{T1}	219A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

L_{T1} (Distributed Load) (R_{T1} =1.2Ω X_{T1} =1.7Ω)

Trunk Line 1

Loading
130%

Rated Current =390A

Voltage V_{i1}
9.6kV (12%Drop)

<Trank Line 2>

Load L_{T2}	288A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3445kVA	

L_{T2} (Distributed Load) (R_{T2} =1.0Ω X_{T2} =.8Ω)

Trunk Line 2

Loading
74%

Rated Current =335A

Voltage V_{i2}
9.3kV (15%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}
9.6kV (12%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}
9.3kV (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}
9.3kV (15%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 C
Feeder Name	C20

: Input data in colored cells

Type-3

Maximum Current I_{max}: 539.0A

Power factor (cosθ): 0.85

Primary Substation

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	233A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

L_{T1} (Distributed Load) (R_{T1} =1.2Ω X_{T1} =1.7Ω)

Trunk Line 1: Loading 138%, Rated Current =390A

Voltage V_{i1}: 9.6kV (13%Drop)

<Trank Line 2>

Load L_{T2}	306A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3445kVA	

L_{T2} (Distributed Load) (R_{T2} =1.0Ω X_{T2} =.8Ω)

Trunk Line 2: Loading 78%, Rated Current =335A

Voltage V_{i2}: 9.2kV (16%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}: 9.6kV (13%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}: 9.2kV (16%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}: 9.2kV (16%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 C
Feeder Name	C20

: Input data in colored cells

Type-3

Maximum Current I_{max}
573.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	248A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<Trank Line 2>

Load L_{T2}	325A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3445kVA	

<Branch Line 2>

Load 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} =1.2Ω X_{T1} =1.7Ω)

Trunk Line 1 Loading 147% (Rated Current =390A)

Voltage V_{i1} 9.5kV (14%Drop)

L_{T2} (Distributed Load) (R_{T2} =1.0Ω X_{T2} =.8Ω)

Trunk Line 2 Loading 83% (Rated Current =335A)

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} =.0Ω X_{B1} =.0Ω)

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

Voltage V_{r1} 9.5kV (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 (17%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 C
Feeder Name	C20

: Input data in colored cells

Type-3

Maximum Current I_{max}
609.0A

Power factor (cosθ)
0.85

<Trank Line 1>

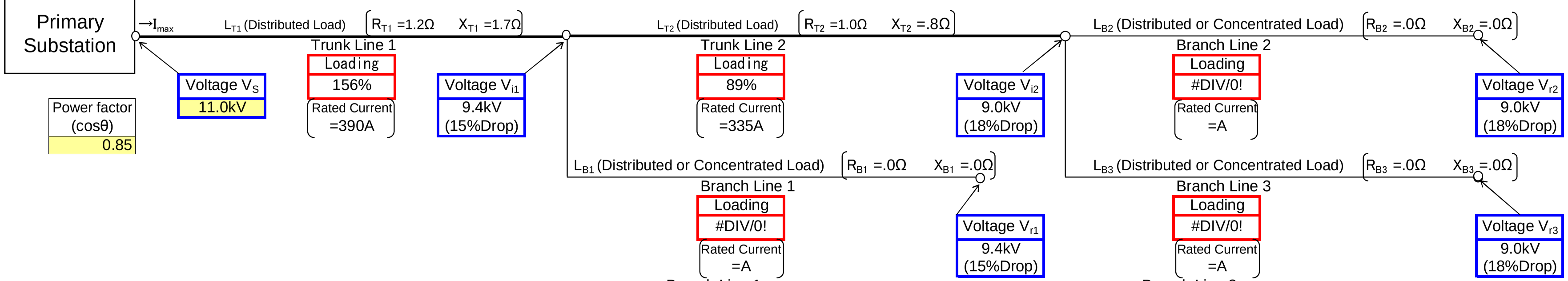
Load L_{T1}	264A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<Trank Line 2>

Load L_{T2}	345A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3445kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C20

: Input data in colored cells

Type-3

Maximum Current I_{max}: 647.0A

Power factor (cosθ): 0.85

<Trank Line 1>

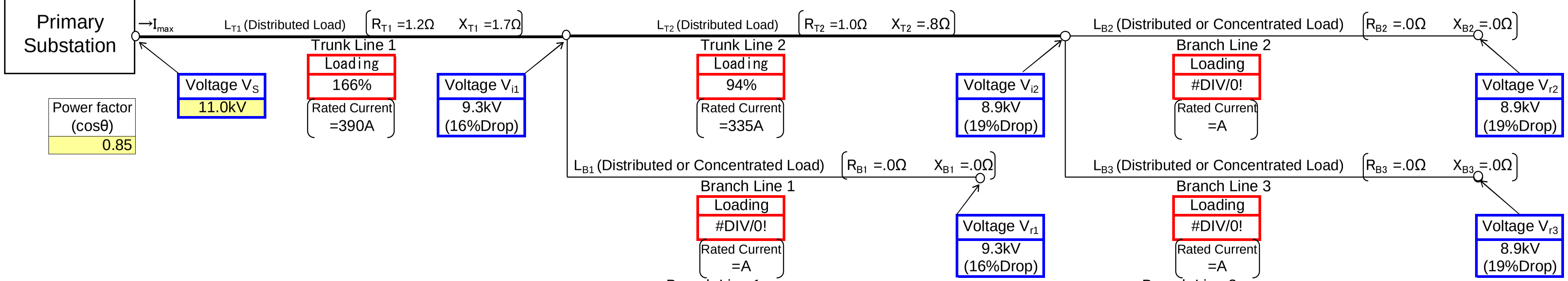
Load L_{T1}	280A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.9km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	2630kVA	

<Trank Line 2>

Load L_{T2}	367A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T2}	6.4km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3445kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C60

: Input data in colored cells

Type-3

Maximum Current I_{max}
320.0A

Power factor (cosθ)
0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	18A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	515kVA	

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

Trunk Line 1: Loading 82% (Rated Current =390A)

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

<Trank Line 2>

Load L_{T2}	139A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3890kVA	

L_{T2} (Distributed Load) (R_{T2} =1.1Ω X_{T2} =1.6Ω)

Trunk Line 2: Loading 36% (Rated Current =390A)

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

L_{B1} (Distributed or Concentrated Load) (R_{B1} =1.3Ω X_{B1} =1.9Ω)

Branch Line 1: Loading 42% (Rated Current =390A)

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

<Branch Line 1>

Load L_{B1}	162A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4520kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C60

: Input data in colored cells

Type-3

Maximum Current I_{max}
336.0A

Power factor (cosθ)
0.85

<Trank Line 1>

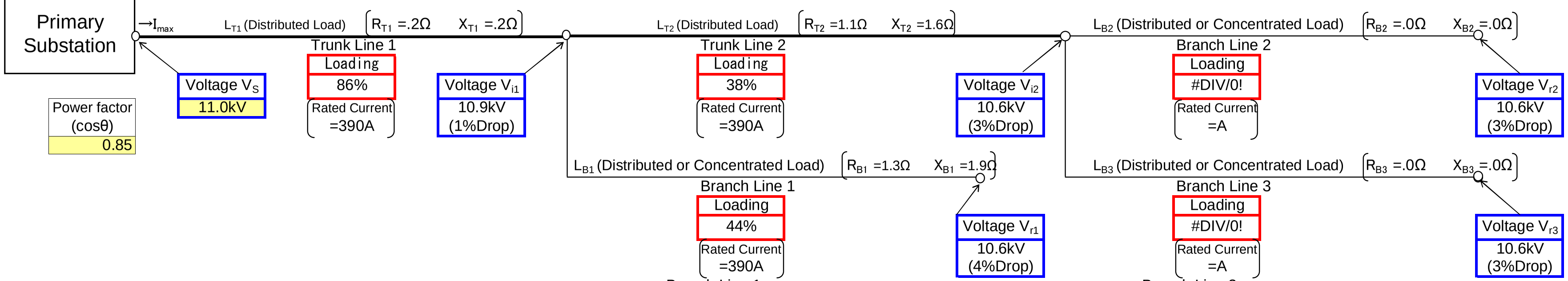
Load L_{T1}	19A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	515kVA	

<Trank Line 2>

Load L_{T2}	146A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3890kVA	

<Branch Line 2>

Load 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}	170A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4520kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION C
Feeder Name	C60

: Input data in colored cells

Type-3

Maximum Current I_{max}
352.0A

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

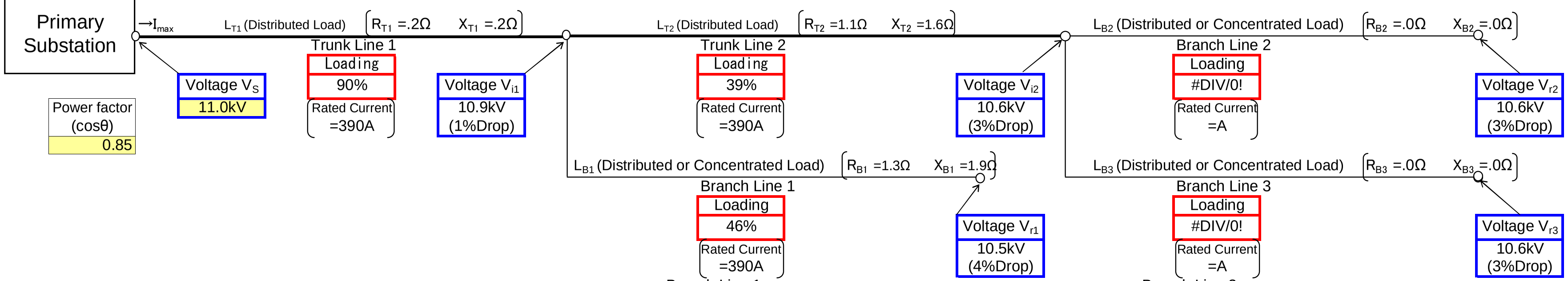
Load L_{T1}	20A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	515kVA	

<Trank Line 2>

Load L_{T2}	153A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3890kVA	

<Branch Line 2>

Load 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}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4520kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

V_s : Supply Voltage	I_{max} : Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: 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 C
Feeder Name	C60

: Input data in colored cells

Type-3

Maximum Current I_{max}
369.0A

Power factor (cosθ)
0.85

<Trank Line 1>

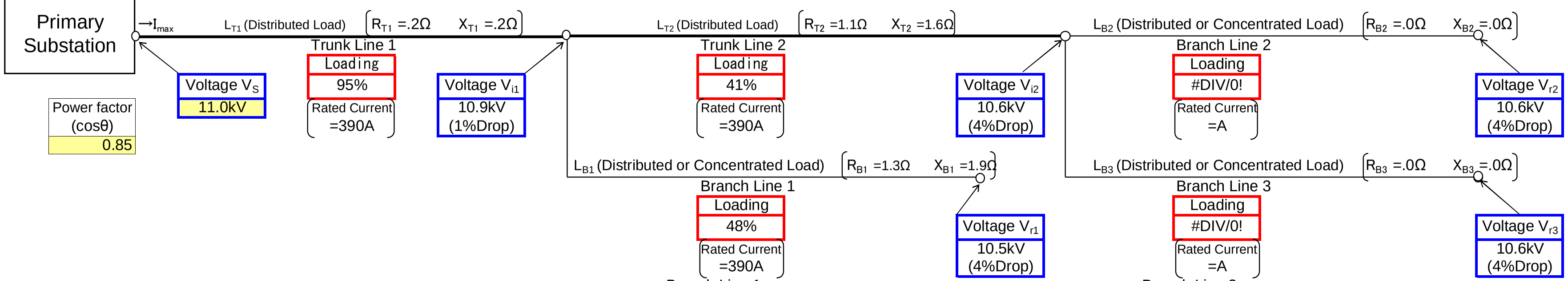
Load L_{T1}	21A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	515kVA	

<Trank Line 2>

Load L_{T2}	161A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3890kVA	

<Branch Line 2>

Load 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}	187A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4520kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION C
Feeder Name	C60

: Input data in colored cells

Type-3

Maximum Current I_{max}	387.0A
Power factor (cosθ)	0.85

<Trank Line 1>

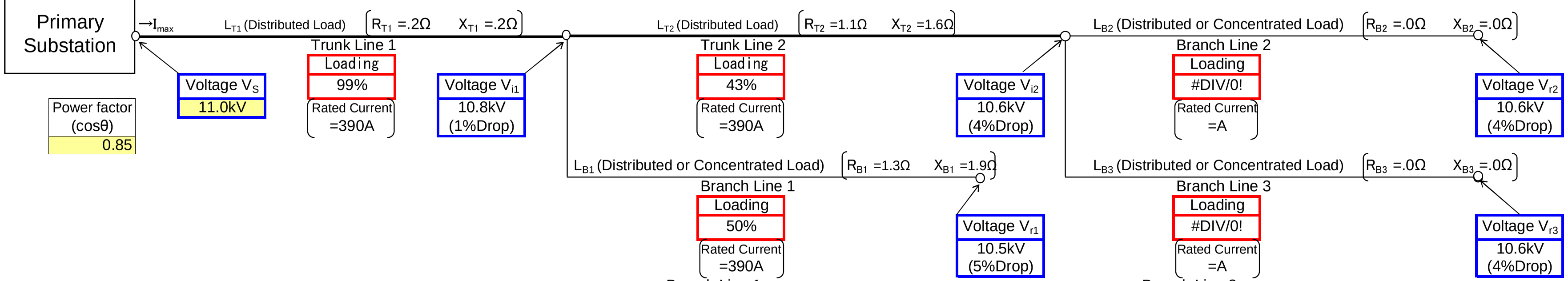
Load L_{T1}	22A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	515kVA	

<Trank Line 2>

Load L_{T2}	169A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3890kVA	

<Branch Line 2>

Load 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}	196A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4520kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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 C
Feeder Name	C60

: Input data in colored cells

Type-3

Maximum Current I_{max}
405.0A

Power factor (cosθ)
0.85

<Trank Line 1>

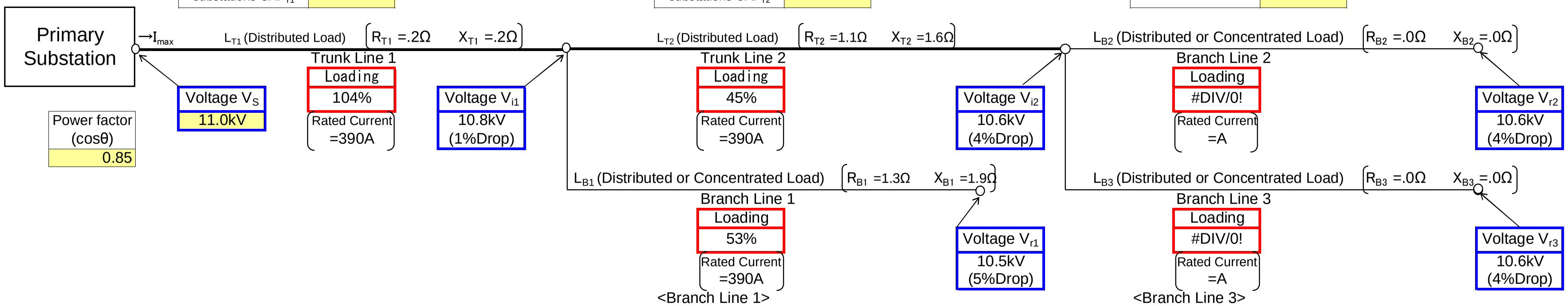
Load L_{T1}	23A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	515kVA	

<Trank Line 2>

Load L_{T2}	177A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3890kVA	

<Branch Line 2>

Load 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}	205A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4520kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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 C
Feeder Name	C60

: Input data in colored cells

Type-3

Maximum Current I_{max}	425.0A

Power factor (cosθ)	0.85

<Trank Line 1>

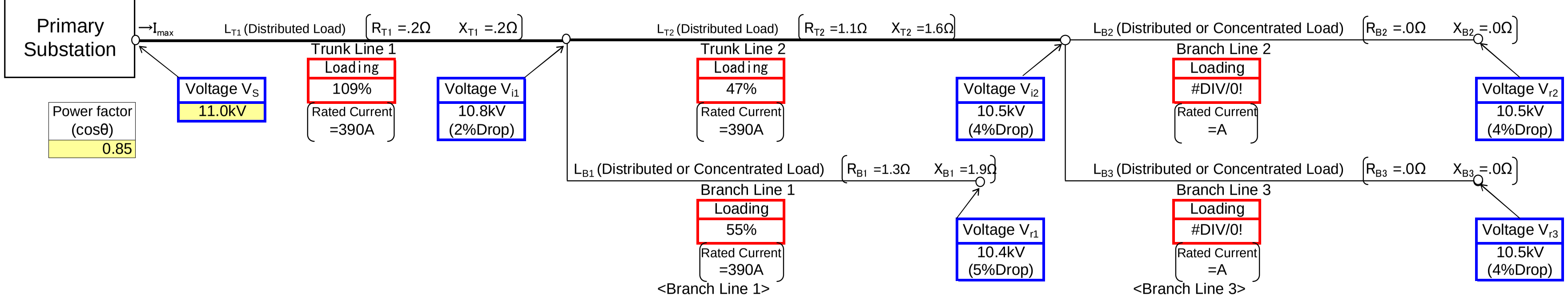
Load L_{T1}	25A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	515kVA	

<Trank Line 2>

Load L_{T2}	185A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3890kVA	

<Branch Line 2>

Load 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}	215A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4520kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

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

Substation Name	STATION C
Feeder Name	C60

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	26A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	515kVA	

<Trank Line 2>

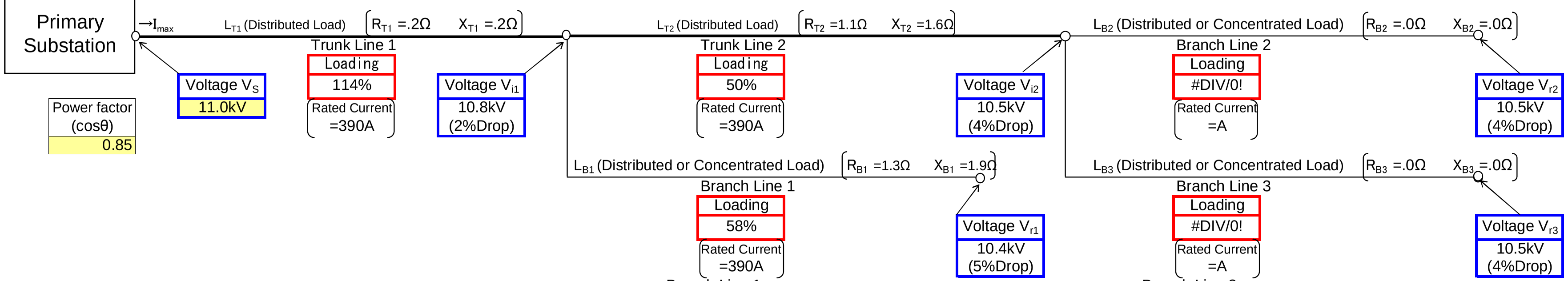
Load L_{T2}	194A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3890kVA	

<Branch Line 2>

Load 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}
446.0A

Power factor ($\cos\theta$)
0.85



<Branch Line 1>

Load L_{B1}	226A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4520kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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
$\cos\theta$: Power Factor

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

Substation Name	STATION C
Feeder Name	C60

: Input data in colored cells

Type-3

Maximum Current I_{max}	
467.0A	

Power factor (cosθ)
0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	27A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	515kVA	

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

Trunk Line 1 — Loading 120% (Rated Current =390A)

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

<Trank Line 2>

Load L_{T2}	204A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3890kVA	

L_{T2} (Distributed Load) (R_{T2} =1.1Ω X_{T2} =1.6Ω)

Trunk Line 2 — Loading 52% (Rated Current =390A)

Voltage V_{i2}: 10.5kV (5%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =1.3Ω X_{B1} =1.9Ω)

Branch Line 1 — Loading 61% (Rated Current =390A)

Voltage V_{r1}: 10.4kV (6%Drop)

<Branch Line 1>

Load L_{B1}	237A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4520kVA	

<Branch Line 2>

Load 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_{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 C
Feeder Name	C60

: Input data in colored cells

Type-3

Maximum Current I_{max}	490.0A
Power factor (cosθ)	0.85

Primary Substation →I_{max}

Voltage V_s
11.0kV

<Trank Line 1>

Load L_{T1}	28A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	515kVA	

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

Trunk Line 1
Loading
126%
Rated Current =390A

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

<Trank Line 2>

Load L_{T2}	214A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3890kVA	

L_{T2} (Distributed Load) (R_{T2} =1.1Ω X_{T2} =1.6Ω)

Trunk Line 2
Loading
55%
Rated Current =390A

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} =1.3Ω X_{B1} =1.9Ω)

Branch Line 1
Loading
64%
Rated Current =390A

Voltage V_{r1}
10.4kV (6%Drop)

<Branch Line 1>

Load L_{B1}	248A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4520kVA	

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 C
Feeder Name	C60

: Input data in colored cells

Type-3

Maximum Current I_{max}
514.0A

Primary Substation

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	30A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	515kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) R_{T1} =.2Ω X_{T1} =.2Ω

