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A1.1 Network Diagram of the Southern Province

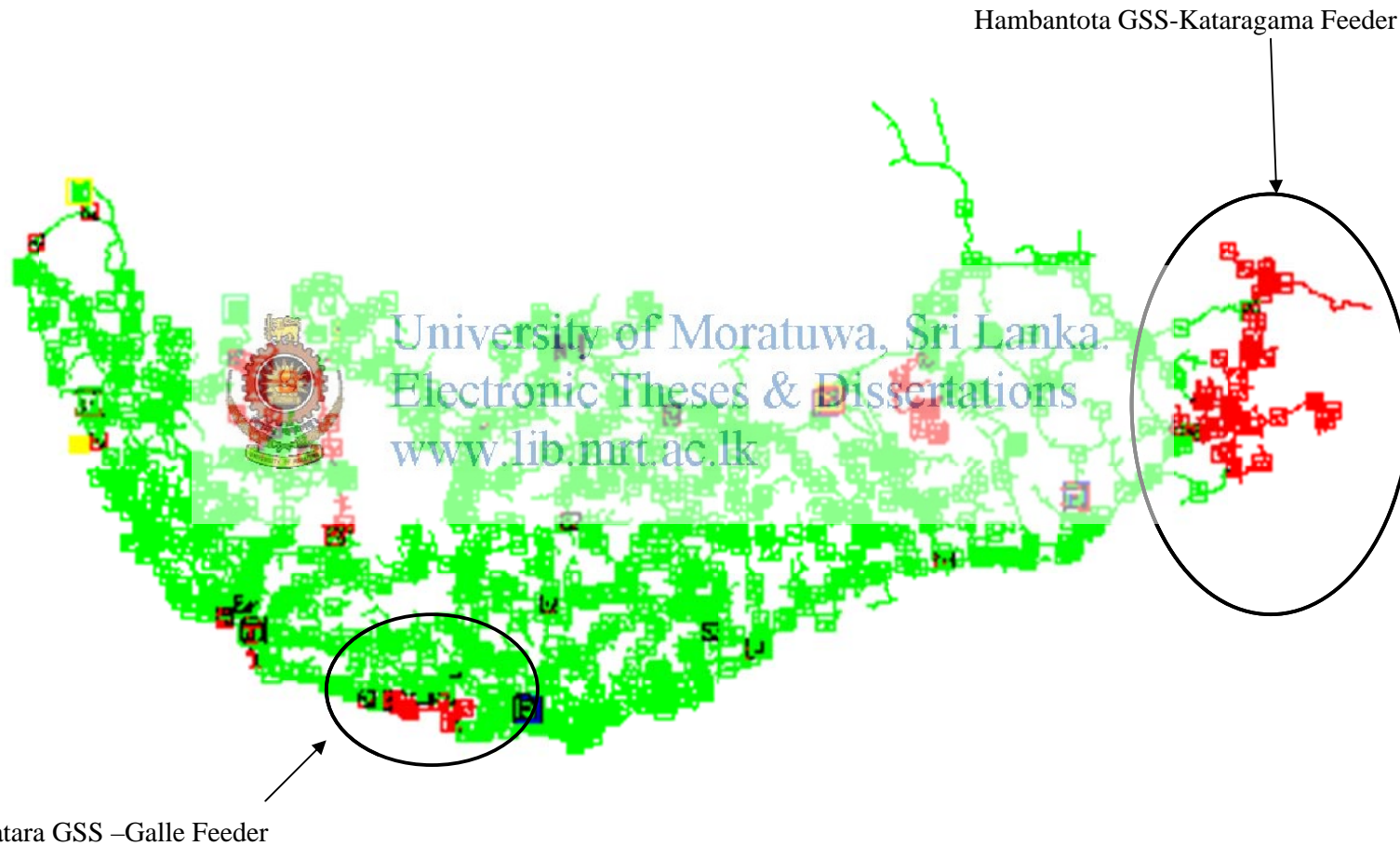


Figure A1.1: Network of the Southern Province

**A2.1 Transformer Load Data**

Table A2.1 Load Reading data of the Transformers in the Kataragama Feeder

No.	SIN	Name	Capacity/volt	Type	Load		Substation Voltage		
					RE	BULK	RN	YN	BN
1	H 380	Siribopura Water	100/33	Bulk/Re	13	29	240	240	240
2	H 390	Sabaragmu Niwasas	100/33		18		236	236	237
3	H 395	CARE Niwasa	100/33		27		237	237	233
4	H 400	Sajith Foundation	100/33		13		236	236	236
5	H 405	Hungama Village	100/33		8		237	237	237
6	H 410	Singapore Niwasa	100/33		38		236	236	236
7	H 415	Harbour house	160/33		9		238	238	239
8	H 420	Harbour house 2	100/33		24		238	237	236
9	H 430	T Suchi	160/33		48		238	237	239
10	H 435	T Suchi International School	400/33		4		238	238	238
11	H 440	Swarnabarnagama	160/33		9		225	236	236
12	H 445	Sahinda Salt	50/33	Bulk		1	<b>244</b>	<b>244</b>	239
13	H 450	Kondankala Salt	100/33	Bulk		12	<b>252</b>	<b>249</b>	<b>254</b>
14	H 455	Work Shop	100/33	Bulk		52	<b>250</b>	<b>251</b>	<b>249</b>

