Department of Infrastructure Electrical

Vacation Work/Experientail training

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1 INTRODUCTION

Passenger railway agency of South Africa (Prasa) is a state-owned enterprise which operates in the South African Transportation industry. One of the Prasa subsidiaries is the Prasa Rail which operates the Metrorail in 3 regions in the country, Gauteng, Kwa-Zulu Natal and Western Cape Region. The Western Cape region operates with the following engineering divisions; Infrastructure electrical (TestLab, Telecontrol, OHTE, maintenance), Signalling, Telecommunications, Rolling stock, Per-way.

Five weeks of exposure training was carried out within the infrastructure electrical department and this report documents the activities and duties performed during this period.

2 INFRA ELECTRICAL AND TEST LAB

The aim of the department is to keep the network live at all times (with low downtime as much as possible), thus ensuring that the trains and signalling equipment gets power and operate without disruptions - Availability and Reliability.

The department is divided into teams to narrow down the scope of work for each specific section. The Maintenance team performs routine and corrective maintenance on the network and the TestLab team performs routine tests on network equipment and assist with equipment states during faults and installations of new (or replaced) equipment.

3 WORK PROCEDURES AND JOBS EXPOSED TO

Working with live high voltage can be very dangerous, hence needs alertness and knowledge of the ”Not to Do’s”, so I undertook a safety induction as the first order of business.
I have learned the Prasa’s 33 kV AC and 11 kV AC networks. Together with the Test lab team, we performed metering at the Eskom power feeding point at the Substations main. We looked at the actual voltage, load current and power factor We also looked at and analysed the harmonics in the system. We were using a power meter from CPUT and had a visiting Dr (power quality analysis specialist) from CPUT also.

I have learned of the 33 kV to 3 kV DC substations (DC sub) and 11 kV substations. I was exposed to the substation equipment from incomer isolators to the output (DC) high-speed circuit breakers. We tested the substations equipment in Diep River (which was out of service). We tested CTs, relay, Primary circuit breaker (PCB), AC earth fault protection, the transformer, and output voltage meter. We configured the relay to give correct trip flag when tripping the PCB.

We had one of the underground cables vandalised in the network. We performed a cable fault finding. We measured the insulation resistance on the phases and found the fault on phase B and the injected square pulses into the line and had a team listen for a loud noise/blast along where the cable is buried. The fault was found, fixed and then the whole line was tested again and then put back into service after successful tests.
I joined the Maintenance team for two weeks. We performed annual routine maintenance on the high-speed circuit breakers. We noted the trip counter and recalibrated when necessary. We performed normal monthly routine maintenance on the high-speed circuit breakers and we were checking for faulty equipment like rusty arc runners and dusty arc shooters.

4 KEEP IT UP TRAITS

Though Prasa is not doing undeniably well operationally due to complex reasons beyond technical/engineering itself, there are good things to be recognised.

The work relationship amongst team's members in the Infra Electrical and their respective members are great and conducive for good work outcomes. The green area meetings every morning are a great source of employee's personal checkpoint. Work procedures (Job cards/plans) and safety procedures are followed well. There are good interteam's relationships and willingness to help each other beyond the allocated work scope.
The Prasa and CPUT partnership working to analyse the power quality from Eskom feeding point is appreciable.

5 RECOMMENDATION/IMPROVEMENTS

These are but a few suggestions for operational improvements in the Infra Electrical.

The Test Lab has aged and is packed. It is suggested that the Lab gets an upgrade; made more spacious and the older equipment (especially equipment, e.g. Relays from sites) be phased out.
Just as the network equipment has planned routine maintenance, the Test Lab testing tools should have planned maintenance to ensure their testing integrity. There should be another vehicle in Test Lab. This should be able to accommodate more people or the current one can be upgraded to have more seats.
Prasa should leverage more on the current relationship with CPUT and also form more relationships with other institutions. Institutions have the privilege of owning the more

recent and advanced technical/equipment and Prasa has great opportunities where the institutions can use their resources and apply their knowledge.

As much as the work relationships are great and a good thing to look forward to when preparing for work, there should be a designed growth plan for Prasa employees outside work promotions. It is believed that training outside the technical scope like, how to further your studies and skills while working and also personal financial management/investments/planning could add a great value to employee happiness and hence to their work efficiency.

And to the Prasa's biggest of challenges, which is believed to be a costly unplanned expenditure - Vandalism (substations and lines/cables), it is suggested that Prasa should form and dedicate a team people to address this issue. Firstly, the cost of the vandalism on the company should be investigated and determined. The team should be made of very diverse individuals from different departments and career backgrounds and also from different levels of positions. This should be a joint effort from all departments (especially Engineering, assets management and protection). An outside perspective would also be of great value.

6 ACKNOWLEDGEMENTS

I would like to thank Mrs Awodele for initiating this opportunity; and Mr Bani and Prasa HR for honouring our request with this huge opportunity. I would like to thank the Test Lab senior technicians for their assistance and patience when sharing their knowledge and experience on the Prasa Electrical Infrastructure. I would like to thank all the managers, substation colleagues, trainees and everyone else for their warm welcome and good cooperation.

My greatest wish is that Prasa and UCT work together to award other students this opportunity during holidays to interact with real-world (out of the class) engineering.

APPENDIX

Figure 1: Counting trip counts during annual routine maintenance

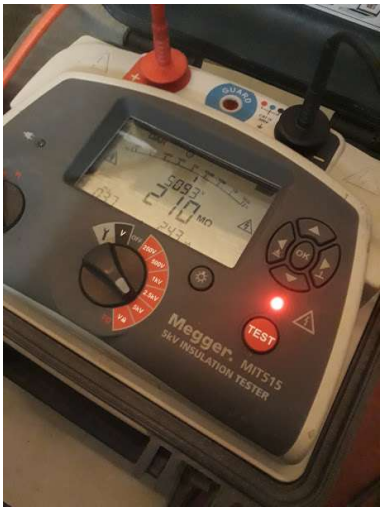

Figure 2: Insulation resistance test.

Figure 3: Cable fault repair.

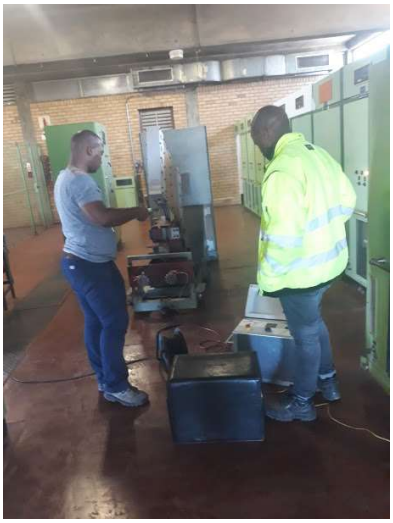

Figure 4: HSCB high pot.