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DESIGN AND IMPLEMENTATION OF IMPROVISED MAINTENANCE PLAN FOR OPTICAL FIBRE IN TELECOM COMPANY (SERVICE SECTOR)

A Project report submitted in the partial fulfilment of the requirement for The 8th And 9th Trimester Of EMBA

At

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Pramay Prakash Karekar

Company Introduction

Tata Communications Transformation Services (TCTS), a 100% subsidiary of Tata Communications Ltd, provides leading business transformation, managed network operations, network outsourcing and consultancy services to telecommunication companies around the world. TCTS delivers operational efficiency, cost transformation and revenue acceleration solutions for all the stages of the carrier process lifecycle including but not limited to network engineering and design, implementation and operations functions.

TCTS is a part of the USD $100+ billion Tata group. Tata group comprises of over 100 operating companies in seven business sectors.

TCTS leverages the market expertise of Tata group's global telecom operation capabilities and globally established IT, process and consulting skills. It carries the rich traditions and business ethics of the Tata companies.

TCTS is headquartered in Mumbai, India with global offices in Australia, Europe, the Middle East and North America. TCTS has 5 world class delivery centres in Pune, Chennai, Bangalore, Hyderabad & Romania. These facilities operate completely independent from its parent affiliate, preserving full

confidentiality in managing all customers' business processes & Teams across Globe supporting all the customers' requirements.

In our thoughts and actions we continuously ensure that we are Ambitious, Collaborative and Transformative. This focus is animated by five basic principles; encapsulated in a one-word philosophy – DRIVE.

Daring || Responsive || Inclusivity || Venturing || Ethical

Inclusivity lies as the bedrock of the culture. We fundamentally believe that our success as a company depends on mutual respect and support – the strengths that underpin true diversity and inclusion. Diversity is something that we will not just tolerate, but something which we will seek out and harmonise to improve the coherent strength of the business as we strive to create an inclusive culture for all.

What is the vision?

To create a high performing organization through a diverse and inclusive culture, by promoting diversity at each strategic level, enabling the organization to create richer solutions, obtain better results and maximize productivity, innovation and creativity.

With D&I we promote diversity of thoughts and creating a sustainable competitive environment. At TCTS, we recognise the fact that our employees are a harbinger of change. We ensure employees at all strategic levels are given the right support through various initiatives, enabling them to scale new heights!

Our Heritage

Videsh Sanchar Nigam Limited (VSNL) was incorporated in 1986 as a public sector enterprise to cater to overseas communication services. In 2002, the Indian government privatised VSNL and the Tata Group acquired a controlling stake in the company.

On July 01, 2005, VSNL acquired Tyco Global Network (TGN), a state-of-the-art undersea cable network that spans 60,000 kms (37,280 miles) and the continents of North America, Europe, and Asia. With this acquisition, VSNL became one of the world's largest providers of submarine cable bandwidth.

On July 25, 2005, VSNL announced another acquisition of Teleglobe International Holdings Ltd., a leading provider of wholesale voice, data, IP and mobile signalling services. The acquisition gave VSNL access to an extensive global network of more than 240 countries and territories with advanced voice, data and signalling capabilities and ownership interests or capacity in more than 80 subsea and terrestrial cables.

During this time, Tata-led VSNL built central global Network Operations Centre (G-NOC) and Service Operations Centre (SOC), and consolidated all international field operations to ensure seamless service delivery to the customers worldwide. This was in itself a large transformation project which involved integration of multiple global entities, complex global networks and staff from varied diversities.

In October 2006, VSNL incorporated a wholly owned Indian subsidiary, VSNL Global Services Limited (VGSL) under the Indian Companies Act, so that it can

derive marketing and cost synergies with the Tata Group's telecom and IT business.

VGSL, in its new avatar, was competing not only with large Indian business groups but also with global tier 1 operators in the international markets. It was then that the board took a landmark decision to rename VGSL in order to capitalise on the immense goodwill and brand awareness attached to the Tata mark globally.

On February 19, 2008 VGSL was renamed as Tata Communications Transformation Services Ltd. (TCTS) as 100% subsidiary of Tata Communications.

Field Operations

Managing field operations efficiently and strategically is critical to maintain successful network and customer service operations at optimum cost.