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No.	SIN	Name	Capacity/Volt	Type	Load		Substation Voltage		
					RE	Bulk	RN	YN	BN
15	H 460	Nawalak Salt	400/33	Bulk		20	248	248	248
16	H 465	8 Paththiya	100/33	Bulk		0	232	235	230
17	H 470	Ralabadanaya	100/33	Bulk		0	240	241	240
18	H 475	T Suchi J	100/33		26		236	236	236
19	H 480	T Suchi H	160/33		23		236	0	236
20	H 485	T Suchi ABC	160/33		19		233	235	236
21	H 490	Mayurapura	160/33		125		232	231	230
22	H 495	Ruwanpura	160/33		1		236	236	237
23	H 500	Sthuthi Villege-Entrance	160/33		10		230	231	231
24	H 501	Sthuthi Village	100/33		14		236	235	236
25	H 505	Methsewana	160/33		17		241	234	235
26	H 510	Koholalankala	100/33		42		241	235	237
27	H 515	Udamalala	100/33		26		230	230	230
28	H 518	Veheragala Aramaya	100/33		0		234	234	234
29	H 520	Julagamuwa	100/33		32		230	230	230
30	H 525	Pallemalala	160/33		71		238	239	228
31	H 530	Wanajeevee	100/33		2		225	227	225

No.	SIN	Name	Capacity/Volt	Type	Load		Substation Voltage		
					RE	Bulk	RN	YN	BN
32	H 535	Weligaththa	100/33		79		230	230	230
33	H 538	Boondala Saltha Factory	160/33	Bulk		1	235	235	234
34	H 539	Boondala Soltam Village	100/33		3		233	232	233
35	H 540	Boondala villege	100/33		32		228	233	234
36	H 545	Siriyagama	100/33		31		233	233	233
37	K 005	Kohombaganapelessa 7th Miles Post	100/33		51		220	220	220
38	K 008	Weerahela	100/33		25		219	219	219
39	K 010	Weerahela Water Board	100/33	Bulk/Re	30	22	220	220	220
40	K 012	Saliyapura	100/33		38		225	225	225
41	K 015	Beralihela 04, 05 Colony	100/33		71		226	226	226
42	K 020	Beralihela 03 Colony	160/33		107		226	226	226
43	K 025	Mahaweli Farm	100/33	Bulk		11	231	231	231
44	K 026	Joolpallama	100/33		66		221	221	221
45	K 027	Tele Cinema Gammanaya	630/33	Bulk		10	228	228	228
46	K 028	Kodigahawewa	250/33		7		238	238	238
47	K 030	Ranminithenna Old	100/33		52		221	221	221
48	K 035	Ranminithenna New	100/33		15		220	220	220

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No.	SIN	Name	Capacity/Volt	Type	Load		Substation Voltage		
					RE	Bulk	RN	YN	BN
49	K 037	Thambarawa	100/33		1		224	224	224
50	K 040	Samaguliya	100/33		36		<b>205</b>	<b>205</b>	<b>205</b>
51	K 045	Kawanthissapura 6th Miles Post	100/33		46		228	230	229
52	K 050	18th Batalian Camp	100/33		7		229	229	229
53	K 055	Wnaudyana(Gamudawa)	100/33		30		230	229	228
54	K 060	Celtel Tower	100/33		32		223	222	221
55	K 065	Jayasingha Hotel	100/33		2		<b>118</b>	<b>118</b>	<b>118</b>
56	K 070	Wedasitkanda	160/33		63		236	236	236
57	K 075	Roshan Hotel	250/33	Bulk		57	234	234	234
58	K 080	Chamila Hotel	100/33		79		222	225	225
59	K 085	Port Authority Pilgrims Rest	100/33	Bulk		2	<b>210</b>	<b>210</b>	<b>210</b>
60	K 090	Kataragama Hospital	160/33		136		223	223	223
61	K 095	C.E.B. Circuit Bunglow	100/33		66		220	220	220
62	K 100	Delman Hotel	100/33	Bulk/Re	26	5	219	220	220
63	K 101	Army Circuit Bunglow	250/33	Bulk		19	224	224	224
64	K 102	Police Circuit Bunglow	160/33	Bulk		3	228	227	227
65	K 105	C.T.B. Deport	400/33		80		225	227	227

