



Blast Furnace Skip Hoist – Wire Rope Life Extension

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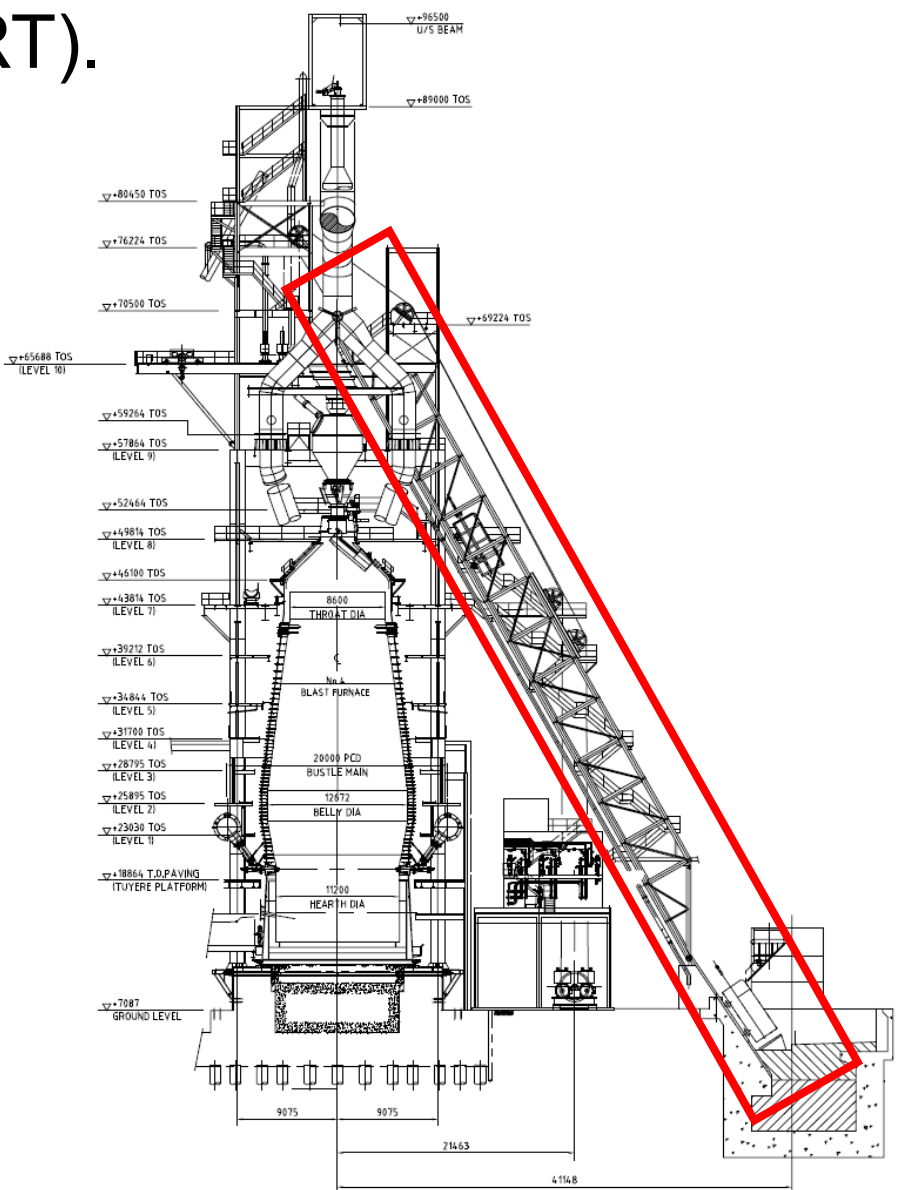
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Introduction

Tata Steel Port Talbot has two blast furnaces that produce iron for the steel making process. Critical to the furnace's operation are the skip car hoists which load raw material into the hearth. The wire ropes of the skip car hoist are currently changed out on a frequency basis of 2.5 Mt of raw material loaded into the blast furnaces. It is the hypothesis that the wire rope frequency could be extended with the utilisation of magnetic wire rope technology (MRT).