Through its own field team and partners across various geographies, TCTS ensures the best of expertise and local knowledge are leveraged. However, from a customer point of view, TCTS acts as a single point of contact for managing deliverables as per desired service levels. We offer operational synergies, wherever possible, to bring in a cost effective solution without compromising on service quality.

Field Services

Proactive and reactive maintenance of 2G, 3G, LTE, transmission, IP data, voice network element and radio

On-field site survey, feasibility

On-site support for unplanned and planned outages

On-field site survey, feasibility

On-site support for field testing and vendor support

On field support for system software upgrade, patch upgrade and reload wherever remote access failed

Antenna realignment and regular health checks

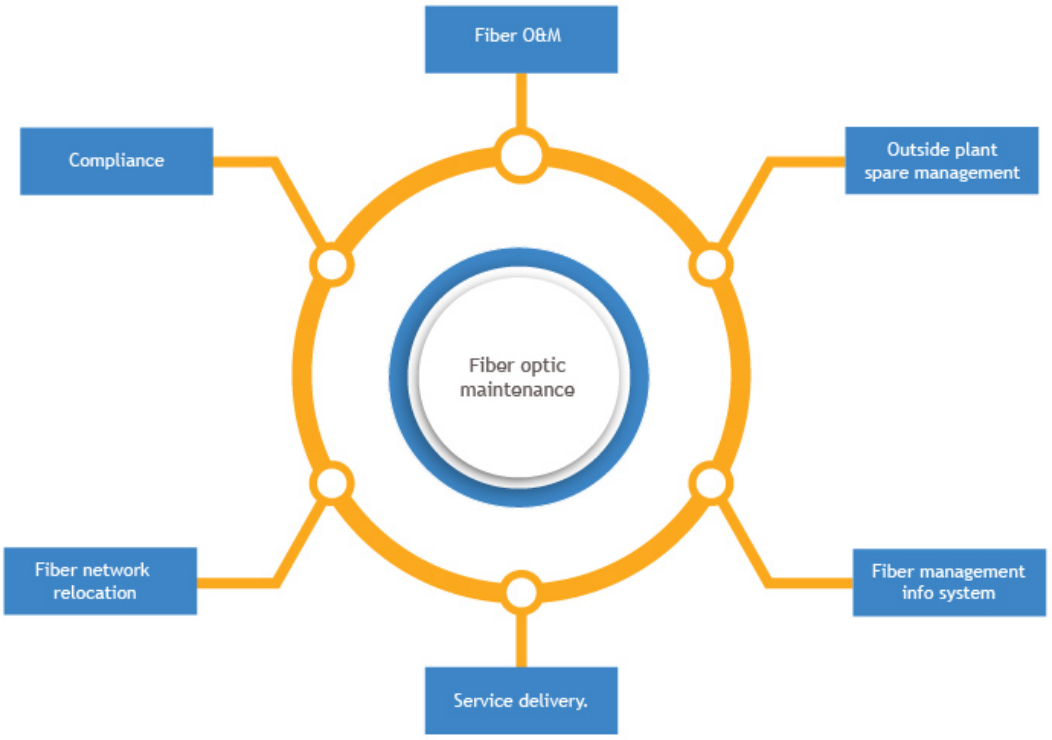
Site inventory and asset management; maintenance of documentation and records.

Support for network expansion activities, migration, commissioning and decommissioning of nodes at sites

Fibre Optic Maintenance

Although Fibre optic maintenance is a part of an overall field service, it is often managed as separate operation considering the importance, complexity, skill set and diversity of fibre network in most of the Service Provider's network.

TCTS leverages its proven rich knowledge and standard processes in managing Fibre Operations and Maintenance operation. The key drivers of managing a fibre network are optimized utilization of available Fibre routes and maintenance of good fibre health.



Need of the Project

In the advanced technology driven world, competition is intense and the uptime of Network is characterized by high degree of service-ability at optimum cost. For this, the major factors which a service industry should possess are good quality and low cost. Though the equipments have been automated, maintenance still to a greater degree depends on human input.

Our aim is to implement Total Productive Maintenance, to eliminate the wastes, increase in up time, thus reducing cost and improving Network availability.

What is Network Availability?

The network availability is the average percentage of time during the network performed its intended function.

Well in layman's terms, average number of hours/days/months network was up and running.

