

INDUSTRIAL TRAINING REPORT I

TRAINING ORGANIZATION : SRI LANKA TELECOM PLC
PERIOD OF TRAINING : FROM 30/10/2017 TO 05/01/2018
**FIELD OF SPECIALIZATION : ELECTRICAL AND ELECTRONIC
ENGINEERING**

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E/14/279

ACKNOWLEDGEMENTS

During my internship at Sri Lanka Telecom (PLC) regional office located in Bandarawela, I had an excellent opportunity to improve my technical knowledge, interpersonal skills and teamwork skills.

I want to thank the staff at Sri Lanka Telecom (PLC) Bandarawela regional office, especially Mr. Manjula Tillakaratne, Out-plant maintenance engineer and Eng. D.G Chamila Sampath, Network engineer at Bandarawela regional office for their significant contribution towards improving my knowledge on the technical aspects during my training period. I have finished this training period successfully with their valuable guidance and teachings. I would also like to thank the technical staff at SLT Bandarawela for guiding me with the technical aspects related to their duties.

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LIST OF ABBREVIATIONS

ADSL	Asymmetric Digital Subscriber Line
CEB	Ceylon Electricity Board
CEO	Chief Executive Officer
DGM	District General Manager
DP	Distribution Point
DSLAM	Digital Subscriber Line Access Multiplexer
FDP	Fiber Distribution Point
FTC	Fiber Termination Cabinet
FTTH	Fiber to The Home
HCS	Human Capital Solutions
LTE	Long Term Evolution
MDF	Main Distribution Frame
MSAG	Multi Service Access Gateway
MSAN	Multi-Service Access Node
MSU	Main Switching Unit
NGN	Next Generation Network
ODF	Optical Distribution Frame
OLT	Optical Line Termination
OPMC	Out-plant Maintenance Centre
P2P	Point to Point
PE	Provider Edge
PLC	Public Limited Company
PON	Passive Optical Network
POTS	Plain Old Telephone Service
PSTN	Public Switched Telephone Network
PVC	Polyvinyl Chloride
RF	Radio Frequency
RSU	Remote Switch Unit
RTO	Regional Telecom Office
SEAE	Senior Executive Assistant Engineer
SDH	Synchronous Digital Hierarchy
SLT	Sri Lanka Telecom
TO	Technical Officer
TTO	Training Technical Officer

UG

Underground

WFM

Work Force Monitor

Chapter 1

INTRODUCTION

1.1 TRAINING SESSION

During this training session, I was allocated to Sri Lanka Telecom (PLC) regional office-Bandarawela throughout the period from 30/10/2017 to 06/01/2018. In this training session, I was assigned with aiding and performing tasks associated with the network and transmission division, outside plant maintenance, and customer service. The functions associated to me were mainly related to provide PSTN, internet and data services to the SLT customers.

1.2 INTRODUCTION TO TRAINING ORGANIZATION

Sri Lanka Telecom (PLC) is a primary telecommunication service provider in Sri Lanka, which is also responsible for maintaining the Sri Lanka Backbone Network (SLBN). SLT provides domestic and corporate services ranging from fixed, wireless telephone services along with Internet access and related IT services to its consumers. SLT maintains the following vision and mission as the cooperate plan.

VISION: All Sri Lankans seamlessly connected with world-class information, communication and entertainment services

MISSION: Your trusted and proven partner for innovative and exciting communication experiences delivered with passion, quality and commitment.

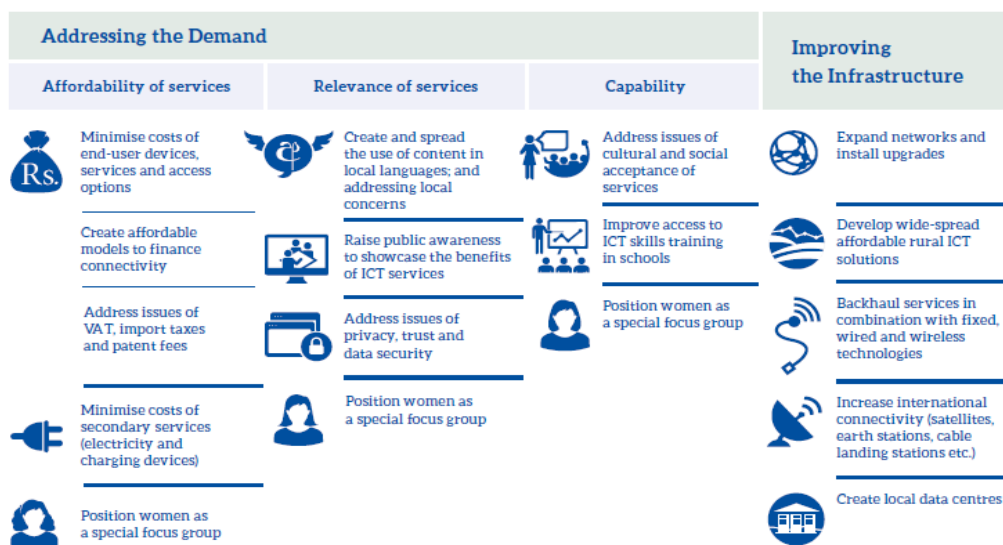


Figure 1.1 Targets of Sri Lanka Telecom

The company targets are as shown in Figure 1.1, with the primary focus of addressing the demand and improving existing network infrastructure. The Sri Lanka Telecom (PLC) also consists of multiple subsidiaries, as shown in Figure 1.3.