Voltage V_S: 11.0kV

Trunk Line 1 — Loading: 132%; Rated Current =390A

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

<Trank Line 2>

Load L_{T2}	224A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3890kVA	

L_{T2} (Distributed Load) R_{T2} =1.1Ω X_{T2} =1.6Ω

Trunk Line 2 — Loading: 57%; Rated Current =390A

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

L_{B1} (Distributed or Concentrated Load) R_{B1} =1.3Ω X_{B1} =1.9Ω

Branch Line 1 — Loading: 67%; Rated Current =390A

Voltage V_{r1}: 10.3kV (6%Drop)

<Branch Line 1>

Load L_{B1}	260A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4520kVA	

<Branch Line 2>

Load 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 C
Feeder Name	C60

: Input data in colored cells

Type-3

Maximum Current I_{max}
539.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	31A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	515kVA	

<Trank Line 2>

Load L_{T2}	235A	
Line Type	120ALBARE	No.37
Line Legth Len_{T2}	4.5km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T2}	3890kVA	

<Branch Line 2>

Load 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 138%, Rated Current =390A

Voltage V_S: 11.0kV

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

L_{T2} (Distributed Load) (R_{T2} =1.1Ω X_{T2} =1.6Ω)

Trunk Line 2: Loading 60%, Rated Current =390A

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

L_{B1} (Distributed or Concentrated Load) (R_{B1} =1.3Ω X_{B1} =1.9Ω)

Branch Line 1: Loading 70%, Rated Current =390A

Voltage V_{r1}: 10.3kV (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 (5%Drop)

<Branch Line 1>

Load L_{B1}	273A	
Line Type	120ALBARE	No.37
Line Length Len_{B1}	5.2km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{B1}	4520kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

: Input data in colored cells

Type-3

Maximum Current I_{max}
230.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	200A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	81.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	4810kVA	

<Trank Line 2>

Load L_{T2}	5A	
Line Type	35CUBARE	No.33
Line Legth Len_{T2}	14.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	125kVA	

<Branch Line 2>

Load 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} =48.2Ω X_{T1} =38.2Ω)

Trunk Line 1 — Loading: 97% — Rated Current =236A

Voltage V_{i1}: .8kV (93%Drop)

L_{T2} (Distributed Load) (R_{T2} =8.7Ω X_{T2} =6.9Ω)

Trunk Line 2 — Loading: 2% — Rated Current =236A

Voltage V_{i2}: .7kV (93%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}: .7kV (93%Drop)

L_{B1} (Distributed or Concentrated Load) (R_{B1} =19.9Ω X_{B1} =15.8Ω)

Branch Line 1 — Loading: 11% — 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}: .7kV (93%Drop)

<Branch Line 1>

Load L_{B1}	25A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	33.6km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	600kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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 N
Feeder Name	ADOAGYIRI

: Input data in colored cells

Type-3

Maximum Current I_{max}	241.0A
Power factor (cosθ)	0.85

<Trank Line 1>

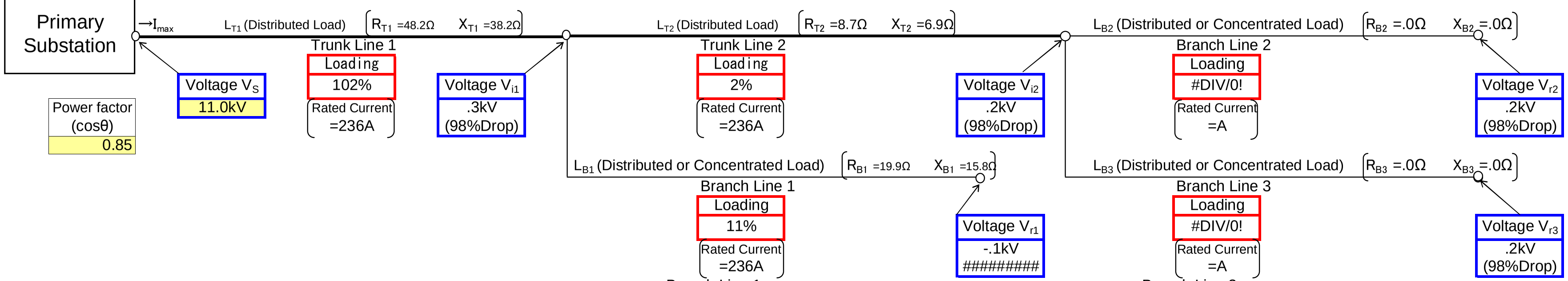
Load L_{T1}	209A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	81.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	4810kVA	

<Trank Line 2>

Load L_{T2}	5A	
Line Type	35CUBARE	No.33
Line Legth Len_{T2}	14.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	125kVA	

<Branch Line 2>

Load 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}	26A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	33.6km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	600kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	220A
Line Type	35CUBARE No.33
Line Legth Len_{T1}	81.4km
Type of Distributed Load	Sending Larger
Total Transformer Capacity of secondary substations CAP_{T1}	4810kVA

<Trank Line 2>

Load L_{T2}	6A
Line Type	35CUBARE No.33
Line Legth Len_{T2}	14.7km
Type of Distributed Load	Sending Larger
Total Transformer Capacity of secondary substations CAP_{T2}	125kVA

<Branch Line 2>

Load 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

$\rightarrow I_{max}$

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =48.2Ω X_{T1} =38.2Ω)

Trunk Line 1 — Loading: 107% — Rated Current =236A

Voltage V_{i1}: -.3kV ##########

L_{T2} (Distributed Load) (R_{T2} =8.7Ω X_{T2} =6.9Ω)

Trunk Line 2 — Loading: 2% — Rated Current =236A

Voltage V_{i2}: -.3kV ##########

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

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

Voltage V_{r2}: -.3kV ##########

L_{B1} (Distributed or Concentrated Load) (R_{B1} =19.9Ω X_{B1} =15.8Ω)

Branch Line 1 — Loading: 12% — Rated Current =236A

Voltage V_{r1}: -.7kV ##########

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

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

Voltage V_{r3}: -.3kV ##########

<Branch Line 1>

Load L_{B1}	27A
Line Type	35CUBARE No.33
Line Length Len_{B1}	33.6km
Type of Distributed Load	Sending Larger
Total Transformer Capacity of secondary substations CAP_{B1}	600kVA

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

: Input data in colored cells

Type-3

Maximum Current I_{max}	
265.0A	
Power factor ($\cos\theta$)	0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	230A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	81.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	4810kVA	

<Trank Line 2>

Load L_{T2}	6A	
Line Type	35CUBARE	No.33
Line Legth Len_{T2}	14.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	125kVA	

<Branch Line 2>

Load 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} =48.2Ω X_{T1} =38.2Ω)

Trunk Line 1 — Loading 112% — Rated Current =236A

Voltage V_S: 11.0kV

Voltage V_{i1}: -.8kV, #########

L_{T2} (Distributed Load) (R_{T2} =8.7Ω X_{T2} =6.9Ω)

Trunk Line 2 — Loading 3% — Rated Current =236A

Voltage V_{i2}: -.8kV, #########

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

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

Voltage V_{r2}: -.8kV, #########

L_{B1} (Distributed or Concentrated Load) (R_{B1} =19.9Ω X_{B1} =15.8Ω)

Branch Line 1 — Loading 12% — Rated Current =236A

Voltage V_{r1}: -1.2kV, #########

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

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

Voltage V_{r3}: -.8kV, #########

<Branch Line 1>

Load L_{B1}	29A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	33.6km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	600kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

: Input data in colored cells

Type-3

Maximum Current I_{max}	278.0A

Power factor (cosθ)	0.85

<Trank Line 1>

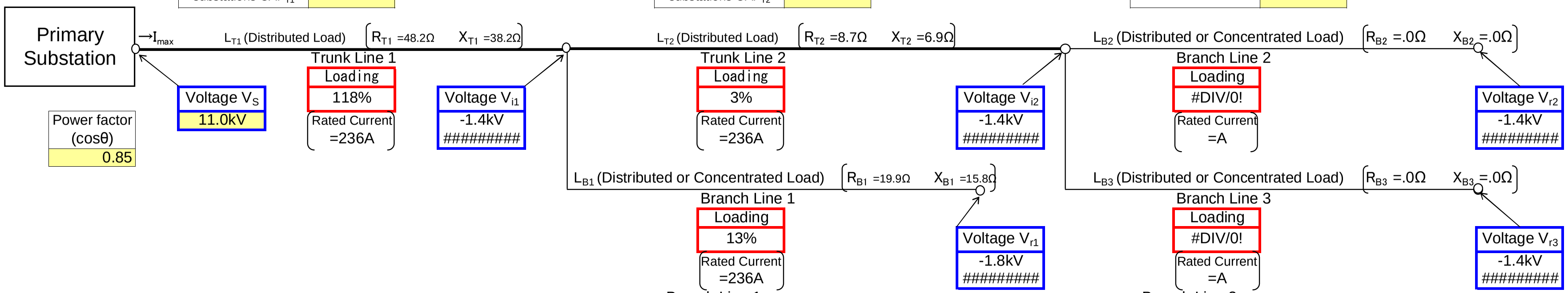
Load L_{T1}	242A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	81.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	4810kVA	

<Trank Line 2>

Load L_{T2}	6A	
Line Type	35CUBARE	No.33
Line Legth Len_{T2}	14.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	125kVA	

<Branch Line 2>

Load 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}	30A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	33.6km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	600kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

: 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}	254A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	81.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	4810kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =48.2Ω X_{T1} =38.2Ω)

Voltage V_S: 11.0kV

Trunk Line 1 — Loading: 124% — Rated Current =236A

Voltage V_{i1}: -2.0kV #########

<Trank Line 2>

Load L_{T2}	7A	
Line Type	35CUBARE	No.33
Line Legth Len_{T2}	14.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	125kVA	

L_{T2} (Distributed Load) (R_{T2} =8.7Ω X_{T2} =6.9Ω)

Trunk Line 2 — Loading: 3% — Rated Current =236A

Voltage V_{i2}: -2.0kV #########

<Branch Line 2>

Load 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}: -2.0kV #########

L_{B1} (Distributed or Concentrated Load) (R_{B1} =19.9Ω X_{B1} =15.8Ω)

Branch Line 1 — Loading: 13% — Rated Current =236A

Voltage V_{r1}: -2.5kV #########

<Branch Line 1>

Load L_{B1}	32A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	33.6km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	600kVA	

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

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

Voltage V_{r3}: -2.0kV #########

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

: Input data in colored cells

Type-3

Maximum Current I_{max}	
306.0A	

Power factor (cosθ)	
0.85	

<Trank Line 1>

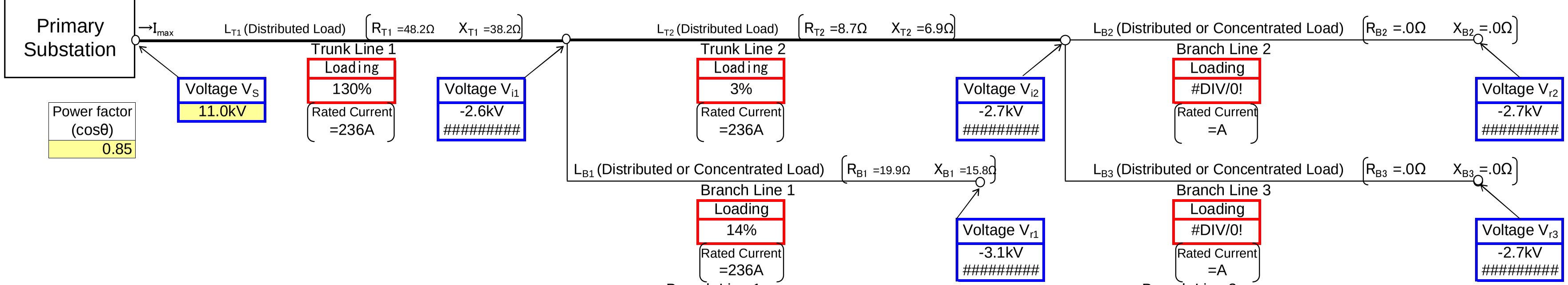
Load L_{T1}	266A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	81.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	4810kVA	

<Trank Line 2>

Load L_{T2}	7A	
Line Type	35CUBARE	No.33
Line Legth Len_{T2}	14.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	125kVA	

<Branch Line 2>

Load 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}	33A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	33.6km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	600kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

: Input data in colored cells

Type-3

Maximum Current I_{max}
321.0A

Power factor (cosθ)
0.85

Primary Substation

$\rightarrow I_{max}$

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	279A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	81.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	4810kVA	

L_{T1} (Distributed Load) (R_{T1} =48.2Ω X_{T1} =38.2Ω)

Trunk Line 1 — Loading: 136% (Rated Current =236A)

Voltage V_{i1}: -3.3kV, #########

<Trank Line 2>

Load L_{T2}	7A	
Line Type	35CUBARE	No.33
Line Legth Len_{T2}	14.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	125kVA	

L_{T2} (Distributed Load) (R_{T2} =8.7Ω X_{T2} =6.9Ω)

Trunk Line 2 — Loading: 3% (Rated Current =236A)

Voltage V_{i2}: -3.3kV, #########

<Branch Line 2>

Load 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}: -3.3kV, #########

L_{B1} (Distributed or Concentrated Load) (R_{B1} =19.9Ω X_{B1} =15.8Ω)

Branch Line 1 — Loading: 15% (Rated Current =236A)

Voltage V_{r1}: -3.8kV, #########

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

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

Voltage V_{r3}: -3.3kV, #########

<Branch Line 1>

Load L_{B1}	35A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	33.6km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	600kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

: Input data in colored cells

Type-3

Maximum Current I_{max}
337.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	293A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	81.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	4810kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =48.2Ω X_{T1} =38.2Ω)

Voltage V_S: 11.0kV

Trunk Line 1 — Loading: 143% — Rated Current =236A

Voltage V_{i1}: -4.0kV ##########

<Trank Line 2>

Load L_{T2}	8A	
Line Type	35CUBARE	No.33
Line Legth Len_{T2}	14.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	125kVA	

L_{T2} (Distributed Load) (R_{T2} =8.7Ω X_{T2} =6.9Ω)

Trunk Line 2 — Loading: 3% — Rated Current =236A

Voltage V_{i2}: -4.0kV ##########

<Branch Line 2>

Load 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}: -4.0kV ##########

L_{B1} (Distributed or Concentrated Load) (R_{B1} =19.9Ω X_{B1} =15.8Ω)

Branch Line 1 — Loading: 15% — Rated Current =236A

Voltage V_{r1}: -4.5kV ##########

<Branch Line 1>

Load L_{B1}	37A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	33.6km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	600kVA	

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

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

Voltage V_{r3}: -4.0kV ##########

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

: Input data in colored cells

Type-3

Maximum Current I_{max}
354.0A

Primary Substation

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	308A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	81.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	4810kVA	

<Trank Line 2>

Load L_{T2}	8A	
Line Type	35CUBARE	No.33
Line Legth Len_{T2}	14.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	125kVA	

<Branch Line 2>

Load 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} =48.2Ω X_{T1} =38.2Ω)

Trunk Line 1: Loading 150%; Rated Current =236A

Voltage V_S: 11.0kV

Voltage V_{i1}: -4.8kV ##########

L_{T2} (Distributed Load) (R_{T2} =8.7Ω X_{T2} =6.9Ω)

Trunk Line 2: Loading 3%; Rated Current =236A

Voltage V_{i2}: -4.8kV ##########

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

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

Voltage V_{r2}: -4.8kV ##########

L_{B1} (Distributed or Concentrated Load) (R_{B1} =19.9Ω X_{B1} =15.8Ω)

Branch Line 1: Loading 16%; Rated Current =236A

Voltage V_{r1}: -5.3kV ##########

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

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

Voltage V_{r3}: -4.8kV ##########

<Branch Line 1>

Load L_{B1}	38A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	33.6km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	600kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

: Input data in colored cells

Type-3

Maximum Current I_{max}	
371.0A	

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	322A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	81.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	4810kVA	

<Trank Line 2>

Load L_{T2}	8A	
Line Type	35CUBARE	No.33
Line Legth Len_{T2}	14.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	125kVA	

<Branch Line 2>

Load 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} =48.2Ω X_{T1} =38.2Ω)

Trunk Line 1: Loading 157%, Rated Current =236A

Voltage V_S: 11.0kV

Voltage V_{i1}: -5.5kV, #########

L_{T2} (Distributed Load) (R_{T2} =8.7Ω X_{T2} =6.9Ω)

Trunk Line 2: Loading 4%, Rated Current =236A

Voltage V_{i2}: -5.6kV, #########

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

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

Voltage V_{r2}: -5.6kV, #########

L_{B1} (Distributed or Concentrated Load) (R_{B1} =19.9Ω X_{B1} =15.8Ω)

Branch Line 1: Loading 17%, Rated Current =236A

Voltage V_{r1}: -6.1kV, #########

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

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

Voltage V_{r3}: -5.6kV, #########

<Branch Line 1>

Load L_{B1}	40A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	33.6km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	600kVA	

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

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

: Input data in colored cells

Type-3

Maximum Current I_{max}
389.0A

Primary Substation

Power factor (cosθ)
0.85

Voltage V_S
11.0kV

<Trank Line 1>

Load L_{T1}	338A	
Line Type	35CUBARE	No.33
Line Legth Len_{T1}	81.4km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	4810kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =48.2Ω X_{T1} =38.2Ω)

Trunk Line 1: Loading 165%, (Rated Current =236A)

Voltage V_{i1}
-6.3kV
#########

<Trank Line 2>

Load L_{T2}	9A	
Line Type	35CUBARE	No.33
Line Legth Len_{T2}	14.7km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T2}	125kVA	

L_{T2} (Distributed Load) (R_{T2} =8.7Ω X_{T2} =6.9Ω)

Trunk Line 2: Loading 4%, (Rated Current =236A)

Voltage V_{i2}
-6.4kV
#########

<Branch Line 2>

Load 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}
-6.4kV
#########

L_{B1} (Distributed or Concentrated Load) (R_{B1} =19.9Ω X_{B1} =15.8Ω)

Branch Line 1: Loading 18%, (Rated Current =236A)

Voltage V_{r1}
-6.9kV
#########

<Branch Line 1>

Load L_{B1}	42A	
Line Type	35CUBARE	No.33
Line Length Len_{B1}	33.6km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{B1}	600kVA	

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

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

Voltage V_{r3}
-6.4kV
#########

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

V_s : Supply Voltage	I_{max} : Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: 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	D01

: Input data in colored cells

Type-3

Maximum Current I_{max}
267.0A

Power factor (cosθ)
0.85

<Trank Line 1>

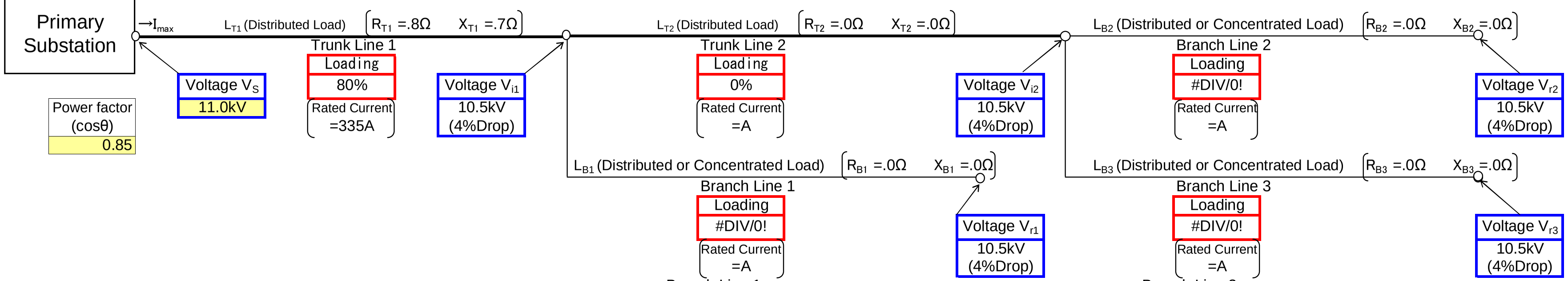
Load L_{T1}	267A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7805kVA	

<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	D01

: Input data in colored cells

Type-3

Maximum Current I_{max}
280.0A

Power factor (cosθ)
0.85

<Trank Line 1>

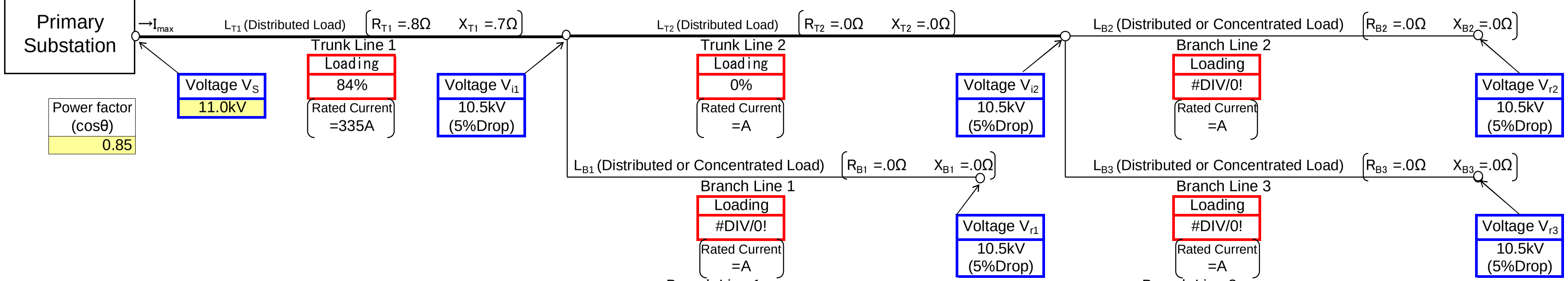
Load L_{T1}	280A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7805kVA	