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No.	SIN	Name	Capacity/Volt	Type	Load		Substation Voltage		
					RE	Bulk	RN	YN	BN
66	K 110	Wallimatagama	100/33		76		218	218	219
67	K 113	Bodirajapura	100/33		16		218	218	219
68	K 114	Kataragama Army Camp	100/33		4		228	229	228
69	K 115	Sithulpawwa	250/33		22		<b>212</b>	<b>212</b>	<b>213</b>
70	K 120	C.E.B. Depot	400/33		268		238	238	238
71	K 125	President Circuit Bunglow	100/33	Bulk	12		225	225	225
72	K 126	President Circuit Bunglow New	160/33	Bulk	20		234	234	234
73	K 130	Kiriwehera New	250/33		114		226	225	226
74	<b>K 132</b>	<b>Mailagama New</b>	100/33		103		224	226	226
75	K 135	Milagama	100/33		74		223	223	223
76	K 140	Galahitiya Diyawaragammanaya	100/33		10		223	223	223
77	K 145	Sellakataragama New Darmanikethana	100/33		71		219	219	218
78	<b>K 150</b>	<b>Sella Kataragama</b>	160/33		172		226	226	226
79	K 151	Kohombadigana	100/33		32		229	229	229
80	K 152	Dambe	100/33		16		230	230	230
81	K 154	Shopping Complex Sella	100/33	Bulk		0	<b>214</b>	<b>214</b>	<b>214</b>
82	K 155	Sacret City 1	100/33		93		<b>215</b>	<b>215</b>	<b>215</b>



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No.	SIN	Name	Capacity/Volt	Type	Load		Substation Voltage		
					RE	Bulk	RN	YN	BN
83	K 157	Sacret City 2	250/33		98		230	230	230
84	K 160	Water Board Kataragama	650/33	Bulk		84	228	228	228
85	K 165	Dewalaya	160/33		41		225	225	225
86	K 170	Gothamigama	100/33		54		222	222	222
87	K 171	Gaminipura	100/33		33		231	231	231
88	K 172	Nagahaweediya	100/33		23		228	228	228
89	K 175	Kiriwehera	250/33		54		220	224	224
90	T 005	Colony 11	100/33		64		<b>215</b>	<b>215</b>	<b>218</b>
91	T 010	Air Force Camp 1	100/33	Bulk		1	224	225	225
92	T 015	Weerawila Farm 1	100/33	Bulk/RE	5	2	226	226	225
93	T 020	Senasuma	100/33		23		224	223	221
94	T 025	Air Force Camp 2	400/33	Bulk		63	225	223	224
95	T 030	Weerawila Farm 2	150/33		36		225	226	227
96	T 035	Weeravila Garment	400/33	Bulk/RE	7	0	225	225	225
97	T 040	Weeravila New Town	100/33		47		221	221	220
98	T 041	Weerawila Tea	250/33	Bulk		0	221	221	221
99	T 045	Open Prison	100/33	Bulk/RE	54	17	223	<b>213</b>	221

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No.	SIN	Name	Capacity/Volt	Type	Load		Substation Voltage		
					RE	Bulk	RN	YN	BN
100	T 050	Saliyapura	100/33		54		220	219	217
101	T 055	Uduwila	100/33		60		225	226	227
102	T 060	Gangeyaya	100/33		55		<b>215</b>	<b>216</b>	<b>215</b>
103	T 065	Rubberwatta New	100/33		85		220	220	220
104	T 070	Rubberwatta Old	250/33		155		223	224	223
105	T 075	Medavelena	250/33		161		229	228	238
106	T 080	Akkara 80	100/33		88		220	218	<b>212</b>
107	T 085	Koththamalliyaya	100/33	Bulk/Re	1	1	221	221	220
108	T 090	Kasingama Old	160/33		72		<b>216</b>	<b>215</b>	<b>216</b>
109	T 095	Kerenodaya	100/33		61		228	226	221
110	T 100	Welipothewela Old	100/33		54		223	222	225
111	T 105	Walagampatthuwa	100/33		21		217	217	219
112	T 108	Diyasyaya	100/33		34		<b>214</b>	217	<b>215</b>
113	T 110	Welipothewela Near	100/33		21		<b>215</b>	<b>216</b>	<b>215</b>
114	T 115	Nedigamwila (Navodya)	100/33		34		<b>211</b>	<b>216</b>	<b>216</b>
115	T 120	Unawa	100/33		71		219	220	218
116	T 121	Ikkapallama	100/33		51		220	219	220

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No.	SIN	Name	Capacity/Volt	Type	Load		Substation Voltage		
					RE	Bulk	RN	YN	BN
117	T 125	Halmillawa(Attikkawa)	160/33		85		228	228	226
118	T 130	Thelulla Water Board	160/11		76		228	227	227
119	T 135	Pustholamulla	100/11		41		<b>213</b>	<b>212</b>	<b>214</b>
120	T 138	Elephant Reach	100/11	Bulk		44	230	230	229
121	T 140	Yala Junction	100/11		94		<b>207</b>	<b>206</b>	<b>205</b>
122	T 145	Modara Pelessa	100/11		11		216	217	218
123	T 150	Andaragasyaya	100/11		74		219	222	220
124	T 155	Sidujayapura	100/11		52		218	221	220
125	T 160	Kirinda	160/11		120		221	218	<b>210</b>
126	T 165	Kirinda Harbour	160/33	Bulk		4	225	226	226
127	T 170	Yodakandiya	250/33		144		<b>210</b>	<b>207</b>	<b>211</b>
128	T 175	Uddagandara	100/33		30		<b>211</b>	<b>212</b>	<b>211</b>
129	T 176	Vilamulla	100/33		33		218	217	219
130	T 180	Diyawara Gammanaya	250/33		72		<b>210</b>	<b>210</b>	<b>211</b>
131	T 185	Wewayaya	100/33		5		<b>213</b>	<b>214</b>	<b>213</b>
132	T 186	Wanamal	100/33		2		228	228	228
133	T 190	Koragaha Ulpatha	100/33		4		<b>214</b>	<b>214</b>	<b>214</b>