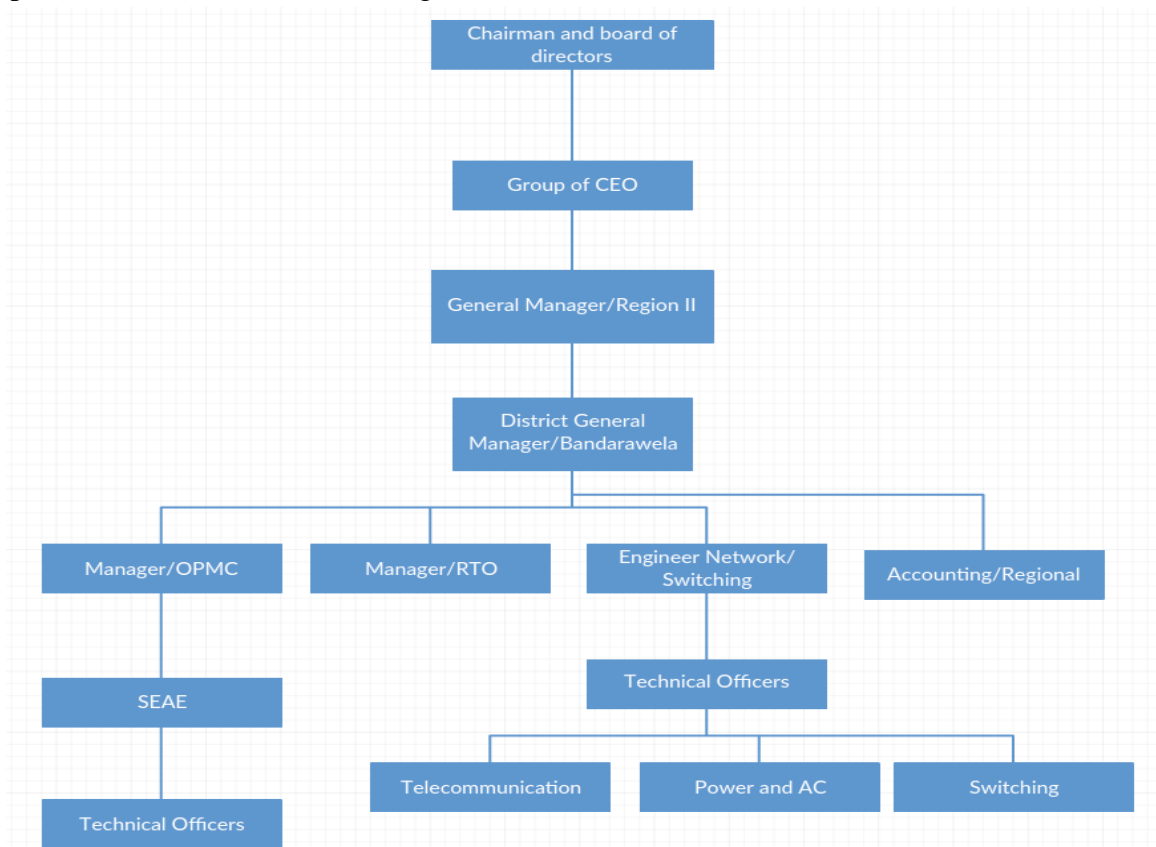


Figure 1.2 Company hierarchy for SLT region office Bandarawela

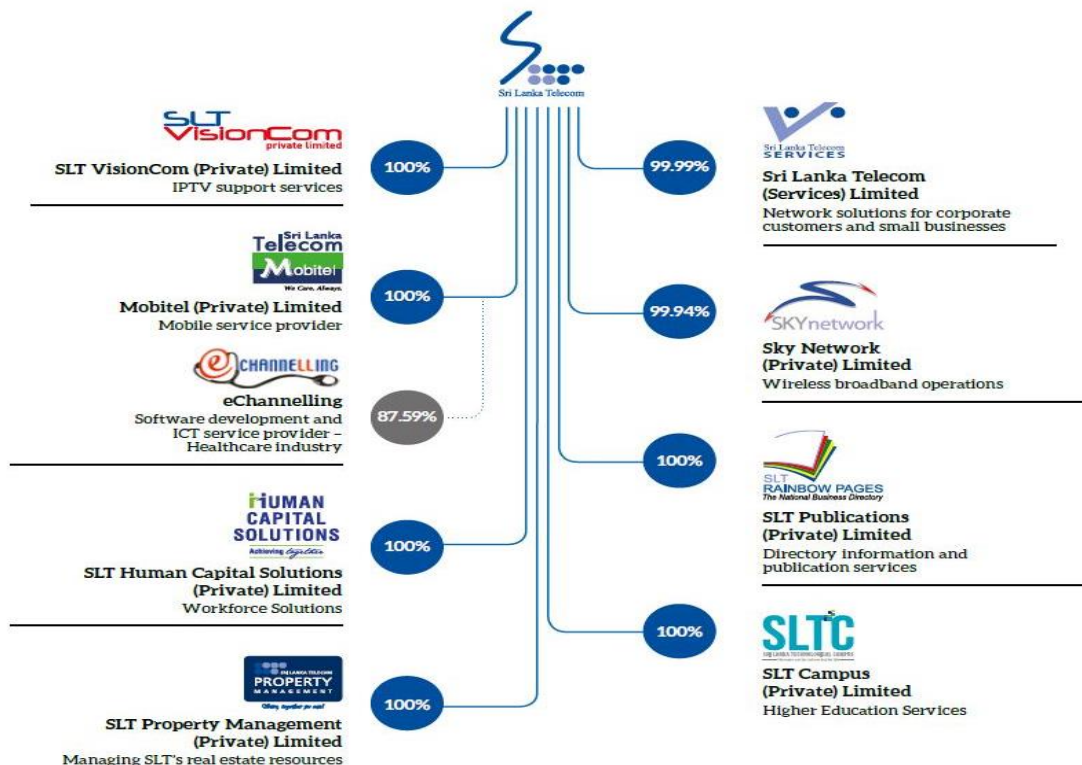


Figure 1.3 SLT subsidiaries

Sri Lanka telecom consists of multiple custom regions that allow them to manage resources and equipment efficiently. SLT Bandarawela office belongs to Region II, and the company hierarchy of Bandarawela regional office is shown in figure 1.2.

Table 1.1 Working hours for the SLT employees

Engineers	8.30AM-4.30PM (8 hours)
Technicians	8.30AM-5.00PM
Drivers	8.30AM-5.30PM
Accountants	9.00AM-4.00PM

Working hours for the employees of SLT depend upon the type of employment they have as shown in Table 1.1. The working staff of the Bandarawela SLT office belongs to multiple companies such as,

- Human Capital Solutions
- SLT
- Outsource
 - Donham Telecom (PVT) Ltd
 - Sierra Construction (PVT) Limited
 - U.S.S Services (PVT) Ltd
- Dealers (Marketing)

The Sri Lanka Telecom also consists of a training division that allows its employees to undergo further training as per their request. These training are provided with paid leaves. Training centers available in Moratuwa, Peradeniya, Galle and Walisara. For Sri Lanka Telecom, the mode of recruitment usually takes place by methods such as,

- By newspaper advertisements
- By in person CV drop
- Via online CV submission (For HCS)

The employees of Network and OPMC division can work overtime for hour limitation, as shown in Table 1.2. Approval of the overtime is processed through an online system called ERP for SLT employees while the HCS employees use a system called EM.

Table 1.2 Allowable overtime allocation for SLT Workforce

Division	Maximum allowable overtime
Network division	100>hours
OPMC	60>hours

For each year, the leave entitlements are 21 days for the SLT employees. For probationary staff, this number is much less. The number of leaves available increases with the job title and the number of years worked as an SLT employee.

The management structure also consists of objectives and strategies that allow them to improve their efficiency for the future development of the company, as shown in Table 1.3.