Let us understand to calculate Network availability.

A Fibre Channel switch has eight ports, and all ports must be operational 24x7. However, a failure of a port occurs on a particular week as follows:

- Monday = 11 AM to 12 PM
- Thursday = 7 AM to 11 AM
- Saturday = 11 AM to 1 PM

What is the availability of Port 5 in that week?

Network availability = uptime / total time
where, total time= downtime + uptime

So from the given data, Downtime :
For Monday :1 Hr
For Thursday: 4 Hr
For Saturday : 2 Hr
total downtime = 1 + 4+2 =7Hr

Now, Uptime:
For the Monday: 24 hrs — 1 hr = 23Hr
similarly for Thursday: 20 Hr
For Saturday: 22 Hr

So, total uptime = 23+20+22 + 96= 161 Hrs

Reason for 96 Hrs: notice that according to the data no downtime was mentioned on the other 4 days of the week, so we consider all 24 Hrs of a day as uptime only.

total time will be: 7 Hr + 161 Hr = 168 Hrs

Using the formula from above,

Network availability = 161/ 168 = 95.8%

For any Telecom service provider, Uptime of Network and Serviceability Quality are closely related functions. Competition has increased rapidly. Customers tend to prioritize on response quality, ability of fault detection, service delivery time and costs. This has lead to company focus to introduce technique for determination of service attributes, identify tools for measurement of quality of service personnel, cost reduction methods, reduction in service time.

Over a period of time the concept of improvised man management, need for multi-skilling personnel of service sector, advanced inventory management techniques, cost reduction using quantitative techniques, use of maintenance tools like 5S, Total Productive Maintenance (TPM), have been felt necessary to retain higher edge over competitors and provide efficient and quality service. Total productive maintenance (TPM) is a methodology that aims to increase the availability of existing equipment hence reducing or delaying the need for further capital investment

Total Productive Maintenance is a method, which involves total participation on all levels and functions in an organization in order to raise overall effectiveness of equipment used in the production. TPM capitalizes on proactive and progressive maintenance methodologies and calls upon the knowledge and cooperation of operators, equipment vendors, engineering, and support personnel to

optimize machine performance. Results of this optimized performance include elimination of breakdowns, reduction of unscheduled and scheduled downtime, improved utilization, higher throughput, and better product quality. Bottom-line results include lower operating costs, longer equipment life, and lower overall maintenance costs.

The most important goals of TPM are as follows:

Wastage avoidance
Cost reduction
Making workers multi-skilled and exible
Zero equipment breakdowns by maintaining equipments at optimal level
Zero product defects.

Prinicples of TPM

There are four major TPM principles:

Improving OEE by identifying possible losses of facilities and equipment, and monitoring all of them in case of speed losses, defect losses and down-time losses

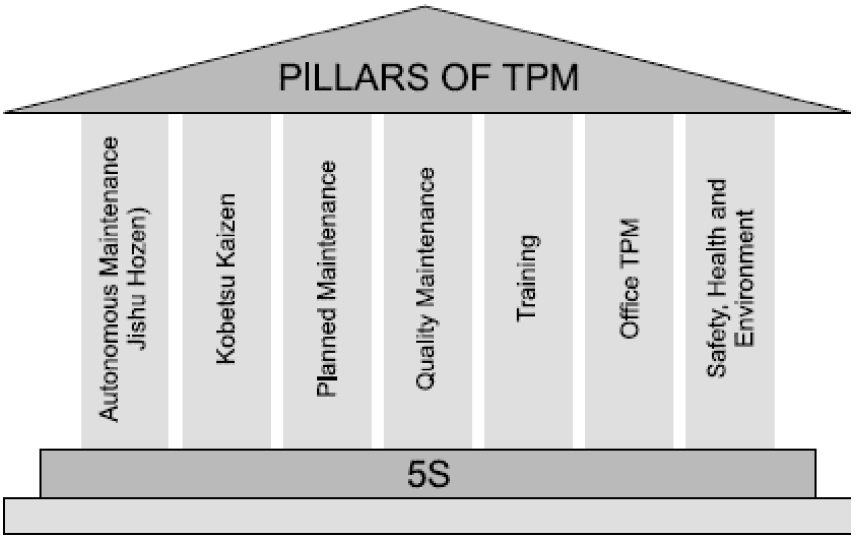
Making front-line asset care as a part of the job:
Front-line asset care (Autonomous Maintenance) is carried out by the operator, with support from the maintenance department. The operator should be able to fulfil at least some maintenance tasks including simple repairs, preventive actions and improvements e.g. corrective actions and proposing ways to prevent re-occurrence.

