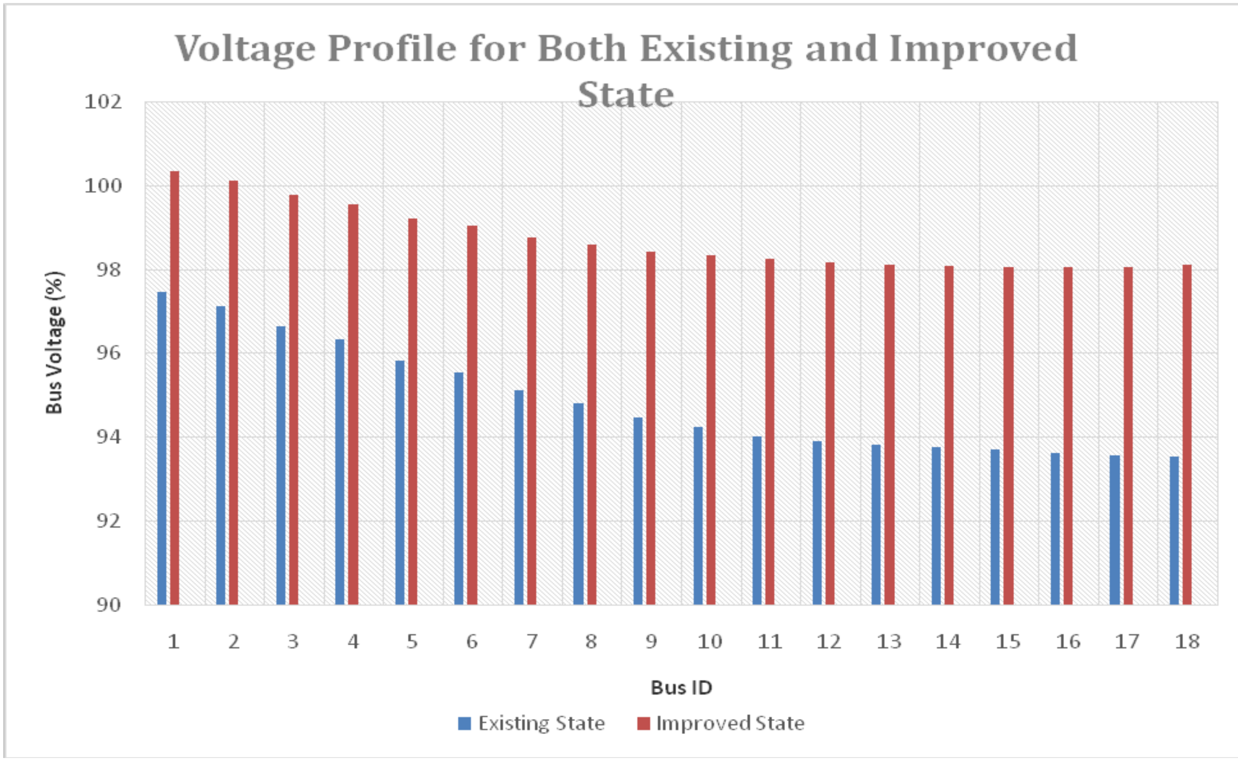


**Figure 3: Voltage Profile of Marine Base 11kV Distribution Network**

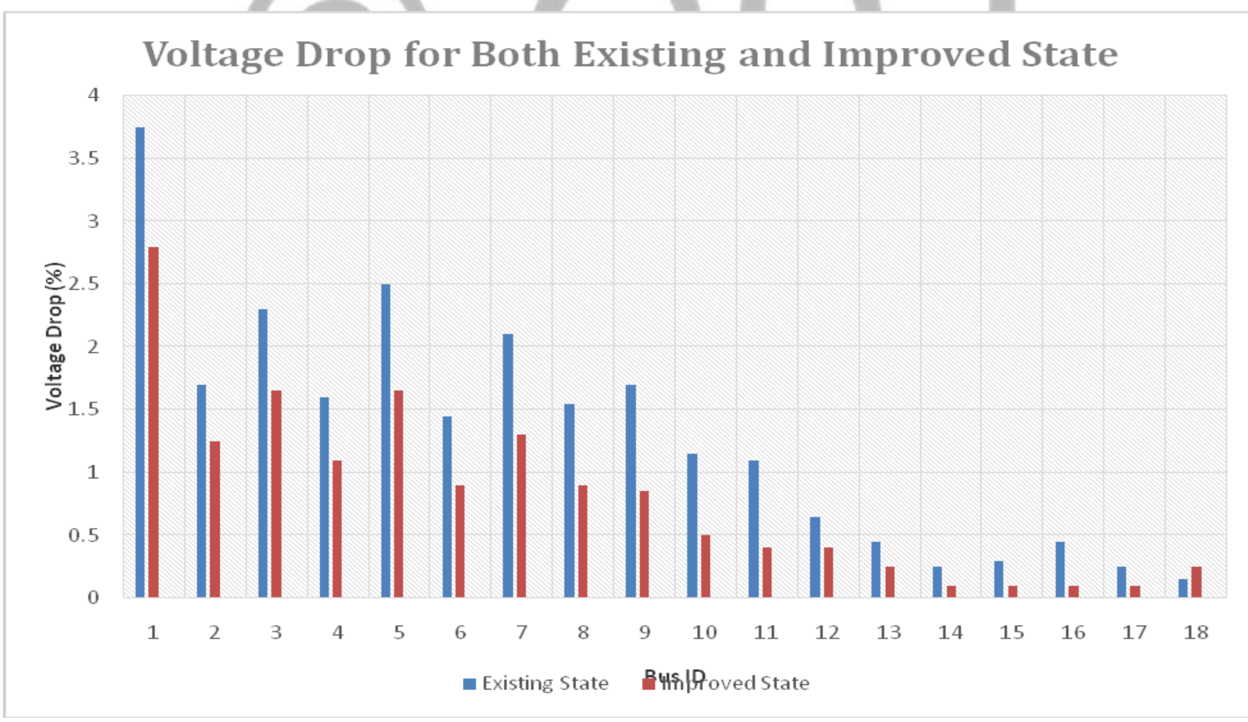


**Figure 4: Voltage Drop in Marine Base 11kV Distribution Network**

## 4.1 Result Discussion

Table 3 shows the nominal and operating values at each bus for both existing and improved state in the distribution network. A quick look at the voltage profile shows that violation of lower voltage statutory limit of 95% occurred at bus 10 (10.368kV), 11 (10.343kV), 12 (10.330kV), 13 (10.320kV), 14 (10.315kV), 15 (10.309kV), 16 (10.299kV), 17(10.294kV), and 18 (10.291kV) violated the lower voltage statutory limit of 95%. However, when static var compensation was added to the network the voltage profile improved as shown in table 4.1 bus 10 (10.368kV), 11 (10.343kV), 12 (10.330kV), 13 (10.320kV), 14 (10.315kV), 15 (10.309kV), 16 (10.299kV), 17(10.294kV), and 18 (10.291kV).

Table 4 shows the voltage drop along line section of the distribution network for both existing and improved state. For the existing state, the total voltage is 23.4% when no static var compensation is connected to the network while for the improved state, the total voltage is 14.6% when static var compensation is connected to the network. The voltage drop experienced in the distribution network is as a result of either increased in load demand by consumers, power theft or technical losses. A quick look at the table4.2 shows that the improvement in voltage at the buses is as a result of voltage drop reduction by 8.8% when static var compensation was connected to the system.

Figure3 shows the graph of voltage profile of Marine Base 11kV distribution network for both existing and improved state. The blue colour shows the existing state when no static var compensation is connected to the network. Similarly, the brown colours shows the improved state when static var compensation is connected to the network. A quick look at the figure 3 shows that the voltage profile of the network improved significantly when static var compensation was connected to the system.

