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Load Flow & Short Circuit Analysis of 132/33/11KV Substation using ETAP

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Abstract

Electrical power system provides a vital service to the society. For healthy operation of electrical power generation, transmission and distribution, it is important that system should be balanced. Load flow is basic requirement to conduct power system analysis of any system. The load flow gives us information about; voltages, real and reactive power generated and absorbed and line losses across the entire system.

Short Circuit Analysis provides the information required to determine whether the interrupting capacities of the power system components are adequate enough to protect your power system. Also this data is used to evaluate the proper sizing of protective relays and sensing equipment. All the data used for analysis is real time and collected from 132/33/11kV substation under M.S.E.T.C.L.

This research paper deals with the simulation of 132/33/11kV substation. The analysis is done by using advance software Electrical Transient Analyser Program (ETAP) with detailed load flow analysis.Also, we have carried short circuit study of 132/33/11 kV substation system using ETAP software. From the ETAP generated load flow details and the short circuit details are studied.

Keywords: ETAP Software, Load Flow, Short Circuit, 132 kV Substations

INTRODUCTION:

Electrical power system is back bone of the development of a nation. There is big issue of power quality for developed nations but the developing countries like India the load is increasing rapidly but generation is not up to the level of demand. Hence there is need of load flow management. Load flow analysis using software is accurate and gives highly reliable results. This research makes effective use of Electrical Transient Analyzer Program (ETAP) to carry out load flow analysis of 132kV substation. The actual ratings of Power Transformers, Circuit Breakers, Current Transformers, Potential Transformers and Isolating switches are taken and modelled accordingly in ETAP. This 132kV substation is located in Latur district owned by Maharashtra State Electricity Transmission Corporation Limited (MSETCL) which comprises of 16 Transmission Lines, 3 cables, 4 Power Transformers, 27 Circuit Breakers, 27 Current Transformers, 27 Buses, 4 Potential Transformers and 56 Isolating switches, and 15 Load Centres.

The major cause of almost all power system disturbances is under voltage, voltage drops and power factor. In order to identify and pinpoint these disturbances, load flow studies are conducted. The result of these studies help to address the system disturbances with the help of additional devices (capacitors..etc).

Short circuits can occur anywhere in the system. In order to protect the system against short circuits, it is necessary to install circuit breakers which can safely isolate the circuit in fault conditions. The results of these studies help in proper selection & settings of protective device such as fuses, circuit breakers, and relays used in the protection scheme. Thus helping utilities maintain a safe, reliable and efficient electrical distribution system

The single line diagram of the substation is simulated in ETAP based upon actual data, and it is seen that at the 11kV, 33kV feeder buses and 132 kV buses there is under voltage. To overcome the under voltage at the 11kV, 33kV feeder buses and 132 kV buses capacitor bank of suitable ratings are added.

Section 1.1 is introduction of ETAP software. Section 2 is the details of the components. Section 3 is the simulation of single line diagram of 132 kV substation in ETAP based upon practical data. Section 4 is the Load Flow Analysis of the substation. Three conditions have been simulated in order to analyse the behaviour of the power system in these situations. Section 5 contains the observations on the load flow analysis. Section 6 is the recommendation to correct the problems encountered.

Section 7 is the Short Circuit Analysis of the substation as per IEC 60909. Section 8 is the device duty summary of the substation. This indicates the revised selection of circuit breakers in order to cater to the short circuit currents. Section 9 is the conclusion of the study.

DETAILS OF COMPONENTS

COMPONENT	TYPE	RATINGS
Power Transformer	Transformer 1	25MVA, 132/33kV
	Transformer 2	25MVA, 132/11kV
	Transformer 3	50MVA, 132/33kV
	Transformer 4	25MVA, 132/11kV
Circuit Breaker	RL-CKT-1-CB	145kV, 4000A, 80kA Siemens
	HL-CKT-1-CB	145kV, 4000A, 80kA Siemens
	MIDC-LT-CKT-II CB	145kV, 4000A, 80kA Siemens
	HL-CKT-II-CB	145kV, 4000A, 80kA Siemens
	MEDICAL CB	36kV, 2000A, 31.5kA, Siemens
	BABALGAON CB	36kV, 2000A, 31.5kA, Siemens
	DHANORA CB	36kV, 2000A, 31.5kA, Siemens
	NALEGAON CB	36kV, 2000A, 31.5kA, Siemens
	OPH CB	36kV, 2000A, 31.5kA, Siemens
	KOLPA CB	40.5kV, 2000A, 26.3kA, CGL
	INDUSTRIAL CB	12kV, 1250A, 50kA, ABB
	TOWN CB	12kV, 1250A, 50kA, ABB
	SIDDHESHWAR CB	12kV, 1250A, 50kA, ABB
	BABALGAON- 1 CB	12kV, 1250A, 50kA, ABB
	AUSA ROAD CB	12kV, 1250A, 50kA, ABB
	SINHAGAD CB	12kV, 1250A, 50kA, ABB
	SAI CB	12kV, 1250A, 50kA, ABB
	SPINNING MILL CB	12kV, 1250A, 50kA, ABB
Current Transformers	132kV Side	800-400-200/1A, 5P20
	33kV Side	400-200/1A, 5P20
	11kV Side	400-200/1A, 5P20
Loads	MEDICAL	5MVA
	BABALGAON	8MVA
	DHANORA	7MVA
	NALEGAON	19MVA
	OPH	6MVA
	KOLPA	18MVA
	INDUSTRIAL	4MVA
	TOWN	5MVA
	SIDDHESHWAR	2MVA
	BABALGAON- 1	5MVA
	AUSA ROAD	3MVA
	SINHAGAD	3MVA
	SAI	2MVA
	SPINNING MILL	3MVA

