final report

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Meat and Livestock Australia Limited
Locked Bag 991
NORTH SYDNEY NSW 2059

Determining the Impact of Maintenance on Equipment Utilisation, Cost and Profit

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ABSTRACT

Research Project M 387 **"Determining the Impact of Maintenance on Equipment Utilisation, Cost and Profit",** identified that there were "potential" benefits of $312 million per annum to be gained by the Meat processing industry pursuing this approach to maintenance. The objective of this "case study" was to validate these results, the methodology developed in this project, and to test the results potential in a large export beef site, as part of the process towards commercialisation. This report concerns the "Case Study" at the Australia Meat Holdings Beaudesert plant

Executive Summary

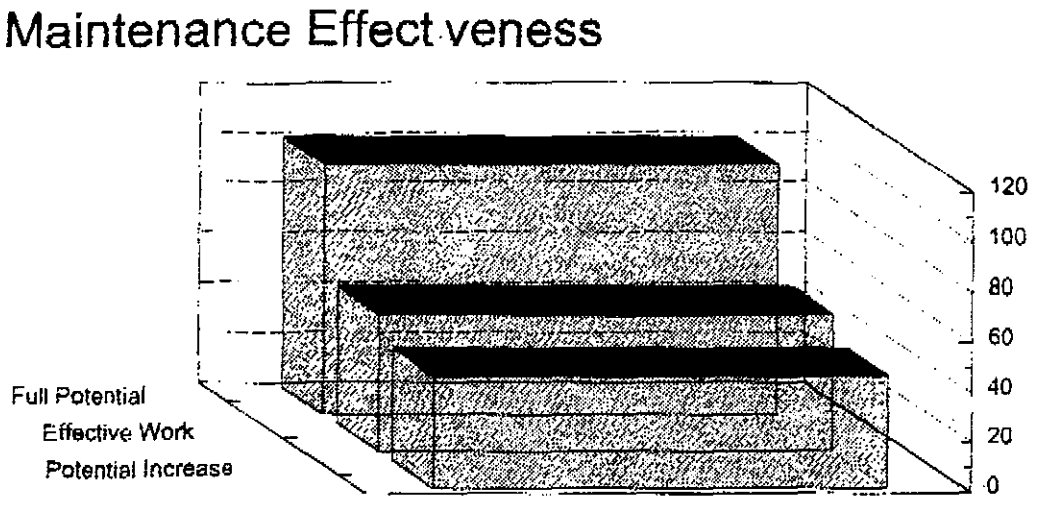
Background

In 1993, MRC funded project M387. "Determining the Impact of Maintenance on Equipment Utilisation, Cost and Profit." A Total Productive Maintenance system was developed and implemented at a domestic abattoir. The project indicated that a significant benefit could accrue to the industry if TPM is implemented by other meat works. Whether value for money is obtained through the TPM approach in a large export abattoir, where a formal maintenance program is already in place, is tested in this project.

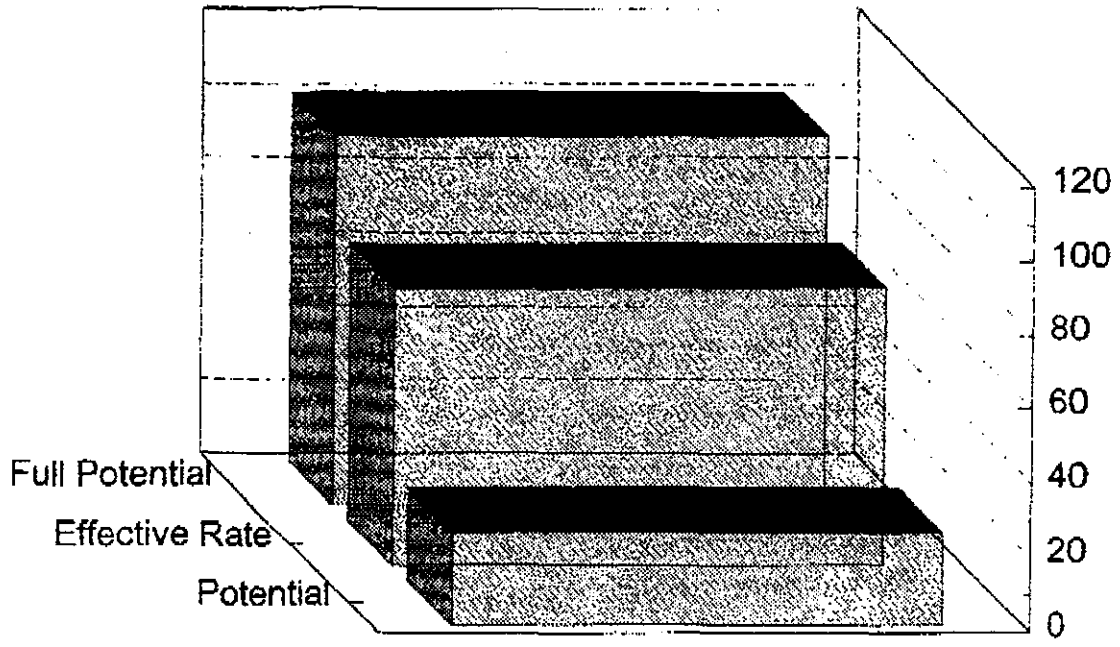
Project Objective(s)