Having a systematic approach toward maintenance activities:
This could be done by:
1. Defining preventive maintenance for each piece of equipment (Time Based Maintenance- TBM)
2. Creating standards for running Condition-Based Maintenance (CBM)
3. Defining maintenance responsibilities for operators and maintenance staff
4. Operators responsibilities - General care.
5. Maintenance staff responsibilities: General breakdown activities, supporting operators by training them, problem diagnosis, devising and assessing maintenance practice, developing maintenance actions and continuous up grading of equipment.

In order to thoroughly fufill their duties and perform all their tasks, the employees need to receive continuous and appropriate training to develop their abilities like hand and operational skills, team working and problem solving.

Pillars of TPM

Altogether there are eight pillars of TPM which are dicussed in detail below. Figure shows the eight pillars of TPM.



PILLAR 1-5S

The Five S's represent Seiri, Seiton, Seiso, Seiketsu, and Shitsuke as shown in Table 2.2. The system as a whole minimizes waste and improves efficiency by ensuring that workers are spending time doing productive task rather than looking for misplaced tools, sorting unnecessary through stacks of waste material or rearranging the work environment at the change of shifts. It also increases customer's confidence. An organization that has organized offices and factories, equipment-specific locations and an excellent communication system reflects an image of high levels of efficiency and quality. All of this goes toward proving the company's efficiency and performance potential to customers.

Table 2.2: 5S and their meaning in English

Seiri	Seiton	Seiso	Seiketsu	Shitsuke
Organize	Set	Scrub	Standardize	Sustain
Systemize	Systemize	Sweep	Regulate	Embed
Simplify	Neatness	Clean	Site-Wide	Self-Discipline
Sort	Set in order	Shine	Standardization	Discipline

Step 1: Sort

The first step of 5S, Sort, involves going through all the tools, furniture, materials, equipment, etc. in a work area to determine what needs to be present and what can be removed. Some questions to ask during this phase include:

What is the purpose of this item?
When was this item last used?
How frequently is it used?
Who uses it?
Does it really need to be here?

These questions help determine the value of each item. A workspace might be better off without unnecessary items or items used infrequently. These things can get in the way or take up space.

When a group has determined that some items aren't necessary, consider the following options:
Give the items to a different department
Recycle/throw away/sell the items
Put items into storage

For cases when an item's value is uncertain—for example, a tool hasn't been used recently, but someone thinks it might be needed in the future—use the red tag method. Red tags are usually cardboard tags or stickers that can be attached to the items in question. Users fill out information about the item such as: Location, Description, Name of person applying the tag, Date of application. Then the item is placed in a “red tag area” with other questionable items. If after a designated amount of time (perhaps a month or two) the item hasn't been used,

it's time to remove it from the workspace. It's not worth hanging onto things that never get used since they just take up space.

Problem: Managing a Larger merged network with less resources.

Solution:- We identified the resources, manpower present and listed out the activites done by each team. The number of faults attended be each team and the frequency of the faults. Also areas were checked which were having high number of faults. After doing this activity we could manage the resources more efficiently. Initially Network Team (OSP, Tx, Bss) was only responsible for their respective profiles. Later Cross functional teams were trained based on their interests and capabilities so that they could manage different types of work.

Step 2: Set in Order

As previously mentioned, steps 1 and 2 are often run in parallel. The items should be stored in an organized way. There should be a place for each item and each place is assigned with only one item.name plates and coloured tags may be used for easy identification. No time should ever need to be wasted looking for or picking parts. All storage spaces, including floors, should be labelled to enable quick identification of locations. Using proper signs, shelf markings, and floor layouts will help the operator become more efficient.

Things to consider:

Which people (or workstations) use which items?
When are items used?
Which items are used most frequently?

Should items be grouped by type?
Where would it be most logical to place items?
Would some placements be more ergonomic for workers than others?
Would some placements cut down on unnecessary motion?
Are more storage containers necessary to keep things organized?