Table 1.3 Objectives and Strategies for the future improvement of SLT

Objectives	Strategies
Improve internal efficiencies	Develop and streamlined the Centres of Excellence (CoE) for planning, sales, network development, regional operations and maintenance and logistics Strengthening Group synergy
Position SLT Group as a digital lifestyle provider and enhance the customer experience	Offer innovative ICT and smart lifestyle solutions to all; anytime and anywhere
Be ahead of the technological advances and improve network and technology capabilities to meet the future national demand for data, quality and speed	Accelerate the roll-out of high speed broadband networks with Fibre to the Home (FTTH) and 4G LTE technologies Enhancing global connectivity
Sustainable and inclusive growth	Fortifying SLT's role as the national ICT service provider Creating a digital-inclusive Sri Lanka Consolidating ICT for human development

1.3 SUMMARY OF THE WORK ENGAGED IN TRAINING

During my training period in Sri Lanka Telecom (PLC), I was assigned to two main sections, as shown in table 1.4. In this period, I carried out tasks such as field visits, fault fixing, collecting and recording various fault data, helping customers to diagnose their line faults. I also participated in various office events such as fire safety drills, farewell parties, religious activities.

Switching and network division tasks mostly associated with monitoring and maintenance of the SLT infrastructure and the OPMC was responsible for dealing with customer faults and the implementation of new connections.

Table 1.4 Training schedule

Worksite	Period	
	From	To
Switching and network division	2017/10/31	2017/12/11
OPMC	2017/12/11	2018/01/05

CHAPTER 2

SWITCHING OFFICE

2.1 INTRODUCTION

Switching office in Bandarawela is the unit responsible for the monitoring, implementation and repairing of the MSAN units. The switching office consists of six technical officers and one Technical training officer (TTO). The switching office Bandarawela is responsible for the operation of MSAN units situated across the region.

2.2 MAIN TASKS CARRIED OUT IN SWITCHING OFFICE

In this section, I was tasked with the following duties during my training period.

2.2.1 Monitor MSAN alarms

The monitoring of MSAN alarms was carried out by the Switching office, and it was done by using a proprietary SLT software called “SLT NOC”. The interface with MSAN Alarms is shown in figure 2.1. Once a standing fault was monitored, a technical team was dispatched to repair the faulty MSAN if necessary.

Standing Faults

Network Engineer D.G. Chamila Sampath ▼

fault_id	ref_id	network	node	init_time	hours	description	other	suppress
1041557	9057921	LTE	IN,Alcatel LTE_Nelumgama (BD)	12/6/2017 11:50:00 AM	24	IN,Alcatel LTE_Nelumgama (BD) OOS;Cause: Site Down 10:52 :06-12-2017 ; Informed to BD TX Staff; FMT LTE	Critical	0
1041640	9061287	CDMA	IN,ZTE CDMA Thalawakale (HT)	12/6/2017 2:15:00 PM	21	IN,ZTE CDMA Thalawakale (HT) OOS;Cause: Site Down 13:13 06-12-2017 ; Informed to HT TX Staff; FMT CDMA	Critical	0
1040973	9017067	Planned Event	WM_MSAG5200_02 (Welimada)	12/6/2017 11:55:00 PM	12	Maintenance activity of WM_MSAG5200_02 (Welimada) starts from 24:00 hrs on 06-12-2017.Max. down time 5 hours.SATEAM	Minor	0
1042100	9073183	BB	WM-YPW_MSAG5200_01	12/7/2017 8:31:33 AM	3	AC Mains Failure [Battery= 7 Hours]	-	0
1042131	9073396	BB	RB-KTK_ZXDSL9806H_01	12/7/2017 8:45:42 AM	3	AC Mains Failure [Battery= 3 Hours]	-	0

Figure 2.1 Interface for the SLT NOC for monitoring MSAN Alarms

2.2.2 CONFIGURATION OF NEW MSAN

After a new MSAN is implemented, the switching office needs to setup the MSAN by installing appropriate network cards and software. During my training period I had once visited a configuration of MSAN in Palawaththa. First, the Network cards need to be installed on the MSAN, then various alarms need to be tested as shown in figure 2.2. Thereafter, the MSAN needs to be configured by installing appropriate programs by using a Laptop computer, as shown in figure 2.3. Once all is done, the MSAN can be used to provide new connections to the customers.



Figure 2.2 Installation of network cards and testing alarms

2.2.3 Replacement of Batteries of MSAN

Throughout the Bandarawela region, there are about 30 MSAN nodes, as shown in figure 2.4. If there is an extended power breakdown; for some specific MSAN models, the internal battery can be replaced so that they can operate for about 5-8 hours until the CEB power supply resumes. The process of replacing an MSAN battery is as shown in figure 2.5.