<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	D01

: 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}	294A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7805kVA	

<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} =.8Ω X_{T1} =.7Ω)

Trunk Line 1 — Loading 88% — Rated Current =335A

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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3} : Received Voltage	L_{B3} : Load (Branch 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	D01

: Input data in colored cells

Type-3

Maximum Current I_{max}
308.0A

Power factor (cosθ)
0.85

<Trank Line 1>

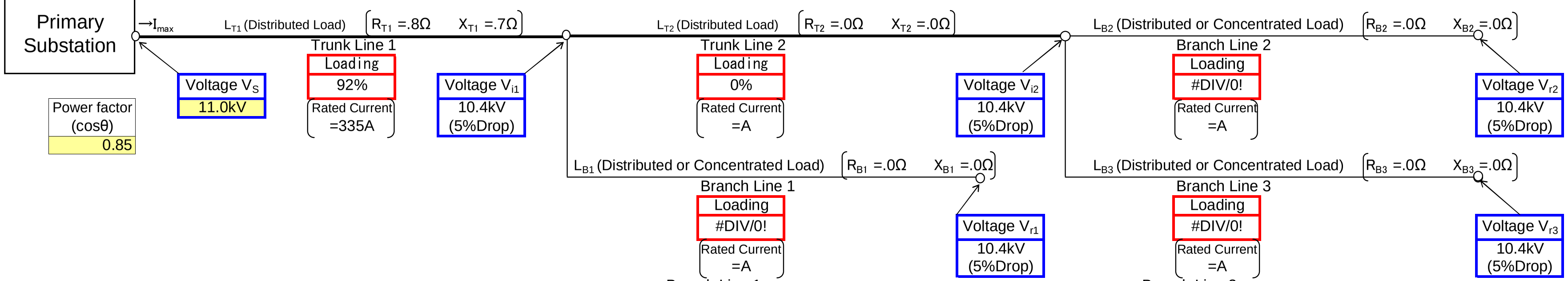
Load L_{T1}	308A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7805kVA	

<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	D01

: Input data in colored cells

Type-3

Maximum Current I_{max}	
323.0A	

Power factor ($\cos\theta$)	
0.85	

<Trank Line 1>

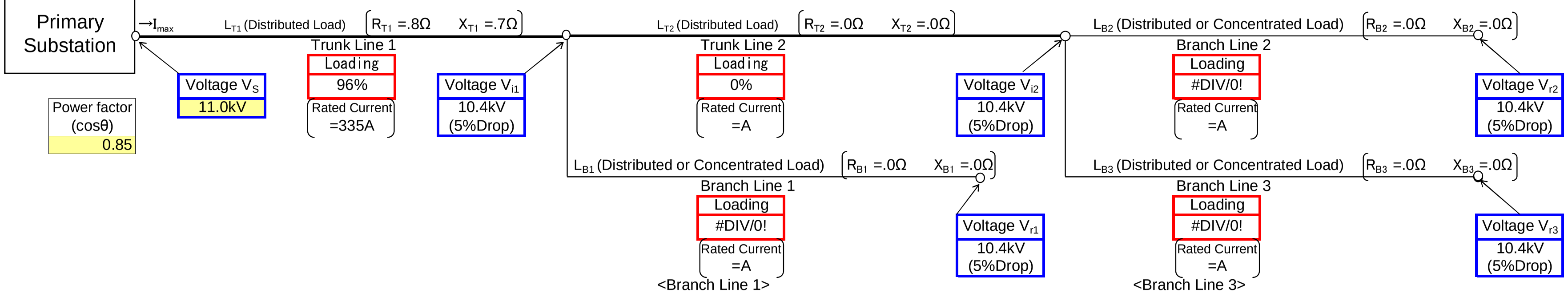
Load L_{T1}	323A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7805kVA	

<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 D
Feeder Name	D01

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	339A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7805kVA	

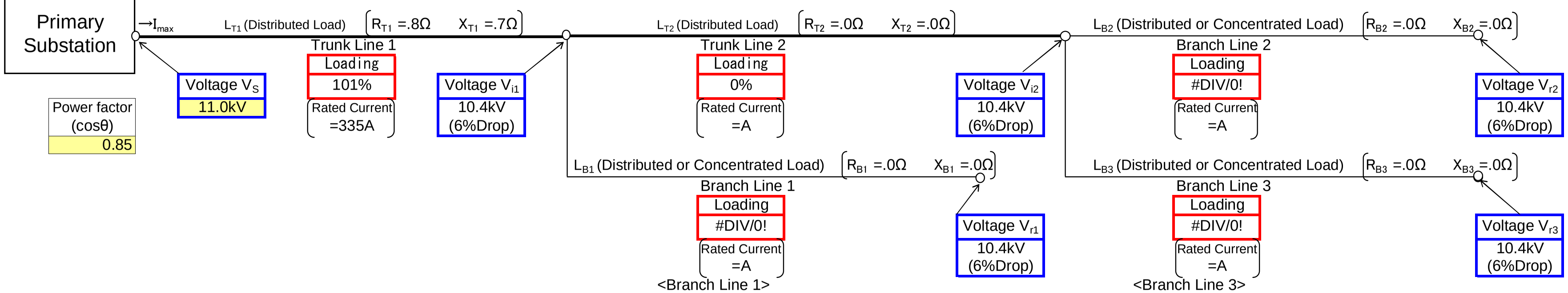
<Trank Line 2>

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}	339.0A
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	D01

: Input data in colored cells

Type-3

Maximum Current I_{max}
356.0A

Power factor (cosθ)
0.85

<Trank Line 1>

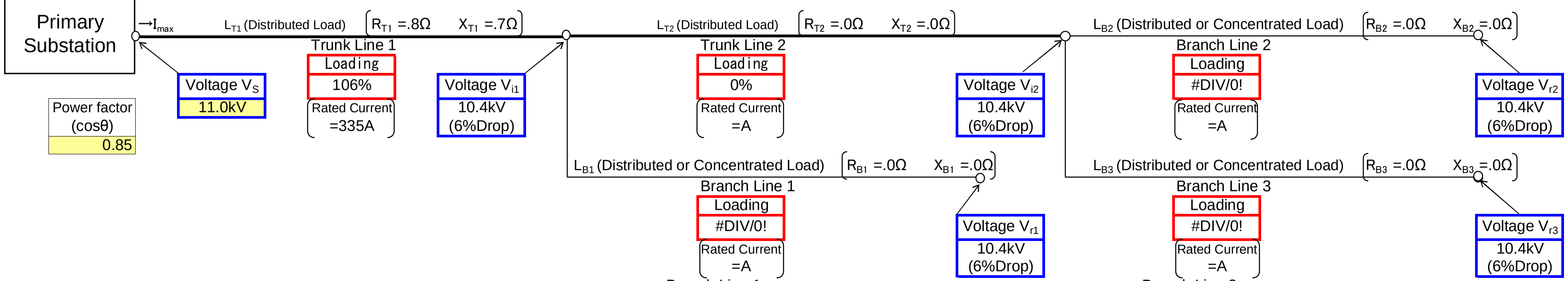
Load L_{T1}	356A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7805kVA	

<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	D01

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	373A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7805kVA	

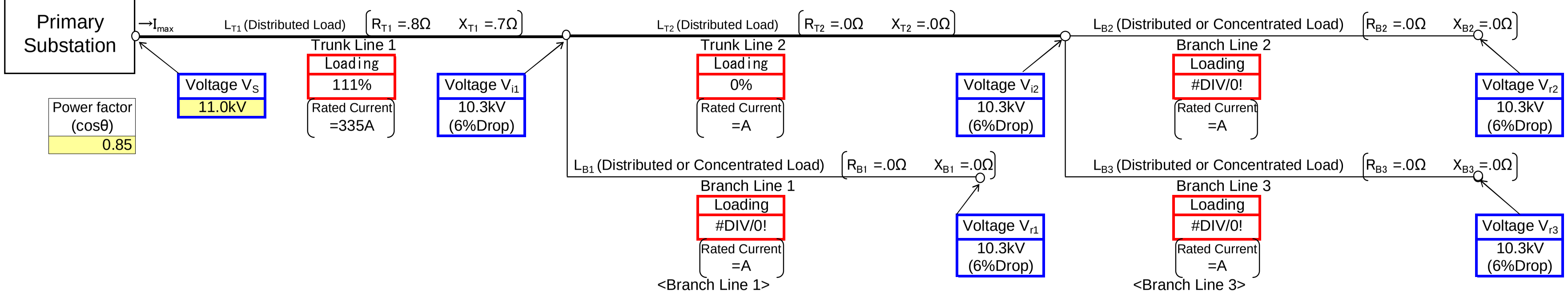
<Trank Line 2>

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}	373.0A
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	D01

: Input data in colored cells

Type-3

Maximum Current I_{max}
391.0A

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

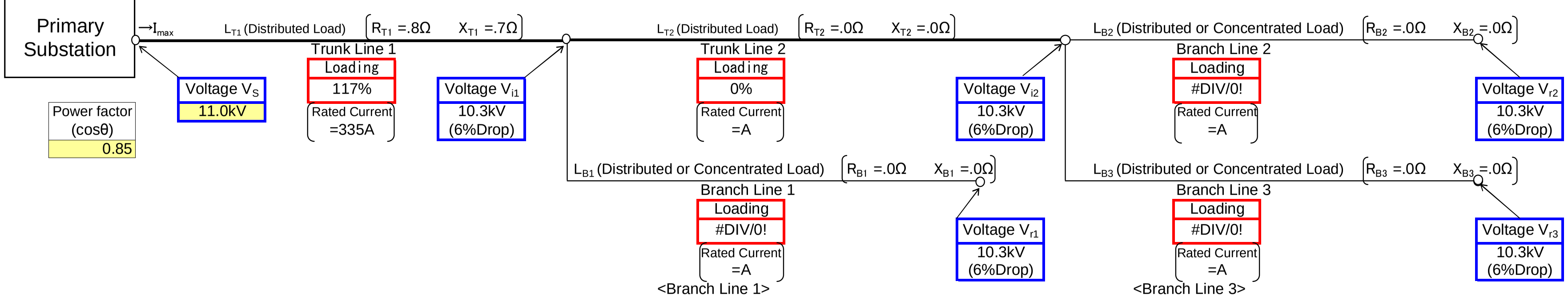
Load L_{T1}	391A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7805kVA	

<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)	$\cos\theta$: Power Factor

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

Substation Name	STATION D
Feeder Name	D01

: Input data in colored cells

Type-3

Maximum Current I_{max}
411.0A

Power factor (cosθ)
0.85

Primary Substation

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	411A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7805kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.8Ω X_{T1} =.7Ω)

Trunk Line 1: Loading 123%, Rated Current =335A

Voltage V_{i1}: 10.3kV (7%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 (7%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 (7%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 (7%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 (7%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	D01

: Input data in colored cells

Type-3

Maximum Current I_{max}	
431.0A	
Power factor (cosθ)	0.85

<Trank Line 1>

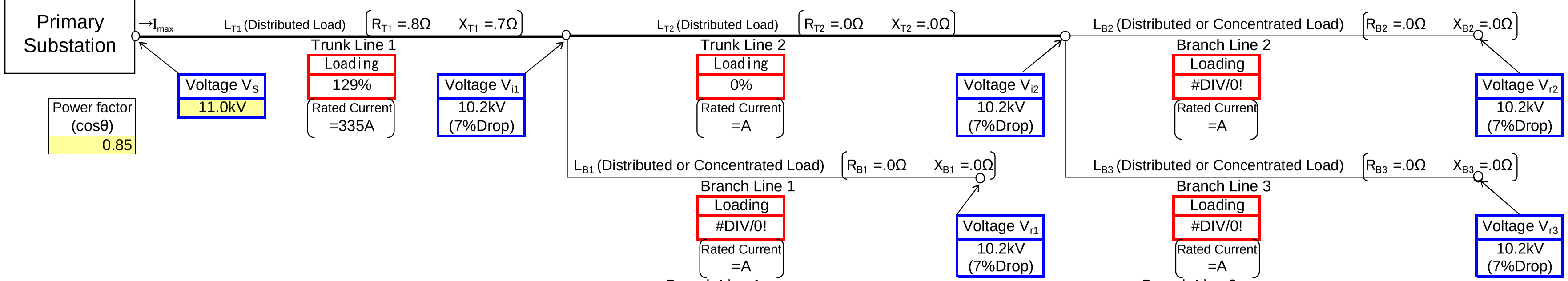
Load L_{T1}	431A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7805kVA	

<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	D01

: Input data in colored cells

Type-3

Maximum Current I_{max}
452.0A

Primary Substation

Power factor (cosθ)
0.85

Voltage V_s
11.0kV

<Trank Line 1>

Load L_{T1}	452A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7805kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.8Ω X_{T1} =.7Ω)

Trunk Line 1

Loading
135%

Rated Current =335A

Voltage V_{i1}
10.2kV (7%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}
10.2kV (7%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}
10.2kV (7%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}
10.2kV (7%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}
10.2kV (7%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	D101

: Input data in colored cells

Type-3

Maximum Current I_{max}	384.0A
Power factor (cosθ)	0.85

<Trank Line 1>

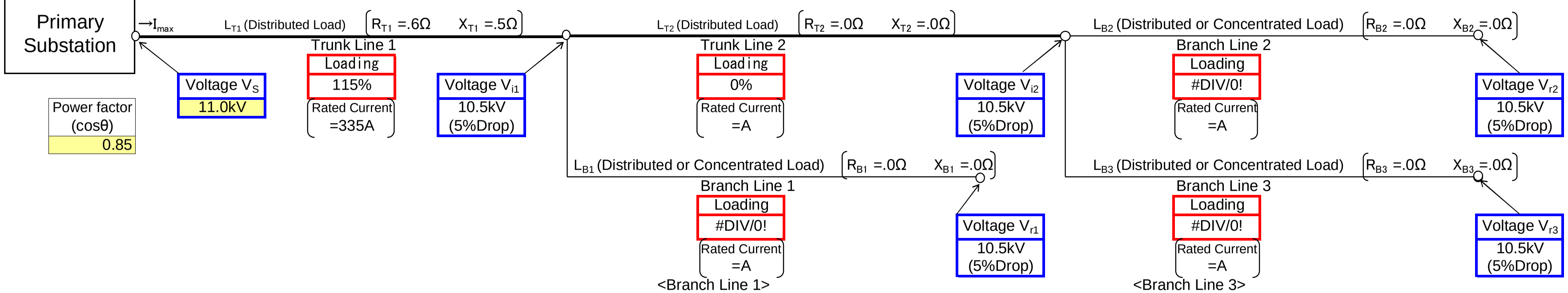
Load L_{T1}	384A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6065kVA	

<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	D101

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	395A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6065kVA	

<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}
395.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)
Trunk Line 1 — Loading 118% — (Rated Current =335A)

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

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_{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_{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)

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 1>

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

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

V_s : Supply Voltage	I_{max} : Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: 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	D101

: Input data in colored cells

Type-3

Maximum Current I_{max}	
405.0A	

Power factor (cosθ)	
0.85	

<Trank Line 1>

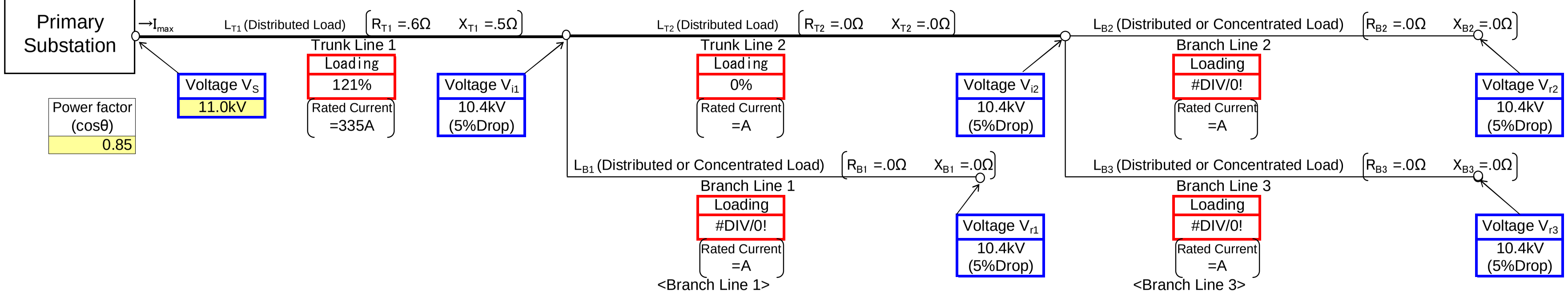
Load L_{T1}	405A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6065kVA	

<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	D101

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	416A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6065kVA	

<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}	416.0A
Power factor (cosθ)	0.85

Primary Substation

$\rightarrow I_{max}$

L_{T1} (Distributed Load) $(R_{T1}$ =.6Ω X_{T1} =.5Ω$)$

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

Voltage V_S: 11.0kV

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

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_{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_{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)

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 1>

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

<Branch Line 3>

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

=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch 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	D101

: Input data in colored cells

Type-3

Maximum Current I_{max}
428.0A

Power factor (cosθ)
0.85

<Trank Line 1>

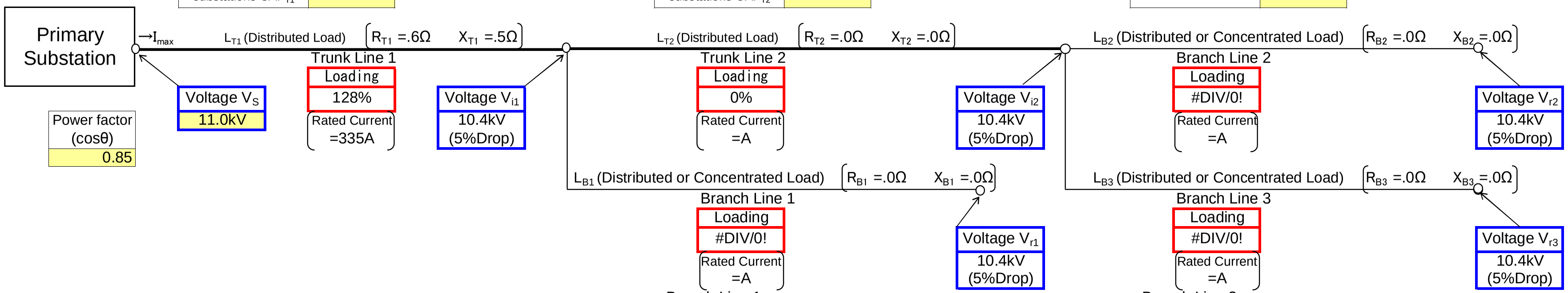
Load L_{T1}	428A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6065kVA	

<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	D101

: Input data in colored cells

Type-3

Maximum Current I_{max}: 440.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	440A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6065kVA	

L_{T1} (Distributed Load) (R_{T1} =.6Ω X_{T1} =.5Ω)

Trunk Line 1: Loading 131%; Rated Current =335A

Voltage V_{i1}: 10.4kV (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}: 10.4kV (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}: 10.4kV (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}		

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=====

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

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

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

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

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

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

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

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

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

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

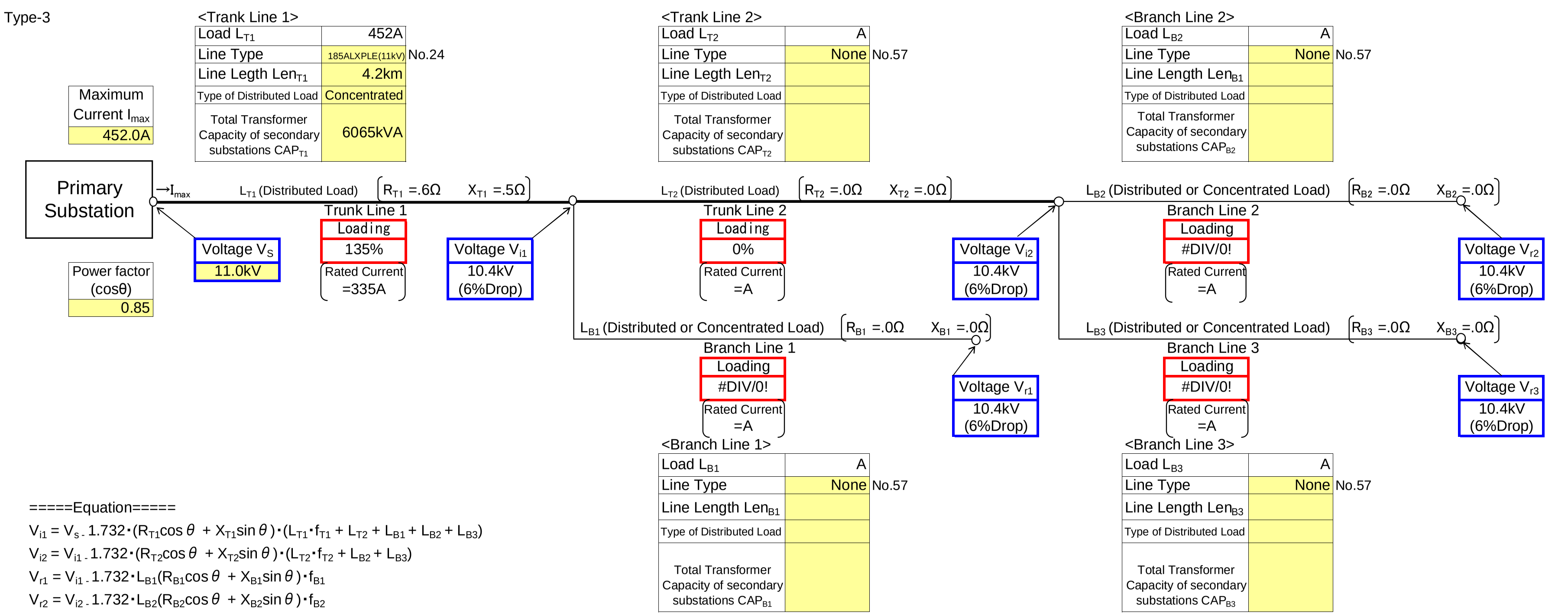
$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

