DAY 1 Details of Maintenance Planning and Scheduling Training Power Point sold at BIN95.com (97 slides)

Ted becomes a Maintenance Planner
Maintenance Planning and Scheduling Training
Presented by Mike Sondalini
Biography of Mike Sondalini
Qualifications:
Tradesman Fitter Machinist
Professional Mechanical Engineer (1st Class Honours)
Project Engineer
Maintenance Engineer
Master Business Administration
Maintenance Manager
The role of Maintenance Planning in business and its foundation basics
Day 1 of the course

Ted is asked to become the Maintenance Planner

Ted begins to learn about Maintenance
Understand How Machines are Designed
The Unforgiving Nature of Machine Design
The 6 Purposes of Maintenance
Maximum Production
Plant and Equipment Life Cycle
What Makes a Productive Equipment Life?
The Asset Management 'Journey'
The Lifetime Reliability 'Journey'
Strategic Business Importance of Maintenance

Joe sets Ted a trick question.

The next day …
The Purpose of Business
Effects of Maintenance Costs
Impact of Defects and Failures
Defect and Failure True (DAFT) Costs go Company-wide
Failure Costs Surge thru the Company
And clearly, repeated plant and equipment failures and stoppages totally destroy the profitability of an operation.
Benefits of Reducing Operating Risk
Calculate the True Downtime Costs
Implications of DAFT Costs on Maintenance
If each failure costs your business $7,000 – $15,000 for every $1,000 of repair cost … what risk is the business willing to carry?

How often will a failure event be accepted?
Equipment Item Failure Total Domain

Joe sets Ted a second trick question.

They meet the next day …
Discovering the Hidden Factory
How Maintenance Planning & Scheduling Help to Reduce Unit Cost of Production
The 'Hidden Factory'
When Operating Costs are Committed
Maximising Life Cycle Profits
Life Cycle Risk Management Strategy
Optimised Operating Profit Method
What Risks Are Out There?
Risk $/yr = Consequence $ x
No of Failures /yr x
Chance of Failure
Grading Risk based on Chance & Consequence
What Risk Means
Risk – Reduce Chance or Reduce Consequence?
Risk Management Process

Joe asks Ted to think about the role of Maintenance.

They meet again …
The Application of Risk Based Principles to Maintenance
Equipment Criticality
Equipment Criticality =

Operating Risk =

Failure Frequency/yr x DAFT Cost Consequence ($)

Equipment Criticality is a business risk rating indicator.
Identify Your Equipment Risks and Priority Equipment
Develop an Equipment Criticality Matrix
Equipment Criticality Matches Business Resources to Business Risk
Match Maint Type to Equipment Criticality *Risk Based Method*
Choosing of Maintenance Type
Simplified RCM Method
Equipment Criticality for Subassemblies

Activity 1 – Equipment Criticality
Using the Workbook identify the equipment criticality for the items of a mining truck

Joe sets Ted another question.

They meet again …
Physics of Failure
Building for the Physics of Failure
The Degradation Cycle
Establish Equipment Condition Monitoring
Failure Mode Effects Analysis (FMEA) Fundamentals
Failure Mode Effects Analysis
Activity 2 – Failure Mode and Effects Analysis (FMEA)
Using the Workbook do a FMEA for an item of plant.

Joe sets Ted a hard question.

The next morning …
What is the Reliability of These Parts and Systems?
Individual Parts Reliability Curves
Reliability for Systems
•Series Systems
$R_{system} = R_1 \times R_2 \times R_3$

•Parallel Systems
$R_{system} = 1-[(1- R_1)x(1- R_2)x(1-R_3)]$
Reliability for Series Systems
$R_{system} = R_1 \times R_2 \times R_3$
Reliability for Parallel Systems
The Reliability of Systems of Parts and Components
The shape and position of the 'system' curve is adjustable by varying the policies controlling quality and maintenance!
Failure Prediction Mathematics – Weibull
Reliability of Parts and Components
Implications of Reliability on Maintenance
• If your machines have parts that show age-based failure, then replace the parts on an accumulated usage basis. (Not on a time basis, unless environment degrades the material.)
• But if you have machines with parts that can fail at any time, and they can last a long time, then when do you replace them? What now becomes important is how 'stressful' has each part's life been to this point in time? How many failure modes has it seen? That is dependent on what happened to it during its operating service. This means we must know the part's condition all the time. Especially we must count the number and size of 'stress' excursions of all failure modes.
When and How Much Maintenance?

If a part ages/wears with use, replace it after use accumulates to the allowed amount. *(PM)*

If a part's life is chance-failure based, and was not stressed, it will last indefinitely. (Precision Maintenance)
But if it was stressed we must check the part's condition to decide how much life is left in it, and when to replace it. *(PdM)*
Equipment Reliability Strategies

That morning …
Maintenance Strategies for Risk Reduction
Match Maintenance Strategies to Risk
Move from Reactive to Proactive to Risk Reduction.
Opportunity Maintenance Explained
Maximum Allowable Downtime
Measuring Plant & Equipment Performance
We need
to
know
the
impact
of
equipment
not
performing.
Benefits of Failure Elimination
Set Standards and Standardise their Use

- Lubrication
- Vibration
- Shaft Alignment
- Balancing
- Component Stress and Fatigue
- Component Tolerance
- Material Selection
- Equipment Deformation Limits
- Torque and Tension
- Looseness
- Contamination
- …? …

6 Mechanical Equipment Care Standards to Set, Use and Keep Using
Vibration:
Activity 3 – Setting Reliability Standards
Using the Workbook identify what reliability standards to use for the various types of equipment and situations

At the end of the session …

They meet in the morning …
Precision Maintenance of Machinery is …
•Accurate Fits and Tolerance at Operating Temperature
•Impeccably Clean, Contaminant-Free Lubricant Life-long
•Distortion-Free Equipment for its Entire Life
•Forces and Loads into Rigid Mounts and Supports
•Laser Accurate Alignment of Shafts at Operating Temperature
•High Quality Balancing of Rotating Parts
•Low Total Machine Vibration
•Correct Torques and Tensions in all Components
•Correct Tools in the Condition to do the Task Precisely
•Only In-specification Parts
•Failure Cause Removal to Increase Reliability
● A **system** to make all the above happen
Precision Maintenance Delivers Big Savings
Using Precision Maintenance
Creative Disassembly –
Pre-shutdown of Equipment
Gather historical and background data whilst still in service …

•vibration, bearing, thermography, oil data for diagnostic purposes. Look at this for varied process conditions

•check for running 'soft-foot' (machine distortion when at operating under load)

•look for resonance in machine, structure, pipe work, other attachments

•look at the equipment's maintenance history for tell-tale evidence
Creative Disassembly –
At Shutdown
Before Strip-down …

•where thermal growth is important for alignment, obtain hot alignment readings while still at operating temperature

•look for witness marks, evidence of shifts or relative movement

•check for static soft foot (machine distortion when at stand-still)

•sample lubricants and other fluids
Creative Disassembly –
At Strip-down
•Look for witness marks, evidence of fretting etc
•Disassemble in clean and well lit areas
•Photograph damage if applicable
•Avoid damaging during removal
•Mark the relative locations of bearings in housings, top and side, inboard and outboard
•Gearing wear patterns - eccentricity, backlash, misalignment etc

As the day's session draws to a close …

Using Condition Monitoring to
Optimise Availability
A Roadmap for Reliability Improvement

The sessions on Maintenance and Reliability end …
End of Day 1
What's on in Day 2
•Two Planning Activities
•Planning Systems
•Job Standards
•Project Management
•The Planning Process