Figure 2.3 Configuration of MSAN using laptop Interface

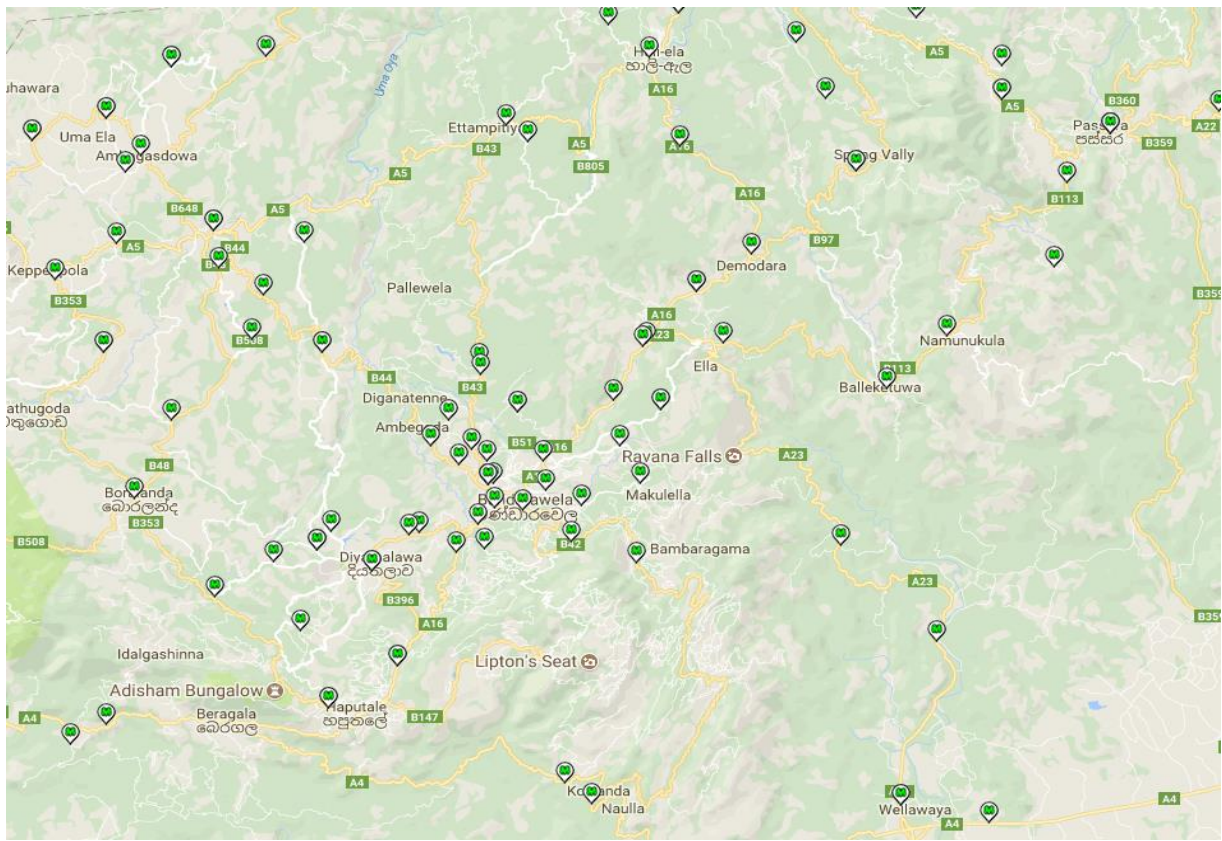


Figure 2.4 MSAN locations in Bandarawela region

2.2.4 Replacement of damaged cards of MSAN and testing

Throughout my training period, there were cases where telephone line faults were present due to faulty MSAN cards or cables. In such cases it was required to visit the MSAN location and replace the defective card or cables and test the lines afterward. The replacement of an MSAN card is shown in figure 2.6. After the card has been replaced, the lines were tested by using the test phone by connecting it to the relevant probe in the MSAN node, as shown in figure 2.7.



Figure 2.5 Battery replacement in Kithalella MSAN



Figure 2.6 Damaged Cable replacement in Randeniya MSAN



Figure 2.7 Line testing by using a test phone

In most cases, it was observed that the damaged cables in the MSAN were due to rodent infestations. Where rodents gained access to the MSAN by digging holes and nested inside the MSAN cabinet. I have identified this problem could be solved either by placing a net-like protective barrier in the base of the MSAN where rodents can't chew through, or either place some rodent poison to avoid damage to cables and circuitry inside the MSAN cabinet.

2.2.5 Visits to provide generator power in case of a CEB breakdown

Some of the MSAN available in the region are connected to banks and other critical points such as ATM machines where an always-on data connection is required. In case of a power breakdown of such MSAN node, the power needs to be supplied externally by using a standby generator until the CEB power supply resumes. The connection portal for the standby generator is shown in figure 2.8. During my training period, I have visited multiple MSAN nodes that required standby generator power in case of a grid supply breakdown.



Figure 2.8 Generator connection terminal in case of a breakdown

The yellow switch, as shown in figure 2.8, is used for changing the power source when connecting the generator terminal. Other than these tasks, I have also participated in the following tasks, while in this section.

- MSAN testing
- Routine maintenance of MSAN units

2.3 SUMMERY

During the training period in the switching office, several key features of a communication network were identified. And the importance of switching office was also acknowledged for the reliable operation of SLT services. The process of performing fault analysis of a telephone line was also studied in this section.

CHAPTER 3

NETWORK DIVISION

3.1 INTRODUCTION

The network division is responsible for the implementation and maintenance of the fiber network and the maintenance of carrier Ethernet switches that are available in the Bandarawela SLT building. The carrier Ethernet switch available in the Bandarawela switching office is shown in figure 3.1, where each of the yellow fiber lines connected to separate MSAN units in the Bandarawela region. All surrounding remote switching units in the Bandarawela region are connected to the main switching unit using Carrier Ethernet Aggression lines, as shown in figure 3.2. The main switch then connects to a provider edge router which finally connects to the SLT backbone fiber network.

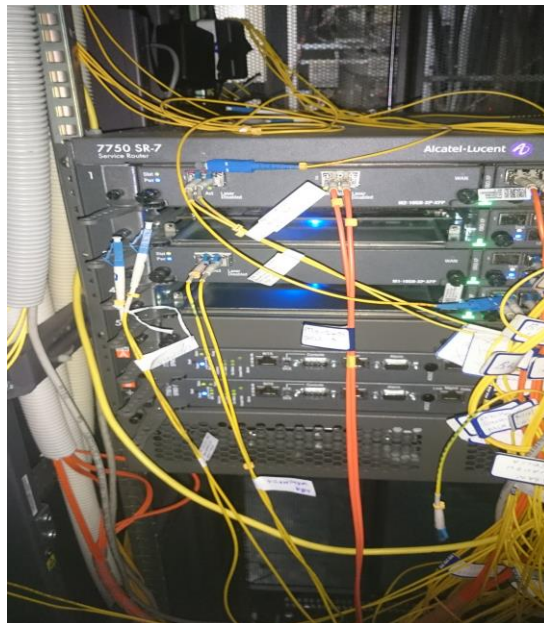


Figure 3.1 Carrier Ethernet switch in Bandarawela SLT office

The MSAN nodes and other leased line connections in the Bandarawela region are connected to nearby remote switching unit or the main switching unit via an SDH network as shown in figure 3.2 and figure 3.3

