

Underground Fiber Placement Equipment Maintenance Plan

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Abstract — *Genesis Communications Inc is one of the leading telecommunications companies in Puerto Rico. The company picked a project to turn losses into revenue in less than three months. The project proposed was the Underground Fiber Placement Equipment Plan. Before the implementation of the Maintenance plan the Overall Equipment Effectiveness was 54.78% and after the implementation the Overall Equipment Effectiveness is 94%. The method consisted in elaborating a plan where each equipment will have their own check list for each operator to check daily and report any changes to successfully attack problems encountered. Each operator is trained and transmitted the necessary knowledge to maintain and keep equipment at high standards. With this achievement, the Employees Productivity, Equipment Longevity and Spare part have all been maximized drastically. The Company now focuses the revenue from this project by catering to all employees through benefits including better health care, paid time of and many more services*

Key Terms — *Equipment Longevity, Employees Productivity, Overall Equipment Effectiveness, Revenue, Project Tasks, Telecommunications,*

INTRODUCTION

Private telecommunications consultancy companies depend on the quality, production rate and employee management all to complete projects at the agreed deadlines. Many things situations can make a company lose revenue and competitiveness such as lack of quality, poor employee productivity, constant equipment breakdowns and very bad management. The company proposed a three-month project to turn losses into revenue. The company will invest the earnings of the proposed project towards the benefit of each employee.

Company Background

The Company Genesis Communication was founded back in 2004 in Puerto Rico. The company focuses on the Telecommunications Industry serving as the prime contractor to major industries such as Liberty Cable Vision and AT&T on the island of Puerto Rico. Genesis Communications constructs and installs 50% of the island's coaxial and fiber optic cables either Aerial or Underground with the use of State-of-the-art equipment such as the Horizontal Directional Drilling Machine or Trencher Machine. Genesis Communications is the second largest telecommunication contractor on the island of Puerto Rico.

Main Problem

The main problem that Genesis Communication faces is the constant battling with equipment breakdowns. Meaning GCI is incurring in employee overtime payments, little or no productivity from equipment or employees. GCI is also being backlashed due to not completing projects as per contract deadline requirements. This also affects the company reputation in competing in future project bids.

Objectives

To solve the mentioned problems, the company have decided to implement a maintenance plan. The main objectives to completely solve the mention problems are the following.

- Increase of equipment longevity.
- Increase of employees and equipment productivity.
- Decrease the cost of spare parts.

Project Vision

The vision of the project is to accomplish each objective in the three-month time frame proposed

by management to turn losses into benefits towards the company's employee.

LITERATURE REVIEW

The Total Preventive Maintenance (TPM) is nothing more than a routine inspection of equipment's that have been identified in the past as equipment's that were constantly failing on job sites. The inspections or Preventive Maintenance may include repairs, part replacing, oil changes, lubrication, and most of all cleaning. In other words, the TPM helps keep equipment healthy and ready to work daily. All of this benefiting the company on its projects and metrics [1].

TPM is extremely important for companies who rely on their equipment's to produce income. The advantages are more than the disadvantages. Companies will save money in a drastic way. So, the main benefit is to turn losses in to revenue [2].

- Decrease downtime and number of major repairs.
- It also increasing life span of the equipment.
- Reduce of overtime cost will be drastically.
- Routine repair will take less time as usual.

PROBLEM APPROACH

The main purpose is to implement a Total Productive Maintenance towards their state-of-the-art boring equipment. The main purpose of this equipment is to perform Horizontal Directional Drilling without affecting traffic or the environment. Therefore, the equipment is very sensitive to failures and downtime if not looked after daily. The main problem is that the machine is down 40% of the time. Hence why TPM will be implemented to support this equipment.

Throughout this paper, recommendations are given on how the equipment can be maintained with 100% productivity time and 0% downtime. Data was collected to assess the equipment full capability before and after maintenance implementation plan.

Equipment Assessment & Data Collection

An Overall Equipment Effectiveness study was performed on the equipment to have a clear idea the important aspects that will need improvements.

As stated before, the equipment that will undergo improvements as part of Maintenance Management will be the Vermeer Boring Machine, which is shown in Figure 1 and owned by Genesis Communication Inc. The purpose on the machine mentioned is mainly for Horizontal Directional Drilling. The Machine gives the company an advantage to bore or drill down to 7 ft in depth and bore horizontal up to 1000 ft, depending on the machine's precision. This allows to cross a busy intersection or highway without obstruction of traffic. Boring machines are also used to minimize road or asphalt damage.