Blast furnace showing skip hoist location

Project Aim / Objectives

Aim

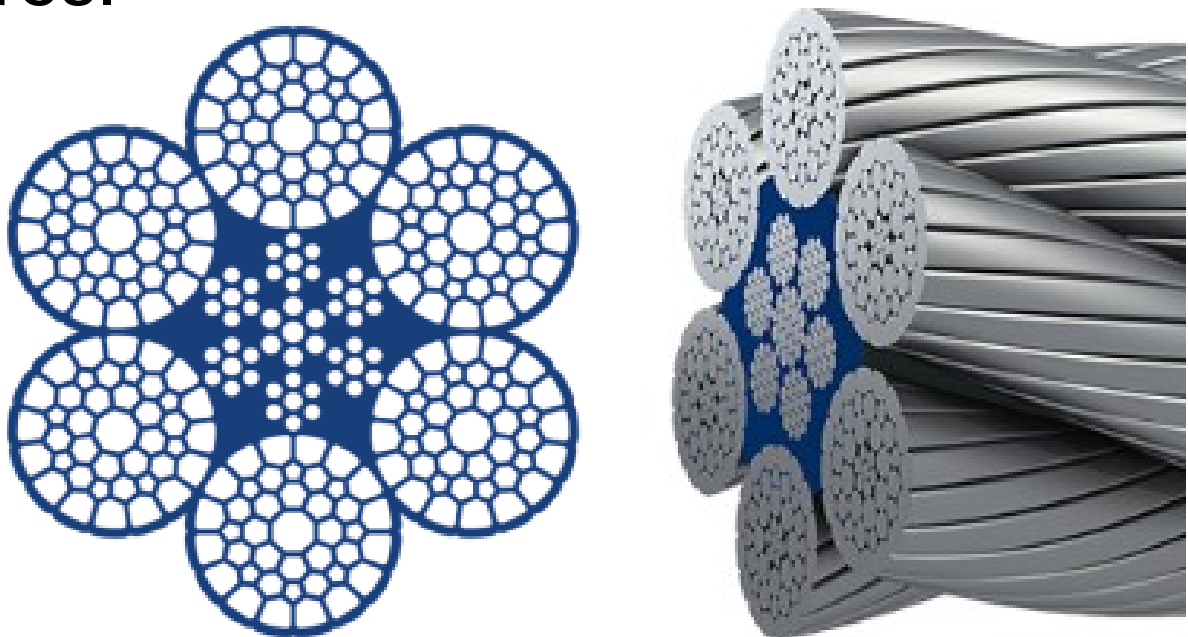
Research and carry out wire rope testing with the use of MRT with a view to increase the lifespan of the skip hoist wire ropes while ensuring that an acceptable level of safety is upheld.

Objectives

1. Provide evidence in support of increasing the lifespan of the skip hoist wire ropes.
2. To increase the overall safety of the wire ropes.
3. Carry out MRT testing on the skip hoist wire ropes.
4. To implement underutilised technology on the skip hoist wire ropes within Tata Steel Port Talbot.

Research & Contextualisation

Research was carried out into the structure and properties of steel wire ropes and the 8 primary failure modes. It was identified that two defect types were inherently difficult to detect which were internal corrosion and internal loss of metallic area through wear or broken wires.