SIMULATION Of 132/33/11kV SUBSTATION IN ETAP:

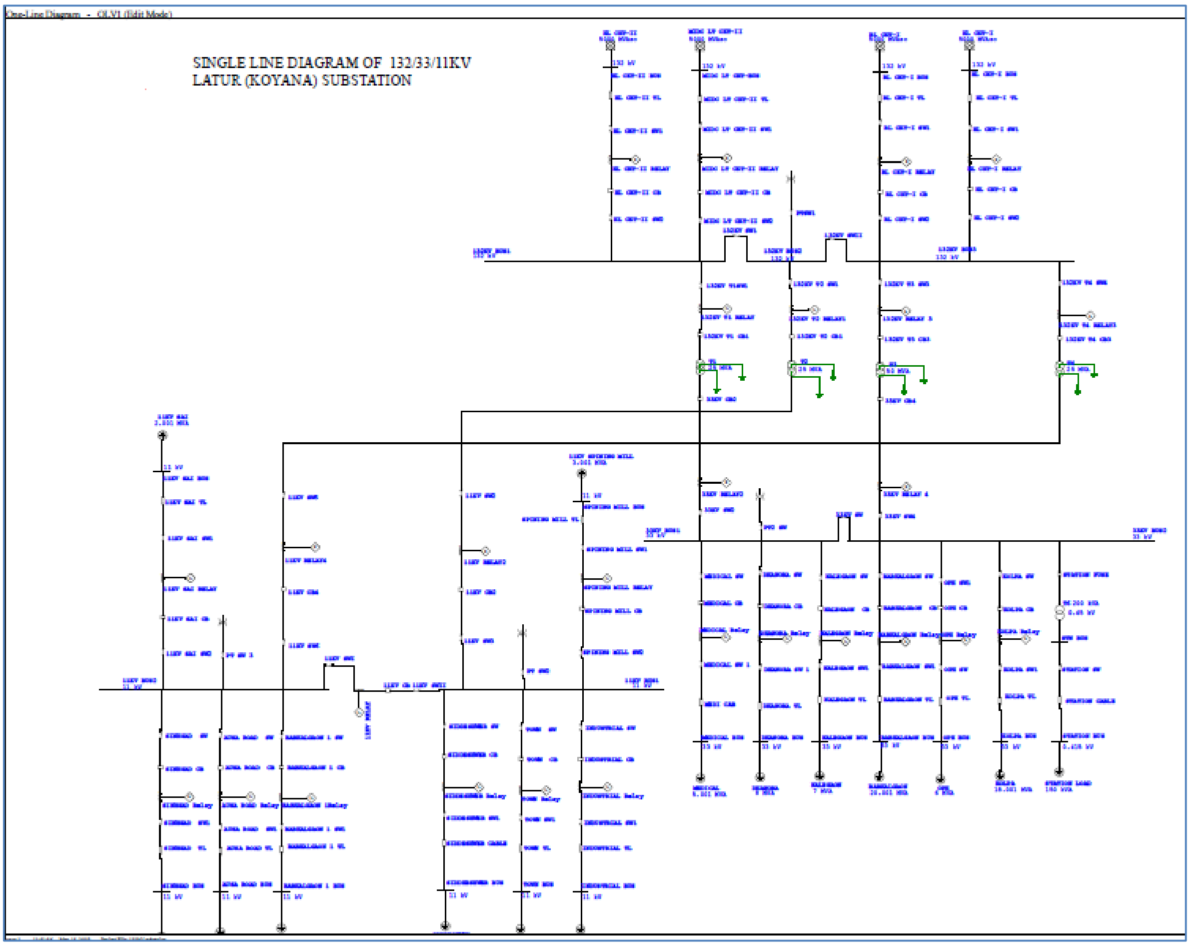


Figure 1: Simulated SLD in ETAP of 132/33/11kV LATUR KOYNA Substation

Fig. 1 shows the 132/33/11kV Latur (Koyna) Substation simulated in ETAP. Power is derived through 4 different sources HL-CKT I, RL–CKT I, HL-CKT II,MIDC-CKT II via ACSR panther conductor. Each source has as fault capacity of 5000MVA fed at 132kV. All these sources feed a 132kV bus which is divided by a bus coupler. This power is stepped down to 33kV and 11kV through T1, T3 and T2, T4 power transformers. The power from T1, T3 is fed to a 33kV bus and the power from T2, T4 is fed to a 11kV bus. Both these buses (33kV & 11kV) are divided by bus-couplers. Hence each power transformers feeds one bus. Power is further transferred to individual 33kV & 11kV load centres via ACSR conductors.