The overall objective of this project is to have conducted a case study implementing Total Productive Maintenance (TPM) at an export meat processing plant in Queensland. The end purpose of the case study is to determine whether the use of TPM approached at a large export meat processing plant, where a formal maintenance program is already in place, further increases the value for money in that plant. Enhancements to the TPM principle and technique can also be obtained through this case study.

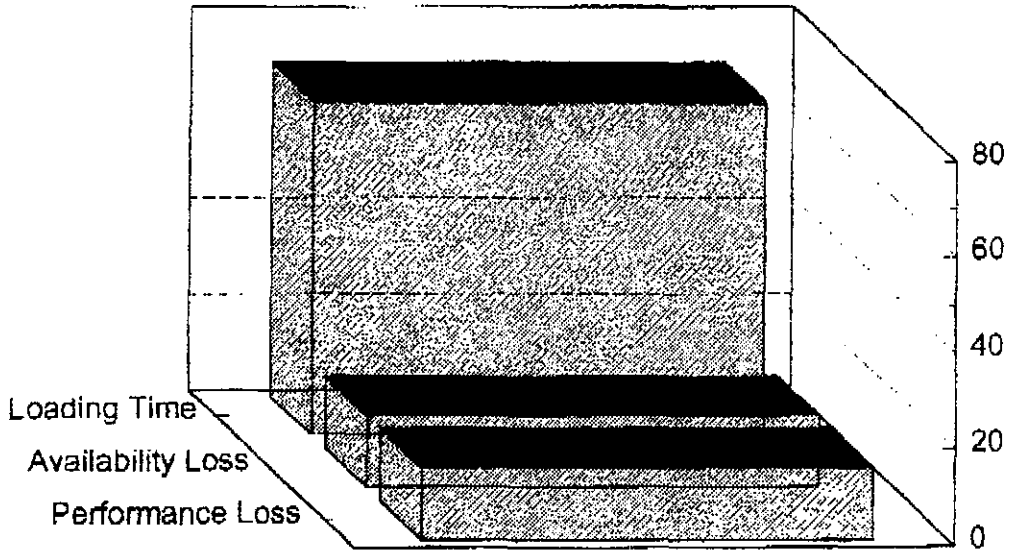
Summary of Results



Line Effectiveness



By-Products Analysis Results



BACKGROUND TO CASE STUDY PROJECT

General Background

Research Project M.387

Research Project M 387 "**Determining the Impact of Maintenance on Equipment U sation, Cost and Profit**", identified that there was substantial Meat processing indus "potential" benefits in pursuing this approach to maintenance.

Summary of Results From Development Site

- Time period results achieved in = 6 months
- Overall Kill Floor Capacity increased by 16%
- Cost of providing maintenance service down 30%
- Maintenance Jobs Backlog down 98%

Extrapolating these results, identified a potential saving to the Meat Processing indus of:-

- Expected (minimum) gains after stage 1 TPM introduction $164.56 r per annum.
- Projected (minimum) gains after stage 2 TPM introduction $3 million per annum

Starting Conditions at research site

The research site had prepared the ground so to speak, by implementing an approac employee involvement, that this project could build on, allowing stage one to be reach by the site within 6 months.

On sites with poor industrial relations it was estimated that stage one would take 9 mo to complete, the additional 3 months being to improve the industrial climate using em- ployee involvement.

Reason for Case Study

To validate these results, and the methodology developed in this project, in "non-prepared" sites, in plants of different size and complexities, and to generally gain industry exposure, "case study" projects were commissioned by the MRC.

This report concerns the "Case Study" at the AMH Beaudesert site.