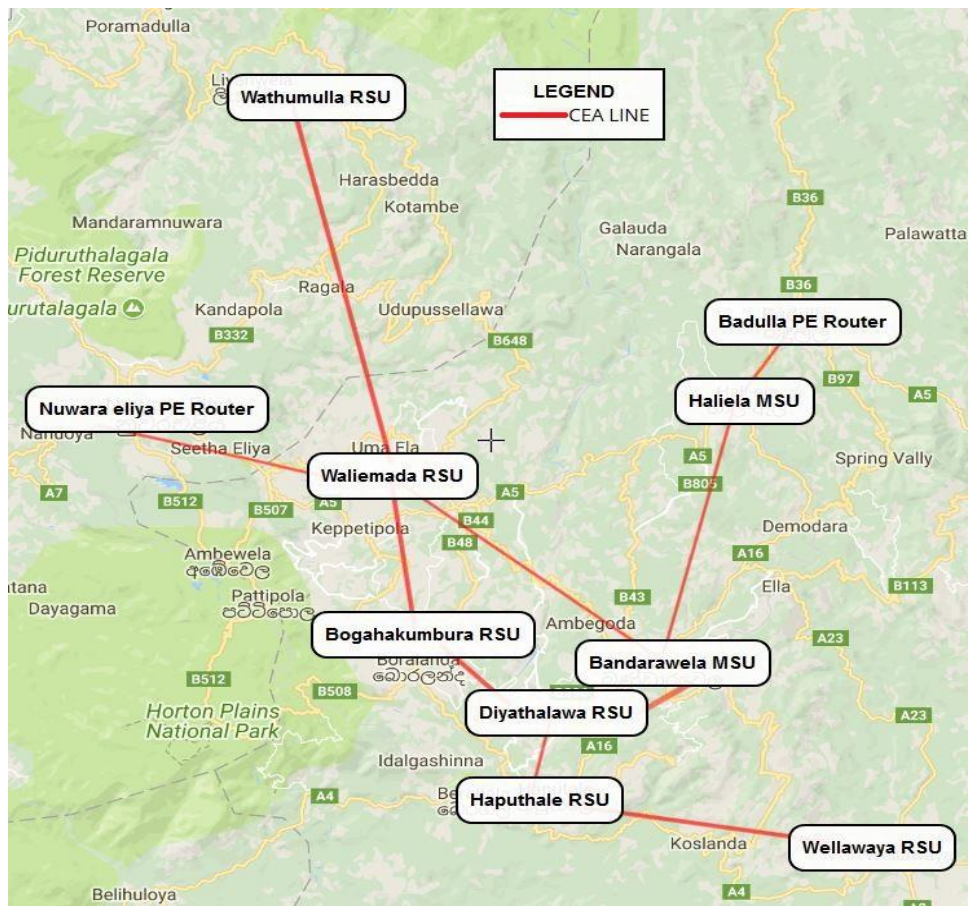


Figure 3.2 Carrier Ethernet Aggression Lines in Bandarawela Region

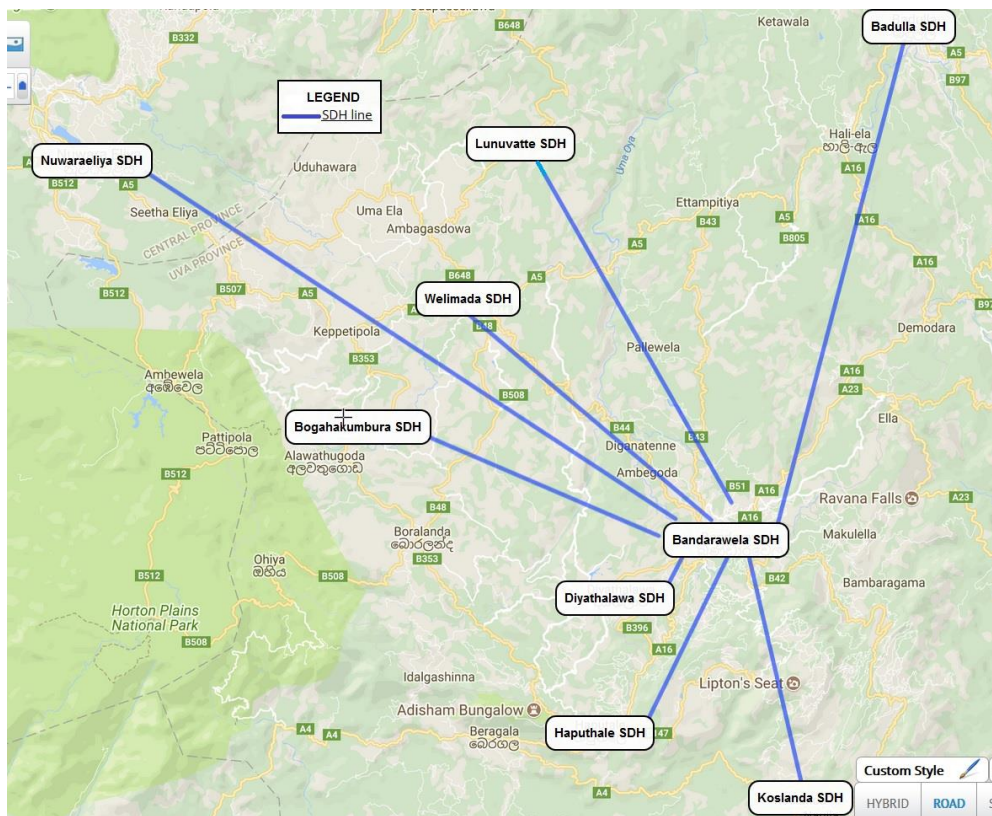


Figure 3.3 SDH links in Bandarawela region

3.2 MAIN TASKS CARRIED OUT IN NETWORKING DIVISION

3.2.1 Optical distribution frame (ODF) implementation

In the Bandarawela region office, I was tasked with setup an optical distribution frame panel with 64 fiber connections in the Main switch room with the help of a technician. This task involved fiber splicing, fiber fusion and testing of connected fiber lines using a line loss tester tool to measure the losses of the fiber splicing is within the recommended range. The fixing of the installed ODF panel is shown in Figures 3.4 and 3.5.

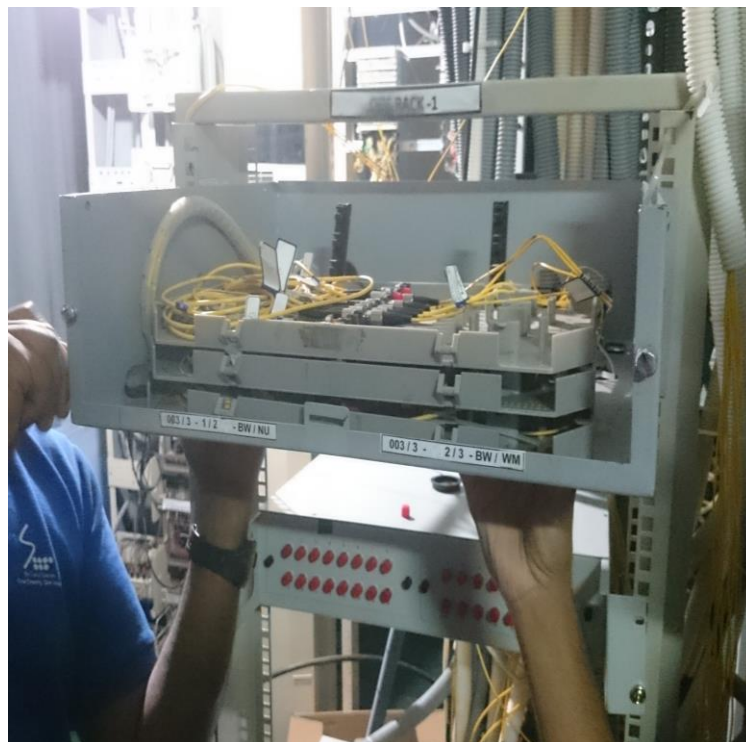


Figure 3.4 Fixing of the 64-fiber line ODF panel



Figure 3.5 Arranging fiber cables in the ODF panel

3.2.2 Optical distribution frame (ODF) panel implementation in government offices

During my training period in the network division, I visited several government offices such as district secretary offices, zonal education offices to implement optical fiber panels as a part of the Lanka Government Network project. The implementation of an optical distribution frame in the district secretary office is shown in figure 3.6.



Figure 3.6 Fixing of an optical distribution frame in divisional secretariat office Bandarawela

3.2.3 Fixing of optical fiber enclosures joining areal fiber lines and underground fiber lines.

In urban areas, some of the fiber lines are routed through underground lines and needs to be joined with the areal fiber lines to provide connections to the customers. In such cases, optical fiber enclosures are implemented that protects the fiber splicing from weather conditions and external damages. The process of implementing an optical fiber enclosure is shown in figure 3.7.