During this phase, everyone should determine what arrangements are most logical. That will require thinking through tasks, the frequency of those tasks, the paths people take through the space, etc.
Businesses may want to stop and think about the relationship between organization and larger Lean efforts. What arrangement will cause the least amount of waste?

Waste can take the form waiting time, excess inventory, overproduction, unnecessary transportation, unutilized talents etc.

Problem: Delay in Restoration of Fault thus failing to meet the MTTR
MTTR (mean time to restore) is the average time it takes to recover from a product or system failure. This includes the full time of the outage—from the time the system or product fails to the time that it becomes fully operational again.

Solution: Here we consider how the layout and organization of an area could increase/decrease travelling time. For every fault reported, we need to retore it in given TAT of 4hrs. When the fault was at remote location (eg Sindhudurg) team travelling time was 2-3 hrs and further fault rectification would take another 2hrs, which meant we could not meet the TAT. In order to tackle this we approached other operator teams whose location was nearby to the fault location and restored it. To facilitate this material which is required during fault

restoration is already kept at such remote locations well in advance. In return we restore other Operator faults which are near to our base location.

Step 3: Shine

Everyone thinks they know what housekeeping is, but it's one of the easiest things to overlook, especially when work gets busy. The Shine stage of 5S focuses on cleaning up the work area, which means sweeping, mopping, dusting, wiping down surfaces, putting tools and materials away, etc.

In addition to basic cleaning, Shine also involves performing regular maintenance on equipment and machinery. Planning for maintenance ahead of time means businesses can catch problems and prevent breakdowns. That means less wasted time and no loss of profits related to work stoppages.

Shining the workplace might not sound exciting, but it's important. And it shouldn't just be left up to the janitorial staff. In 5S, everyone takes responsibility for cleaning up their workspace, ideally daily. Doing so makes people take ownership of the space, which in the long run means people will be more invested in their work and in the company.

How to clean may seem obvious, but make sure people know how to properly Shine their spaces. Show employees—especially new employees—which cleaners to use, where cleaning materials are stored, and how to clean equipment, particularly if it's equipment that could be easily damaged.

Problem: High rate of hardware failure

Solution: Goa being a coastal state we have higher humidity levels which resulted in frequent hardware failures due to dust and corrosion. Critical sites were identified, and proactive maintenance was done. This has benefited to

reduce the number of faults. Continuous follow ups are being done with infra providers to improve site hygiene. Site alarm extensions are done so that all stakeholders get notifications when there is high room temperature, power failure, Air conditioning unit malfunctioning, site door open. All this alarm extensions have helped to take preventive measures in advance and thus reduce MTTR.

Step 4: Standardization

Once the first three steps of 5S are completed, things should look pretty good. All the extra stuff is gone, everything is organized, spaces are cleaned, and equipment is in good working order.

The problem is, when 5S is new at a company, it's easy to clean and get organized…and then slowly let things slide back to the way they were. Standardize makes 5S different from the typical spring-cleaning project. Standardize systematizes everything that just happened and turns one-time efforts into habits. Standardize assigns regular tasks, creates schedules, and posts instructions so these activities become routines. It makes standard operating procedures for 5S so that orderliness doesn't fall by the wayside.

Depending on the workspace, a daily 5S checklist or a chart might be useful. A posted schedule indicating how frequently certain cleaning tasks must occur and who is responsible for them is another helpful tool.

Initially, people will probably need reminders about 5S. Small amounts of time may need to be set aside daily for 5S tasks. But over time, tasks will become routine and 5S organizing and cleaning will become a part of regular work.

Visual cues such as signs, labels, posters, floor marking tape, and tool organizers also play an important role in 5S. They can provide directions and keep items in place, in many cases without words.

Problem: delay in material procurement and lack of awareness of field activities.

Solution: We have made it a regular practice that inventory data is shared to the circle team on monthly basis. This ensures that all the spares which are required for the maintenance of the network are received at our zone well in advance. Further the local team stores the material at different locations in their zone. This distribution is prioritized based on the field knowledge of different ongoing infra works throughout the state.

Another good practice which we have started is pasting of stickers on Excavators. These stickers have the contact details of the local engineer. This has helped the us to get prior information of infra works from the excavator operator before he commences his excavation. This allows the team to save the optical fiber cable by doing proactive locating.