PROJECT OBJECTIVES AND METHODOLOGY

Description

In 1993, MRC funded project M387. "Determining the Impact of Maintenance on Equipment Utilisation, Cost and Profit." A Total Productive Maintenance system was developed and implemented at a domestic abattoir. The project indicated that a significant benefit could accrue to the industry if TPM is implemented by other meat works. Whether value for money is obtained through the TPM approach in a large export abattoir, where a formal maintenance program is already in place, is tested in this project.

Project Objective(s)

The overall objective of this project is by March 1995, to have conducted a case study implementing Total Productive Maintenance (TPM) at an export meat processing plant in Queensland. The end purpose of the case study is to determine whether the use of TPM approached at a large export meat processing plant, where a formal maintenance program is already in place, further increases the value for money in that plant. Enhancements to the TPM principle and technique can also be obtained through this case study.

METHODOLOGY

Stage 1

The consultant will work with the meat works personnel interactively to build a present profile of the meat works and put in place enhanced measures of performance, cost, etc. Training of personnel in the philosophy and principles of TPM will also be undertaken.

Stage 2

The consultant will work on site to reinforce the techniques and methods taught under the first stage. Systems and procedures used in the plant will be reviewed and possible improvements suggested. Clear goals will be set with the plant.

Stage 3

Further training will be carried out by the consultants after ownership starts building up with the employees.

Stage 4

Participation and input from the production personnel will be encouraged; further courses will be run and practical training conducted, as necessary, by the consultant.

GENERAL BACKGROUND

Case Study Site

The Beaudesert site differed by way of size and complexity of operation markedly from original Research Site.

Size of Maintenance Operation

The Maintenance department was staffed by 40 personnel at the commencement of th project

Type of Operation

High Volume, Beef (export) with boning and packing operations. Throughput at the pr commencement was in excess of 1100 head per day.

Maintenance Hierarchical Structure

While the Maintenance Manager reported to the Plant Manager, there was also a sub nate / reporting responsibility to "Head Office" personnel and support functions.

Employee Involvement

There had been no employee involvement activities on this site

Formal Planning and Set up

At the commencement of the project a Computer Aided Planned Maintenance Syste being installed.

RESULTS AND DISCUSSION

Employee Involvement

While we had expected, some activity to have commenced in this area, it was quickly a parent that although an attempt had been made some months previously to implement ployee involvement in the maintenance area, due to key personnel being reassigned, th had fallen by the wayside.

The lack of any small group involvement, and team oriented problem action groups at th beginning of the project, caused the project to concentrate on developing this with the maintenance personnel at the beginning of stage one TPM development, and prohibite in the time frame the initial impact gained at the development site, and the progression "operator small action groups".

Commencing TPM and Employee Involvement.

Pre-Work

The site Manger Mr John McAuliffe, lent valuable commitment and support to getting t project off the ground. The project started with the Plant Manager informing all the site supervision, and the entire maintenance division, of the project.

Initial Training Workshops

The situation regarding starting employee involvement and TPM, was viewed with sc healthy scepticism, by the maintenance mechanics. However they were a good bunc decided that they would "give it a go", while reserving judgement.

The Maintenance personnel where divided into 2 groups for the initial TPM training w shops.

The "healthy" scepticism, came to the forefront at the end of the first introductory TPM workshop, to a man both groups came to a conclusion at the end of their respective i ductory sessions, which can be summed up by the statement "This is good, we all w do this, but we doubt this could be done here.

To overcome this, we continued the session, where the format encouraged the maint nance mechanics to "get it off there chests" this included recording all the reasons w would not work here. All these reason were recorded on large charts to create visibi This proved to be a highly successful medium, with the maintenance mechanics, sol

many of the reasons it would not work for themselves during this first and subsequent session.

At the end of these initial sessions, the maintenance mechanics enthusiastically participated in the start-up of small action groups, and embraced the concepts of TPM, however they had one reservation left and that was, they were still sceptical of the extent of management commitment to the concepts of TPM and the introductory project.

Advanced TPM Workshops

The majority of the maintenance mechanics, enthusiastically participated in all the training sessions. The case study, conformed that the subject matter of the workshops was suitable and easily understood.

Some more specialist subjects were also introduced, and after overviews of subjects such as project management, selected a small team from amongst themselves to receive the detail training of that subject.

Getting The Teams Started on Implementing TPM

The case study plant being large and complex, and the necessity to develop employee involvement from scratch, lead to the isolating of a few areas to act as a pilot study.