Figure 3.7 Splice joining of fiber cables in an optical fiber enclosure

The splicing process was done with the use of a portable fiber splicing kit and a portable table as shown in figure 3.7. It is noted that due to dust particles present in the outside areas, where these dust particles can affect the signal transmission noise in the fiber lines. So, it would be preferable if extra precautions to be taken when splicing the fiber lines.

Other than these tasks, I was involved in helping the technicians with the following tasks during my time in the network division.

- Measuring of link budget of a fiber line (Overall power loss in a fiber line) and recording the losses
- Configuration of fiber service switches.
- Routine Line condition checks of the fiber lines in Walimada remote service unit (RSU)

2.3 SUMMERY

During the training period within this section, the procedure to perform a fiber splicing was identified and studied. The process of how to check line losses was also studied in this section. Debugging of MSAN units was also performed within this section.

CHAPTER 4

MAIN DISTRIBUTION FRAME

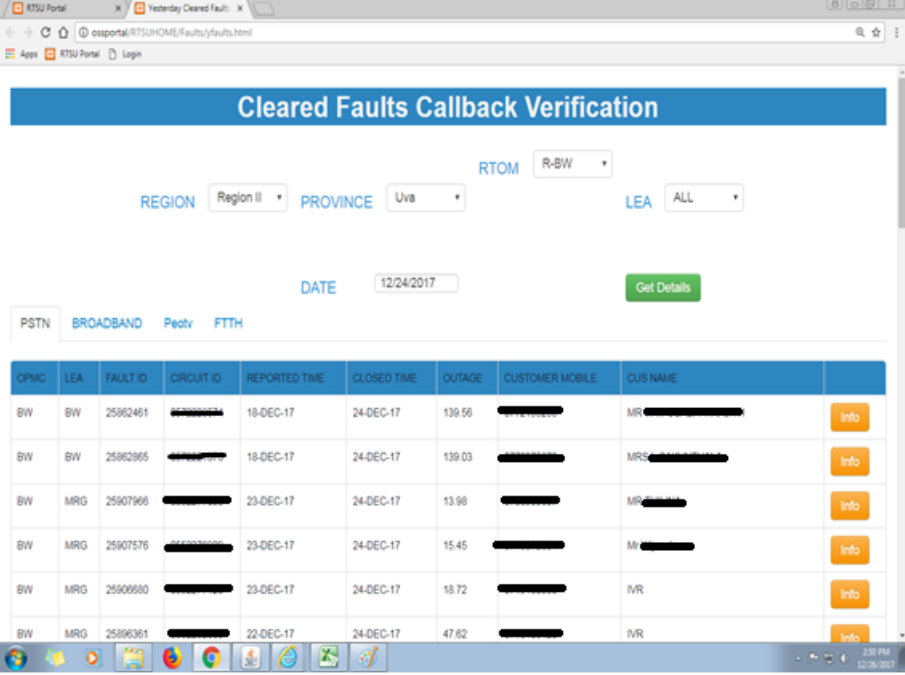
4.1 INTRODUCTION

MDF is a subsection of the Outplant maintenance center, where this section tasked with services such as testing the phone line connections, clearing of resolved faults, helping field visit teams with functions such as password reset.

4.2 MAIN TASKS CARRIED OUT IN MDF SECTION

4.2.1 COMPLETED FAULT VISIT VERIFICATION

- During this part of my training period I was tasked with calling SLT numbers with faults, which were cleared by the field visit team and verify if the issue has been resolved. SLT used a verification system as shown in figure 4.1 for this task. After the fault clearance is confirmed, the status was updated to the system by using the “CLARITY” software which manages the faults.



OPNC	LEA	FAULT ID	CIRCUIT ID	REPORTED TIME	CLOSED TIME	OUTAGE	CUSTOMER MOBILE	CUS NAME	
BW	BW	25962461	██████████	18-DEC-17	24-DEC-17	139.56	██████████	MR ██████████	Info
BW	BW	25962965	██████████	18-DEC-17	24-DEC-17	139.03	██████████	MRS ██████████	Info
BW	MKG	25907966	██████████	23-DEC-17	24-DEC-17	13.98	██████████	MR ██████████	Info
BW	MKG	25907576	██████████	23-DEC-17	24-DEC-17	15.45	██████████	MR ██████████	Info
BW	MKG	25909680	██████████	23-DEC-17	24-DEC-17	18.72	██████████	IVR	Info
BW	MKG	25896361	██████████	22-DEC-17	24-DEC-17	47.62	██████████	IVR	Info

Figure 4.1 Cleared errors call back verification system

4.2.2 Providing the maintenance teams with the updated fault lists

Every morning the MDF staff is tasked with providing the field visit teams with printouts of the faults available in their route, so that they can attend to the fault locations efficiently. The number of pending failures and completed fault attending's can be monitored through the workforce monitor application as shown in figure 4.2