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 D
Feeder Name	D101

: 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 D
Feeder Name	D101

: Input data in colored cells

Type-3

Maximum Current I_{max}
464.0A

<Trank Line 1>

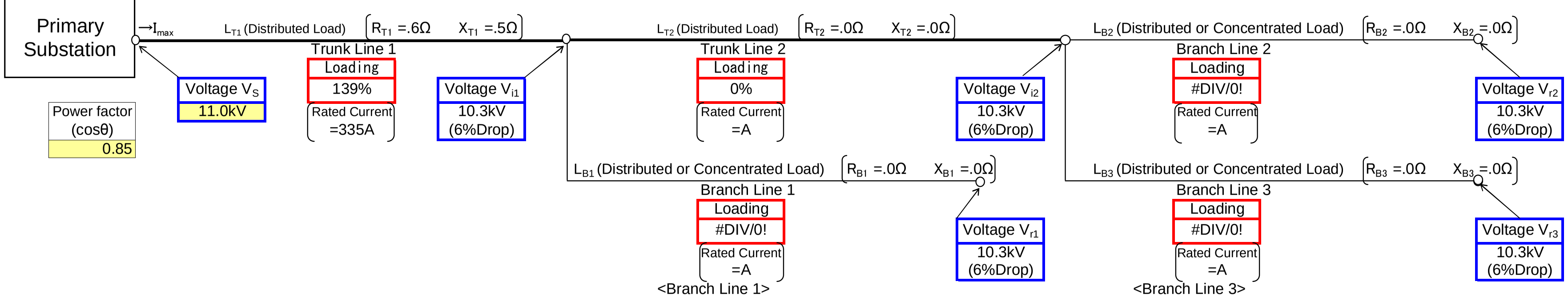
Load L_{T1}	464A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6065kVA	

<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	D101

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	477A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6065kVA	

<Trank Line 2>

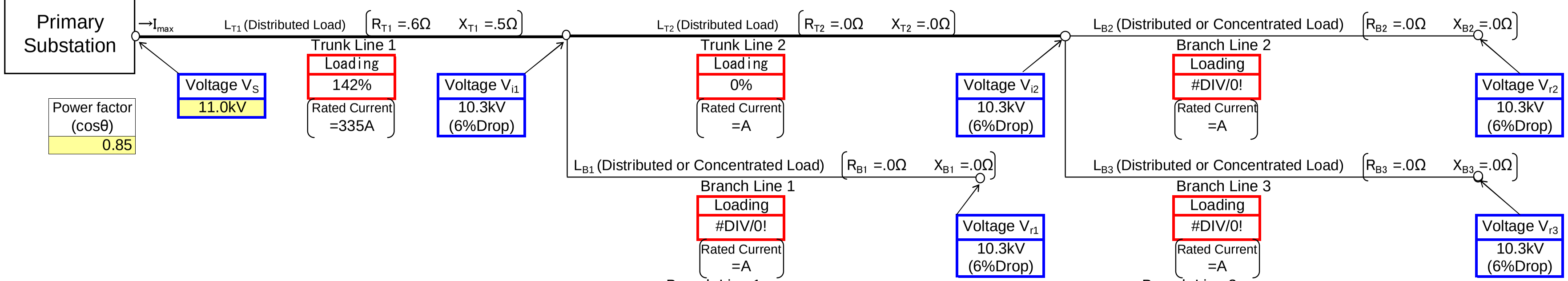
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
477.0A

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 D
Feeder Name	D101

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	490A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6065kVA	

<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}: 490.0A

Primary Substation $\rightarrow I_{max}$

Power factor (cosθ): 0.85

Voltage V_S: 11.0kV

L_{T1} (Distributed Load) R_{T1} =.6Ω X_{T1} =.5Ω

Trunk Line 1 — Loading 146% — Rated Current =335A

Voltage V_{i1}: 10.3kV (6%Drop)

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)

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)

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 D
Feeder Name	D101

: Input data in colored cells

Type-3

Maximum Current I_{max}
503.0A

Power factor (cosθ)
0.85

<Trank Line 1>

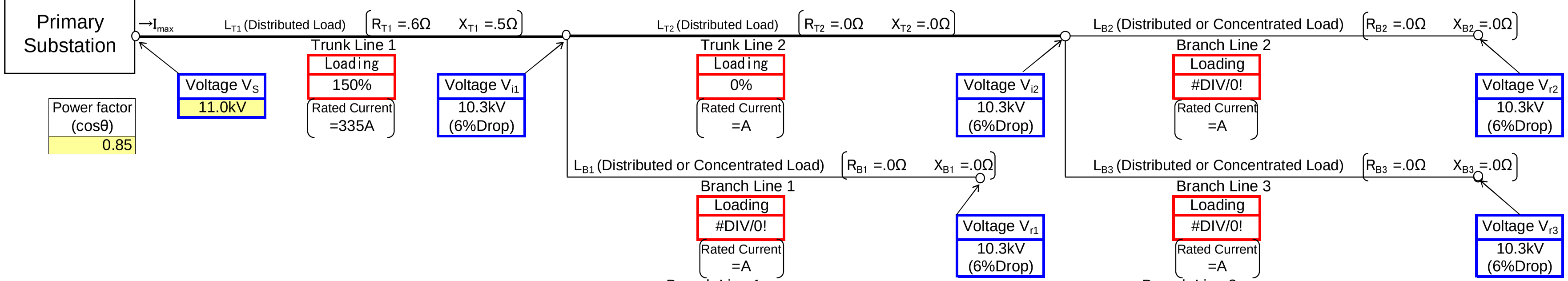
Load L_{T1}	503A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6065kVA	

<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=====

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

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

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

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

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

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

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

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

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

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

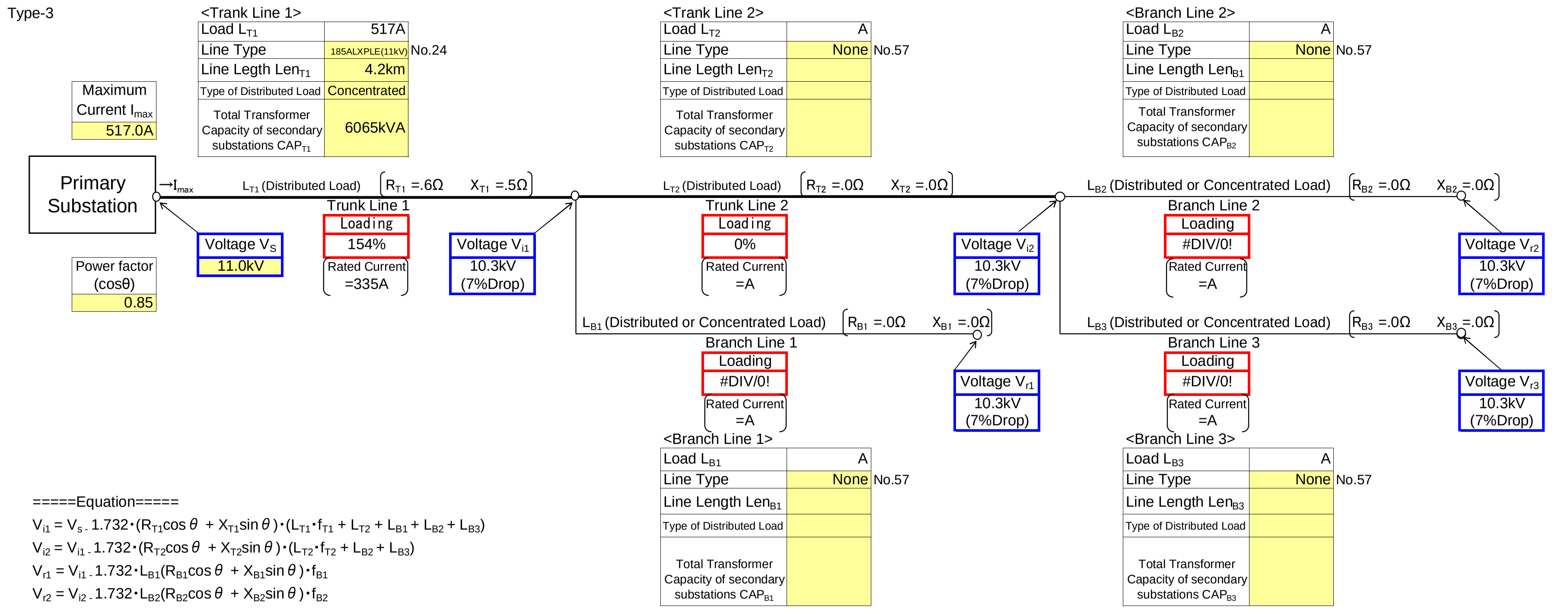
$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

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	D101

: 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 D
Feeder Name	D103

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	380A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7580kVA	

<Trank Line 2>

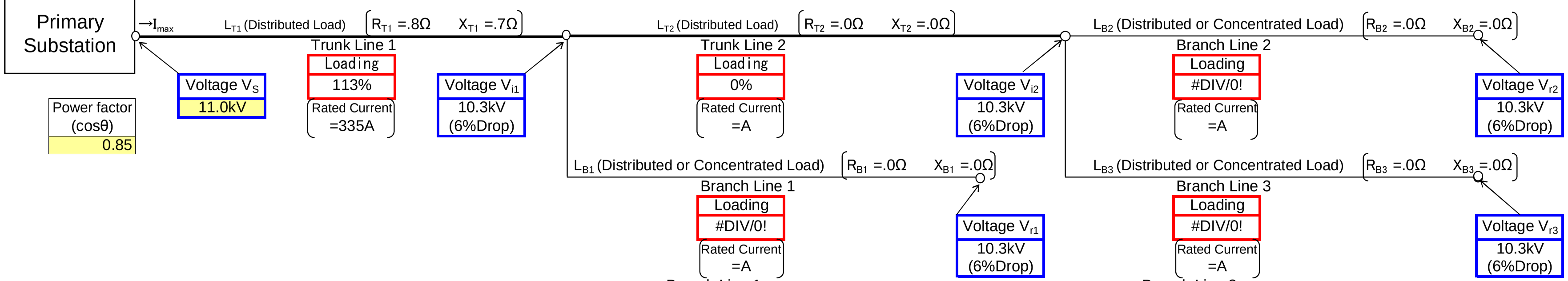
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
380.0A

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	D103

: Input data in colored cells

Type-3

Maximum Current I_{max}
388.0A

<Trank Line 1>

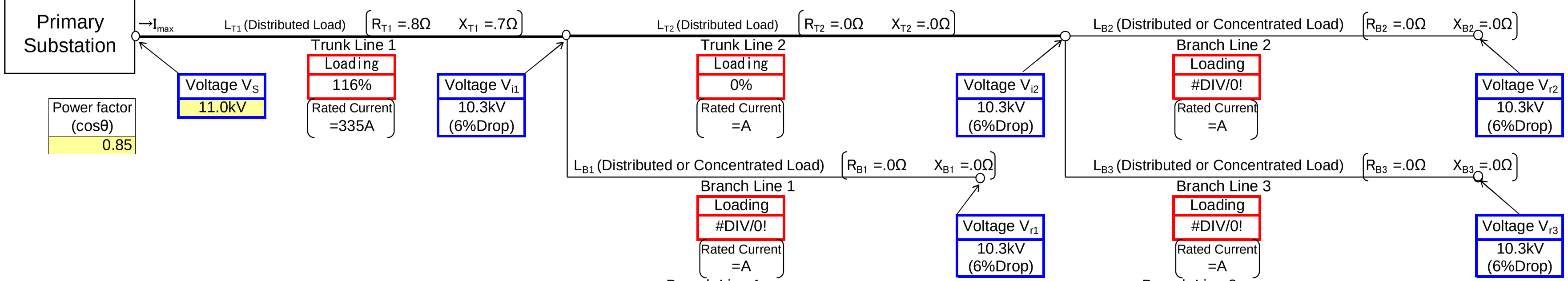
Load L_{T1}	388A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7580kVA	

<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 ($\cos\theta$)
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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
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 D
Feeder Name	D103

: Input data in colored cells

Type-3

Maximum Current I_{max}
396.0A

Power factor ($\cos\theta$)
0.85

<Trank Line 1>

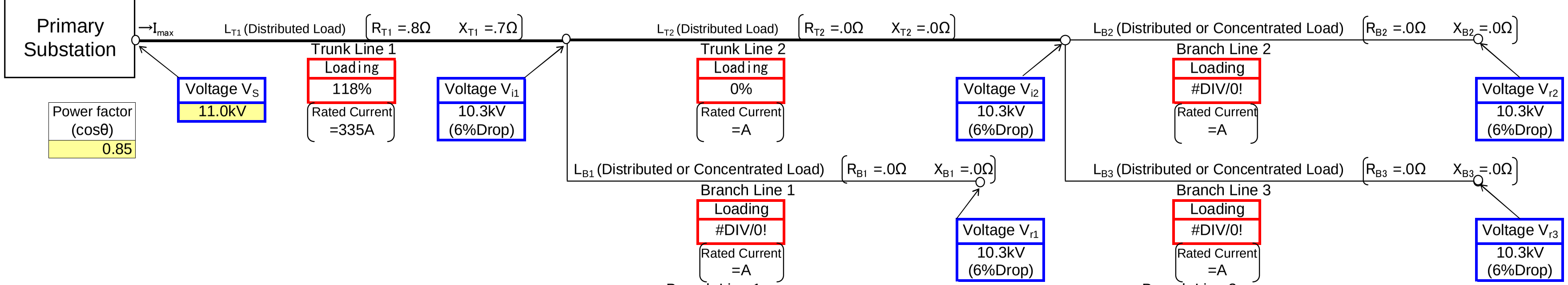
Load L_{T1}	396A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7580kVA	

<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 D
Feeder Name	D103

: Input data in colored cells

Type-3

Maximum Current I_{max}
404.0A

Power factor (cosθ)
0.85

Primary Substation

$\rightarrow I_{max}$

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	404A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7580kVA	

L_{T1} (Distributed Load) (R_{T1} =.8Ω X_{T1} =.7Ω)

Trunk Line 1: Loading 121% (Rated Current =335A)

Voltage V_{i1} 10.3kV (7%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 (7%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 (7%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 (7%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 (7%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	D103

: Input data in colored cells

Type-3

Maximum Current I_{max}
412.0A

Power factor (cosθ)
0.85

<Trank Line 1>

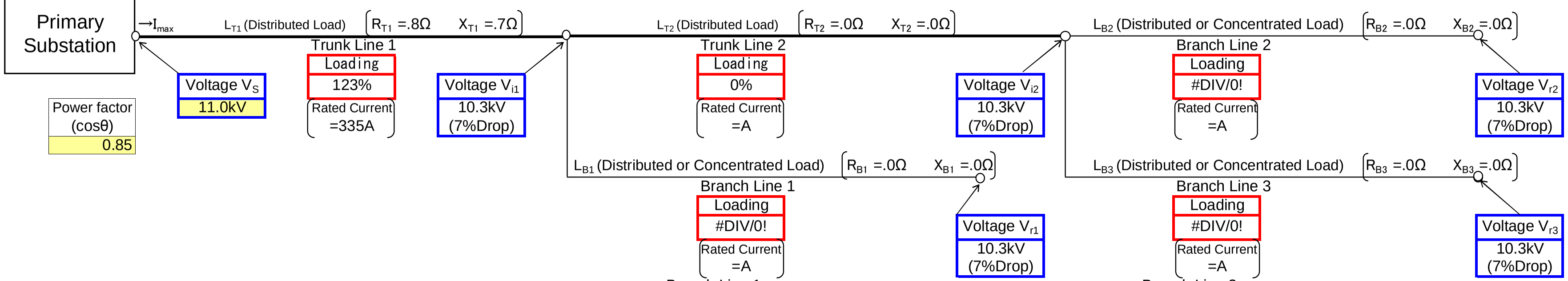
Load L_{T1}	412A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7580kVA	

<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=====

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

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

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

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

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

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

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

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

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

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

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

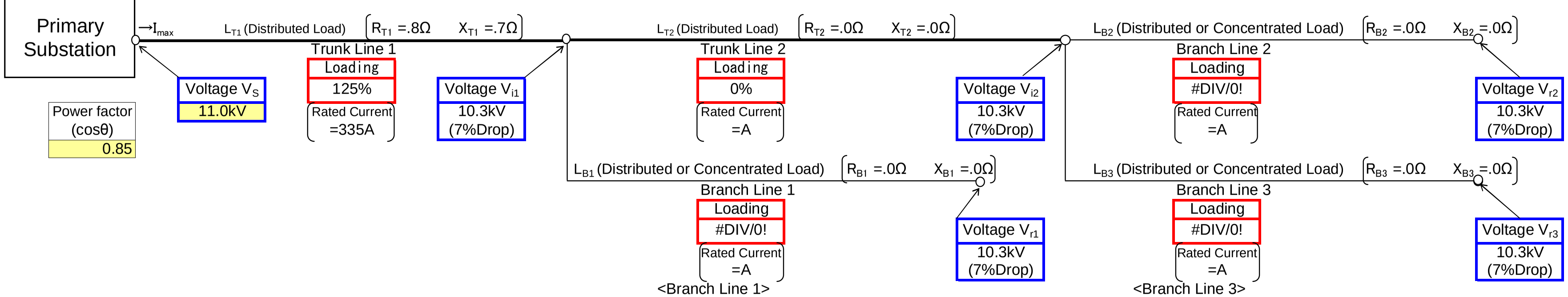
V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: 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	D103

: Input data in colored cells

Type-3



<Trank Line 1>

Load L_{T1}	420A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7580kVA	

<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	D103

: Input data in colored cells

Type-3

Maximum Current I_{max}
429.0A

Power factor (cosθ)
0.85

<Trank Line 1>

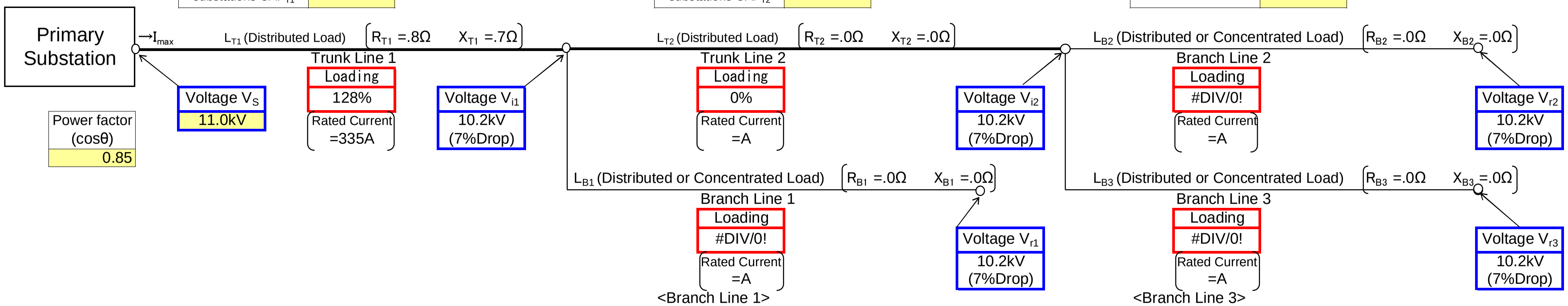
Load L_{T1}	429A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7580kVA	

<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	D103

: Input data in colored cells

Type-3

Maximum Current I_{max} 438.0A

Power factor (cosθ) 0.85

Primary Substation

Voltage V_s 11.0kV

<Trank Line 1>

Load L_{T1}	438A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7580kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.8Ω X_{T1} =.7Ω)

Trunk Line 1 Loading 131% (Rated Current =335A)

Voltage V_{i1} 10.2kV (7%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} 10.2kV (7%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} 10.2kV (7%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} 10.2kV (7%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} 10.2kV (7%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	D103

: Input data in colored cells

Type-3

Maximum Current I_{max}
447.0A

Power factor ($\cos\theta$)
0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	447A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7580kVA	

L_{T1} (Distributed Load) (R_{T1} =.8Ω X_{T1} =.7Ω)

Trunk Line 1: Loading 133%, Rated Current =335A

Voltage V_{i1} 10.2kV (7%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} 10.2kV (7%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} 10.2kV (7%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} 10.2kV (7%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} 10.2kV (7%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 D
Feeder Name	D103