LITERATURE SURVEY

According to literature survey after studying various IEEE paper, collected some related papers and documents some of the point describe here;

1. **Yogesh Patel1, Dixit Tandel , Dharti Katti "Simulation and Analysis of 220kV Substation".**
   The main objective of this thesis is to simulate and analyze the 220 KV Substations. The simulation and analysis includes power flow analysis and short circuit analysis. Power flow study also known as load flow constitutes an important part of power system analysis and design of any power system network. The power flow analysis and short circuit analysis is done in the Power World Simulator Software. For the power flow analysis using the single line diagram of 220 KV substations, the model of the substation is developed in the Power World Simulator. The different kinds of faults are also simulated at various buses of the substation. Power World Simulator is very useful software for analyzing power system operation. By doing the power flow analysis in the Power World Simulator we estimate the real and reactive power flows, power losses in the entire network and phase angle using Power World Simulator. Short circuit analysis is also useful to select, set, and coordinate protective equipment such as circuit breakers, fuses, relays, and instrument transformers. Simulation technique is very useful in the power system planning and design..
2. **Sudipta Sen ,Arindam Chatterjee ,Debanjan Sarkar, "Design of 132/33KV Substation"**. The project work assigned to us was to design a 132/33 KV EHV sub-station. We considered incoming power at 132 KV and the power was transferred to main bus through isolator-

circuit breaker-isolator combination. The power from main bus was fed into a 20MVA transformer which stepped the voltage down to 33KV. The power is then fed into a 33KV bus from which different loads were tapped. In the process, the surge impedance loading of 132 KV and 33 KV lines were calculated and they were used to estimate the maximum power that can be transferred by one transmission line. The design of the entire substation was made keeping in mind the most basic requirements of a proper substation including the civil and domestic requirements. The design is then submitted to our mentor for verification.

3. **Nirav Taunk , Gaurang Sharma "Load Flow and Short Circuit Study of 220 kV Substation".** Short Circuit Analysis provides the information required to determine if the interrupting capacities of the power system components are adequate enough to protect your power system. Load flow is basic requirement to conduct the short circuit analysis of any system. The load flow gives us the sinusoidal steady state of the entire system - voltages, real and reactive power generated and absorbed and line losses. In this study, we have carried short circuit study of 220 kV substation system using ETAP software. From the ETAP generated report, load flow and short circuit system are studied.
4. **Kiran V. Natkar, Naveen Kumar2 [4] "Short Circuit Analysis Of 220/132 Kv Substation By Using Etap".** Modern power system is different from older system. The character of load is drastically changed now days. As most of the load is controlled and operated by using digital electronics controller. It is also important to focus on protection of the modern power system. For healthy operation of electrical power generation, transmission and distribution, it is important that system should be balanced and fault current should be in design limits. This paper deals with the simulation of 220/132 kV substation fault current calculation. The analysis is done by using advance software Electrical Transient Analyzer Program (ETAP) with detailed short circuit analysis. All the data used for analysis is real time and collected from 220/132 KV substation under M.S.E.T.C.L.
5. **Rana A. Jabbar Khan, Muhammad Junaid "Analyses and Monitoring of 132 kV Grid using ETAP Software".** Power System study and analyses are important parts of power system engineering. This innovative concept deal with a 132 kV Grid simulation in Electrical Transient Analyzer Program (ETAP). Existing power distribution system in Pakistan consists of approximately 6000 11 kV feeders, which are mainly analyzed by software FDR-ANA (Feeder Analyses). This software does not have capability to provide comprehensive analyses for integrated power system which is essential. This research paper focused on the detailed analyses and monitoring by using the most modern software ETAP, which performs numerical calculations of large integrated power system with fabulous speed besides, generating output reports. In a developing country like Pakistan it is first time that Off-line monitoring is made which includes current flowing in every branch, power factor, active and reactive power flow, harmonic distortion etc. of large power system. Based upon the recorded data obtained from an actual 132 kV grid which has been implemented in ETAP for Off-line monitoring and analyses.
6. M.J.Katira, K.B.Porate, "**Load Flow Analysis of 132 / 11 kV Distribution Sub Station using Static Var Compensator for Voltage Enhancement – A Case Study**". In a power system, load varies from one hour to another, reactive power varies accordingly which results into unacceptable voltage variation. This affects the performance of load and other parameters like power loss and power factor. This paper deals with Simulation of 132 / 11 kV Distribution Sub Station using SVC for voltage enhancement. Load Flow I carried out, considering balanced system during peak load condition, with the voltage enhancement is the main objective. Other objectives of the paper are the reduction in power loss and improvement in power factor. Simulation is developed in Electrical Transient Analyzer Program (ETAP) environment and recorded parameters are compared with Simulation results.

PROBLEM STATEMENT

FDR-ANA doesn't have capability to produce comprehensive analysis. the most reason for disturbance in power system is below voltage. Future up gradation of grid network. The voltage at every bus ought to be celebrated for losses calculation.

GOALS AND OBJECTIVES

- To monitor and analyze the power system accurately.
- To overcome the under voltage problem.
- To expand the substations in future demand.
- To improve the power factor of power system.
- To minimize the losses of power system

LOAD FLOW ANALYSIS:

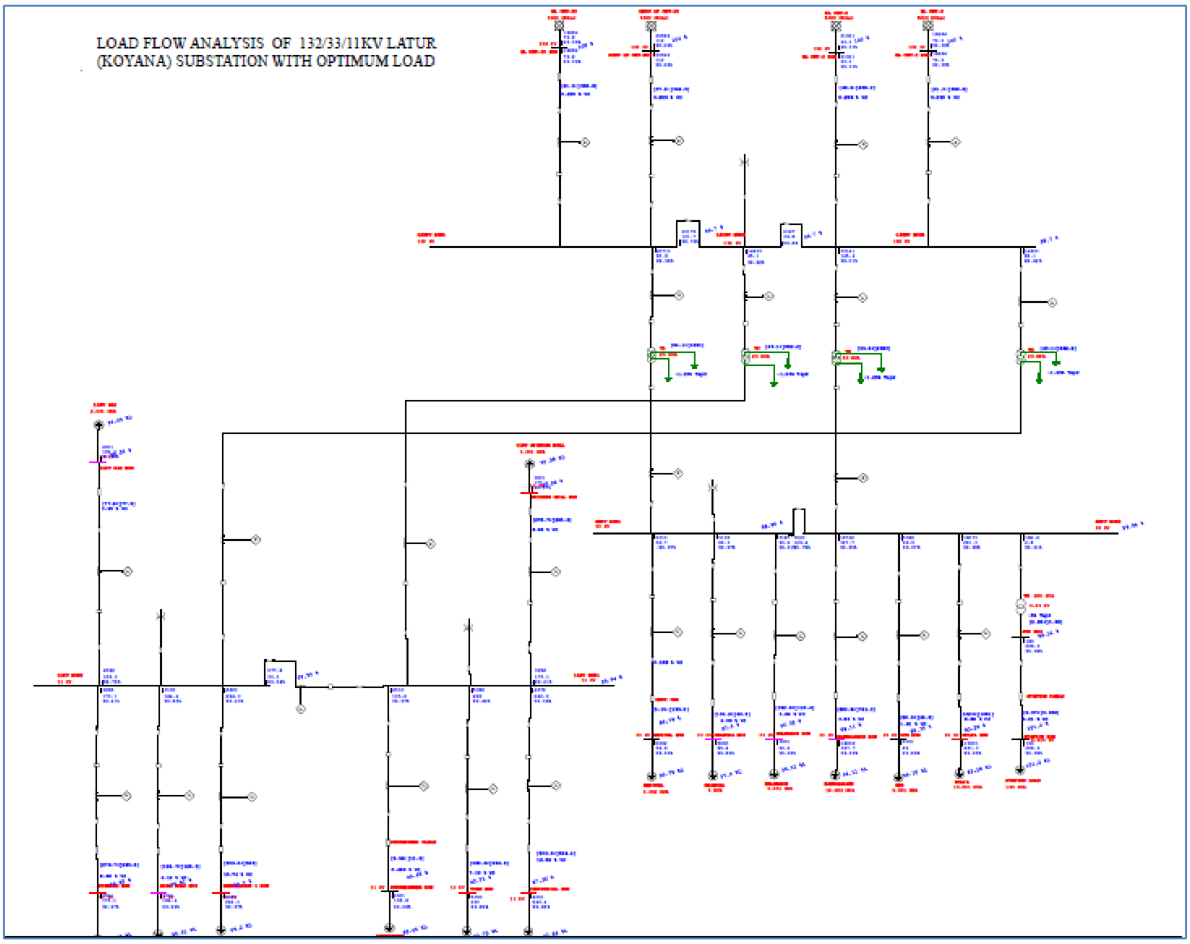
The load flow study of 132/33/11kV substation is divided in 3 categories;

The load flow studies are conducted using Newton-Raphson method and the following are the tabulated results;

a. OPTIMUM LOAD:In this category all the sources are feeding the loads, and are on.

All the bus couplers are closed

All the loads are in normal configuration



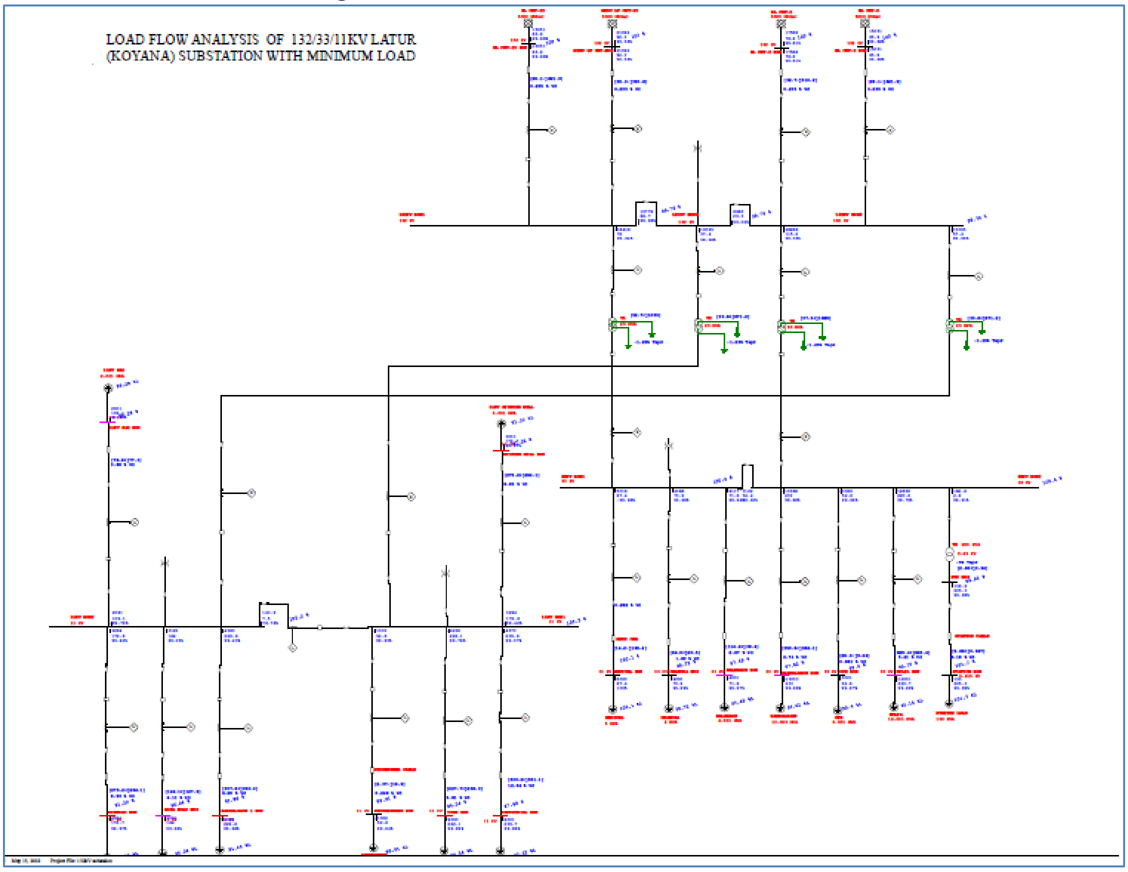
LOAD FLOW ANALYSIS OF 132/33/11KV LATUR KOYANA SUBATATION (33KV BUS) OPTIMUM LOAD							
BUS NAME	**MVA**	**MW**	**MVAR**	**% P.F**	**AMPERE**	**% LINE VOLTAGE DROP**	**LOAD BUS VOLTAGE**
MEDICAL	3.001	3	0.024	99.99	52.5	2.06	97.9
DHANORA	5	5	0.0606	99.99	87.48	3.64	96.32
NALEGAON	5	5	0.0588	99.99	87.48	3.85	96.11
BABHALGAON	18.001	18	0.188	99.99	314.9	1.61	98.35
OPH	5	5	0.0707	99.99	87.46	6.68	93.28
KOLPA	15.001	15	0.182	99.99	262.5	6.21	101.21