Step 5: Sustain

Once standard procedures for 5S are in place, businesses must perform the ongoing work of maintaining those procedures and updating them as necessary. Sustain refers to the process of keeping 5S running smoothly, but also of keeping everyone in the organization involved. Managers need to participate, as do employees out on the manufacturing floor, in the warehouse, or in the office. Sustain is about making 5S a long-term program, not just an event or short-term project. Ideally, 5S becomes a part of an organization's culture. And when 5S is sustained over time, that's when businesses will start to notice continuous positive results.

To help sustain 5S practices, make sure all new employees (or employees who switch departments) receive training about their area's 5S procedures.

Keep things interesting. Look at what other companies are doing with 5S. New ideas for organization can keep things improving and keep employees engaged.

Step 6: Safety – The 6th S

Some companies like to include a sixth S in their 5S program: Safety. When safety is included, the system is often called 6S. The Safety step involves focusing on what can be done to eliminate risks in work processes by arranging things in certain ways.

Problem: Employee safety and performance management.

Solution: Smart fiber is a software application which is managed by third party, enables to track the movement of the field teams at different locations. Employee's login into the application which marks their attendance. When your team works in the field, it is almost impossible to keep track of your entire field team manually. Therefore, tracking employee location just makes sense. After all, you cannot fix the problems you cannot see. Tracking application gives you visibility into how your team moves from one location to another. This means you can track their time and attendance based on their locations without needing to travel to each site yourself.

The Smart fiber employee tracking application makes it easier to dispatch your teams and to trust they are working as required. This gives you more time to focus on other tasks while building trust with your workers. The Smart fiber application offers both live and historical location tracking options. You can see routes taken, stops made, and time spent at each location from the detailed dashboard. This data helps the backend team to take important decisions, such as identifying overworked teams/drivers thus reminding your employees to take

breaks on schedule and helps you handle time off and holidays. This ensures your workforce is rested and motivated. It also helps us to identify which tasks are taking longer than expected time. Or which ones require more resources. Thus, can use this information to plan better project timelines in the future or generate payroll and performance review reports. You can also warn the employees when they are not where they are supposed to be during work hours.

Before the field employees attend the assigned task, they must upload photo of the work area in the software application, post which safety inspection is done by the safety team from remote location. If the work conditions are found to be safe than the field team is given a go ahead to attend the task or else, it is kept on hold due to safety concerns.

Safety audits are done on monthly basis to ensure that team is following the safety guidelines and That they are equipped with Personal protective equipment of required standard.

The device which is plugged to the vehicle also monitors the speed at which it is being driven. As per safety standards set by the company maximum speed allowed is 80km/hr. If any driver violates the limit, automated alerts are generated in the form of mails, messages and sent to the concerned team. Warnings are issued at the first few incidents and strict action is taken if the person is a repeated offender.

If a department is starting 5S, managers and all other employees should be included. If anyone is left out, this could lead to confusion or to messes that people don't want to take ownership of.

It is possible that some people will play a bigger role in 5S than others, which is fine. There might be 5S coordinators who are in charge of installing and maintaining 5S labeling, keeping tracking of assigned tasks, or introducing new department members to the 5S system. These people will obviously spend a lot of time thinking about 5S compared to others. Everyone should think about 5S

regularly, though. 5S might initially take place as an event, but ideally it becomes a part of daily work for everyone.

The basic steps of 5S can be applied to any workplace. It's really just a matter of determining what workspaces and work processes will benefit most from improved workplace organization.

PILLAR 2- AUTONOMOUS MAINTENANCE

This pillar stresses on performing simple maintenance tasks by the operators- Activities like lubrication, tightening of loosened bolts, visual inspection, cleaning. This will help more experienced maintenance staff to take care of more important maintenance tasks, which create more added values. The aim is keeping machines in good condition. The operators are responsible for upkeep of their equipment to prevent it from deteriorating.

Steps in Autonomous Maintenance are:

1. Train the employees about the TPM, its advantages. Educate the employee about the abnormalities in the equipments.
2. Initial clean up of the machine- cleaning the equipment, all dust, stains, oil and
grease has to be removed. After the clean up problems are identified they are categorised and tagged. Tags are placed where the operator can solve the problem. Some tags are also placed where the aid of maintenance department is needed.
3. Counter measures- to prevent work out of machine parts necessary action must be taken. Machine parts should be modified to prevent accumulation of dust and dirt.