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No.	SIN	Name	Capacity/Volt	Type	Load		Substation Voltage		
					RE	Bulk	RN	YN	BN
134	T 192	Magulmal Viharaya	100/33		0		<b>216</b>	<b>214</b>	<b>216</b>
135	T 195	Yala	100/33	Bulk		13	225	224	226
136	T 196	Yala Village	400/11	Bulk/Re	0	74	227	229	228
137	T 197	Palatupana Salt	100/11	Bulk		8	220	219	219
138	<b>T 198</b>	<b>Yala camp</b>	100/11	Bulk		8	<b>215</b>	<b>216</b>	<b>214</b>
139	T 200	Kasingama	160/33		81		218	218	218
140	T 205	CEB Thissa	400/33		95		230	229	230
141	T 210	Kachchenyagama	100/33		87		225	225	225
142	T 215	Selinco	100/33	Bulk		3	229	229	229
143	T 220	Pehekamhala	160/33		98		230	230	230
144	T 222	Ruvini Rice Mill	100/33	Bulk		1	238	236	238
145	T 223	Halambagaswewa	100/33		80		220	221	223
146	T 225	Tissa Rest House	630/33	Bulk/RE	133	131	223	223	223
147	T 226	Tikiriudanagama	100/33		30		<b>212</b>	<b>211</b>	<b>209</b>
148	T 230	Yatala	100/33		82		<b>205</b>	<b>206</b>	<b>209</b>
149	T 235	Ekamutugama	100/33		44		<b>210</b>	<b>213</b>	<b>214</b>
150	T 240	Sadungama	100/33		84		217	219	217

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No.	SIN	Name	Capacity/Volt	Type	Load		Substation Voltage		
					RE	Bulk	RN	YN	BN
151	T 245	Gemunupura	160/33		53		226	227	227
152	T 250	Wijithapura	100/33		35		219	218	218
153	T 255	Dambewelena	100/33		39		227	227	227
154	T 260	Debarawewa Water Board(Villege)	100/33		71		225	226	227
155	T 265	Debarawewa Water Board(Bulk)	160/33	Bulk		0	228	228	228
156	T 270	Debarawewa Telecom	100/33	Bulk		8	223	224	223
157	T 275	Debarawewa Hospital	400/33	Bulk/Re	83	16	224	224	223
158	T 280	Polgahavelena	400/33		59		226	229	228
159	T 360	Weeravila Economical Centre	250/33	Bulk		1	224	224	223
160	T 385	Priyankara Hotel	160/33	Bulk/Re	79	38	219	219	219
161	T 390	Sandagirigama	100/33		5		<b>210</b>	219	<b>212</b>
162	T 395	Sandagirigama Junction	100/33		86		<b>214</b>	<b>214</b>	<b>216</b>
163	T 400	High biscus Hotel	100/33	Bulk		12	220	220	220

## A2.2 Planning Process

The planning task is to ascertain the capability of the network with respect to the demand growth and identify reinforcement proposals that enable the network to handle the future demand, within the planning horizon.

The basic variables involve in this task are described below.

Table A2.2: Planning Process

Task	Description
1. Network Data updating	The network is being modified continually. At present updating of the network database with these modifications is not done methodically. Therefore, the existing network will be visited by field staff and all the modifications will be noted and network database will be up-dated accordingly.
2. Load Data updating	Load reading of each substation will be taken during peak hours. This loading data will be used to run computer simulation to ascertain network performance theoretically.
3. Load forecasting	Future demand will be forecasted using past sales data and anticipated major loads.
4. Modeling and Analysis	Computer aided modeling and load flow studies are used for this purpose. Network performance is analyzed and reinforcement proposals are made for each case when the planning criteria is violated thus bringing the network parameters in to acceptable limits.
5. Economic Evaluation	Although implementations of reinforcement proposals are mandatory from social view point, it incurs substantial cost to the utility. Therefore it is much imperative to foresee cost benefit scenario of each proposal. The analysis is given in Chapter 8.

### A2.3 Terms

#### *Load factor*

Load factor is defined as the ratio between average demand of any customer or group of customers over a period to the Maximum Demand over the same period.

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

Electrical circuits have to be designed to provide the peak power which may occur for a short period of duration. During off peak, the capacity of the network is under-utilized. Therefore, load factor can be considered as a measure of utilization of electricity network.