: Input data in colored cells

Type-3

Maximum Current I_{max}	
456.0A	

Power factor (cosθ)
0.85

<Trank Line 1>

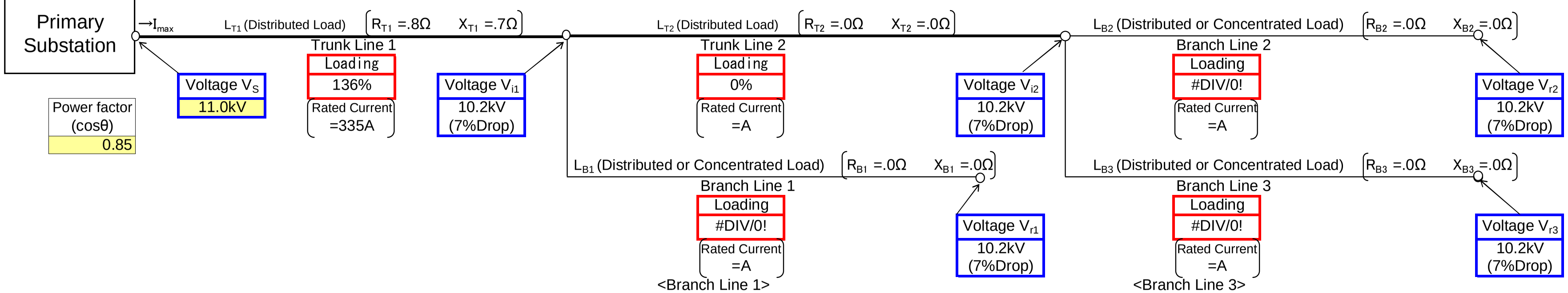
Load L_{T1}	456A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7580kVA	

<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	D103

: Input data in colored cells

Type-3

Maximum Current I_{max}: 465.0A

Power factor (cosθ): 0.85

Primary Substation → I_{max}

Voltage V_s: 11.0kV

<Trank Line 1>

Load L_{T1}	465A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7580kVA	

L_{T1} (Distributed Load) (R_{T1} =.8Ω X_{T1} =.7Ω)

Trunk Line 1: Loading 139%; (Rated Current =335A)

Voltage V_{i1}: 10.2kV (7%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}: 10.2kV (7%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}: 10.2kV (7%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}: 10.2kV (7%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}: 10.2kV (7%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	D103

: Input data in colored cells

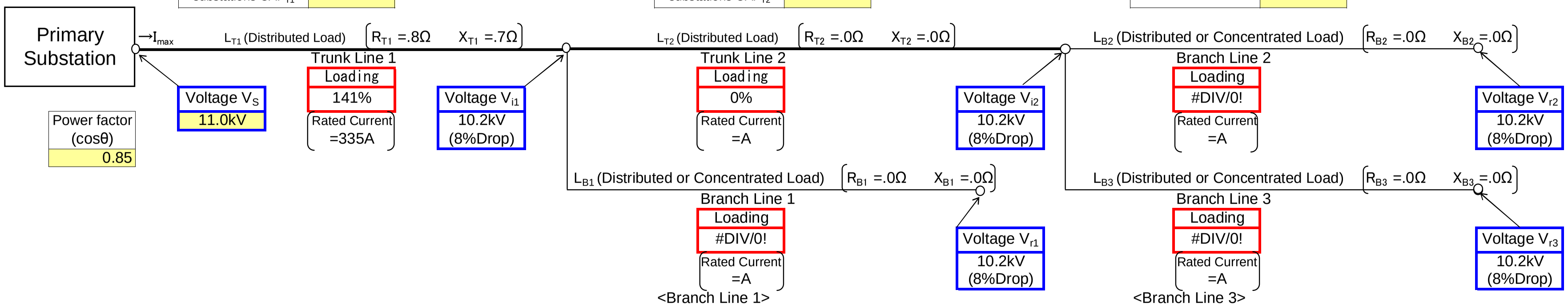
Type-3

<Trank Line 1>		
Load L_{T1}	474A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	5.3km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	7580kVA	

<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}	474.0A
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	D10

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	350A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3270kVA	

<Trank Line 2>

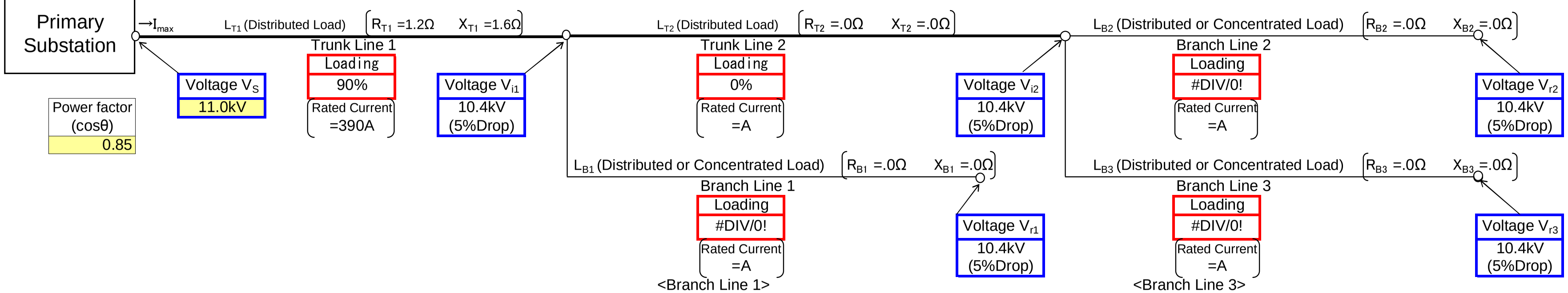
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
350.0A

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	D10

: Input data in colored cells

Type-3

Maximum Current I_{max}
367.0A

<Trank Line 1>

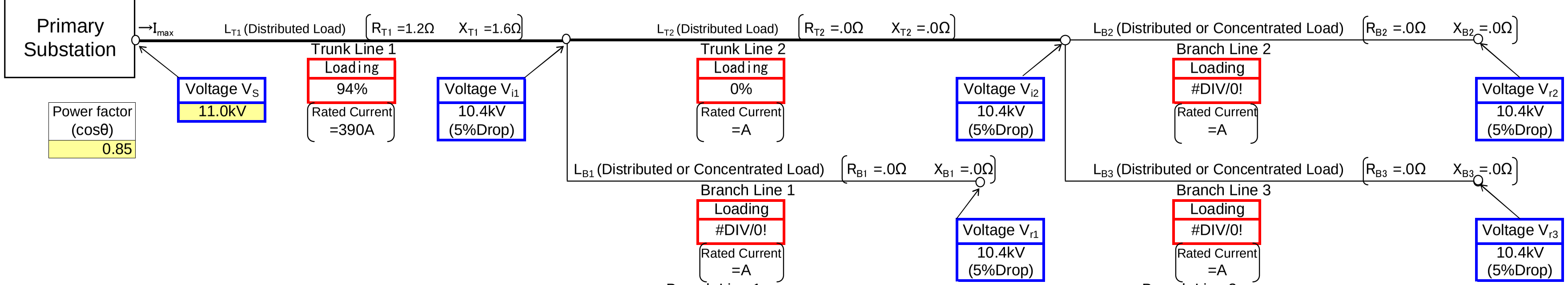
Load L_{T1}	367A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3270kVA	

<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	D10

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	385A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3270kVA	

<Trank Line 2>

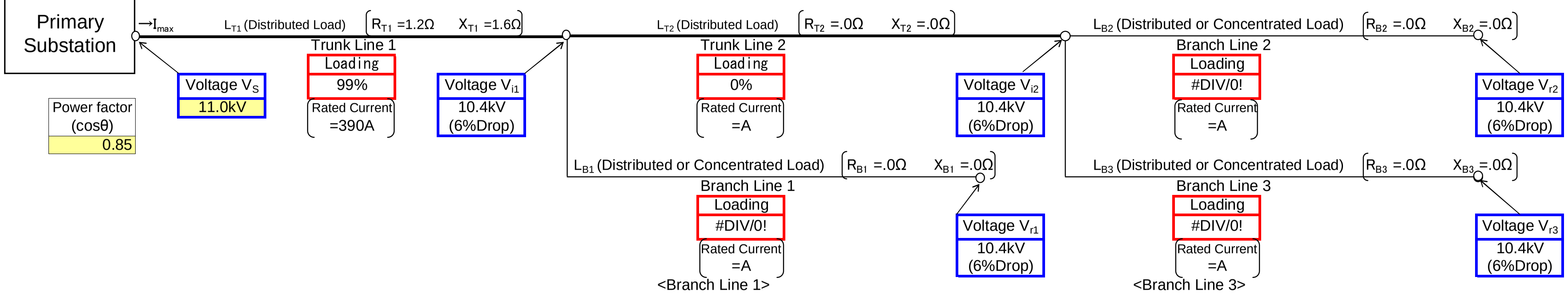
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
385.0A

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	D10

: Input data in colored cells

Type-3

Primary Substation

Maximum Current I_{max}
404.0A

Power factor (cosθ)
0.85

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	404A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3270kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =1.2Ω X_{T1} =1.6Ω)

Trunk Line 1: Loading 104%, Rated Current =390A

Voltage V_{i1}: 10.4kV (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}: 10.4kV (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}: 10.4kV (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}		

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 D
Feeder Name	D10

: Input data in colored cells

Type-3

Maximum Current I_{max}
424.0A

Power factor (cosθ)
0.85

<Trank Line 1>

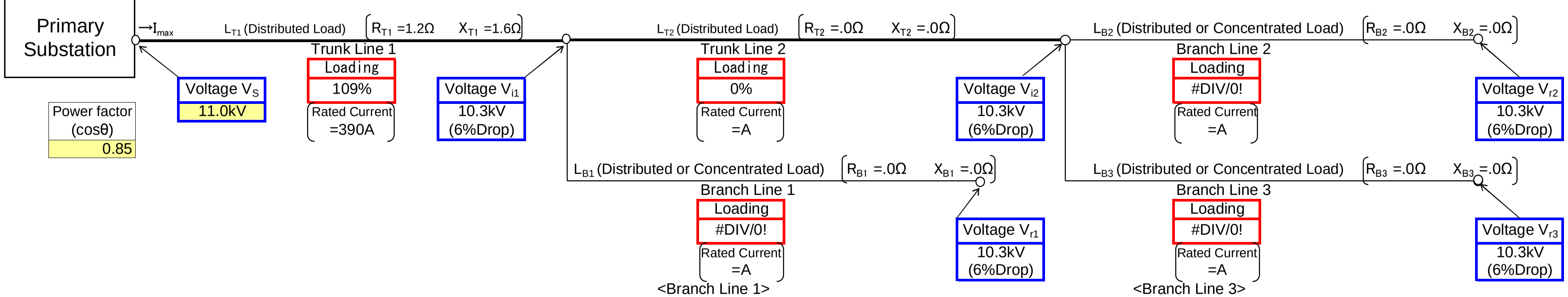
Load L_{T1}	424A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3270kVA	

<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	D10

: Input data in colored cells

Type-3

Maximum Current I_{max}
445.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_S 11.0kV

<Trank Line 1>

Load L_{T1}	445A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3270kVA	

L_{T1} (Distributed Load) (R_{T1} =1.2Ω X_{T1} =1.6Ω)

Trunk Line 1 Loading 114% (Rated Current =390A)

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=====

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

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

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

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

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

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

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

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

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

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

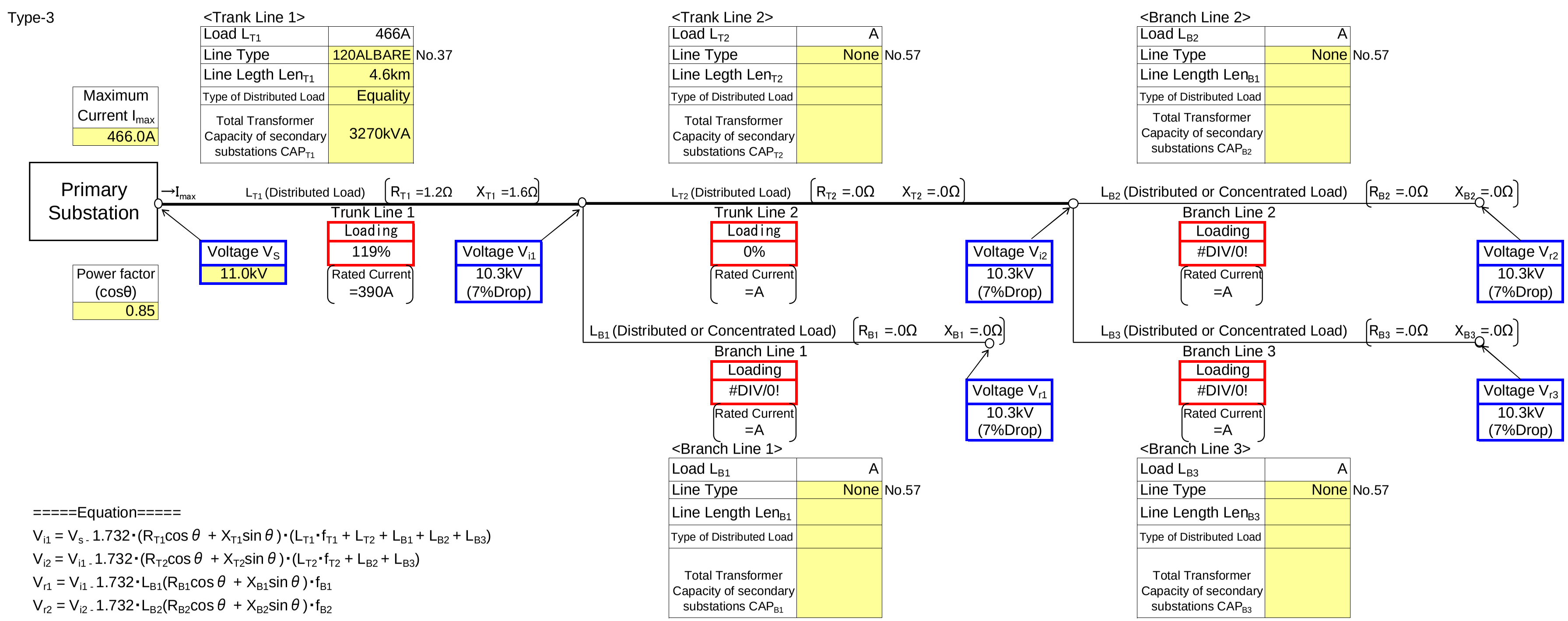
$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

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}	: Total Transformer Capacity of secondary substations
V_{r2} : Received Voltage	L_{B2} : Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3} : Received Voltage	L_{B3} : Load (Branch 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	D10

: 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 D
Feeder Name	D10

: Input data in colored cells

Type-3

Maximum Current I_{max}
489.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	489A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3270kVA	

<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} =1.2Ω X_{T1} =1.6Ω

Trunk Line 1: Loading 125%, Rated Current =390A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.2kV (7%Drop)

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

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

Voltage V_{i2}: 10.2kV (7%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}: 10.2kV (7%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}: 10.2kV (7%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}: 10.2kV (7%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	D10

: Input data in colored cells

Type-3

Maximum Current I_{max}
513.0A

Primary Substation

Power factor (cosθ)
0.85

Voltage V_S
11.0kV

<Trank Line 1>

Load L_{T1}	513A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3270kVA	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =1.2Ω X_{T1} =1.6Ω)

Trunk Line 1

Loading
132%

Rated Current =390A

Voltage V_{i1}
10.2kV (7%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}
10.2kV (7%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}
10.2kV (7%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}
10.2kV (7%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}
10.2kV (7%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	D10

: Input data in colored cells

Type-3

Maximum Current I_{max}
538.0A

Power factor (cosθ)
0.85

<Trank Line 1>

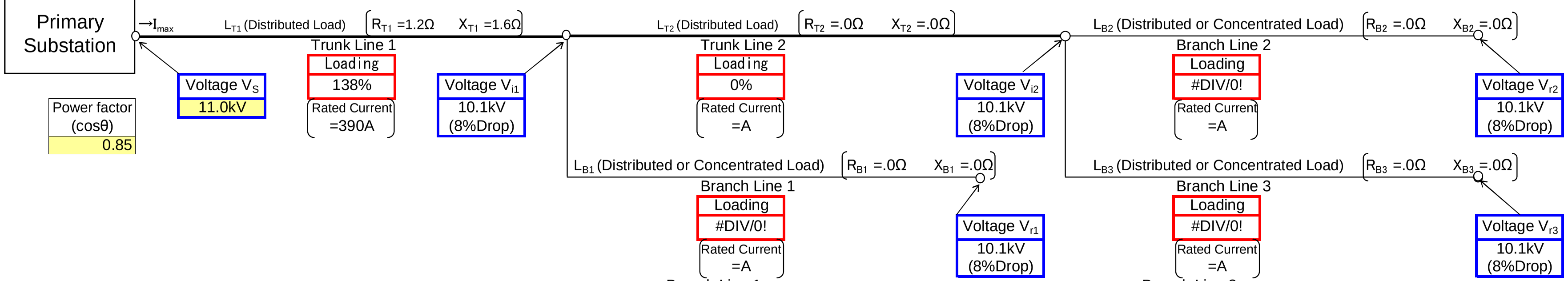
Load L_{T1}	538A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3270kVA	

<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	D10

: Input data in colored cells

Type-3

Maximum Current I_{max}
565.0A

Power factor (cosθ)
0.85

<Trank Line 1>

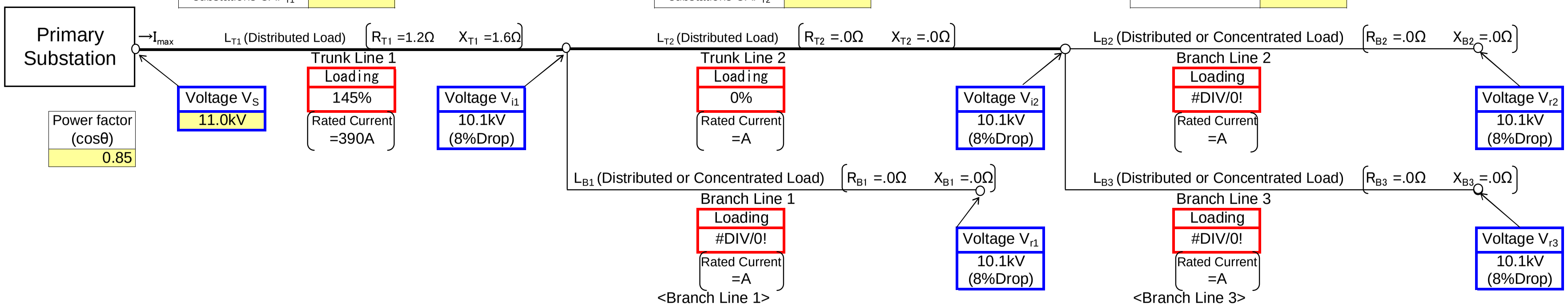
Load L_{T1}	565A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3270kVA	

<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	D10

: Input data in colored cells

Type-3

Maximum Current I_{max}: 565.0A

Power factor (cosθ): 0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	565A	
Line Type	120ALBARE	No.37
Line Legth Len_{T1}	4.6km	
Type of Distributed Load	Equality	
Total Transformer Capacity of secondary substations CAP_{T1}	3270kVA	

L_{T1} (Distributed Load) (R_{T1} =1.2Ω X_{T1} =1.6Ω)

Trunk Line 1: Loading 145%; Rated Current =390A

Voltage V_{i1}: 10.1kV (8%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}: 10.1kV (8%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}: 10.1kV (8%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}: 10.1kV (8%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}: 10.1kV (8%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 D
Feeder Name	D114

: Input data in colored cells

Type-3

Maximum Current I_{max}	340.0A

Power factor (cosθ)	0.85

<Trank Line 1>

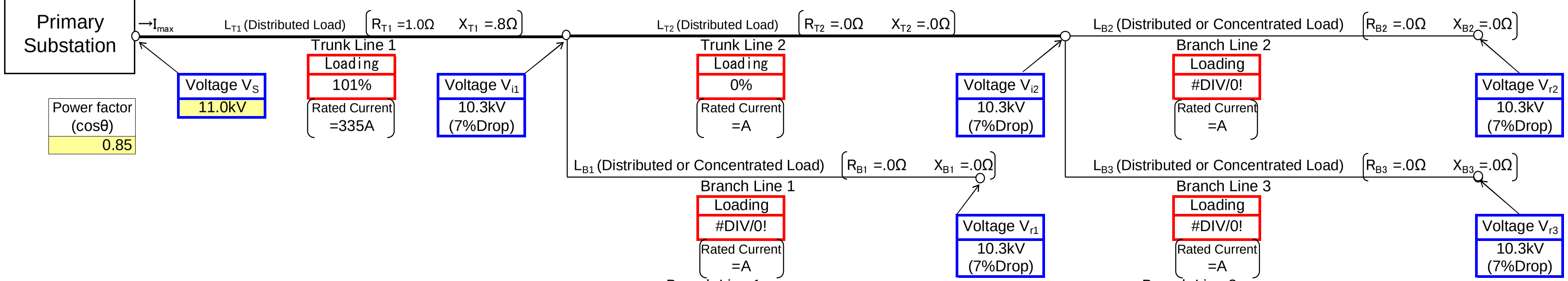
Load L_{T1}	340A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	9950kVA	