4. Tentative standard- schedule has to be made regarding cleaning, inspection and lubrication and the schedule should also include details like when, what and
how.
5. General inspection- the employees are trained in disciplines like pneumatics, bolts, nuts and safety. This is necessary to improve technical skills of employees and to become aware of machine parts.
6. Autonomous inspection- new methods of cleaning and lubrication are used. Each employee prepares his own autonomous chart or schedule. Parts which create problems are inspected. The frequency of inspection is reduced based on the experience.
7. Standardization- in this step the surrounding of the machine are organised. Working environment is modified such that there is no difficulty in getting that part.

Problem: Frequent Ant/Rat Bite in Joint Closures

Solution: cables are installed in almost all types of environments, and some are in areas more conducive for exposure to pests, rodents or termites. This is especially so for cables that are buried direct or for underground use cables. Cable materials are attractive to rodents due to the presence of plasticizers and aromatic odours.. Termites live in underground nests deep in the soil. While their basic diet is cellulose, such as organic wastes and roots of plants, once they have consumed natural sources of cellulose, they would look for other manmade sources such as cables. Greasing is done at the cable entry point of the joint closures so that the ants are unable to enter the Joint Closures. Also chemical additives labelled pest resistance (PR), anti-rodent (AR) are placed inside chambers to prevent rat bites.

PILLAR 3- KAIZEN (FOCUSED IMPROVEMENT)

Kai means change and Zen means good (for the better). Basically kaizen is for small improvements, but carried out on a continual basis and involve all people in the organization. The principle behind is that a very large number of small improvements are more effective in an organizational environment than a few improvements of large value. This pillar is aimed at reducing losses in the workplace that affect our efficiencies. By using a detailed and thorough procedure we eliminate losses in a systematic method using various Kaizen tools. Its target is to achieve and sustain zero loses with respect to minor stops, measurement and adjustments, defects, and unavoidable downtimes. It also aims to achieve 30% manufacturing cost reduction.

Problem: Increasing aerial cabling in Network

Solution: Fiber optics cable are cut extensively due to road excavation during road and other construction activities along the shoulders of the road. To avoid further cuts in that section aerial cabling is done during restoration. As a result more network is being shifted Undergrond to Aerial which again under threat of being intentionally cut. To address this issue each team has been given a target to do a minimum of 20m of shallow trenching daily so that this aerial can be again shifted back to underground. Tracker is maintained to check the overall aerial present in the network and how much is buried back to underground on daily basis.

PILLAR 4- PLANNED MAINTENANCE

In order to reach customer satisfaction, the products must be defect free. Defect

free product requires machinery without trouble. Planned maintenance focuses on reducing spares inventory, optimum maintenance cost, higher reliability and maintainability of machines, achieving and sustaining machine availability. The role of an information system is undeniable; therefore, an information management system like Computerized Maintenance Management System (CMMS) should be established. The information system collects data relevant to time and parts of equipment's for maintenance planning.
Planned maintenance is comprised of four parts:

1. Breakdown Maintenance: This type is based on the philosophy which says: Let it fail then fix it, and is applicable where failure does not impose any significant effect on production and any cost except the cost of repair.

2. Preventive Maintenance: Maintenance actions like inspection, lubrication, cleaning, tightening to prevent machines from failures through periodic inspection and recognition of equipment condition. It is divided into two parts:

> Periodic Maintenance (Time Based Maintenance - TBM):
> Periodic inspection, servicing, cleaning, lubrication, adjustments and replacing worn out parts to prevent sudden failures.
>
> Predictive Maintenance: (Condition Based Maintenance - CBM):
> After diagnosing the current condition of critical parts of equipment, optimum remaining of their lifetime should be determined. It uses condition monitoring through surveillance system. Some of the tests are Vibration, oil analysis, Thermograph test, sound test, Ultrasonic test, performance test.

3. Corrective Maintenance: To increase the reliability, productivity and improving maintainability, root causes of equipment failures should be

removed. Root causes may originate from the design, manufacturing, installation, or external factors.