#### *Energy Demand*

The energy demand of the system is given by,

$$\text{Energy demand} = \text{Peak demand} \times \text{Load factor} \times \text{duration}$$

$$\text{Annual Energy demand} = \text{Peak demand} \times \text{Load factor} \times 365 \times 24$$

$$\text{Load factor, } e = \frac{\text{Annual Energy demand}}{\text{Peak demand} \times 365 \times 24}$$

$$= \frac{\text{Annual Average demand}}{\text{Peak demand}}$$

The daily load curves of typical days of various seasons are drawn and load factors are derived using above formula.

**Utilization Factor**

Ratio of the Maximum Demand to the rated capacity

$$\text{Utilization Factor} = \frac{\text{Maximum Demand}}{\text{Rated Capacity}}$$

**Loss of Energy**

Loss of energy varies with the time as load varies. Loss curve is steeper than its respective demand curve as the losses are proportionate to the square value of current loss curve.

A hypothetical time, called 'Utilization Time of Losses - UTL' is derived such a way that the losses during this time with continuous load equal to the peak load as same as the losses of the system with actual loading over the day. The following empirical formula known as Jung's formula was used to evaluate the UTL.

$$\text{UTL} = \frac{e^2 (2+e^2) \times 365 \times 24}{(1+2e)} \text{ hrs/year} \quad ; e - \text{Load factor}$$

Energy loss due to actual load is;

$$\text{Loss of Energy} = (\text{Peak Power Loss} \times \text{UTL}) \text{ kWh/year}$$

Peak Power Loss is obtained from load flow studies.



***Cost of Losses***

$$\begin{aligned}\text{Cost of losses} &= \text{Capacity cost} + \text{Energy cost} \\ &= C_c \times (\text{Peak power loss}) + E_c \times (\text{Energy loss})\end{aligned}$$

$C_c$  - Investment per year through generation to distribution required for supplying an incremental 1kW at the point of distribution (Rs./kW, year).

$E_c$  - Operation and maintenance cost of generation, transmission and distribution of 1kW at distribution point. (Rs./kWh, year).

**A2.4 Planning Criteria**

Loading criteria of conductors is the 70% of thermal rating of the conductor and emergency rating is taken as 125% of the thermal rating.



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Table A3.1 Voltage Levels of the existing feeder and the capacitor placement of the feeder

No	Cumulative Length Round/km	Existing Voltage drop %	Existing Voltage	1 cap Voltage drop %	With 1 Cap Voltage	2 cap Voltage drop %	With 2 Cap Voltage	3 cap Voltage drop %	With 3 Cap Voltage	4 cap Voltage drop %	With 4 Cap Voltage	4 cap New Voltage drop %	With 4 Cap New Voltage	5 cap Voltage drop %	With 5 Cap Voltage	6 cap Voltage drop %	With 6 Cap Voltage
1	1.1	0.11	32.9637	0.03	32.9901	0.03	32.9901	0.03	32.9901	0.03	32.9901	0.03	32.9901	0.03	32.9901	0.03	32.9901
2	1.7	0.16	32.9472	0.04	32.9868	0.04	32.9868	0.05	32.9835	0.04	32.9868	0.04	32.9868	0.05	32.9835	0.04	32.9868
3	1.9	0.18	32.9406	0.05	32.9835	0.04	32.9868	0.05	32.9835	0.05	32.9835	0.05	32.9835	0.05	32.9835	0.05	32.9835
4	2.3	0.22	32.9274	0.06	32.9802	0.05	32.9835	0.06	32.9802	0.06	32.9802	0.06	32.9802	0.07	32.9769	0.06	32.9802
5	2.7	0.27	32.9109	0.07	32.9769	0.06	32.9802	0.08	32.9736	0.07	32.9769	0.07	32.9769	0.08	32.9736	0.07	32.9769
6	2.9	0.28	32.9076	0.07	32.9769	0.07	32.9769	0.08	32.9736	0.08	32.9736	0.07	32.9769	0.08	32.9736	0.07	32.9769
7	3.2	0.31	32.8977	0.08	32.9736	0.07	32.9769	0.09	32.9703	0.08	32.9736	0.08	32.9736	0.09	32.9703	0.08	32.9736
8	4.3	0.42	32.8614	0.11	32.9637	0.1	32.967	0.12	32.9604	0.11	32.9637	0.11	32.9637	0.12	32.9604	0.11	32.9637
9	5	0.68	32.7756	0.27	32.9109	0.26	32.9142	0.29	32.9043	0.28	32.9076	0.27	32.9109	0.29	32.9043	0.27	32.9109
10	5.2	0.73	32.7591	0.3	32.901	0.29	32.9043	0.32	32.8944	0.31	32.8977	0.3	32.901	0.32	32.8944	0.3	32.901
11	5.7	0.92	32.6964	0.42	32.8614	0.4	32.868	0.44	32.8548	0.43	32.8581	0.42	32.8614	0.44	32.8548	0.42	32.8614
12	6	1	32.67	0.47	32.8449	0.45	32.8515	0.49	32.8383	0.48	32.8416	0.47	32.8449	0.49	32.8383	0.47	32.8449