Figure 4 shows the graph of voltage drop in the distribution system for both existing and improved network state. The voltage drop experienced in the distribution network is as a result of either increased in load demand by consumers on the network, power theft or technical losses. The blue color shows the existing state when no static VAR compensation is connected to the network. Buses with highest voltage drop are bus 1, bus 5, bus 3 and bus 7. Similarly, the brown color shows the improved state when static VAR compensation is connected to the network. A cursory look at the profile in figure 4 shows that there was significant reduction in voltage drop when static var compensation was connected to the network. Buses with lowest voltage drop are bus 15, bus 13, bus 18 and bus 16 respectively.

## 5.0 Conclusion

The existing Marine base distribution system was examined and modeled in Electrical Transient Analyzer Program (ETAP12.6) software. This research work strongly suggests the need for increasing the number of transformers at the Marine – Base Substation to enhance efficient and reliable power supply in the distribution network. Evidently, strategies are on the view to incorporate reactive power compensation devices, fast device, are suggested on the view to incorporate reactive power compensation device, fast devices, capacitors and capacitor bank.

### 5.1 Recommendations

The following recommendations are made which includes;

i. Provision of additional capacity for the marine-base sub-station to take care of the over stressed
ii. In co-operation of reactive power component devices, fact devices capacitor bank, thyristor in other to adjust voltage profile
iii. Need for expanding distribution network at Marine base

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