

Improving Reliability and Reducing Maintenance Burden

Reliability Centered Maintenance on the 43 tonne dockyard crane.



Reliability Centred Maintenance (RCM) is a proven methodology for establishing the optimum preventive maintenance regime. It begins by identifying the performance required from the equipment, the way in which the equipment fails and the plausible causes of failure, and then details the effects and consequences of failure.

This allows an assessment to be made of the criticality of the failure and identifies significant safety, availability or cost consequences.

The methodology allows the selection of an appropriate maintenance task that addresses each identified failure. RCM is an effective first component in any process to determine maintenance requirements. It provides a fully auditable decision-making process and ensures compliance with statutory requirements.

The RCM Study

LSC Group was requested to conduct an RCM assessment of the current maintenance for the crane and to identify the most appropriate and cost effective maintenance regime, with no detrimental safety, availability or economic impact.

Working alongside DML (now Babcock Marine) LSC Group supplied the RCM expertise and was responsible for recording the analysis and reporting the results. DML supplied the appropriate engineering expertise, allowing the RCM study to be conducted on a team basis. This partnership brought together the following attributes:

- Knowledge and experience of the RCM process.
- Detailed knowledge of the appropriate design features, installation and commissioning.
- Knowledge of how the crane is used, operated, maintained and supported.
- Knowledge of the condition of the crane and its components at overhaul, including understanding of the actual failure modes, and their effects.
- Specialist knowledge of constraining influences, e.g. Health and Safety, environmental legislation, regulatory bodies, etc.

The Challenge

To identify the most appropriate, cost effective maintenance regime for the crane with no detrimental safety, availability or economic impact.

Solution

An RCM analysis that identified the various alternative solutions to manage the crane maintenance schedule.

Customer Benefits

Scheduled maintenance for one crane reduced by 725 man-hours per year.

Time and labour savings as a result of stripping out unnecessary maintenance.

The potential for £1.3 million maintenance saving through the anticipated life of two identical cranes, with the RCM study costs being recouped within the first year.

Detailed technical data was required to conduct the study and was obtained from manufacturer's handbooks, assembly drawings and wiring diagrams. Available failure data was reviewed to ensure that all failures that had previously occurred were addressed. Maintenance records were reviewed to give an indication of the condition of equipment after use. Where historical failure data was not available, the engineering judgement of the team, with a thorough knowledge of the equipment, was used. Site visits were essential to acknowledge the physical attributes of the crane, appreciate any difficulties experienced by operators and maintainers and to assess the environmental conditions under which the crane operated.

Deliverables

The following deliverables were provided in the form of a RCM Study Report:

Operating Context Statement

This statement provided a physical and functional description of the crane and described the physical environment in which the crane was operated. It also provided precise details of the manner in which the crane was used and specified quantitative performance requirements.

Analysis Comments Report

This report provided details of the documents used and referenced during the study, identified individuals involved and listed any assumptions made throughout the study.

FMECA / Consequence & Task Analysis

These outputs recorded the results of the analysis and detailed the justification for maintenance task selection and frequency. The analysis identified 66 functions, 132 functional failures and 694 engineering failure modes for the crane. 180 scheduled maintenance tasks were derived, of which 54 tasks were new tasks that had not previously been carried out. Many of the existing maintenance tasks were not justified by the RCM analysis and auditable rationale was provided to support their removal from the maintenance schedule. 2 'Mandatory Redesigns' were recommended to address engineering failure modes with safety consequences and a 'Desirable Redesign' was recommended to prevent economic consequences.

Planned Maintenance Schedule

This schedule listed the routine preventative maintenance tasks required to support the crane in its operating environment for the duration of its anticipated life cycle (30 years). A move to a calendar based maintenance cycle was recommended, in preference to the existing operating hours based cycle. This allows for easier management and better planning of the maintenance activities and increases crane availability.

Maintenance Comparator Report

This report allowed a direct comparison between the existing maintenance schedule and the RCM-derived maintenance schedule. The comparator showed a 43% reduction in the maintenance effort required to support the crane. This reduction was possible because the man-hours needed to meet the requirements of the RCM-derived maintenance schedule were significantly less than the man-hours required to complete the existing schedule.

When approval is sought from the regulatory body for a design change notification as a result of modifying the maintenance schedule, the RCM Analysis can be used as the supporting justification and validation document. The level of detail in the analysis encompasses and far exceeds that provided in existing procedures and reports, ensuring that all maintenance activity considerations have been addressed.

Benefits

The RCM-derived maintenance schedule identified reductions of 725 man-hours per year compared to the current regime. When applied to a second identical crane this gave a potential saving of £1.3 million through the anticipated life of the cranes, with the RCM study costs being recouped within the first year.

Further cost savings are possible by using this analysis as a template to produce maintenance schedules for other cranes, although a level of revisit would be anticipated dependant upon the type of crane and its location.

Conclusion

The RCM Study has identified the appropriate maintenance tasks to ensure safe, reliable and economical use of the crane throughout its life. The study has justified the removal of existing maintenance tasks from the schedule and has justified new tasks to prevent adverse safety, availability or economic consequences all in a structured, auditable manner with the net result being greater equipment availability at a significantly reduced cost.