LOAD FLOW ANALYSIS OF 132/33/11KV LATUR KOYANA SUBSTATION (11KV BUS) OPTIMUM LOAD							
BUS NAME	**MVA**	**MW**	**MVAR**	**% P.F**	**AMPERE**	**% LINE VOLTAGE DROP**	**LOAD BUS VOLTAGE**
SINHGAD	3	3	0.0434	99.99	157.5	8.96	90.98
AUSA ROAD	3	3	0.0421	99.99	157.5	4.12	89.2
BABHALGAON	5	5	0.062	99.99	262.5	10.74	95.81
SIDDESHWAR	2	2	0.0205	99.99	105	0.48	99.45
TOWN	5	5	0.057	99.99	262.4	7.19	92.75
INDUSTRIAL	4	4	0.0428	99.99	209.9	12.58	87.36
SAI	2	2	0.032	99.99	105	3.98	96.05
SPINING MILL	3	3	0.0495	99.99	157.5	8.96	90.98

b. MINIMUM LOAD: In this category all the sources are feeding the loads, and are on.

All the bus couplers are closed

All the loads are in minimum configuration



LOAD FLOW OF 132/33/11 kV LATUR KOYANA SUBSTATION (33KV BUS) MINIMUM LOAD							
BUS NAME	**MVA**	**MW**	**MVAR**	**% P.F**	**AMPERE**	**% LINE VOLTAGE DROP**	**LOAD BUS VOLTAGE**
MEDICAL	5.078	5.077	0.0718	99.99	88.84	0	100
DHANORA	4.282	4.282	0.0606	99.99	74.92	1.63	98.72
NALEGAON	4.158	4.158	0.0588	99.99	72.75	2.87	97.49
BABHALGAON	13.272	13.271	0.188	99.99	232.2	2.74	97.62
OPH	3.499	3.498	0.0495	99.99	61.21	0.961	99.4
KOLPA	12.883	12.882	0.182	99.99	225.4	5.21	95.15

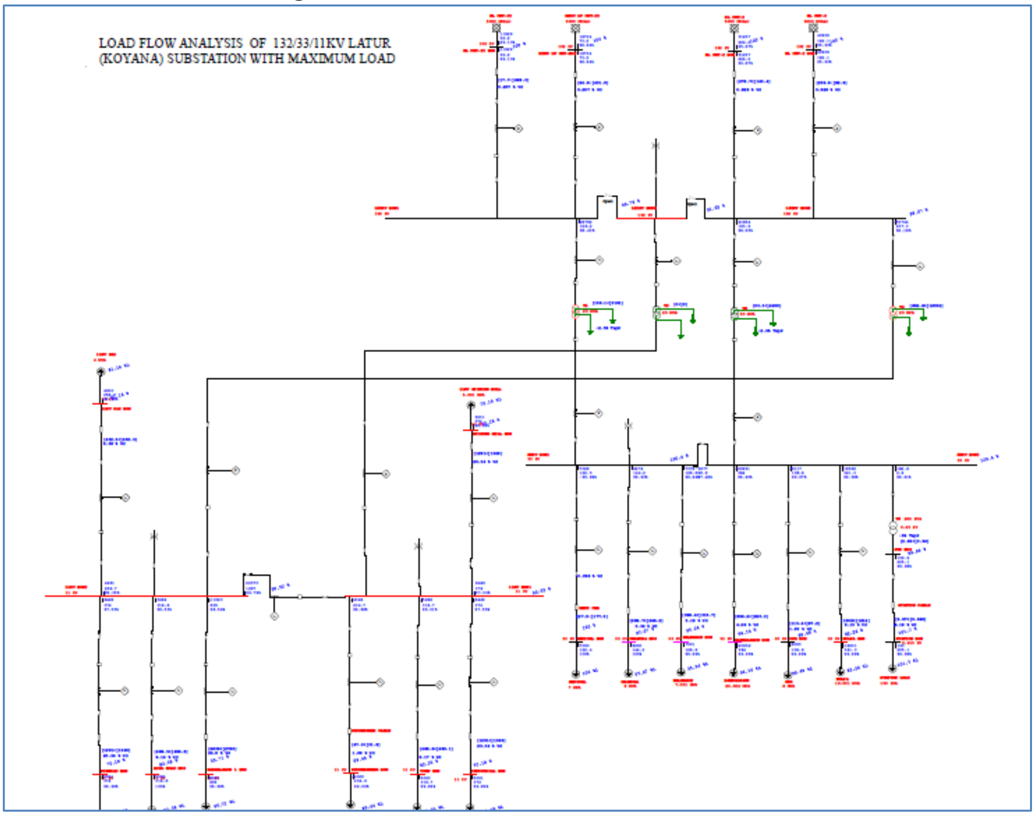
LOAD FLOW OF 132/33/11 kV LATUR KOYANA SUBSTATION (11KV BUS) MINIMUM LOAD							
BUS NAME	**MVA**	**MW**	**MVAR**	**% P.F**	**AMPERE**	**% LINE VOLTAGE DROP**	**LOAD BUS VOLTAGE**
SINHGAD	3.068	3.067	0.0434	99.99	161	8.93	91.22
AUSA ROAD	2.976	2.976	0.0421	99.99	156.2	4.11	96.04
BABHALGAON 1	4.822	4.822	0.0682	99.99	253.1	8.24	99.84
SIDDESHWAR	1.453	1.452	0.0205	99.99	76.24	0.248	99.81
TOWN	4.032	4.031	0.057	99.99	211.6	5.61	94.54
INDUSTRIAL	4.545	4.544	0.0643	99.99	238.5	12.54	87.62
SAI	2.261	2.26	0.032	99.99	118.6	3.88	96.28
SPINING MILL	3.499	3.498	0.0495	99.99	183.6	8.93	91.22