4. Maintenance Prevention: After checking current equipments and data gathering about their weaknesses, failure records and safety, new equipments are redesigned and installed. Easier maintenance, failure prevention, better safety, defects prevention and ease of manufacturing are some consequences.

Problem: Increasing trend of OFC cuts.

Solution: The causes of fiber optics cable failures have been attributed mainly to excavation activities, lack of communication between stakeholders, and lack of accurate mapping and location data on optical network routes. Excavation by road contractors during road construction is a significant cause of fiber optics cable cut. Main reason behind this being fiber optics cable routes are not communicated to road contractors, hence their inability to determine the presence of fiber optics cable along the construction route. To address this issue copies of update fiber route were made available to the all local authorities, major road contractors, and the roads and high ways department. By this, any contractor who excavates should be surcharged with the cost of the damage.

PILLAR 5- QUALITY MAINTENANCE

Through defect-free manufacturing, higher quality and customer satisfaction are accessible respectively. This pillar focuses on the equipment parts, which are critical for product quality. The trend of quality maintenance starts from elimination of current quality problems, which are reactive measures, and in form of Quality Control. The trend is continued with consideration of potential quality problems, which results in proactive measures and in form of Quality

Assurance. Quality Maintenance focuses on prevention of defects at source, in-line detection and segregation of defects, effective implementation of Operator Quality Assurance and Poka-yoke. It is aimed towards customer delight through highest quality through defect free manufacturing. Focus is on eliminating non-conformances in a systematic manner, much like Focused Improvement. We gain understanding of what parts of the equipment affect product quality and begin to eliminate current quality concerns, and then move to potential quality concerns. Transition is from reactive to proactive (Quality Control to Quality Assurance)

PILLAR 6- TRAINING

The aim of this pillar is making employees multi-skilled with high eagerness to come to work and fulfil their duties completely and independently. The knowledge and skills of the employees should be improved. Also, the training environment must be in such a way that employees want to learn by themselves based on their felt needs as well as making work more enjoyable. It is not sufficient that knowledge of the employees is limited to “Know-How". They should also be aware of “Know-Why" to recognize the root causes of problems. All employees should gain knowledge and skills relevant to their duties

PILLAR 7- OFFICE TPM

Office TPM should be implemented in administrative and logistic parts to increase efficiency and productivity in addition to identification of losses and elimination. Logistics and support functions have significant impact on the production and manufacturing. The effectiveness and productivity of a production system can be increased by improving any activity that supports the production. Many administration losses are unmeasured and remain hidden.

Losses addressed by Office TPM

- Cost loss including in areas such as procurement, accounts, marketing, sales,leading to high inventories.
- Non availability of correct on line stock status.
- Customer complaints due to logistics.
- Expenses on emergency dispatches/purchases.

PILLAR 8- HEALTH, SAFETY AND ENVIROMENT

This pillar plays an important role in all the other pillars. TPM program is not meaningful without focusing on health and environmental issues because some policies of TPM are Equipment reliability, human error prevention, eliminating accidents and pollutions. The objectives of this pillar are zero accidents, zero injuries and zero environmental impact. Unreliable and faulty equipment is a threat to the operator and the environment. Autonomous maintenance helps the operator get more familiar with the equipment, its potential hazards, and ways of safe and effective working. In addition, TPM will increase commitment of the operators towards health and environmental issues. With using 5S techniques like cleaning and setting the workplace (Seiton and Seiso), the risks of accidents will be reduced

Benefits of TPM

Direct benefits are as follows:

- Increase productivity and OEE
- Reduces customer complaints
- Reduces manufacturing cost by 30%

- Reduces accidents
- Increases customer satisfaction
- Indirect Benefits are as follows:
- Increases employee morale
- Increases teamwork
- Workplace remains clean, neat and attractive
- Sharing of knowledge and experience
- Operators gets a feeling of owning the machine

Conclusion

Implementation of TPM is a continuous improvement process. We have implemented main pillars of TPM, 5S, Autonomous Maintenance, Safety. Autonomous Maintenance checklist was also prepared to make the field restoration teams self-sustained and get well versed with the equipments. Root causes were identified for higher MTTR, and action plan was suggested. The suggestions given to the company will help them to reduce the downtime and improve the Overall availability of the network.