No	Cumulative Length	Existing Voltage drop	Existing Voltage	1 cap Voltage drop %	With 1 Cap Voltage	2 cap Voltage drop %	With 2 Cap Voltage	3 cap Voltage drop %	With 3 Cap Voltage	4 cap Voltage drop %	With 4 Cap Voltage	4 cap New Voltage drop	With 4 Cap New Voltage	5 cap Voltage drop %	With 5 Cap Voltage	6 cap Voltage drop %	With 6 Cap Voltage
13	6.3	1.07	32.6469	0.51	32.8317	0.5	32.835	0.54	32.8218	0.52	32.8284	0.52	32.8284	0.54	32.8218	0.51	32.8317
14	6.7	1.21	32.6007	0.6	32.802	0.58	32.8086	0.62	32.7954	0.61	32.7987	0.6	32.802	0.63	32.7921	0.6	32.802
15	7.6	1.49	32.5083	0.76	32.7492	0.74	32.7558	0.79	32.7393	0.78	32.7426	0.77	32.7459	0.8	32.736	0.76	32.7492
16	8.6	1.83	32.3961	0.96	32.6832	0.94	32.6898	1	32.67	0.98	32.6766	0.96	32.6832	1	32.67	0.96	32.6832
17	9	1.96	32.3532	1.06	32.6502	1.01	32.6667	1.08	32.6436	1.05	32.6535	1.04	32.6568	1.08	32.6436	1.04	32.6568
18	9.4	2.07	32.3169	1.1	32.637	1.07	32.6469	1.14	32.6238	1.12	32.6304	1.1	32.637	1.15	32.6205	1.1	32.637
19	11.9	2.87	32.0529	1.56	32.4852	1.52	32.4984	1.61	32.4687	1.58	32.4786	1.56	32.4852	1.62	32.4654	1.56	32.4852
20	12.7	3.1	31.977	1.69	32.4423	1.64	32.4588	1.75	32.4225	1.71	32.4357	1.69	32.4423	1.75	32.4225	1.69	32.4423
21	12.8	3.15	31.9605	1.72	32.4324	1.67	32.4489	1.78	32.4126	1.74	32.4258	1.72	32.4324	1.79	32.4093	1.72	32.4324
22	14.2	3.56	31.8252	1.95	32.3565	1.9	32.373	2.01	32.3367	1.97	32.3499	1.95	32.3565	2.02	32.3334	1.95	32.3565
23	15.6	3.99	31.6833	2.18	32.2806	2.13	32.2971	2.26	32.2542	2.22	32.2674	2.19	32.2773	2.27	32.2509	2.19	32.2773
24	19.3	5.1	31.317	2.77	32.0859	2.7	32.109	2.87	32.0529	2.81	32.0727	2.78	32.0826	2.88	32.0496	2.78	32.0826
25	19.8	5.25	31.2675	2.85	32.0595	2.78	32.0826	2.95	32.0265	2.89	32.0463	2.86	32.0562	2.97	32.0199	2.86	32.0562
26	20.5	5.45	31.2015	2.95	32.0265	2.88	32.0496	3.06	31.9902	3	32.01	2.96	32.0232	3.07	31.9869	2.96	32.0232
27	21.7	5.8	31.086	3.14	31.9638	3.05	31.9935	3.25	31.9275	3.18	31.9506	3.14	31.9638	3.26	31.9242	3.14	31.9638
28	22	5.87	31.0629	3.17	31.9539	3.09	31.9803	3.29	31.9143	3.22	31.9374	3.18	31.9506	3.3	31.911	3.18	31.9506
29	22.1	5.93	31.0431	3.2	31.944	3.11	31.9737	3.32	31.9044	3.25	31.9275	3.21	31.9407	3.33	31.9011	3.21	31.9407
30	22.4	5.99	31.0233	3.23	31.9341	3.14	31.9638	3.35	31.8945	3.28	31.9176	3.24	31.9308	3.36	31.8912	3.24	31.9308
31	23.2	6.23	30.9441	3.35	31.8945	3.26	31.9242	3.47	31.8549	3.4	31.878	3.36	31.8912	3.49	31.8483	3.36	31.8912
32	24.2	6.5	30.855	3.47	31.8549	3.38	31.8846	3.6	31.812	3.53	31.8351	3.48	31.8516	3.62	31.8054	3.48	31.8516