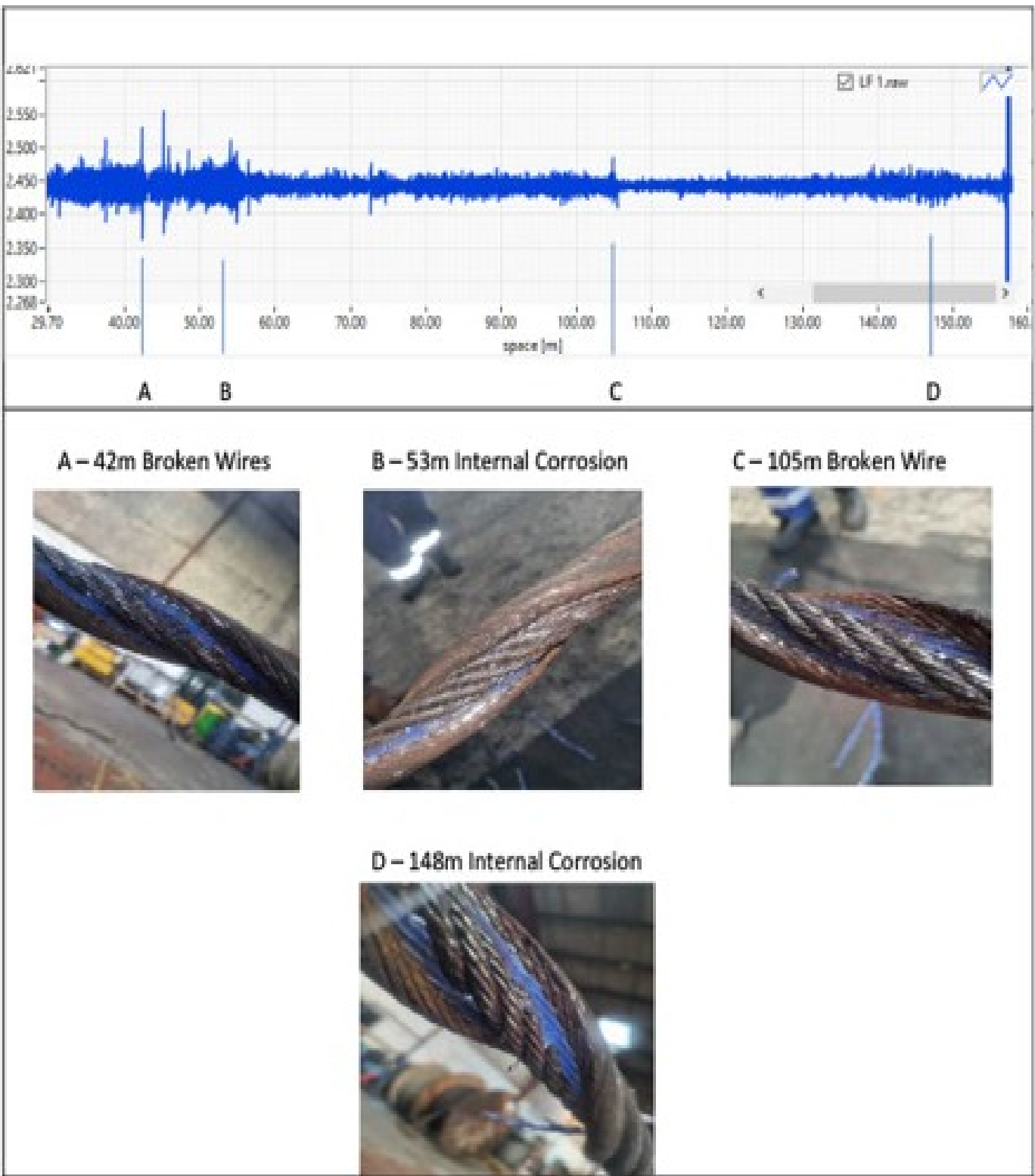


6x41 IWRC wire rope as used on the skip hoist

Once the internal defects were understood, the research was directed to techniques used to identify these types of degradation. This led to the notion that MRT could be used for internal defect identification. MRT was then scrutinised for suitability, and it was understood that it was the only technique claimed by the standards EN12927 and ISO4309.

Results

The MRT results show several potential defects within the wire ropes at varying points throughout their 160m length as shown in the MRT trace below.



MRT results showing potential defects

There was potential internal corrosion identified alongside singular and multiple broken wires. However, upon destructive testing there is evidence that the defects may not have met discard under ISO4309.

Conclusions & Further Work

Conclusion

- There is clear evidence MRT identifies internal defects, however, somewhat subjectively and qualitatively.
- Baseline inspections would build data to follow degradation of the wire ropes.
- Potentially spurious sections of results due to the removal procedure and storage.
- Identified corrosion can be prevented with a robust lubrication regime.

Further Work

- Testing to be carried out on the live asset wire ropes at set intervals to ascertain real world data with consideration to continuous monitoring.
- Maintenance plans to be further scrutinised for improvements including lubrication schedule.

Acknowledgements

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References

British Standards Institute, 2017. *BS ISO 4309:2017 Cranes - Wire ropes - Care and Maintenance, Inspection and Discard*. London: British Standards Institution.

British Standards Institution, 2019. *BS EN 12927:2019 - Safety requirements for cableway installations - Ropes*. London: British Standards Institution.

Torkar, M. & Arzensek, B., 2002. Failure of a Crane Wire Ropes. *Engineering Failure Analysis*, Volume 9, pp. 227-233.

Verreet, R. & Ridge, I., 2005. *Wire Rope Forensics*. Stavanger, CASAR Special Wire Ropes.