

BRIDGE ASSET MANAGEMENT

REDUCE MAINTENANCE COSTS AND IMPROVE RELIABILITY WITH RISK-BASED MANAGEMENT



An Industry First

Lloyd's Register has combined its innovative KBAI™ technology with Structures Condition Rating (SCR) methodology, delivering a next generation risk-based solution for bridge inspection and maintenance.

This integrated approach enables you to prioritize funding, implement dynamic maintenance regimes that can evolve over time, and establish risk-based inspection intervals.

KBAI™: The Next Generation

Knowledge-Based Asset Integrity (KBAI™) is a risk-based technology for improving asset reliability and integrity using cost/benefit analysis. Within KBAI™, *benefit* is measured as a reduction in risk to the operation.

For example, a KBAI™ analysis may identify that a £5,000 preventive maintenance activity on a busy rail system will reduce the risk of an unplanned closure by £10,000 and should therefore be undertaken. Or a KBAI™ analysis may identify that the same £5,000 maintenance activity on a less busy rail system

will only reduce risk by £100, and therefore should not be undertaken.

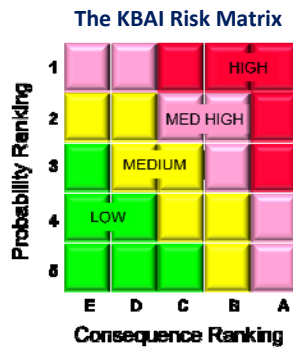
Traditional maintenance programs are founded on time-based inspection, time-based preventive maintenance (pre-emptive replacement), and reactive maintenance (repair after failure). The traditional approach does not place a priority on incorporating the risk of failure and resulting business impact, thus over allocating resources to low risk assets and under allocating resources to high risk assets.

In contrast, KBAI™ is a dynamic inspection and maintenance approach which determines resource allocation based on risk. KBAI™ increases resource allocation to high risk assets (where it is needed most) and reduces allocations to low risk assets. The KBAI™ goal is to increase the reliability of critical assets and reduce expenditures on low risk, non-critical assets.

"It is not often that you come across truly innovative ideas such as this in the field of asset management. KBAI™ has proved itself as a cost effective means for managing risk across large scale asset bases."

- Keith Elliott
Royal Mail Group Property
former Facilities Management
Director

Risk-based asset maintenance strategies deliver improved asset performance while simultaneously reducing costs. Our tools and services enable the successful delivery of risk based asset management strategies, and can be applied to a range of assets including bridges. By adopting an innovative risk-based management approach, you will be able to intelligently deploy maintenance resources to the areas that have the greatest potential to positively impact to your systems, reduce maintenance costs, improve asset reliability, and model future performance throughout the asset lifecycle.



The KBAI Risk Matrix
Illustrated above, the KBAI™ Risk Matrix is used to recommend inspection and maintenance intervals. The matrix characterizes both the risk and criticality of an individual or group of assets by plotting the Probability of a Failure (PoF) against the Consequence of a Failure (CoF). KBAI™ develops the recommendations using criticality. Like the previous example, a busy road bridge might be in a high criticality category and thus require maintenance once a year, while a rural road bridge might be in a lower category thus requiring maintenance only every six years.

- Design
- Build
- Operate
- Decom.



The PoF is driven by statistical analysis and failure statistics from our entire customer and asset database, with a focus on Mean Time to Failure (MTTF) for each asset and their components. This information is reinforced with public data sources and the insight from recognized Subject Matter Experts from Lloyd's Register. Over time, the KBAI™ regimes are refined with MTTF data collected in the program.

The CoF assessment models a combination of factors to quantify an event based on availability, safety, environmental, and political impact. The CoF assessment can be driven by either qualitative or quantitative modeling techniques. The more complex quantitative approach provides the most accurate estimates on the impact of an event, while the less complex qualitative approach provides a range of possible impacts and supports more subjective input.

KBAI™ supported by SCR

KBAI™ users can now leverage Structures Condition Rating (SCR) methodology. SCR is a high level bridge management methodology for objectively calculating bridge condition.

Structures Condition Marking Index (SCMI) was developed using SCR methodology to support Network Rail's management of their 40,000 bridges and their strategic goal of maintaining versus renewing. With a lifespan often in excess of 150 years, bridge diversity requires that the condition of each structure be



appraised individually and site specific actions be defined.

Previously, examiners gathered bridge condition data at regular intervals and rated them as good, poor and fair. This approach lacked objectivity and consistency, and did not substantiate funding requests.

In contrast, SCMI demonstrated to the UK regulatory agency that Network Rail has a robust bridge condition marking system. SCR methodology reinforces consistent and objective condition information, a key requirement for asset management systems.

SCR Delivers:

- Standardized element identification, enabling sketches and structure-specific element breakdowns for every bridge.
- Consistent element condition records using quantitative, material specific codes for both defect severity and extent.
- Relational database with the ability to prepare examination

forms and interface to other systems.

- One time element identification on the first visit, with condition marking and data updates at each detailed examination.

SCR Advantages:

- Demonstrates to regulatory bodies a robust and numerate system for establishing the asset condition.
- Provides readily understood best practices
- Delivers process standardization, from detailed element inventory to objective defect recording.
- Results in a substantial decrease in risk arising from the use of ambiguous terminology (for example, reducing the risk of the wrong bridge element being repaired)
- Documents that objectivity and standard practices are not inherent without a system to support process implementation and ongoing management.

Working better by working together.

By combining your operating knowledge with our 4th generation, KBAI™-based risk management methodology and SCMI, you will be positioned to dramatically improve your transportation asset portfolio. And you will be confident that your inspection and maintenance decisions are based on accurate, intelligent and highly engineered strategies.

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April 2010

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Lloyd's Register is an independent risk management organisation providing risk assessment and risk mitigation solutions and management system certification around the world.



LIFE MATTERS