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# Synopsis

# Introduction

I have completed 6 weeks of my vacation work at the Kwa-Zulu Natal branch of Tolplan Operations Ltd (herein after referred to as TPO), situated in Village Park, Kloof. Here I was an assistant to the Resident Electronic Engineer, Mr Seekandar Mahomed.

TPO is a consulting firm that specialises in Toll operations. South African National Road Agency Limited (herein referred to as SANRAL) is TPO’s main client. SANRAL contracts companies such as TPO to mediate the development, operations and maintenance of these Toll systems. TPO ensures that the toll systems owned by SANRAL are running smoothly and report back and forth between their client (SANRAL) and their many contractors (Tolcon, Intertoll, SceniVision, etc.). ***Appendix A*** gives a graphical representations of the relationship amongst the companies and their duties. Tolplan has been responsible for the following services at more than 30 mainline and 40 ramp toll plazas in South Africa, Hungary, Greece, Malaysia, Brazil, Mozambique, Swaziland and New Zealand.

TPO’s core members consist of one managing director, four directors, five technical directors and eight associates. Their qualifications range from civil, electronic, electrical engineering and transportation to project and business management. Due to the nature of work done the company has a fairly linear structure between directors and associates.

Mr Seekandar Mahomed, the resident engineer and an associate, is in charge of the tolls on the N2 north route up to Mvoti, N2 south route and the Mariannhill toll plaza.

Toll Systems, surprisingly, rely heavily on electronic systems to carry out processes, therefore TPO requires electronic engineers to manage this sector. The duties of the resident electronic engineer begins with converting SANRAL’s requirements into high-level specifications for the tender documents. Thereafter he/she assess tenders received with a team in order to decide the tender awardee. Once awarded it becomes the engineer’s job to approve the proposed system design, assess its restrictions. When implementation begins it is the resident engineer’s duty to award milestones (such as factor acceptance test, provisional compliance, functional compliance, etc) when they are achieved. These systems implemented are now all property of SANRAL therefore it becomes TPO’s (the resident engineer’s) responsibility to inspect and report on the condition and functionality of these systems. Finally at the end of the contract period a comprehensive asset register is to be complied for the client in preparation for the next contractor and hence the cycle repeats from the beginning.

While at Tolplan Operations I was fortunate to be exposed to infrastructure that is generally unnoticed, this was an eye opener as to the vast amount of unique electronic systems there are. Some of the electronic systems I encounter are the Automated Vehicle Classification (AVC) controller which uses treadle sensors to determine the classification of a vehicle in terms of the number of axles. The Toll Collector Computer (TCC) used for classification of vehicles by the toll collector. As well as Intelligent Transport System (ITS) which marries multiple sectors such as transportation engineering, financial analysis, electronic engineering and information technology to provide a comprehensive free flowing toll system. ***Appendix B*** is a block diagram of how the system operates.

Working as an assistant to a consulting engineer has made me realise that the scope of work done by an engineer in industry does not confine to the qualification that has been attained. As an engineer you have to be able to quickly adapt to fields outside your specific degree and have a holistic approach to each task. Engineers must also be able to adapt to working with financial and managerial situations.

# Outline of work

I had to first familiarize myself with the toll industry, how it operates and the different systems and measures involved through an orientation and by reading the tender documents.

I then went on to compile eight-monthly/yearly “Toll operations and maintenance” reports for the N2 North, N2 South and Mariannhill Toll Plazas. I was responsible for documenting events and their progress at each of the toll plazas for the client (South African National Road Agency Ltd). This helped me understand the practical workings of the terminologies and terms and conditions I read in the tender documents.

Due to logistical reasons all of my duties out of office duties were at the Mariannhill Toll Plaza on the N3 route in Pinetown.

This toll consists of eighteen lanes. There are eight South Bound, eight North Bound and two emergency lanes. Each direction has a dedicated eTag lane known as the “Shesha” Lane and an automated accepts cards only. The rest are manual lanes were a toll operator collects payment.

The Mariannhill contract was awarded to the Tolcon Group. Their duties includes operation of toll plaza facilities and comprises traffic management - including all systems and maintenance of the plaza building and lane area. In addition, tolling design, supply, installation and maintenance is included.

Scenivision (Pty) Ltd is a South African based toll system designer, supplier, integrator & maintainer. Scenivision’s core business is developing systems tailored to the needs of each toll operation as well as maintaining them. They are a sub company of Tolcon.

The operation at the toll plaza is to collect payment as accurately as possible. When a vehicle drives into a manual lane the toll operator classifies the vehicle based on the number of axles and wheels as per the government gazette (Apendx it). The collector selects the class on the Toll Collector Computer (TCC). This is specially designed computer that’s allows for classification of a vehicle, processes the payment, controls traffic light for the land and boom gate which also comprises of a height sensor. While this takes place a system specially designed by Scenivision to determine the class of a vehicle is in operation name Automated Vehicle Classification (AVC). The AVC uses an entry loop, axle detector, double wheel detector and exit loop to identify the class. The axle detector uses a horizontal treadle sensors and counts each axle as a pulse. Double wheel detectors make use of two treadle sensors placed diagonally in a “V” shape. The AVC is a security measure to prevent fraud. Along with the AVC cameras are placed in each lane. All this information is then transferred to the “Back Office” which is in the control room of the main building and later transferted to the Intelligent Transport System (ITS).