<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	D114

: Input data in colored cells

Type-3

Maximum Current I_{max}	341.0A

Power factor (cosθ)	0.85

Primary Substation $\rightarrow I_{max}$

Voltage V_s
11.0kV

<Trank Line 1>

Load L_{T1}	341A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	9950kVA	

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

Trunk Line 1

Loading
102%

Rated Current =335A

Voltage V_{i1}
10.2kV (7%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}
10.2kV (7%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}
10.2kV (7%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}
10.2kV (7%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}
10.2kV (7%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	D114

: Input data in colored cells

Type-3

Maximum Current I_{max}
341.0A

Power factor (cosθ)
0.85

<Trank Line 1>

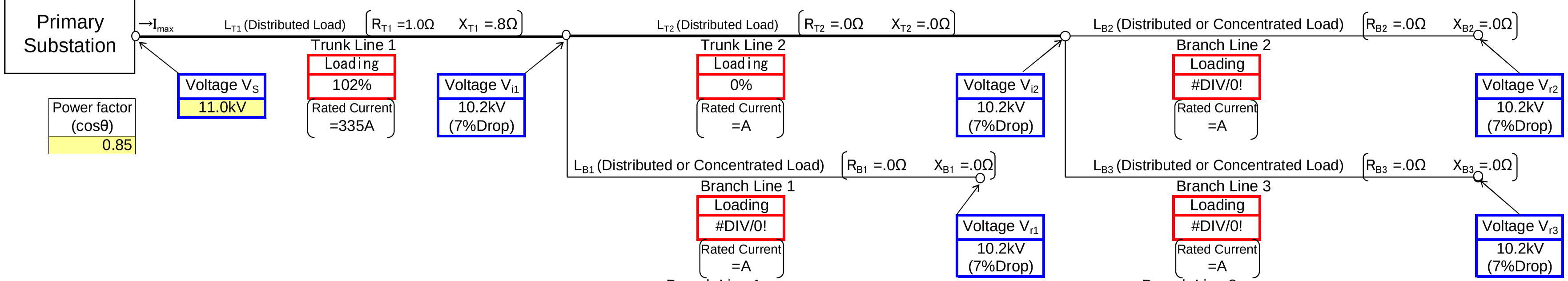
Load L_{T1}	341A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	9950kVA	

<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	D114

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	342A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	9950kVA	

<Trank Line 2>

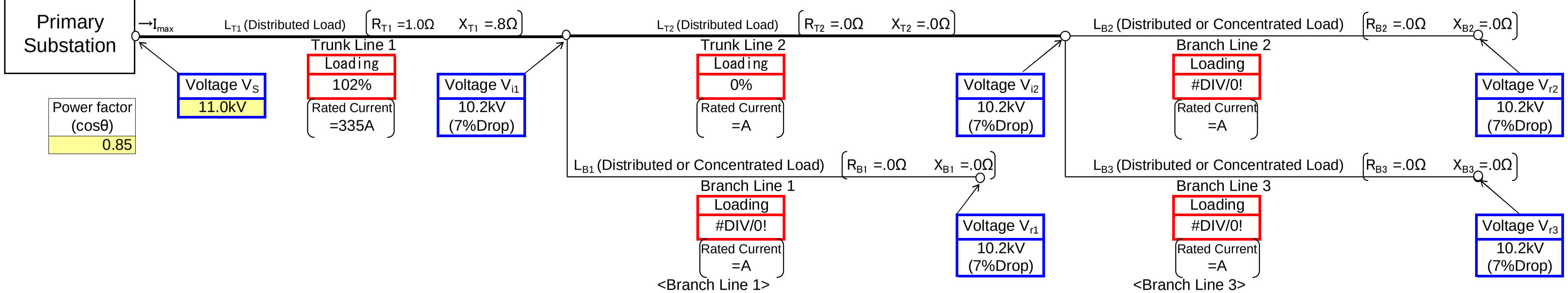
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
342.0A

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	D114

: Input data in colored cells

Type-3

Maximum Current I_{max}	Power factor (cosθ)
342.0A	0.85

Primary Substation →I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	342A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	9950kVA	

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

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

Voltage V_{i1}: 10.2kV (7%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}: 10.2kV (7%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}: 10.2kV (7%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}: 10.2kV (7%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}: 10.2kV (7%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	D114

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	342A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	9950kVA	

<Trank Line 2>

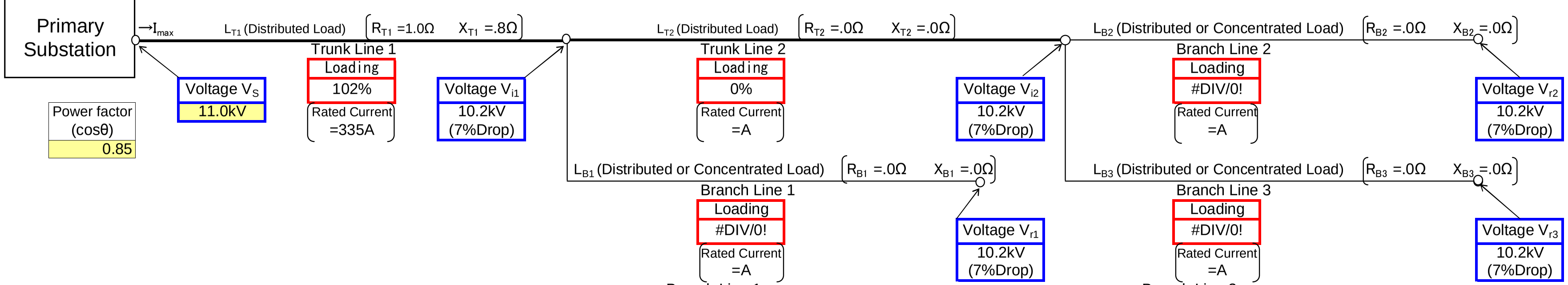
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
342.0A

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	D114

: Input data in colored cells

Type-3

Maximum Current I_{max}	343.0A

Power factor (cosθ)	
	0.85

<Trank Line 1>

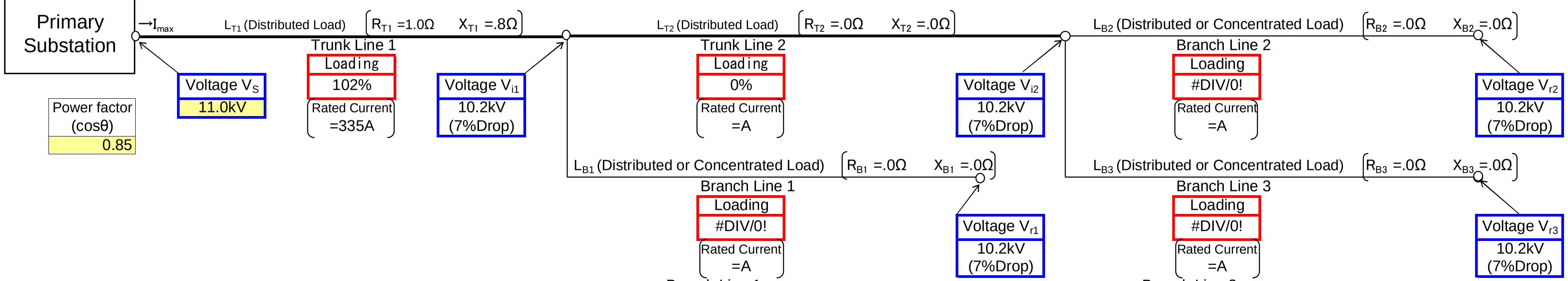
Load L_{T1}	343A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	9950kVA	

<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	D114

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	344A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	9950kVA	

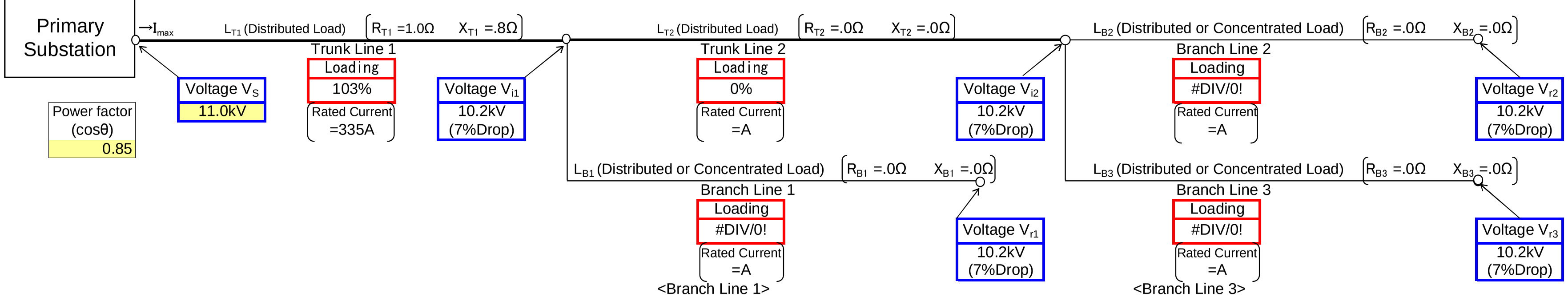
<Trank Line 2>

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}	344.0A
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 D
Feeder Name	D114

: Input data in colored cells

Type-3

Maximum Current I_{max}
344.0A

Power factor (cosθ)
0.85

<Trank Line 1>

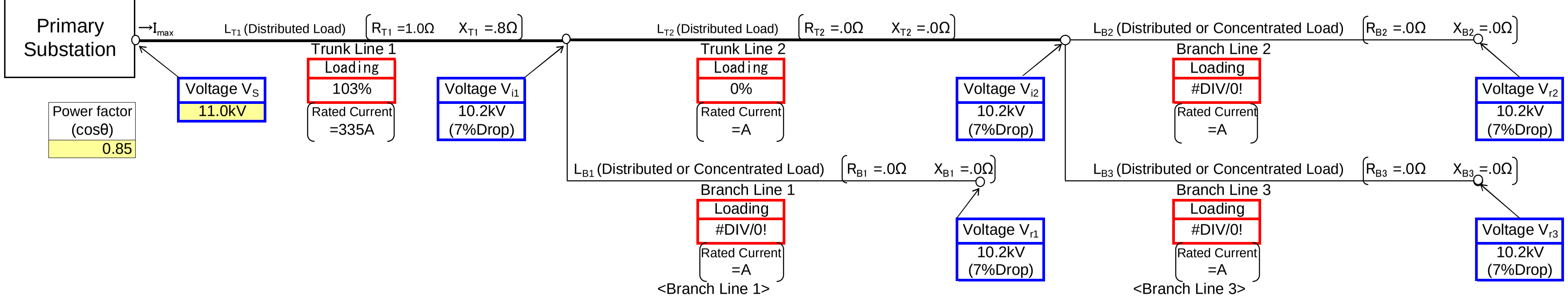
Load L_{T1}	344A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	9950kVA	

<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	D114

: Input data in colored cells

Type-3

Maximum Current I_{max}
345.0A

Power factor (cosθ)
0.85

<Trank Line 1>

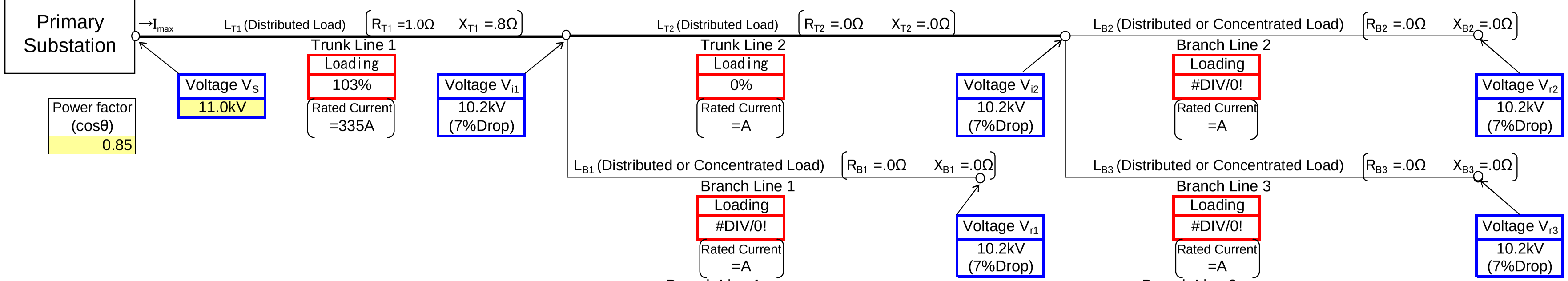
Load L_{T1}	345A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	9950kVA	

<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	D114

: Input data in colored cells

Type-3

Maximum Current I_{max}	346.0A
Power factor (cosθ)	0.85

<Trank Line 1>

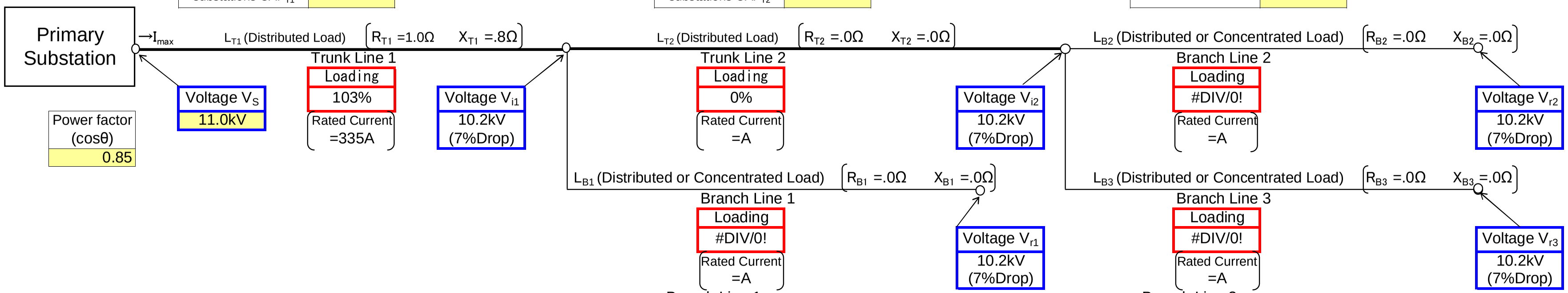
Load L_{T1}	346A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	6.6km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	9950kVA	

<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=====

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

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

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

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

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

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

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

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

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

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

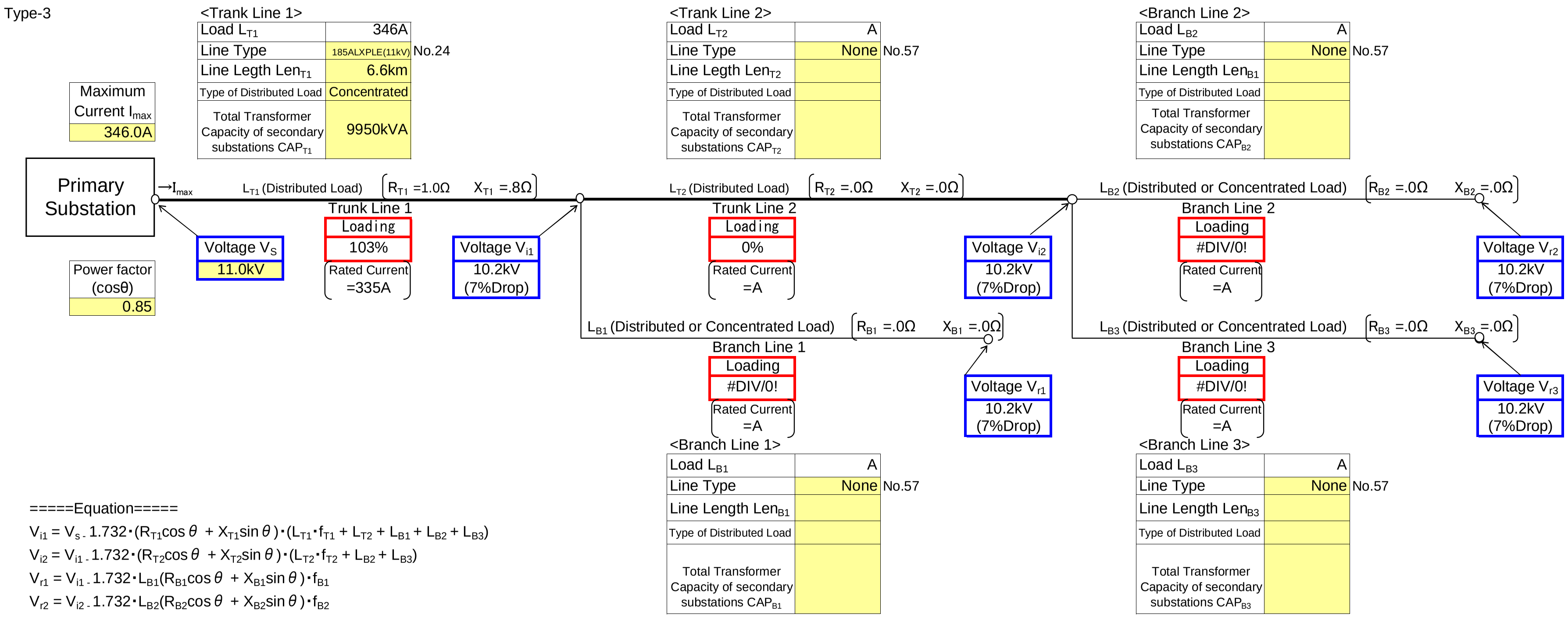
$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

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	D114

: 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 D
Feeder Name	D123

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	280A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6380kVA	

<Trank Line 2>

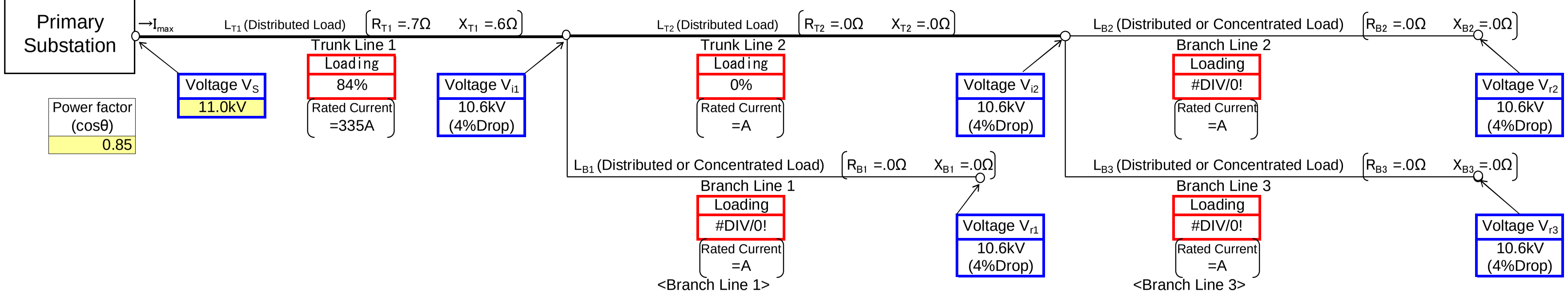
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
280.0A

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	D123

: Input data in colored cells

Type-3

Maximum Current I_{max}
294.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	294A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6380kVA	

<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} =.7Ω X_{T1} =.6Ω)

Trunk Line 1 — Loading 88% — 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	D123

: Input data in colored cells

Type-3

Maximum Current I_{max}	308.0A

Power factor (cosθ)	0.85

<Trank Line 1>

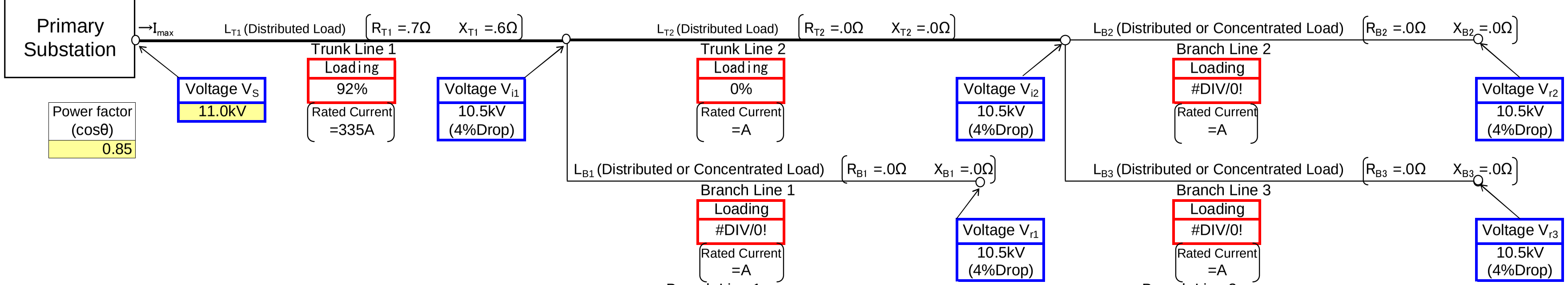
Load L_{T1}	308A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6380kVA	

<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	D123

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	323A
Line Type	185ALXPLE(11kV) No.24
Line Legth Len_{T1}	4.4km
Type of Distributed Load	Concentrated
Total Transformer Capacity of secondary substations CAP_{T1}	6380kVA