Figure 1
Vermeer Boring Machine

During collection and data analysis from the raw data obtained from the field work on the boring machine equipment the following data was obtained and analyzed using Equations (1) to (4). By using these equations, it will give the company a better understanding on what to improve and how to improve at the time of Total Preventive Maintenance Implementation.

$$\text{Availability} = \frac{\text{Time available for production} - \text{Down Time}}{\text{Time Available for production}}$$

(1)

$$Performance = \frac{Ideal\ Cycle\ X\ processing\ quantity}{Operating\ Time} \quad (2)$$

$$Quality\ Yield = \frac{Operating\ Time - defect}{Total\ processed\ quantity} \quad (3)$$

$$OEE = (Availability)(Performance)(Quality\ Yield) \quad (4)$$

The following data was used:

- Time machine was available for production: 720minutes
- Down time machine: 120 minutes
- Ideal Cycle: 100 miles
- Processing quantity: 400 miles
- Operating time: 400 miles
- Defects: 0

Using Equations (1) to (4), the company obtained:

- Availability: 83%
- Performance: 66%
- Quality yield: 100%
- Overall Equipment Effectiveness:54.78%

The Overall Equipment Effectiveness needs to be improved to a much higher number for the project completion. Currently, these machines are only maintained after the project has finalized, meaning the equipment is never maintained. The only time it can be maintained is when it suffers a breakdown during the project. These machines will need to be inspected after each use that has been made during the project at hand. By doing so, machines will be taken care of and ready for sale if an upgrade is needed, thus converting the machine into money during any time needed.

Method Used

The main tool that was used to improve the availability of the equipment is the Total Preventive Maintenance Tool. The guidelines used to for the success of the project is on Figure 2.



Figure 2
Total Preventive Maintenance Guidelines

RESULTS

Full Implementation of the Total Preventive Maintenance Plan was achieved. An early Maintenance Plan was implemented with the sole purpose to achieve milestones established by management. The Daily Maintenance Prevention Design minimizes future maintenance cost and deterioration losses of the new equipment by considering the necessary planning and construction [3]. During the implementation of the mentioned plans, many important aspects were taken into consideration. With the use of Total Preventive Maintenance guidelines structure the team elaborated crucial steps to achieve project timeline such as the following steps from 1-4.

- Step #1: The company identified the Pilot area of need which was the Boring Equipment Machines.
- Step #2: Once established the operators and maintenance staff should begin their autonomous maintenance program, which involves cleaning equipment while inspecting it for deterioration or abnormalities, identifying and eliminating factors that contribute to deterioration, and establishing standards to clean, inspect, and lubricate an asset properly.
- Step #3: The Overall Equipment Effectiveness was measured meaning how available our equipment is, how it performs, and what kind of quality it produces. Measuring this regularly will give a great indicator of whether the TPM program is performing as planned catered towards the boring machines.
- Step #4: Using the focus improvement Pillar, we then take the OEE and assemble a cross

functional team that will look at the data and analyze it and determine the losses and reasons behind of them.

Total Preventive Maintenance Implementation

Each employee who operated the equipment underwent a complete training on the Daily maintenance procedure presented in Figure 3. A full assessment of the equipment was performed to calculate the Overall Equipment Effectiveness after the implementation to view positive results which were the following:

- Time machine was available for production: 720 minutes.
- Down time machine: 40 minutes
- Ideal Cycle 150 miles
- Processing quantity: 400 miles
- Operating time: 600miles
- Defects: 0

Using Equations (1) to (4), the company obtained:

- Availability: 94%
- Performance: 100%
- Quality yield: 100%
- Overall Equipment Effectiveness: 94%

These numbers represent a drastic improvement from the initial OEE before implementation.





Genesis Communications, Inc. Daily Inspection for Boring Machines		
Vehiculo #	Plate#	Daily
Item	Daily Inspection & Operation	
Engine Maintenance	Check Fluids Levels Check air cleaner indicator Perform walk around Inspection.	
Hydraulic Fluid Level Check	Clean hydraulic fluid is very important. Do not spill dirt or other contaminants into the tank. Filter all hydraulic fluid through a 5-micron filter before adding it to the tank. Keep tank filled to sight gauge level. Machine must be level and in transport position.	
Coolant Level Check	Fill to within 1/2" (13 mm) of bottom of fill pipe with a low-silicate (ethylene glycol) antifreeze and clean water mixture.	
Fuel Tank	Fill to within 1/2" (13 mm) of bottom of fill pipe with a low-silicate (ethylene glycol) antifreeze and clean water mixture.	

Figure 3
Daily Maintenance Plan

CONCLUSION

All the objectives presented during the beginning of the project have been completed and accomplished. Results presented helped improve employee's productivity drastically since equipment are not constantly broken-down. Equipment longevity are now up to last ten or more years. The company will be investing their revenue from this project towards their employees benefits such as raises, medical insurance, and 401k. The project completed is the first of many to continue growing the company and its horizons. Many tasks were performed to complete the project such as the following: Addition of diverse team members, complete equipment assessment plan, data collection and analysis, operational procedures and approvals, Implementation of a fully functional Maintenance Plan. The Company now focuses the revenue from this project for all employee benefits including better health care, paid time off and many more services.

RECOMMENDATIONS

It is recommended that management be kept in the loop with the employees servicing their equipment. Thus, management will educate, create teams, allow time, provide resources, and encourage involvement. Employees will learn, educate other coworkers, and promote the method being used. Employees will also transmit their concerns about the implementation to management.

Highly Communicative teams are essential and vital to the accomplishment of mention method. Once these criteria are met the company will see the ROI in a few months. Equipment's are the life and source of revenue of each company, so taking care of them are essential. Without healthy equipment's company will fall and will bleed until bankrupt. Genesis Communications is seeing the results and transferring them into investments for future equipment's and projects to be developed.

REFERENCES

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