The Toll plaza and assets are divided into subsections. “Civil, Build, Structure”, “Computer Equipment (Hardware)”,”Computer Equipment (Software)” and ”Electrical and Mechanical”. These are further split into sub sections “Lane” and “Building” except for “Electrical and Mechanical” which is general for the whole plaza.

I was given the responsibility of inspecting the condition of all the assets that fell under the “Computer Equipment (Hardware)”, “Computer Equipment (Software)” and “Electrical and Mechanical” Categories. The results of my inspection was documented and then sent to the client and operator.

The contract period at Mariannhill had been completed and therefore a complete asset register had to be complied for the client. It became my responsibility to verify the assets at the plaza and snag any issues. From this an updated asset register was compiled and handed to the client and operator.

# Details of work

## Orientation

For me to have been able to carry out any of my duties at Tolplan Operations Ltd, I first needed to have grasped a great understanding of the industry, the systems in place and the duties involved in my position. As part of my orientation by Mr S Mahomed I had to familiarize myself with the duties of the company and their relationship with client and operators. (Check spelling below) [Appendix the hierarchy diagram]

The second phase of my orientation consisted of understanding the content of the tender documents. These documents contained details of each system and their operations. I was also able to understand the different milestones [appendix] and their importance. The contract documents gave me a clearer idea of my duties and responsibilities at the company.

## Eight-Monthly/Yearly Reports

The purpose of this document is to summarise all the relevant information and statistics regarding a contract for a specified period in terms of the relevant contract documentation and to make recommendations to the South African National Roads Agency SOC Limited, where necessary. The duty of the resident engineer to complete the “DEVELOPMENT AND MAINTENANCE OF TOLL SYSTEMS” and “MAINTENANCE OF E&M AND ASSETS” sections of the report became my responsibility. Representatives from the client (SANRAL), the contractors (Tolcon, SceniVision) and the Operations Manager (Tolcon operation) attend a bi-monthly Contract meeting. Here the happenings of the Toll plaza’s, the status of specific operations and any concerns are discussed. Due to the nature and seriousness of these meetings I was not allowed to attend them. Also I was not present at the company from the beginning of any of these projects and did not know the current status of each project hence compiling these reports efficiently was a challenge. To overcome this I meticulously sifted through previous minutes of meetings to catch up on each project. After following the thread of each issues, concern and project I was finally able to summarize the actions over the required time frame. Improved report writing skills

### OPERATIONS AND MAINTENANCE OF THE N3 MARIANNHILL TOLL PLAZA

In 2013 a new toll system was installed and whilst doing this report I learned about the difference stages of design and implementation [Appendix]. 2014 and 2015 reports were based on the resolving of minor issues such as Queue Length Camera remote access, communication and staff training. Electronic Toll Collector (ETC) or better known as eToll is a technologically exciting project by SANRAL. With this system commuters do not need to stop make a payment but rather purchase an eTag and load it with money. When an eTag is detected by the beacon, the boom picks up automatically and deducts the amount from the users account without having the user to stop. This system was installed and configured in 2015 and were rolled out. This toll plaza includes two pioneering lanes known as the “Shesha” lane which catered for eTag users only. Due to the “shesha” lanes properties specialised Automatic Vehicle Calssification controllers were used. By the end of 2015 this system was implemented but with minor snags.

### OPERATIONS AND MAINTENANCE OF THE N2 SOUTH TOLL PLAZA

This toll plaza had mainly maintenance issues. The proposed AVC loops had a greater impedance which altered the output of the system. The contractor also did not update the AVC treadles as stipulated in the contract documents. Many other minor snags were discovered and discussed and resolved during the three year period between 2013 to 2015.

### OPERATIONS AND MAINTENANCE OF THE N2 NORTH TOLL PLAZA

The Mtunzini, Mvoti and Tongaat toll plaza’s are combined into one report due to the smaller size of these plaza’s. Handling a lower amount of traffic results in lower maintenance issues but still a few minor snags were handled.

## General maintenance inspection

As part of Tolplan’s contractual duties to ensure the up keep of SANRAL’s assests genral maintenance inspections are carried out bi-monthly. At the end of the inspection a report is drawn up with the condition of the assets and any snags that needs attention.

I was tasked the duty to carry out the inspection and to draw up a report for Mariannhill Toll Plaza on the N3 Route. I was made aware of what exactly I was looking for with each item and the rules of the inspection. A safety induction was conducted by the safety marshal of the plaza and then we were accompanied by the electrical and mechanical technician for the plaza Mr Prinolan Achayya. It was of utmost importance that the technician handles all the equipment and that I just visually inspect. This is so that Tolplan operations cannot be held responsible for any damage caused during this process.