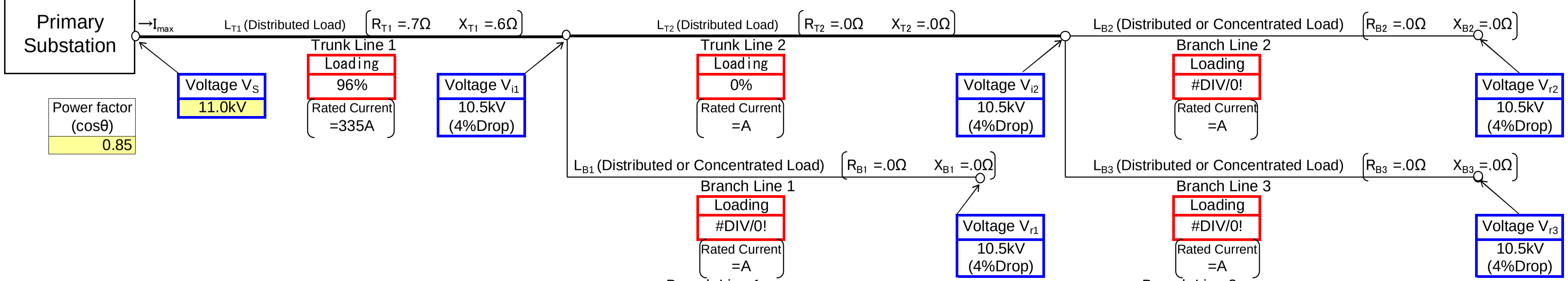
<Trank Line 2>

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 D
Feeder Name	D123

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	339A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6380kVA	

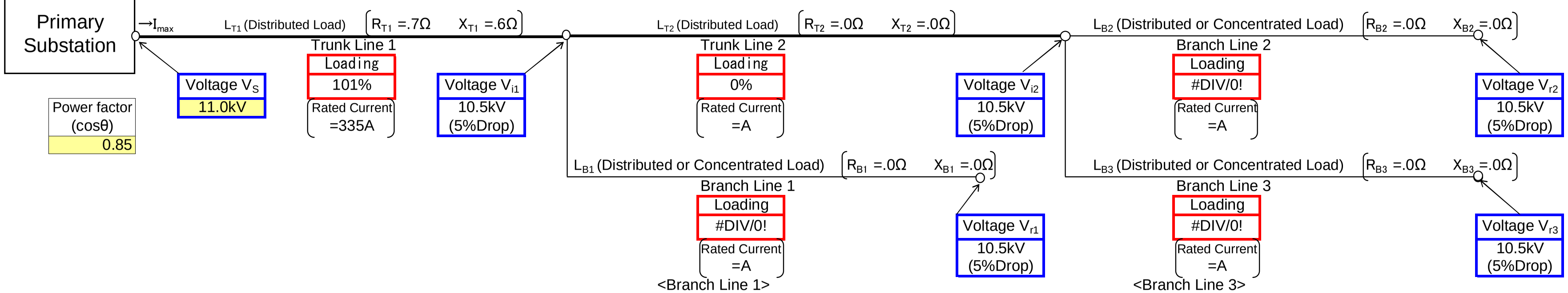
<Trank Line 2>

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}	339.0A
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	D123

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	356A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6380kVA	

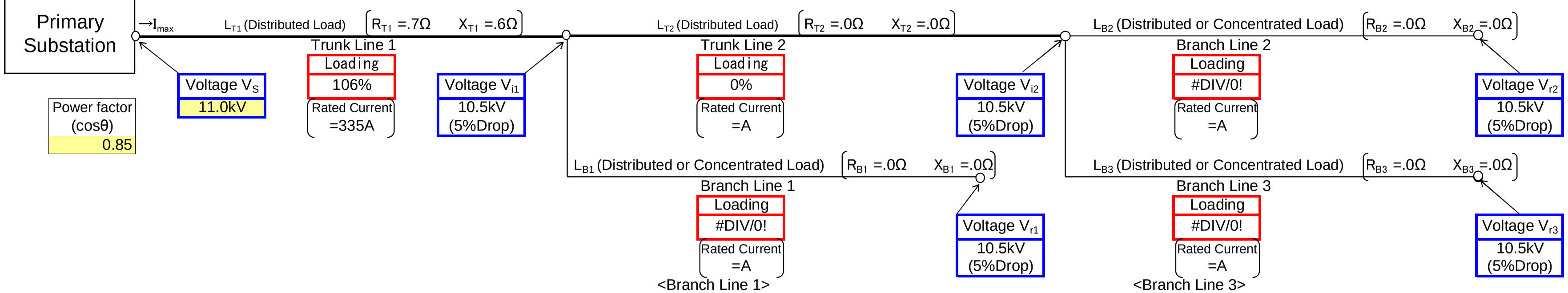
<Trank Line 2>

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}	356.0A
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	D123

: Input data in colored cells

Type-3

Maximum Current I_{max}
373.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	373A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6380kVA	

<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)

Voltage V_S 11.0kV

Trunk Line 1 Loading 111% Rated Current =335A

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)	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	D123

: Input data in colored cells

Type-3

Maximum Current I_{max}	391.0A

Power factor (cosθ)	0.85

<Trank Line 1>

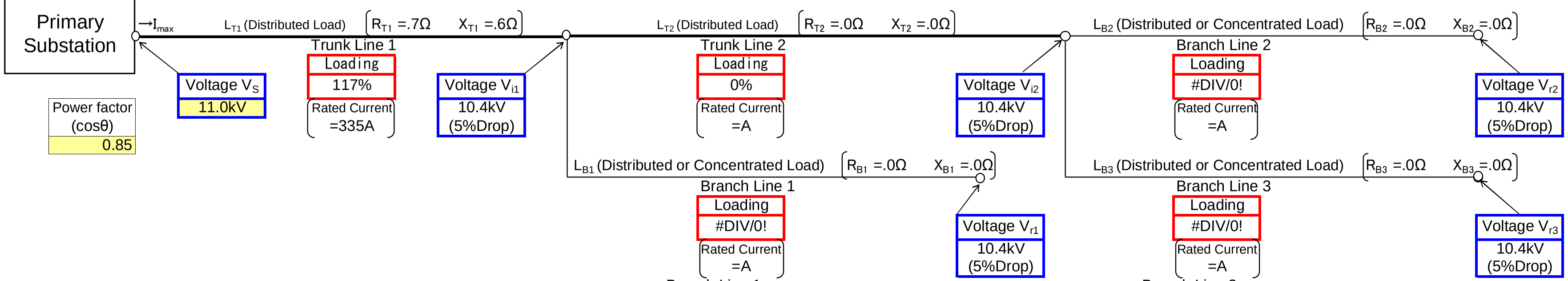
Load L_{T1}	391A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6380kVA	

<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	D123

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	410A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6380kVA	

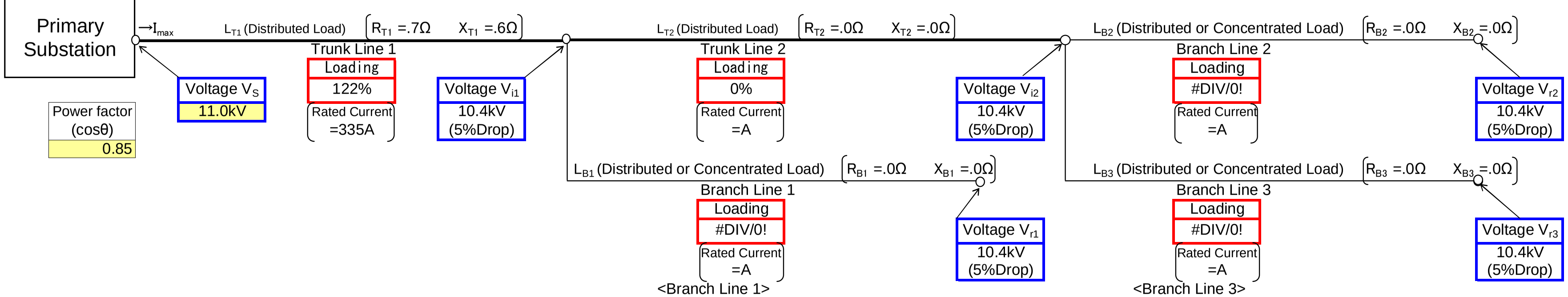
<Trank Line 2>

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}	410.0A
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=====

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

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

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

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

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

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

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

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

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

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

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

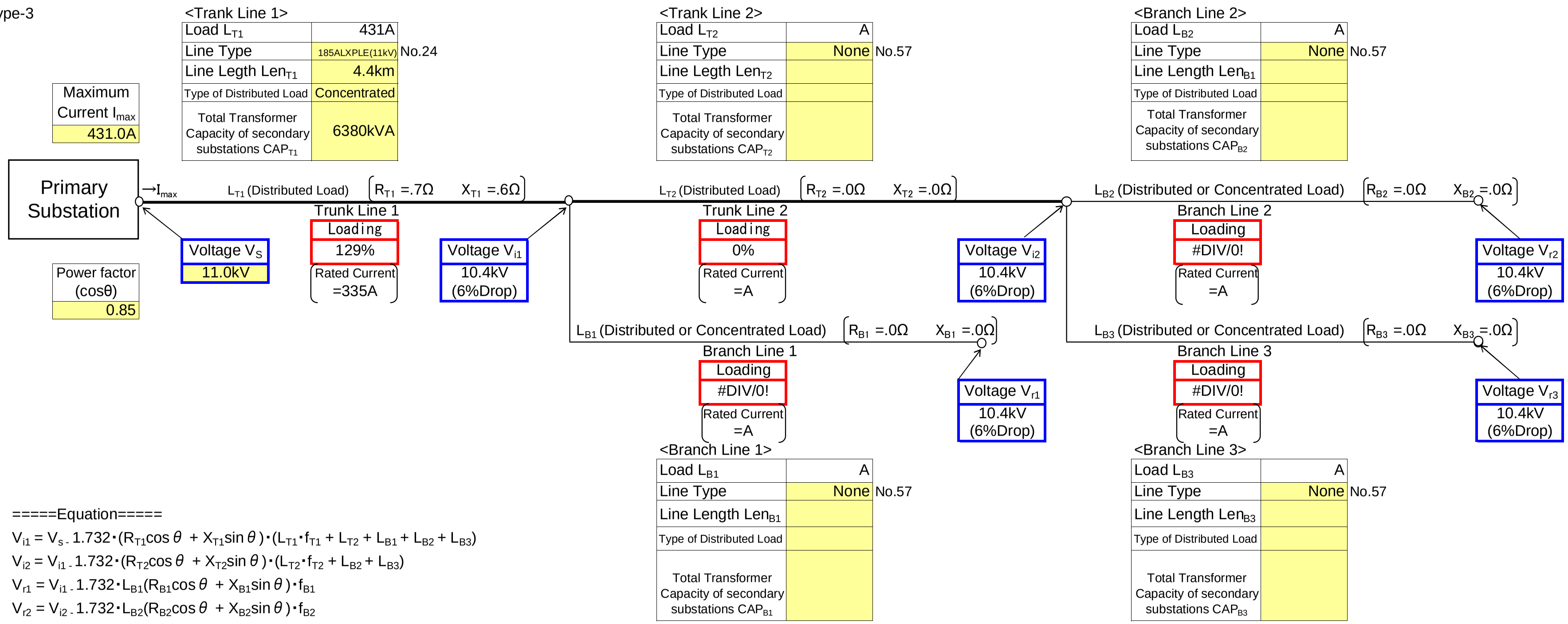
V_s : Supply Voltage	I_{max} : Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$: 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 D
Feeder Name	D123

: 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 D
Feeder Name	D123

: Input data in colored cells

Type-3

Maximum Current I_{max}
452.0A

Power factor (cosθ)
0.85

<Trank Line 1>

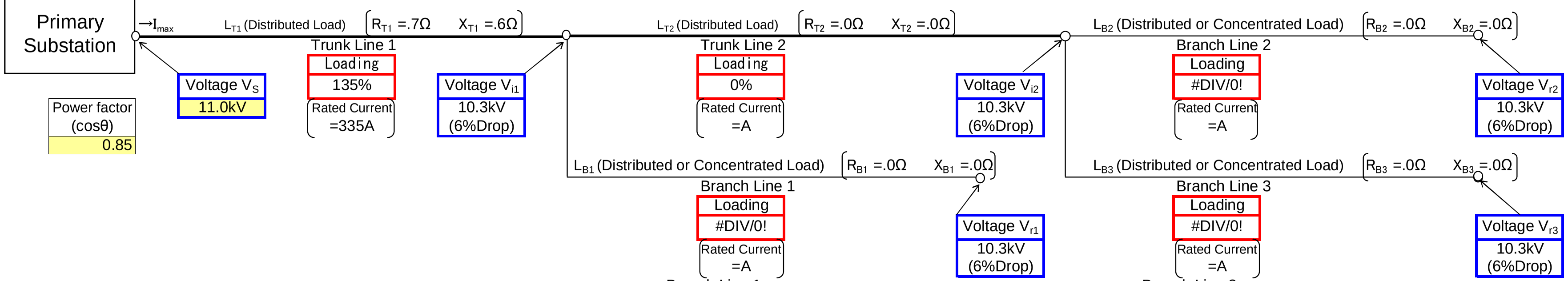
Load L_{T1}	452A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	4.4km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6380kVA	

<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	D123

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	474A
Line Type	185ALXPLE(11kV) No.24
Line Legth Len_{T1}	4.4km
Type of Distributed Load	Concentrated
Total Transformer Capacity of secondary substations CAP_{T1}	6380kVA

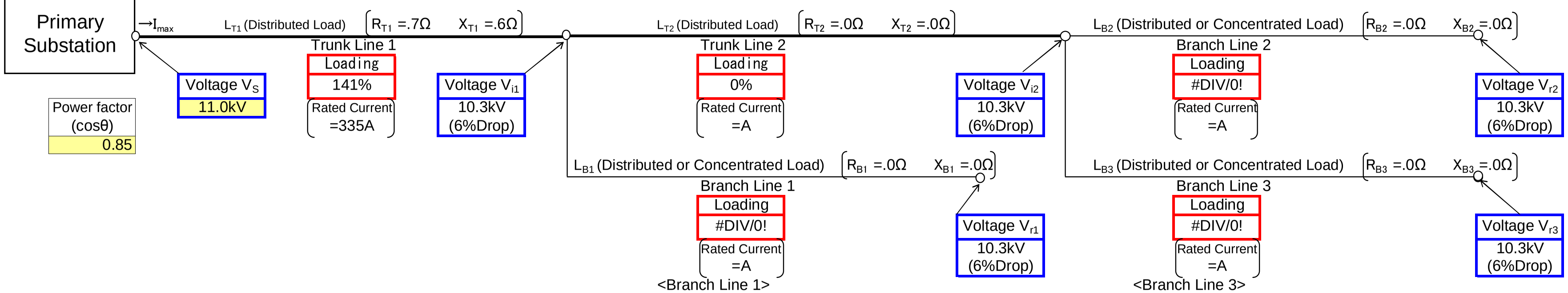
<Trank Line 2>

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}	474.0A
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)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
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 D
Feeder Name	D150

: Input data in colored cells

Type-3

Maximum Current I_{max}
270.0A

<Trank Line 1>

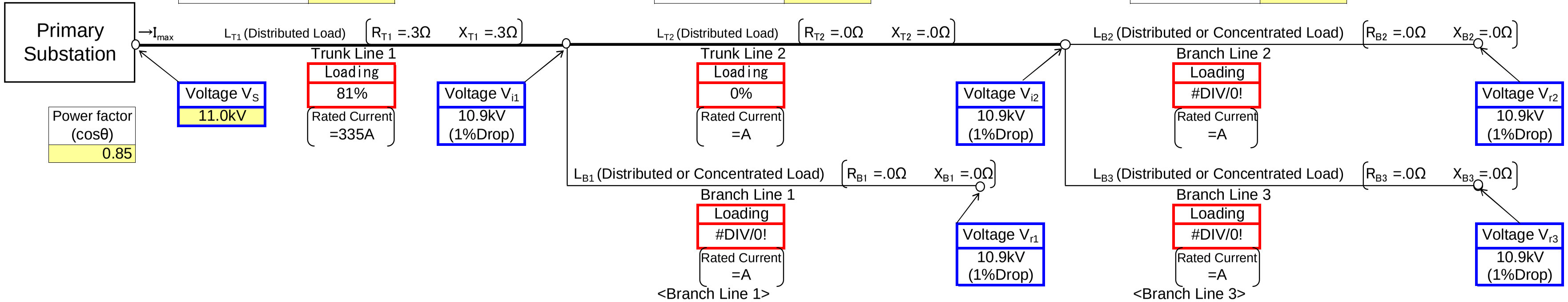
Load L_{T1}	270A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3065kVA	

<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 D
Feeder Name	D150

: Input data in colored cells

Type-3

Maximum Current I_{max}	283.0A
Power factor (cosθ)	0.85

<Trank Line 1>

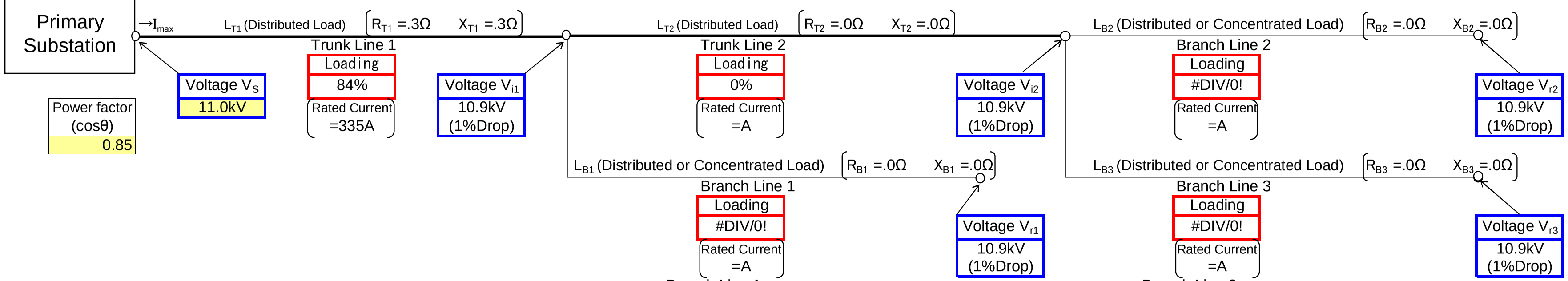
Load L_{T1}	283A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3065kVA	

<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	D150

: Input data in colored cells

Type-3

Maximum Current I_{max}	297.0A

Power factor (cosθ)	0.85

<Trank Line 1>

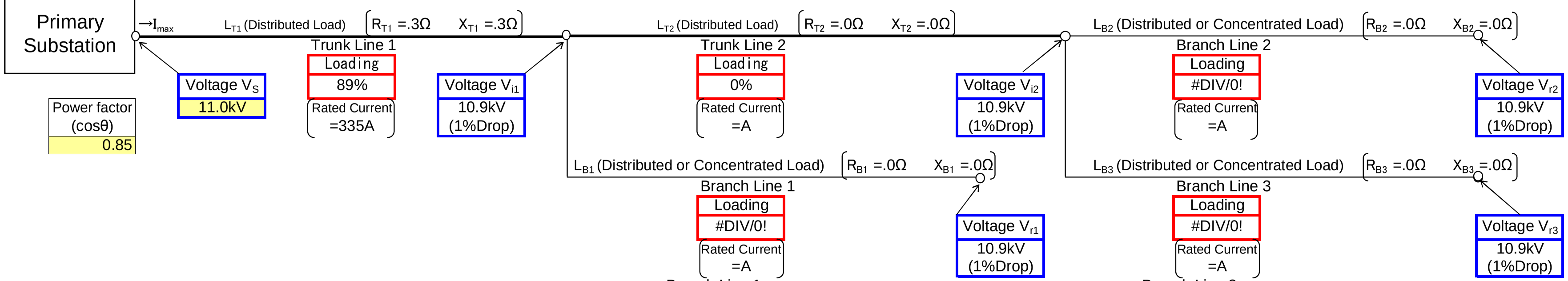
Load L_{T1}	297A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3065kVA	

<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	D150

: Input data in colored cells

Type-3

Maximum Current I_{max}
312.0A

Power factor (cosθ)
0.85

<Trank Line 1>

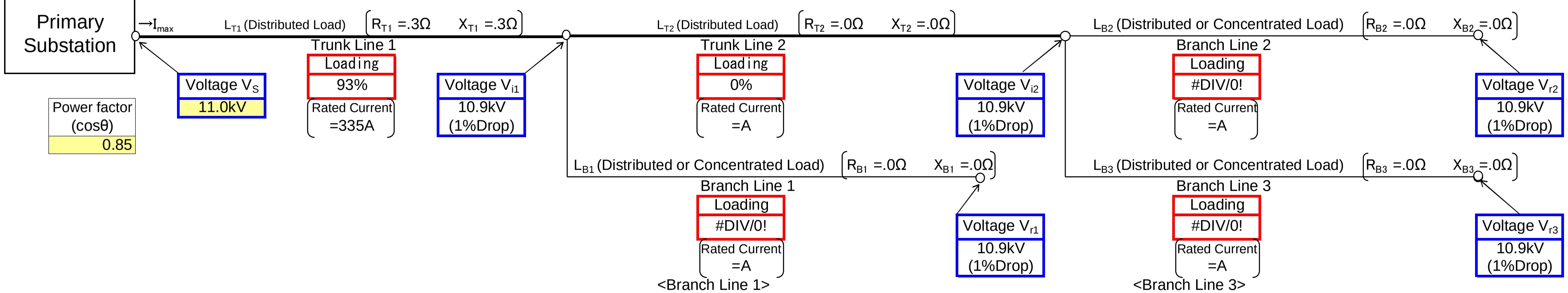
Load L_{T1}	312A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3065kVA	