International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 11 (2018) pp. 9943-9952

c. MAXIMUM LOAD: In this category two sources are feeding the loads, and are on.

All the bus couplers are open

All the loads are in maximum configuration



LOAD FLOW OF 132/33/11 kV LATUR KOYANA SUBSTATION (33KV BUS) MAXIMUM LOAD							
BUS NAME	**MVA**	**MW**	**MVAR**	**% P.F**	**AMPERE**	**% LINE VOLTAGE DROP**	**LOAD BUS VOLTAGE**
MEDICAL	7	6.999	0.999	99.99	122.5	0	100
DHANORA	8	8	0.0606	99.99	140	3.34	97.07
NALEGAON	7	7	0.0589	99.99	122.8	5.18	95.24
BABHALGAON	20	19.999	0.283	99.99	349.9	4.28	96.14
OPH	6	6	0.0707	99.99	105	1.93	98.48
KOLPA	18	18	0.182	99.99	314.9	8.15	92.26

LOAD FLOW OF 132/33/11 kV LATUR KOYANA SUBSTATION (11KV) MAXIMUM LOAD							
BUS NAME	**MVA**	**MW**	**MVAR**	**% P.F**	**AMPERE**	**% LINE VOLTAGE DROP**	**LOAD BUS VOLTAGE**
SINHGAD	5	5	0.042	99.99	262.4	20.34	70.18
AUSA ROAD	5	5	0.0432	99.99	262.4	8.14	82.38
BABHALGAON	8	8	0.0662	99.99	419.9	24.8	65.71
SIDDESHWAR	4	4	0.0566	99.99	209.9	1.08	89.44
TOWN	5	5	0.057	99.99	262.4	8.17	82.35
INDUSTRIAL	5	5	0.0707	99.99	262.4	20.34	1.38
SAI	4	4	0.032	210	99.99	7.16	81.6
SPINING MILL	5	5	0.0707	99.99	262.4	20.34	70.18

OBSERVATIONS ON THE LOAD FLOW ANALYSIS:

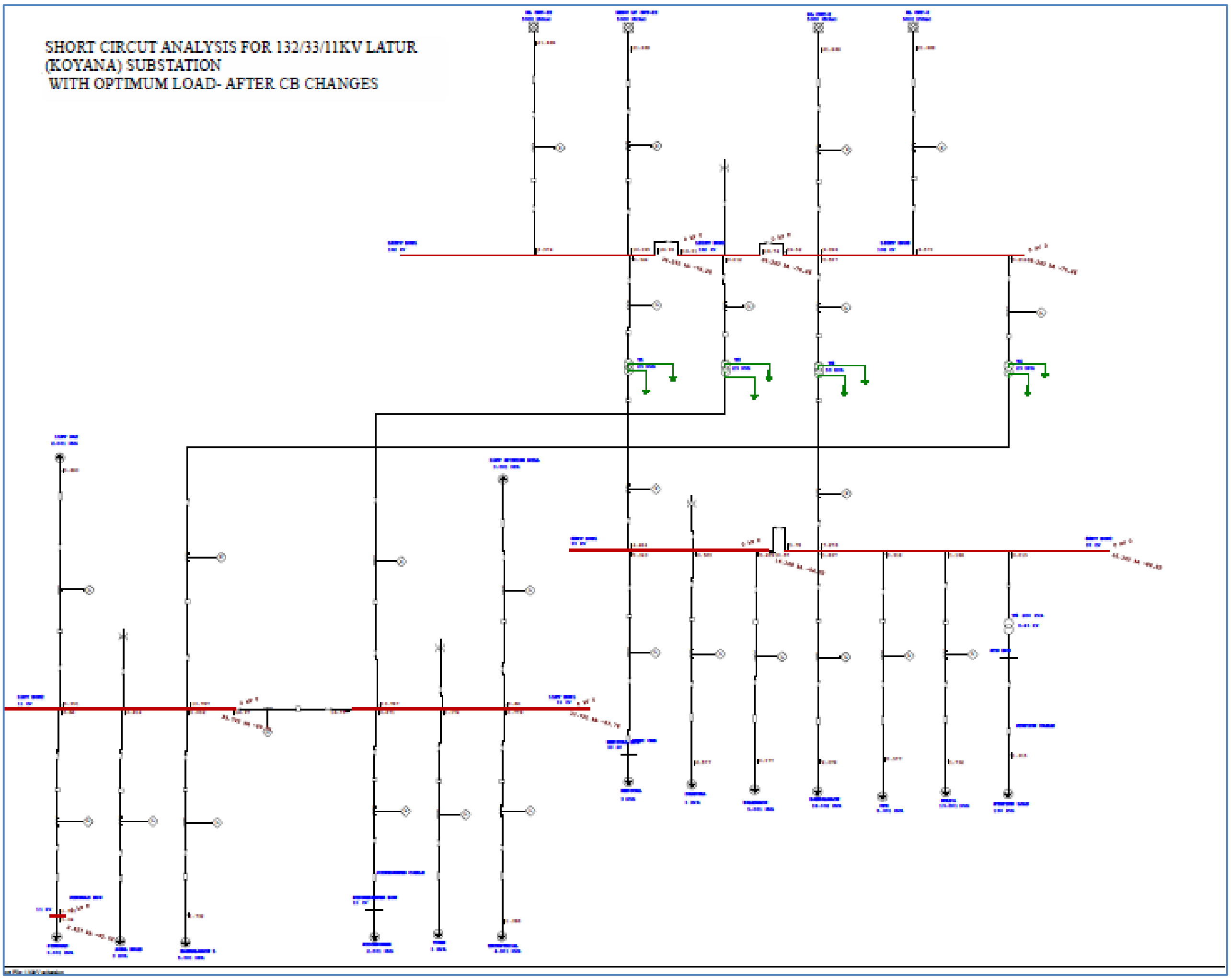
- From the above tables it is quite clear that the line drops/losses are higher than the tolerable limits. This is resulting in reduced voltages at the load buses. Hence the load is getting operated at reduced voltages, which might lead to over current and overheating of the load equipment.
- In the 'maximum load' simulation, the transformers are getting overloaded, which might lead to un-necessary tripping.
- Line voltage drops have exceeded the maximum tolerable limits.

RECOMMENDTAIONS ON THE PROBLEMS ENCOUNTERED:

- In order to limit the line voltage drops and reduced voltages, the transmission lines connected to the loads need to be upgraded.
- As far as possible, it is recommended to avoid the 'maximum load' condition. If this situation is inevitable, 'load shedding' need to be implemented.

SHORT CIRCUIT ANALYSIS AS PER IEC-60909:

IEC 60909 'Short Circuit Currents in Three Phase Systems' describes an internationally accepted method for the calculation of fault currents. The following is the short circuit analysis as per IEC-60909 conducted on ETAP.



International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 11 (2018) pp. 9943-9952

Project:	132 KV SUBSTATION	ETAP	Page:	37
Location:	LATUR	16.2.0C	Date:	15-05-2018
Contract:	STUDY		SN:	SRUJANCONS
Engineer:	BHAGYASHRI PATIL	Study Case: SCIEC	Revision:	Base
Filename:	132kV substaion		Config.:	OPTIMUM

Short-Circuit Summary Report

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
11KV BUS1	11.000	33.722	83.917	27.536	30.462	75.806	30.462	30.462	29.204	72.674	29.204	29.204	32.678	81.320	32.678	32.678
11KV BUS2	11.000	33.722	83.917	27.536	30.462	75.806	30.462	30.462	29.204	72.674	29.204	29.204	32.678	81.320	32.678	32.678
11KV SAI BUS	11.000	2.718	4.953	2.107	1.229	2.240	1.229	1.229	2.354	4.290	2.354	2.354	2.491	4.539	2.491	2.491
33KV BUS1	33.000	16.349	40.694	11.748	13.844	34.460	13.844	13.844	14.158	35.242	14.158	14.158	15.544	38.692	15.544	15.544
33KV BUS2	33.000	16.349	40.694	11.748	13.844	34.460	13.844	13.844	14.158	35.242	14.158	14.158	15.544	38.692	15.544	15.544
132KV BUS1	132.000	38.262	80.700	36.938	26.096	55.039	26.096	26.096	33.136	69.888	33.136	33.136	34.787	73.370	34.787	34.787
132KV BUS2	132.000	38.262	80.700	36.938	26.096	55.039	26.096	26.096	33.136	69.888	33.136	33.136	34.787	73.370	34.787	34.787
132KV BUS3	132.000	38.262	80.700	36.938	26.096	55.039	26.096	26.096	33.136	69.888	33.136	33.136	34.787	73.370	34.787	34.787
BABHALGAON 1 BUS	11.000	3.673	7.510	2.107	1.323	2.705	1.323	1.323	3.181	6.504	3.181	3.181	3.271	6.688	3.271	3.271
BABHALGAON BUS	33.000	6.673	13.071	4.434	3.185	6.238	3.185	3.185	5.779	11.319	5.779	5.779	6.018	11.788	6.018	6.018
DHANORA BUS	33.000	3.296	5.866	2.660	1.678	2.986	1.678	1.678	2.855	5.080	2.855	2.855	3.042	5.413	3.042	3.042
HL CKT-I BUS	132.000	31.129	74.253	30.994	28.792	68.677	28.792	28.792	26.959	64.305	26.959	26.959	30.564	72.905	30.564	30.564
HL CKT-II BUS	132.000	31.129	74.253	30.994	28.792	68.677	28.792	28.792	26.959	64.305	26.959	26.959	30.565	72.905	30.565	30.565
INDUSTRIAL BUS	11.000	2.752	5.704	1.502	0.945	1.959	0.945	0.945	2.384	4.940	2.384	2.384	2.443	5.063	2.443	2.443
KOLPA BUS	33.000	4.357	8.713	2.660	1.816	3.632	1.816	1.816	3.773	7.545	3.773	3.773	3.900	7.799	3.900	3.900
MIDC LT CKT-BUS	132.000	33.109	78.271	32.883	30.233	71.472	30.233	30.233	28.674	67.784	28.674	28.674	32.391	76.572	32.391	32.391
NALEGAON BUS	33.000	2.241	4.137	1.686	1.050	1.938	1.050	1.050	1.941	3.583	1.941	1.941	2.048	3.780	2.048	2.048
OPH BUS	33.000	3.917	6.917	3.214	2.058	3.633	2.058	2.058	3.392	5.990	3.392	3.392	3.625	6.400	3.625	3.625
RL CKT-I BUS	132.000	32.040	76.097	31.867	29.455	69.959	29.455	29.455	27.747	65.902	27.747	27.747	31.407	74.594	31.407	31.407
SINHGAD BUS	11.000	2.427	4.856	1.502	0.919	1.838	0.919	0.919	2.102	4.205	2.102	2.102	2.174	4.349	2.174	2.174
STATION BUS	0.415	3.427	5.349	2.380	2.088	3.258	2.088	2.088	2.968	4.632	2.968	2.968	3.295	5.143	3.295	3.295