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| Item | Description | Issues of concern |
| Toll Booth and Canopy | Large covering over the area and the office for the toll collector. | The canopy had to be secure free of rust and intact. |
| Road Surface | Area in which the treadle sensors lie. | The road had to be free of oil spills, pot holes and treadle sensor coverings had to be completely grouted and free of gaps. |
| New Jersey Barriers | Concrete barrier protecting around the toll booth. | Barrier had to be neat, painted and have no cracks. |
| Bull nose | Pure concrete structure in front of the toll boot to protect it from a head on collision. | The structure had to be solid, neat, painted and contain no cracks. |
| Impact Attenuators Structure | Dense lead blocks placed before the bull nose to slow a vehicle down. | The attenuators had to be straight and in line of each other. |
| Lighting and Air-conditioning | Cooling and lighting to toll booth. | Lighting and Aircon had to be secure and fully functional. |
| Toll System Equipment Functionality | Traffic signals, overhead lane signs, toll collector computer. | System components had to be of a good condition and fully functional. |

## Asset and Register

The tender period at Mariannhill was approaching its end so the concluding duties of Tolplan Operations had begun. My responsibilities towards this was to update an Asset Register. The asset register is an important document in terms of safe guarding the Client, SANRAL, against loss. All assets purchased by the contractor, Tolcon/SceniVision, on behalf of the Client, SANRAL, are listed here. This is to ensure the property of SANRAL is left at the plaza and not taken with the contractor. Later this register is handed to the new contractor to inform them of SANRAL’s current assets for security purposes.

The inspection took place over two days. The first day I inspected and accounted for the electronic and computer equipment in the lanes and control building. I was accompanied by my mentor Mr S Mahomed who guided me through, the Electronic technician Mr S Ramkissoon of SceniVision, a fellow student Mr K Naidoo who was working with SecniVision and Mr P.Iyer of Tolcon.

At each lane the Electronic technician had to open the Automatic Vehicle Callsification control box and Toll Collector Computer box. I then had to assess the condition inside and that all the components are present. I then had to assess and confirm presence of the Fibre Optic treadle Sensor, Optical Height Sensor, Exit traffic Barrier (Boom gate) , User Fare Display, Overhead display sign, point of sale unit, Receipt printer, proximity switch , siren , traffic light signal, ETC beacon and optical light curtain.

We progressed over to the computer equipment in the control building. Here the computer systems of each room was inspected in search of items on the register and new items.

The second day was dedicated to the electrical and mechanical assets. The toll plaza manager Mrs M Ullbricht and Mr Wiseman had accompanied. Items assessed in the control building included ups plugs, standard plugs, switches, Air con units, Intercoms, DB’s, Alarm panels, generators , fuel tanks , UPS’s systems, water pumps, fresh air supply unit. Thereafter I had to inspect each lane’s man hole. Inside the man hole I had to assess the condition of the wiring and check for rusting and leaks.

I then began to compile the Asset register. In this process I removed items not found, added new items and the commented on condition. Photographs of items of a poor condition were taken by me and these had to be mapped to the items in the register.

# Conclusion

My time at Tolplan Operations (Pty) gave me a great insight into the electronic/computer engineering sector of SANRAL. This is vital to me as I am a SANRAL bursary student and therefore I am likely to work in such a department after graduation.

During the work period I realized that the work of an engineer goes far beyond the degree attained and the learning process never stops.

Whilst compiling the many reports I gained great experience in report writing. This experience will not only assist me whilst doing design and assignments at university but also after at the work place as reporting is an integral part of an engineer’s job. My Microsoft Office Word and Excel skills have greatly improved through this process.

Being at an office I learnt basic office etiquette and staff communication. I was able to communicate with people of a wide spectrum on a professional level and pass suggestions and comments in a respectable manner.

**Appendix A –** Relationship among companies and duties

Tolling is an essential tool used by South African National Road Agency Ltd (SANRAL) to generate funds. These funds allows for maintaining and building of infrastructure on South African roads efficiently. SANRAL contracts companies such as Tolplan Operations Ltd (TPO) to mediate the development, operations and maintenance of these Toll systems. Tolplan has been responsible for the following services at more than 30 mainline and 40 ramp toll plazas in South Africa, Hungary, Greece, Malaysia, Brazil, Mozambique, Swaziland and New Zealand.

Tolplans duties include:

* Drawing up high level System requirements and tender documents that the Operator needs to fulfil.
* Tender documents and tender Adjudication
* Evaluating and testing low level designs solutions for the required system.
* Evaluating and testing the implantation of the system.
* Monitoring the operation of the toll plaza and other assets of the client(SANRAL)
* Awarding of milestone and operational fees as well as penalties when conditions of the tender documents have been violated.
* System and forensic audits
* Overall project management