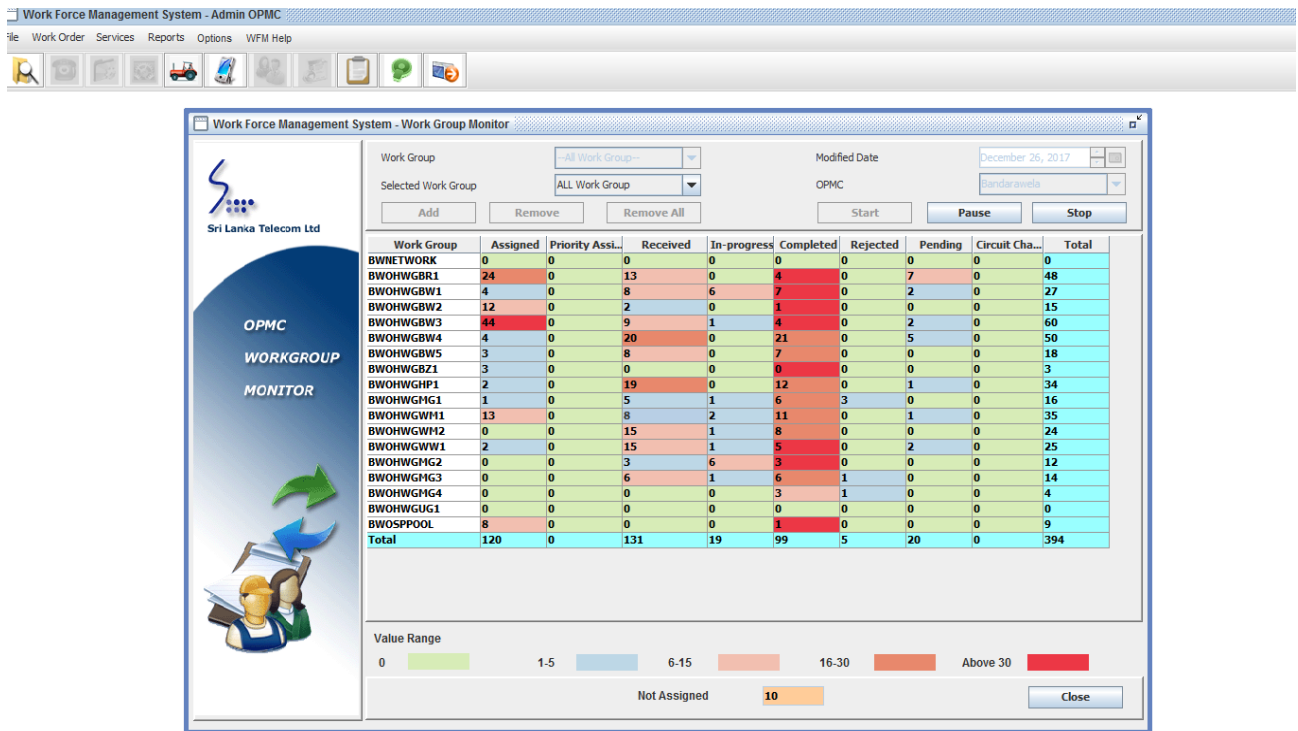


Figure 4.2 Workforce management fault status for the Bandarawela branch

4.2.3 Resetting of PEO TV STB boxes mac addresses

If a set-top box needs to be replaced by a fault visit team, they will place a call to the MDF section requesting the reset of the MAC address of the corresponding box so that the STB can be replaced. The method of resetting the MAC address is showing figure 4.3



Device removal from PEO TV Phase1 System

Enter Telephone Number

[Home](#)

Figure 4.3 MAC removal system for the PEO TV STB

4.2.4 Monitoring of field visit team locations

MDF also has the capabilities to monitor field team locations when necessary, using the attached GPS trackers in the field vehicles. Figure 4.4 shows real-time tracking of all the field vehicles belongs to the Bandarawela region.

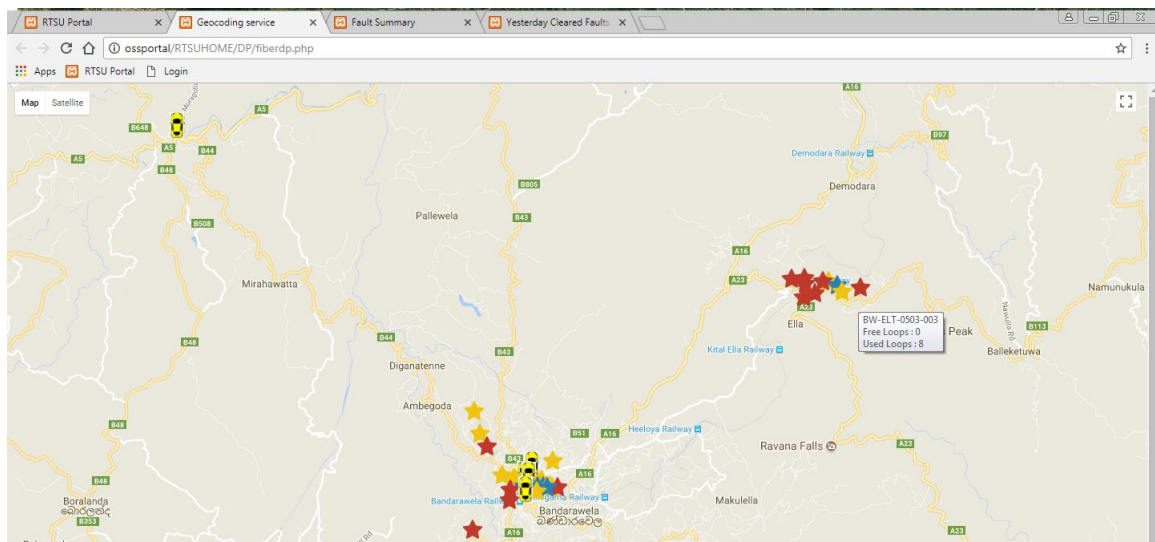


Figure 4.4 Real-time tracking's of field vehicles

4.2.5 Resting of ADSL internet passwords

MDF division also has access to reset the ADSL passwords as per the request of the field team when necessary. The interface for the reset of ADSL passwords can be seen in figure 4.5. Most of the time, reset requests are received when a faulty router is found on customer premises.

A screenshot of a web interface titled 'Internet User Info'. Below the title is a navigation bar with links: 'SLTNET LDAP Interface', 'Online User Check', and 'Authentication Log View'. The main content area is titled 'SLTNET LDAP Interface' and contains two sections. The first section, 'LDAP Account Details', has a 'Username' label, a text input field, and a 'Submit' button. The second section, 'Check Password', has a 'Username' label and a text input field.

Figure 4.5 Interface for resetting of ADSL passwords

Other than these mentioned works, I was assigned to set up internal wiring of network cables in the Bandarawela SLT office building during my period with the MDF section.

CHAPTER 5

MAINTENANCE

5.1 INTRODUCTION

The maintenance division is tasked with undergoing repairs of the SLT infrastructure to ensure customer satisfaction. In my training placement, I was assigned to a team that covered the Ella region, where we were assigned with both voice and internet-related faults. The maintenance staff used an android application called “WFM” (Work Force Management), which provides them with the functionality to get information and update the fault status to the system via the internet. The screenshots of the WFM can be seen in figure 5.1 and figure 5.2. The tool also provides details about the number of pending faults assigned to the relevant team.



Figure 5.1 Workforce Monitor application

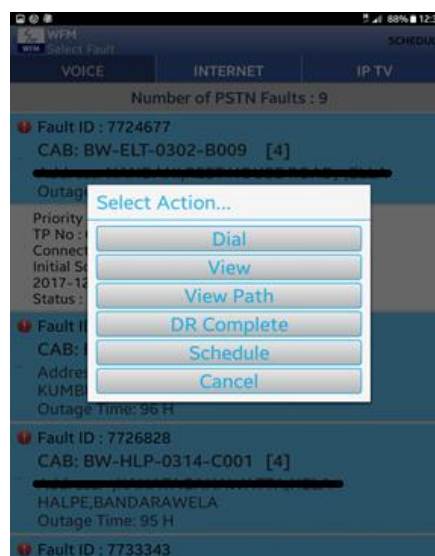


Figure 5.2 Workforce Monitor interface

5.2 MAIN TASKS CARRIED OUT IN MAINTENANCE DIVISION

5.2.1 Fault drop wire replacement to a distribution point

Throughout this section of my training period, there were cases where line faults have been occurred due to fallen trees, entanglement to moving vehicles, landslides. In such cases, the copper line that is from the distribution point to the customer premises needs to be replaced. Figure 5.3 shows the process of replacing a damaged copper line with a new line. And figure 5.4 shows connecting the new line to the distribution point.