No	Cumulative Length	Existing Voltage drop	Existing Voltage	1 cap Voltage drop %	With 1 Cap Voltage	2 cap Voltage drop %	With 2 Cap Voltage	3 cap Voltage drop %	With 3 Cap Voltage	4 cap Voltage drop %	With 4 Cap Voltage	4 cap New Voltage drop	With 4 Cap New Voltage	5 cap Voltage drop %	With 5 Cap Voltage	6 cap Voltage drop %	With 6 Cap Voltage
33	24.4	6.57	30.8319	3.51	31.8417	3.41	31.8747	3.64	31.7988	3.56	31.8252	3.52	31.8384	3.65	31.7955	3.51	31.8417
34	25.1	6.74	30.7758	3.59	31.8153	3.5	31.845	3.72	31.7724	3.64	31.7988	3.6	31.812	3.74	31.7658	3.6	31.812
35	26.8	7.18	30.6306	3.77	31.7559	3.67	31.7889	3.92	31.7064	3.83	31.7361	3.78	31.7526	3.94	31.6998	3.78	31.7526
36	28.1	7.49	30.5283	3.9	31.713	3.79	31.7493	4.05	31.6635	3.96	31.6932	3.91	31.7097	4.07	31.6569	3.91	31.7097
37	28.4	7.57	30.5019	3.93	31.7031	3.82	31.7394	4.09	31.6503	4	31.68	3.95	31.6965	4.11	31.6437	3.94	31.6998
38	28.5	7.61	30.4887	3.95	31.6965	3.83	31.7361	4.11	31.6437	4.01	31.6767	3.96	31.6932	4.13	31.6371	3.96	31.6932
39	28.6	7.63	30.4821	3.96	31.6932	3.84	31.7328	4.12	31.6404	4.02	31.6734	3.97	31.6899	4.14	31.6338	3.97	31.6899
40	28.9	7.69	30.4623	4.01	31.6767	3.88	31.7196	4.16	31.6272	4.05	31.6635	4	31.68	4.18	31.6206	4.01	31.6767
41	29.3	7.75	30.4425	4.08	31.6536	3.93	31.7031	4.21	31.6107	4.09	31.6503	4.06	31.6602	4.23	31.6041	4.07	31.6569
42	29.4	7.77	30.4359	4.09	31.6503	3.94	31.6998	4.22	31.6074	4.1	31.647	4.08	31.6536	4.24	31.6008	4.09	31.6503
43	30	7.86	30.4062	4.19	31.6173	4.01	31.6767	4.28	31.5876	4.15	31.6305	4.16	31.6272	4.3	31.581	4.17	31.6239
44	30.8	7.95	30.3765	4.28	31.5876	4.06	31.6602	4.33	31.5711	4.19	31.6173	4.25	31.5975	4.36	31.5612	4.26	31.5942
45	32.1	8.09	30.3303	4.42	31.5414	4.14	31.6338	4.41	31.5447	4.23	31.6041	4.38	31.5546	4.44	31.5348	4.38	31.5546
46	32.3	8.11	30.3237	4.44	31.5348	4.15	31.6305	4.42	31.5414	4.24	31.6008	4.39	31.5513	4.44	31.5348	4.4	31.548
47	32.4	8.12	30.3204	4.45	31.5315	4.16	31.6272	4.43	31.5381	4.24	31.6008	4.4	31.548	4.45	31.5315	4.41	31.5447
48	32.9	8.17	30.3039	4.5	31.515	4.18	31.6206	4.46	31.5282	4.25	31.5975	4.45	31.5315	4.48	31.5216	4.45	31.5315
49	34.2	8.31	30.2577	4.64	31.4688	4.26	31.5942	4.53	31.5051	4.29	31.5843	4.57	31.4919	4.55	31.4985	4.58	31.4886
50	35.3	8.41	30.2247	4.73	31.4391	4.35	31.5645	4.63	31.4721	4.33	31.5711	4.66	31.4622	4.62	31.4754	4.66	31.4622
51	36.1	8.47	30.2049	4.8	31.416	4.42	31.5414	4.69	31.4523	4.36	31.5612	4.71	31.4457	4.66	31.4622	4.72	31.4424
52	36.6	8.51	30.1917	4.84	31.4028	4.46	31.5282	4.73	31.4391	4.38	31.5546	4.75	31.4325	4.69	31.4523	4.76	31.4292