All fault currents are in rms kA. Current ip is calculated using Method C.

* LLG fault current is the larger of the two faulted line currents.

DEVICE DUTY SHORT CIRCUIT ANALYSIS:

The following is the device duty analysis, which indicates the capability of the devices to handle the short circuit currents; As per the above values, it indicates that some of the devices (circuit breakers) are not capable enough to handle the short circuit currents. Hence these devices were upgraded and short circuit study was conducted again. The following is the comparison between the actual device and the proposed device to handle short circuit currents;

SHORT CKT OF 132/33/11 kV LATUR KOYANA SUBSTATION (132KV BUS)					
BUS NAME	OLD CB	ACTUAL BREAKING CAPACITY	ACTUAL FAULT CURRENT	PROPOSED CB	PROPOSED BREAKING CAPACITY (kA)
HL CKT-II	ABB	40	79.5	SIEMENS	80
MIDC CKT-II	CGL	40	79.5	SIEMENS	80
RL CKT-I	SIEMENS	40	79.5	SIEMENS	80
HL CKT-II	CGL	40	79.5	SIEMENS	80

SHORT CKT OF 132/33/11 kV LATUR KOYANA SUBSTATION (33KV BUS)					
BUS NAME	OLD CB	ACTUAL BREAKING CAPACITY	ACTUAL FAULT CURRENT	PROPOSED CB	PROPOSED BREAKING CAPACITY (kA)
MEDICAL	CGL	31.5	13.601	SIEMENS	40
DHANORA	SIEMENS	31.5	13.601	SIEMENS	40
NALEGAON	SIEMENS	31.5	13.601	SIEMENS	40
BABHALGAON	CGL	31.5	13.601	SIEMENS	40
OPH	SIEMENS	31.5	13.601	SIEMENS	40
KOLPA	CGL	31.5	13.601	SIEMENS	40

LOAD FLOW OF 132/33/11 kV LATUR KOYANA SUBSTATION (11KV BUS)					
BUS NAME	OLD CB	ACTUAL BREAKING CAPACITY	ACTUAL FAULT CURRENT	PROPOSED CB	PROPOSED BREAKING CAPACITY (kA)
SINHGAD	AREVA	25	29.888	SIEMENS	50
AUSA ROAD	AREVA	25	29.888	SIEMENS	50
BABHALGAON	AREVA	25	29.888	SIEMENS	50
SIDDESHWAR	AREVA	25	29.888	SIEMENS	50
TOWN	AREVA	25	29.888	SIEMENS	50
INDUSTRIAL	AREVA	25	29.888	SIEMENS	50
SAI	AREVA	25	29.888	SIEMENS	50
SPINING MILL	AREVA	25	29.888	SIEMENS	50

CONCLUSION

Load-flow studies are important for planning future expansion of power systems as well as in determining the best operation of existing systems. In this paper analysis of 132/33/11 kV substation using ETAP software is carried out with an approach to overcome the problem of an under voltage, line losses and voltage drops. Load Flow Studies using ETAP software is an excellent tool for system planning. A number of operating procedures can be analysed such as the loss of generator, a transmission line, a transformer or a load. This can be used to determine the optimum size and location of capacitors to surmount the problem of an under voltage. Also, they are useful in determining the system voltages under conditions of suddenly applied or disconnected loads. Load flow studies determine if system voltages remain within specified limits under various contingency conditions, and whether equipment such as transformers and conductors are overloaded. It was often used to identify the need for additionalgeneration, capacitive, or inductive VAR support, or the placement of capacitors and/or reactors to maintain system voltages within specified limits.

Short circuits studies are the most required in a power system in order to adequately size the devices, so that they are capable to handle the short circuit currents. Also these studies provide information regarding the intensity and the probable damage which can be caused in the event of the short circuit. These studies also help to adequately design the protection system. And, equally important, short circuit study is the prerequisite for Relay Co-ordination and Arc Flash Studies.

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