<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	D150

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	327A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3065kVA	

<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}	327.0A
Power factor (cosθ)	0.85

Primary Substation

$\rightarrow I_{max}$

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

Trunk Line 1: Loading 98%, 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 D
Feeder Name	D150

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	343A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3065kVA	

<Trank Line 2>

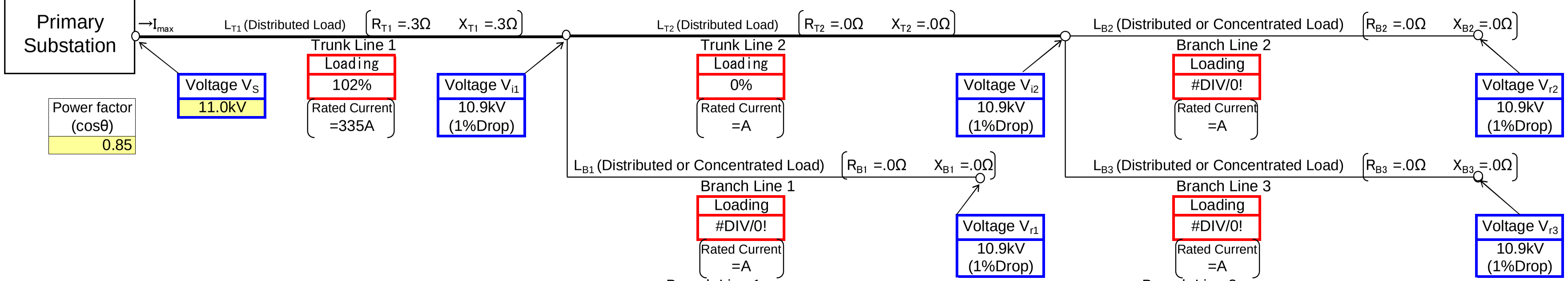
Load L_{T2}	A	
Line Type	None	No.57
Line Legth Len_{T2}		
Type of Distributed Load		
Total Transformer Capacity of secondary substations CAP_{T2}		

<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}
343.0A

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	D150

: Input data in colored cells

Type-3

Maximum Current I_{max}
360.0A

Primary Substation

$\rightarrow I_{max}$

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	360A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3065kVA	

<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}		

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

Trunk Line 1: Loading 107%; 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 D
Feeder Name	D150

: Input data in colored cells

Type-3

Maximum Current I_{max}
377.0A

Power factor ($\cos\theta$)
0.85

Primary Substation

$\rightarrow I_{max}$

Voltage V_S
11.0kV

<Trank Line 1>

Load L_{T1}	377A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3065kVA	

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

Trunk Line 1

Loading
113%

(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)	$\cos\theta$	: Power Factor

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

Substation Name	STATION D
Feeder Name	D150

: Input data in colored cells

Type-3

Maximum Current I_{max}
396.0A

Power factor (cosθ)
0.85

<Trank Line 1>

Load L_{T1}	396A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3065kVA	

<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} =.3Ω X_{T1} =.3Ω)

Trunk Line 1: Loading 118%; 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 D
Feeder Name	D150

: Input data in colored cells

Type-3

Maximum Current I_{max}
415.0A

Power factor (cosθ)
0.85

Primary Substation →I_{max}

Voltage V_s 11.0kV

<Trank Line 1>

Load L_{T1}	415A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3065kVA	

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

Trunk Line 1: Loading 124% (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 D
Feeder Name	D150

: Input data in colored cells

Type-3

<Trank Line 1>

Load L_{T1}	436A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3065kVA	

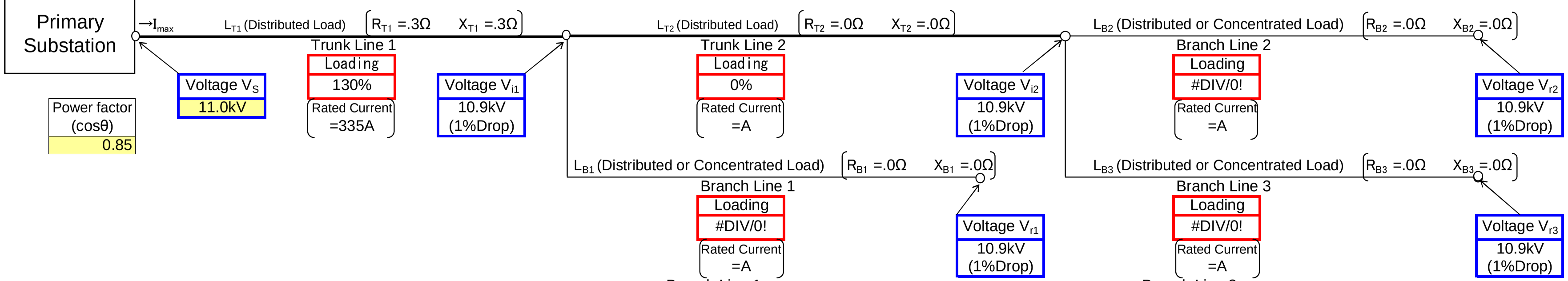
<Trank Line 2>

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 (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	D150

: Input data in colored cells

Type-3

Maximum Current I_{max}
457.0A

Power factor (cosθ)
0.85

<Trank Line 1>

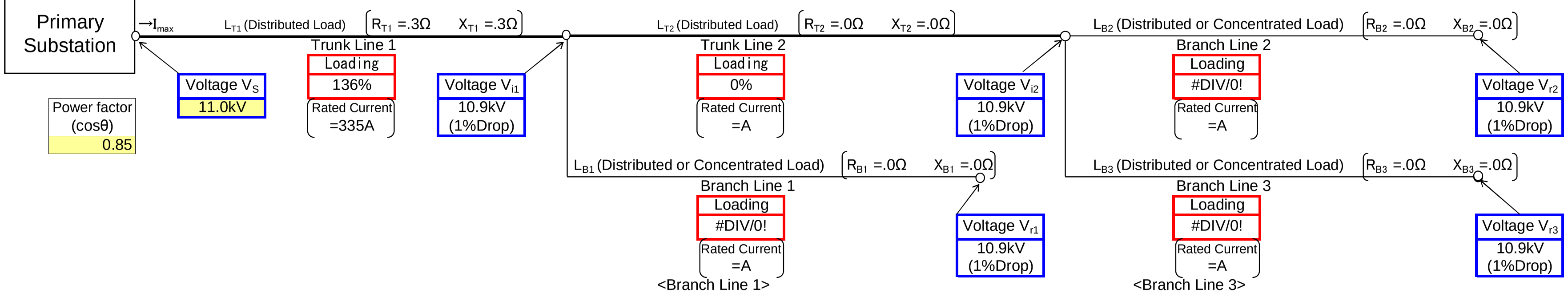
Load L_{T1}	457A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	2.2km	
Type of Distributed Load	Sending Larger	
Total Transformer Capacity of secondary substations CAP_{T1}	3065kVA	

<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

<Trank Line 1>

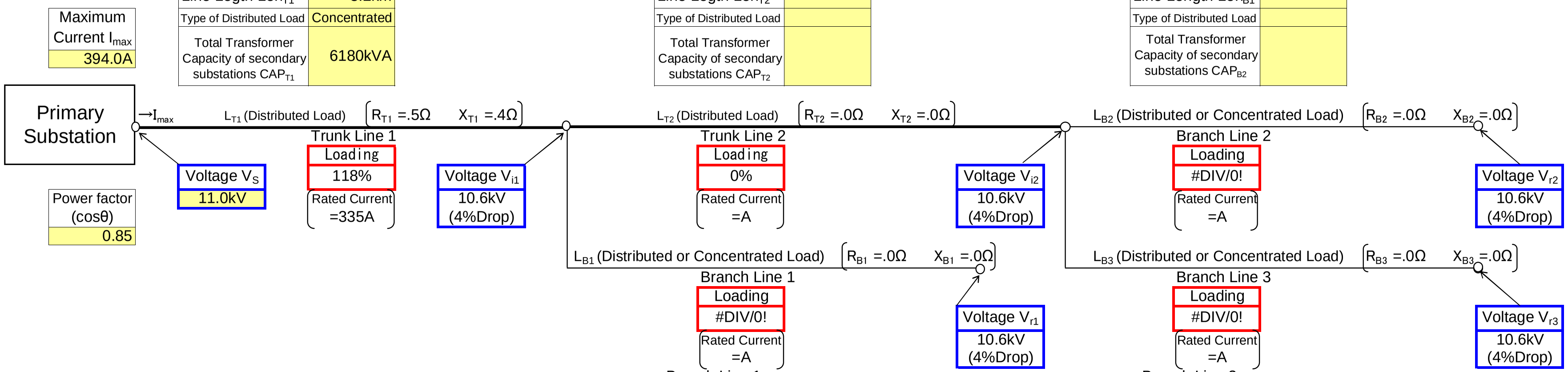
Load L_{T1}	394A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6180kVA	

<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=====

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

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

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

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

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

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

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

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

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

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

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

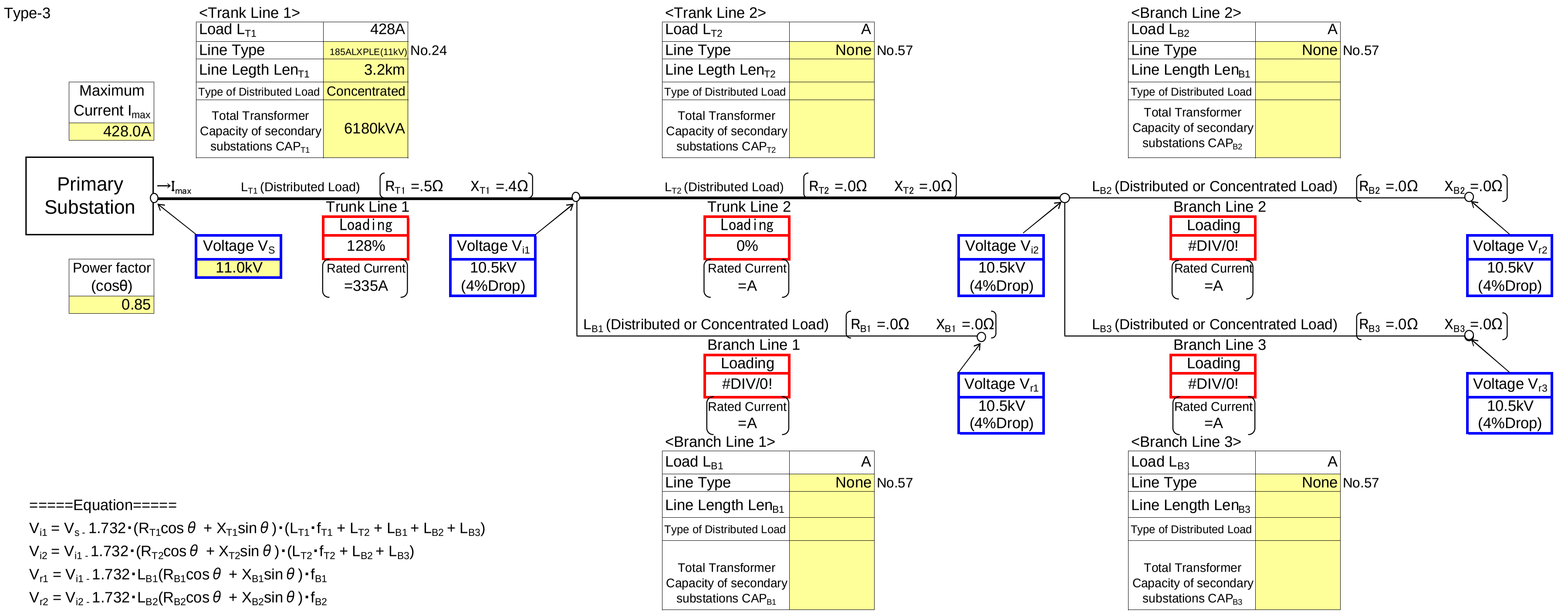
V_s : Supply Voltage	I_{max} : Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1} : Interim Voltage	L_{T1} : Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2} : Interim Voltage	L_{T2} : Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$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



=====Equation=====

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

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

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

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

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

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

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

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

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

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

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

V_s	: Supply Voltage	I_{max}	: Maximum Current	$R_{T1}, R_{T2}, R_{B1}, R_{B2}, R_{B3}$	: Resistance
V_{i1}	: Interim Voltage	L_{T1}	: Load (Trunk line 1)	$X_{T1}, X_{T2}, X_{B1}, X_{B2}, X_{B3}$	: Reactance
V_{i2}	: Interim Voltage	L_{T2}	: Load (Trunk line 2)	$f_{T1}, f_{T2}, f_{B1}, f_{B2}, f_{B3}$	: Dispersal Load Factor
V_{r1}	: Received Voltage	L_{B1}	: Load (Branch Line 1)	$CAP_{T1}, CAP_{T2}, CAP_{B1}$	: Total Transformer Capacity of secondary substations
V_{r2}	: Received Voltage	L_{B2}	: Load (Branch Line 2)	CAP_{B2}, CAP_{B3}	
V_{r3}	: Received Voltage	L_{B3}	: Load (Branch 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}
465.0A

Power factor (cosθ)
0.85

<Trank Line 1>

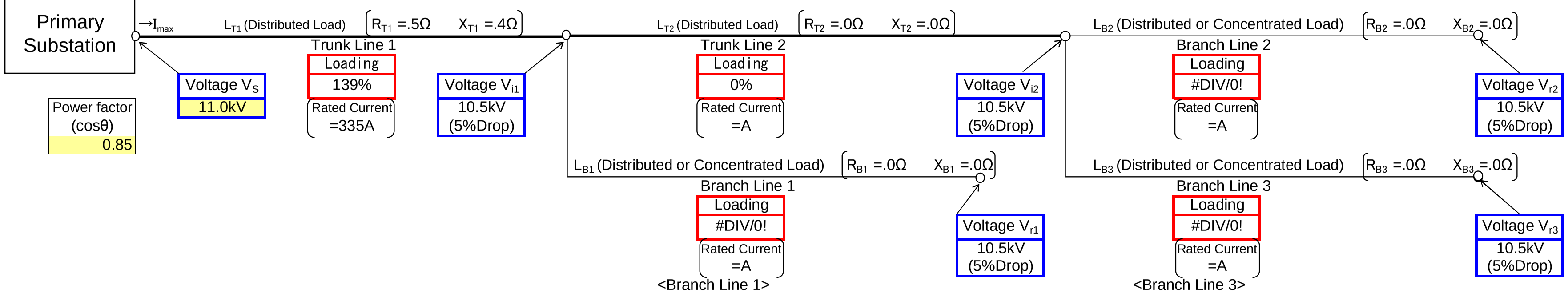
Load L_{T1}	465A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6180kVA	

<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}
504.0A

Power factor (cosθ)
0.85

Primary Substation

→I_{max}

Voltage V_S: 11.0kV

<Trank Line 1>

Load L_{T1}	504A	
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)

Trunk Line 1: Loading 150%; Rated Current =335A

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 D
Feeder Name	D16

: Input data in colored cells

Type-3

Maximum Current I_{max}
548.0A

Power factor (cosθ)
0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	548A
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}	

$\rightarrow I_{max}$ L_{T1} (Distributed Load) (R_{T1} =.5Ω X_{T1} =.4Ω)

Trunk Line 1: Loading 164%; Rated Current =335A

Voltage V_S: 11.0kV

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

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_{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_{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)

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 1>

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

<Branch Line 3>

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

=====Equation=====

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

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

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

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

$V_{r3} = V_{i2} - 1.732 \cdot L_{B3}(R_{B3}\cos\theta + X_{B3}\sin\theta) \cdot f_{B3}$

$L_{T1} = I_{max} \cdot CAP_{T1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{T2} = I_{max} \cdot CAP_{T2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B1} = I_{max} \cdot CAP_{B1} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B2} = I_{max} \cdot CAP_{B2} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$L_{B3} = I_{max} \cdot CAP_{B3} / (CAP_{T1}+CAP_{T2}+CAP_{B1}+CAP_{B2}+CAP_{B3})$

$I_{max} = L_{T1} + L_{T2} + L_{B1} + L_{B2} + L_{B3}$

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	D16

: Input data in colored cells

Type-3

Maximum Current I_{max}	595.0A

Power factor (cosθ)	0.85

<Trank Line 1>

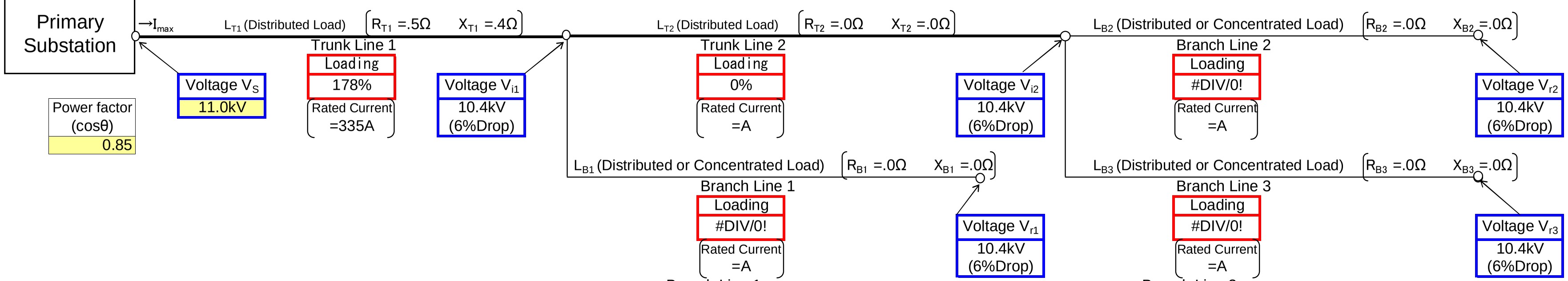
Load L_{T1}	595A	
Line Type	185ALXPLE(11kV)	No.24
Line Legth Len_{T1}	3.2km	
Type of Distributed Load	Concentrated	
Total Transformer Capacity of secondary substations CAP_{T1}	6180kVA	

<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

<Trank Line 1>

Load L_{T1}	646A	
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	

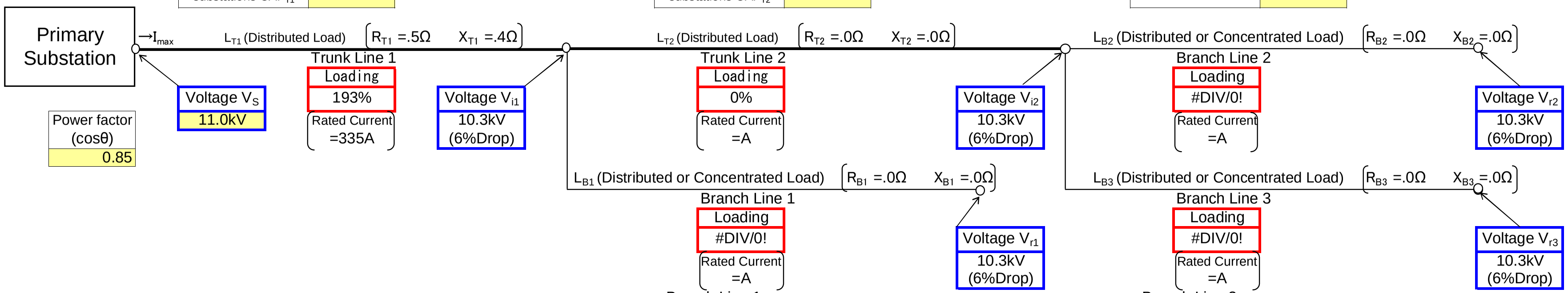
<Trank Line 2>

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}		

Maximum Current I_{max}	646.0A
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	D16

: Input data in colored cells

Type-3

Maximum Current I_{max}
701.0A

Power factor (cosθ)
0.85

Primary Substation

$\rightarrow I_{max}$

Voltage V_S
11.0kV

<Trank Line 1>

Load L_{T1}	701A	
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)

Trunk Line 1

Loading
209%
Rated Current =335A

Voltage V_{i1}
10.3kV (7%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 (7%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 (7%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 (7%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 (7%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	D16

: Input data in colored cells

Type-3

Maximum Current I_{max}: 762.0A

Power factor (cosθ): 0.85

Primary Substation

<Trank Line 1>

Load L_{T1}	762A	
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}		

→I_{max}

L_{T1} (Distributed Load) (R_{T1} =.5Ω X_{T1} =.4Ω)

Trunk Line 1: Loading 227%, Rated Current =335A

Voltage V_S: 11.0kV

Voltage V_{i1}: 10.2kV (7%Drop)

L_{T2} (Distributed Load) (R_{T2} =.0Ω X_{T2} =.0Ω)

Trunk Line 2: Loading 0%, Rated Current =A

Voltage V_{i2}: 10.2kV (7%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}: 10.2kV (7%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}: 10.2kV (7%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}: 10.2kV (7%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