Figure 5.3 Laying of new copper wire in case of a copper line breakdown

5.2.2 Cleaning and replacement of damaged areal enclosure

During my training, there were cases where copper cable connections have been damaged due to rodent infestations in the areal enclosure, which is usually located at the top of the telephone pole. In such cases, the areal enclosure needs to be cleaned, and the wires need to be attached by using drop wire connectors. Reattachment of a damaged areal enclosure by a technician is shown in figure 5.5.



Figure 5.4 Connecting new copper line to the distribution point



Figure 5.5 Reattachment of an aerial enclosure after a rodent infestation

5.2.3 Reattachment of broken drop wires using a drop wire connector

In case a drop-wire was damaged near the customer premises, the wire can be connected by using drop wire connectors and if the wire got unhooked from the hook attached to the household, it needs to be reattached. For such a case the process of a technician reattaching a hook to the slab plate is as shown in figure 5.6.



Figure 5.6 Reattachment of dropwise hook into a customer household

Other than these tasks, the main tasks carried out by myself during the training period with the field visit were

- Replacement of faulty routers and setup boxes
- Configuration of internet access credentials and changing Wi-Fi passwords
- Replacement of faulty phones
- Rerouting of Faulty Overhead line using MSAN switches

For most of the line faults, the faulty part lies between either in,

- The drop wire connecting distribution point to the customer premises
- Between the DP and the MSAN
- In the MSAN distribution frame which is shown in figure 5.7

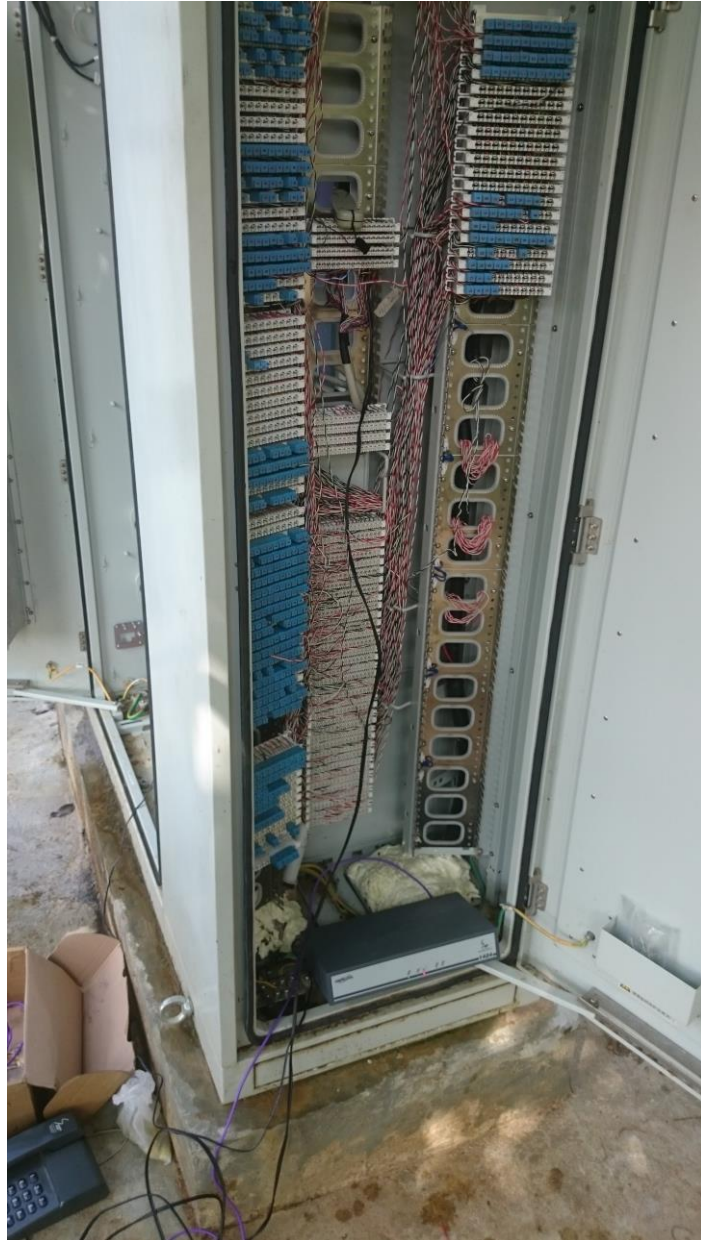


Figure 5.7 Copper line distribution panel of an MSAN

5.3 SUMMERY

Field visits to determine faults were performed in this section and the fault clearing process was also observed during this section. The importance of maintaining good customer relationships was also observed during these field visits. Important components related to the fiber network and the safety standards were also observed during this section.

CHAPTER 6

SAFETY MEASURES

OPMC and Network/Swathing division uses several safety measures in maintaining its employees and other people safe.

- Safety boots
- Cones
- Anti-static wrist straps
- Fire Safety drills
- Safety ropes

A Technician attaching an optical enclosure box to a telephone pole wearing a safety belt and safety shoes is shown in figure 6.1



Figure 6.1 Safety practices when climbing a telephone pole

6.1 FIRE SAFETY DRILL

During my training period, there was a fire safety drill which is organized to educate the staff of the SLT on how to act in case of a fire hazard was held at the SLT premises. The drill demonstration process is shown in Figures 6.1 and 6.2. In these demonstrations, they showed how to extinguish various types of fires using different kinds of fire extinguishers.



Figure 6.2 Demonstration on various types of fires



Figure 6.3 Demonstration to the SLT staff on how to extinguish fires

CONCLUSION

Sri Lanka Telecom (PLC) has carried out an excellent job in arranging industrial training to the engineering undergraduates of University of Peradeniya towards exposing technical, social and workspace related aspects so that we can continue to build our technical and soft skills that are needed to be a better engineer.

Under the engineering course TR400, for phase I of industrial training, I was lucky to be assigned to SLT Bandarawela for undergoing training for ten weeks from 31th of October 2017 to 06th of January 2018 by the Industrial Training and Career Guidance Unit. In the training period, I was undergone in indoor and outdoor training, mainly in the areas around Bandarawela to implement and repair the SLT network infrastructure and interact with customers to provide a better service. The things I have archived during my training period can be summarized as follows.

- Gaining technical knowledge about the latest communication equipment.
- Gaining soft skills that help to increase consumer relations
- Understanding work culture in an office
- Understand methods of workforce management on an SLT environment
- Understanding of welfare and relation-building programs that allow workers to improve their relationships and reduce any work-related stress

During my training period in SLT, the understanding about how digitization, network types, and other aspects that were taught in the second year helped me to understand better how the technology used by the SLT with a clearer picture. Also, the things taught in the third year about multiplexing, signal noise under the communication system were frequently used during my training period in the SLT.

I understood that the training period in SLT is more productive when understanding factors like some technical aspects, work culture, and how the people interact with the management. But as engineers, I think it would be better if we could spend a little bit of time during the training period to study design, planning related to this institution so we can gain more experience from this training.

Finally, it can be concluded that the SLT is a very good place to get an industrial training experience with proper guidance for an electrical and electronic undergraduate/