The system of Small Action Groups is the method for TPM promotion within the company. The model used is illustrated in figure 1. Due to the above starting conditions, the initial emphasis was aimed at the Supervisors and Leading Hands, the core action team, with the members of this group forming Small Action Groups for specific problems / actions as per figure 1.

Starting with the core team, some basic "NOW" (analysis of the current situation) was developed. The analysis identified that the plant worked remarkably well considering its age, however the analysis also identified that the methodology of keeping the plant going was costly so far as maintenance efficiency was concerned, and even though a formal system existed, maintenance was generally not planned, the majority of tasks associated with breakdown maintenance. Other areas that the front-end analysis identified was that a "Computer Aided" Planned Maintenance System was being implemented, but that a distinct lack of project control on its implementation was hindering its success.

The front-end analysis pinpointed some major cost areas of which By-products and Boilers was shown to absorb 20% of maintenance costs. Analysis also identified the annual shutdown as being a major problem.

The shutdown was selected as the major project for focus, with the by-products being selected for a longer team project, that would concentrate more on getting the "team" concept going.

Pilot Projects for Team Focus.

Pilot Project 1 -

Due to the short time frame before the Christmas shutdown, planning, scheduling and project managing the shutdown became the major initial pilot project. This is an area that was shown by the initial analysis to lack co-ordination, to traditionally run over budget and over time. Frequent problems were encountered with the co-ordination and scheduling of personnel into areas that were invariably still being worked on by other functions. This also matched experience in other meat processing facilities, so also qualified as case study material.

Pilot Project 1 - The early days

The core small action team, started off well, the action team members selected 2 members to receive specific training and guidance by the case study consultants in scheduling and project management, which include use of "Microsoft Project" as the computer aided scheduling tool.

Pilot Project 1 - The Progression

Step 1 - Determining the work requirements

The work of the shutdown was divided into the various areas, the core action team was then tasked with specifying the work that had to be done. This stage progressed and each area developed their work requirements.

The group then meet to discuss this, and to review how they would allocate time estimates to the work to be done. This caused the team and the sub groups they had developed some concerns as this was the first time that they had to perform a task like this. This was solved by the "specially trained" team members, sitting down with the individual team members and breaking each task down to working chunks (such as remove pump) and in obtaining by question and answer an worst situation best situation and an estimate of the most likely. The basic work plan and budget was then submitted to management for approval. The basic plan was subsequently approved by management.

Step 2 - Scheduling and Planning the Shutdown.

This front-end analysis was then reviewed by the core team in a number group sessions to work out the relationships between the jobs, work areas, trades and sub-contract work being commissioned. To help smoothly schedule personnel and avoid "clashes" between different tasks, the plant was divided into zones, and zone management implemented as part of the schedule, this was to avoid the situation where for example one trade would be trying to repair the floor while another was stripping or assembling a machine in the same spot. The situation of planning work before doing the work was all very new to the team members, and at times caused heated discussions as to why it was necessary. However as the first draft of the schedule came out of the printer, the attitude towards this planning became positive.

The first draft in the form of a gantt chart was then reviewed over a few sessions by the core team, and fine tuned. After relationships were decided and a number of fine tuning modifications carried out the first "resources graph" as produced.

The resources analysis was an eye opener to the team members as it identified their job planning required 80 people the first week and then alternating for the rest of the project between 8 and 60 people on a day to day basis. This required a team meeting and a discussion of scheduling principles the team then reorganised the work, and then processed a new resources graph. The process took many re-runs over a few weeks, but eventually a smooth and consistent work schedule was developed, with only the only fluctuation on a day by day basis being one man.

Step 3 Actually using the schedule for the shut down.

Here we run into some resistance from the team members, having worked hard on the schedule they thought it was over, and the concept of having to work to and report daily against the schedule was an alien concept. At the end of the first week of shut down, the consultants were forced to issue a schedule, which showed that the work was already massively behind schedule. The truth of the situation was in fact that the teams were basically on schedule but there reporting of it was not. After some short team meetings the situation was resolved, and a team member took responsibility for collecting the daily inputs and issuing the revised, updated schedule to the key personnel to distribute.

The result

The shutdown maintenance was completed on-time and on-cost up to the 3/4 the way through mark. At the end of the third week, senior head office management, activated a revised system and start-up schedule which required the dropping of the plan at that stage and the implementation of different requirements, which have rendered interruption of the final results difficult..