No	Cumulative Length	Existing Voltage drop	Existing Voltage	1 cap Voltage drop %	With 1 Cap Voltage	2 cap Voltage drop %	With 2 Cap Voltage	3 cap Voltage drop %	With 3 Cap Voltage	4 cap Voltage drop %	With 4 Cap Voltage	4 cap New Voltage drop	With 4 Cap New Voltage	5 cap Voltage drop %	With 5 Cap Voltage	6 cap Voltage drop %	With 6 Cap Voltage
53	37.6	8.6	30.162	4.93	31.3731	4.55	31.4985	4.82	31.4094	4.43	31.5381	4.83	31.4061	4.74	31.4358	4.84	31.4028
54	39	8.71	30.1257	5.04	31.3368	4.66	31.4622	4.93	31.3731	4.48	31.5216	4.92	31.3764	4.81	31.4127	4.93	31.3731
55	42.2	8.97	30.0399	5.3	31.251	4.92	31.3764	5.19	31.2873	4.61	31.4787	5.15	31.3005	4.97	31.3599	5.16	31.2972
56	43	9.03	30.0201	5.36	31.2312	4.98	31.3566	5.25	31.2675	4.63	31.4721	5.2	31.284	5.01	31.3467	5.21	31.2807
57	44.1	9.12	29.9904	5.45	31.2015	5.07	31.3269	5.34	31.2378	4.67	31.4589	5.28	31.2576	5.08	31.3236	5.29	31.2543
58	44.6	9.16	29.9772	5.48	31.1916	5.1	31.317	5.38	31.2246	4.69	31.4523	5.31	31.2477	5.11	31.3137	5.32	31.2444
59	44.8	9.17	29.9739	5.5	31.185	5.12	31.3104	5.39	31.2213	4.7	31.449	5.33	31.2411	5.12	31.3104	5.33	31.2411
60	45	9.17	29.9739	5.51	31.1817	5.13	31.3071	5.4	31.218	4.7	31.449	5.34	31.2378	5.13	31.3071	5.35	31.2345
61	46	9.26	29.9442	5.59	31.1553	5.21	31.2807	5.418	31.21206	4.76	31.4292	5.41	31.2147	5.19	31.2873	5.42	31.2114
62	46.3	9.28	29.9376	5.61	31.1487	5.23	31.2741	5.5	31.185	4.78	31.4226	5.43	31.2081	5.21	31.2807	5.44	31.2048
63	46.9	9.33	29.9211	5.66	31.1322	5.28	31.2576	5.55	31.1685	4.83	31.4061	5.48	31.1916	5.25	31.2675	5.48	31.1916
64	47.1	9.34	29.9178	5.67	31.1289	5.29	31.2543	5.56	31.1652	4.84	31.4028	5.49	31.1883	5.26	31.2642	5.5	31.185
65	47.2	9.35	29.9145	5.68	31.1256	5.3	31.251	5.57	31.1619	4.85	31.3995	5.5	31.185	5.26	31.2642	5.5	31.185
66	47.4	9.36	29.9112	5.69	31.1223	5.31	31.2477	5.58	31.1586	4.86	31.3962	5.51	31.1817	5.27	31.2609	5.51	31.1817
67	47.6	9.38	29.9046	5.7	31.119	5.33	31.2411	5.6	31.152	4.87	31.3929	5.52	31.1784	5.28	31.2576	5.53	31.1751
68	47.7	9.38	29.9046	5.71	31.1157	5.33	31.2411	5.61	31.1487	4.88	31.3896	5.53	31.1751	5.29	31.2543	5.54	31.1718
69	48.8	9.45	29.8815	5.78	31.0926	5.4	31.218	5.67	31.1289	4.95	31.3665	5.59	31.1553	5.34	31.2378	5.6	31.152
70	49.1	9.47	29.8749	5.79	31.0893	5.42	31.2114	5.69	31.1223	4.96	31.3632	5.6	31.152	5.35	31.2345	5.61	31.1487
71	49.2	9.47	29.8749	5.8	31.086	5.42	31.2114	5.69	31.1223	4.97	31.3599	5.61	31.1487	5.35	31.2345	5.62	31.1454
72	49.5	9.48	29.8716	5.81	31.0827	5.42	31.2114	5.7	31.119	4.97	31.3599	5.62	31.1454	5.36	31.2312	5.62	31.1454

No	Cumulative Length	Existing Voltage drop	Existing Voltage	1 cap Voltage drop %	With 1 Cap Voltage	2 cap Voltage drop %	With 2 Cap Voltage	3 cap Voltage drop %	With 3 Cap Voltage	4 cap Voltage drop %	With 4 Cap Voltage	4 cap New Voltage drop	With 4 Cap New Voltage	5 cap Voltage drop %	With 5 Cap Voltage	6 cap Voltage drop %	With 6 Cap Voltage
73	49.6	9.49	29.8683	5.81	31.0827	5.43	31.2081	5.71	31.1157	4.98	31.3566	5.62	31.1454	5.36	31.2312	5.63	31.1421
74	49.9	9.49	29.8683	5.82	31.0794	5.43	31.2081	5.71	31.1157	4.98	31.3566	5.63	31.1421	5.37	31.2279	5.63	31.1421
75	50.2	9.49	29.8683	5.82	31.0794	5.44	31.2048	5.71	31.1157	4.99	31.3533	5.63	31.1421	5.37	31.2279	5.63	31.1421
76	50.3	9.49	29.8683	5.82	31.0794	5.44	31.2048	5.71	31.1157	4.99	31.3533	5.63	31.1421	5.37	31.2279	5.63	31.1421
77	50.4	9.49	29.8683	5.82	31.0794	5.44	31.2048	5.71	31.1157	4.99	31.3533	5.63	31.1421	5.37	31.2279	5.63	31.1421
78	50.5	9.49	29.8683	5.82	31.0794	5.44	31.2048	5.72	31.1124	4.99	31.3533	5.63	31.1421	5.37	31.2279	5.64	31.1388
79	51.4	9.5	29.865	5.82	31.0794	5.44	31.2048	5.72	31.1124	4.99	31.3533	5.63	31.1421	5.37	31.2279	5.64	31.1388
80	51.7	9.5	29.865	5.82	31.0794	5.45	31.2015	5.72	31.1124	4.99	31.3533	5.63	31.1421	5.37	31.2279	5.64	31.1388
81	51.9	9.5	29.865	5.82	31.0794	5.45	31.2015	5.72	31.1124	4.99	31.3533	5.63	31.1421	5.37	31.2279	5.64	31.1388