Pilot Project 2

Due to the compactness of the area, and its significant allocation of maintenance resources this was chosen as a longer term project. Workshops were given to start the process rolling.

The project in its entirety will take the team about an estimated 12 months to complete and concentrates on the Equipment Improvements. This pilot project did not get prope underway until the 2nd half of the case study, the first parts being used to develop the ployee involvement, the TPM principles and establish more fertile ground.

Project Time Table (modified)

Phase 1 - (2 - 3 months)	Develop Employe volvement.
Phase 2 - (2 - 3 months)	TPM - front-end A sis
Phase 3 - (6 - 7 months)	Implement TPM ir products

Phase 1

The two principle methods used after TPM training were the Small Action Group and th Problem Solving Technique of CEDAC. (Cause and Effect Analysis [with the addition c Cards).

When faced with a difficult problem, the maintenance mechanics tended to stick unswe ingly to whatever idea they happen to hit upon first.

The first phase of this project tackled the development of the Small Group Concept, wh the group could benefit from a variety of ideas. Some of the members attended the firs meeting with resignation. Thinking "We have already tried many different methods and none of them worked". It is always difficult to start something truly new, however the me bers participated well, with the project emphasis being more the process on working as group and the techniques of information gathering and problem solving.

Phase 2

The first stage of this study was to gather information and perform analysis work to develop a picture of the current situation, and then the (pilot) project potential.

No records existed giving a history of hours lost to breakdowns, speed losses, idling or nor stops, that would have allowed the calculation of the "Overall Equipment Effectiver Rate" One of the early tasks was to develop this measure and get the maintenance me chanics to accept and operate the measure. This was achieved and implemented. To overcome the problem of no immediate data the values were estimated (by the group). The initial analysis indicated that a 20% increase in by-products capacity was achievat within a 12 month time period.

Pilot Project 3

To generally develop the concept of employee involvement the afternoon shift was chos to develop general problem solving activities.

One overall site measure tackled by the general problem solving project group, was to c culate the maintenance effectiveness (in productivity terms). No management informatic of the type necessary to calculate actual effectiveness performance of the maintenance mechanics existed, experience has shown this to be quite normal for maintenance depa ments in any industry. To overcome this and gain a measure of current effectiveness the consultants introduced to the team a format that allows estimation on this based on mor general observations. The overall maintenance effectiveness was shown to be between 45 % and 55 %. Using the same format the line effectiveness was estimated at betwee 65% and 75% .

Methodology

The case study shed light on the methodology developed in project M.387, which can b summarised as follows:

Set an explicit goal and target for the problem

- Extract essential factors necessary for achieving the goal through p tice.
- Establish a strategy to apply them
- Apply them, analyse the results and make necessary adjustment.

CONCLUSIONS AND RECOMMENDATIONS

Achievement of Objectives

The conclusion is drawn that the overall objective of the case study: -

"To Determine whether the use of TPM approach at a large export meat processing plant, where a formal maintenance program is already in place, further increases the value for money in that plant."
has been meet, with the results from the case study indicating, the site could improve plant throughput by up to 20%, and that maintenance efficiency has a potential for a 30% improvement by full implementation of the TPM program to the whole site.

Liberating the benefits

The conclusion is drawn that to liberate 75% of the potential benefits at this site would require a 12 - 18, month program, and this timing should be applied for all large sites, with similar starting conditions. The successful implementation of employee involvement, prior to commencing would reduce these time periods by 3 to 6 months. To fully implement TPM in at the case study site achieving the total potential would require a 24 to 36 month program, (this would be largely self sustaining).

Commitment

While successful implementation and good initial results have been gained on the case study site, time and potential is being lost, due to the "Senior Management" remoteness and "visible commitment" to the improvement process.

Implementation conclusions

From the case study the following conclusions on implementation was reached:

1 - Form an initiative small group

2 - Perform a front-end assessment

3 - Begin employee small group activities

4 - Develop Facilitators who understand TPM and are skilled in facilitating . . small group activities.

5 - Implement the TPM Activities

Identified needs

The case study has identified the following needs.

- A more cost effective way of delivering TPM, that allows for a grater degree of self help.
- Site Champions and Facilitators to assist "fast track" the implementation process.
- A means to gain "Active" Senior Management commitment and dedication prior to commencement of the main program (particularly in the larger companies) identified.

Impact On Meat Processing Industry

The results confirm the research project M387 findings that implementing TPM would save $164.56 million per annum to the industry, after a 12 month program. And $312.41 million per annum after 2 - 3 years.