

INTRODUCTION

Linking London to the West Midlands, the North West of England, Glasgow and Edinburgh, the West Coast Main Line (WCML) is a principal rail corridor absorbing over 2,000 train movements each day and more than 75 million rail journeys each year. As part of a commitment to deliver shorter journey times to cater for the needs of train operators and users, operating close to capacity and supporting line speeds of 100 - 110 mph, investment in a continuing programme of work since 2003 has seen the route being substantially upgraded to increase capacity and reliability.

With Infrastructure and control systems being designed to support the running of tilting trains at speeds of up to 125 mph, the safety and reliability of signalling systems such as circuit breakers are of great importance. In 2003, staff now working for Sotera Risk Solutions Ltd., were commissioned to investigate if a particular circuit breaker product met a number of criteria with regard to its safety and reliability.

The Signet product was proposed as a device to provide appropriate protection against cable faults, as well as maximising the reliability in a 'Radial Feeder' arrangement. This project required investigation as to whether:

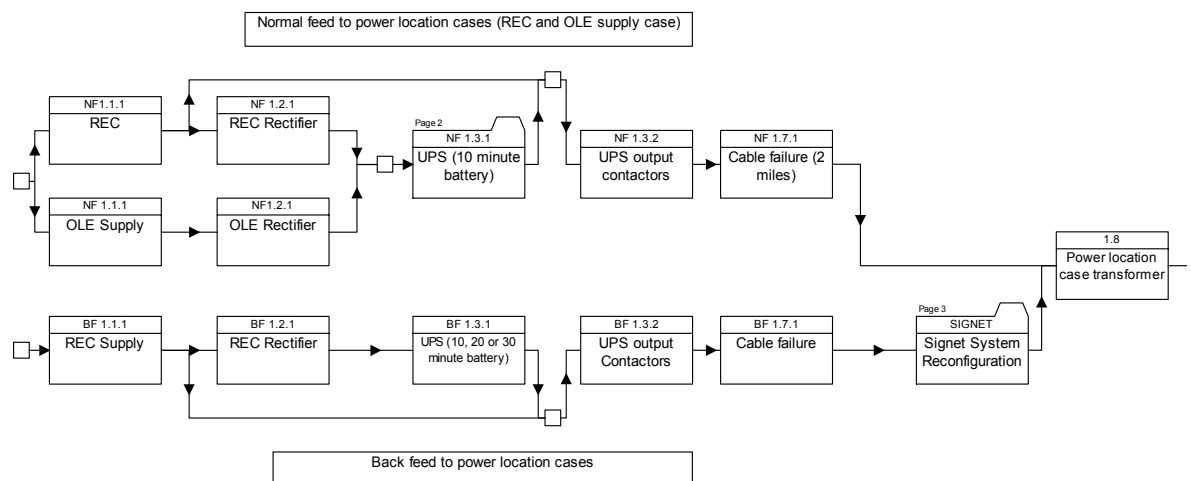
- The Signet product had the potential to mitigate against potential failures in the linked radial feeder arrangement;
- The reliability/maintainability of the Signet product was likely to be sufficient to allow the radial feeder arrangement to meet the RAM requirements;
- The reliability/maintainability of the proposed auxiliary power supply arrangement with single UPS was likely to be sufficient to allow the radial feeder arrangement to meet the RAM requirements.

In addition to these aims, a number of performance targets were set for the power supplies to this resignalling project and a number of schemes were investigated from a RAM (Reliability, Availability and Maintainability - a measure of equipment performance) perspective. It had already been previously determined that a Linked Radial Feeder scheme incorporating the Kelman Signet product in each power location case has the potential to meet the appropriate RAM targets

APPROACH

The scope of work for the project included an update to the auxiliary power Failure Modes, Effects and Criticality Analysis (FMECA) to assess the radial feeder with Signet arrangement, as well as an additional FMECA on the Signet product and reliability quantification using reliability block diagrams (RBDs). Part of the RBD is shown below.

FMECA AND RELIABILITY ASSESSMENT OF THE SIGNET VACUUM CIRCUIT BREAKER



Each FMECA that was carried out addressed:

- 1) The auxiliary power distribution system with Signet incorporated,
- 2) Components within the Signet product.
 - key failure modes of the equipment;
 - associated failure rates.

CONCLUSIONS

The study concluded that the radial feeder arrangement with Signet meets the MTBSAF (Mean time between service affecting failures - the interval between failures potentially resulting in a train delay exceeding 3 minutes) requirements for those power location cases fed from Principal Supply Point (PSPs) with both Regional Electricity Company (REC) and Overhead Line (OLE) supplies. For PSPs fed only by the REC supply, it was found that the predicted reliability level failed to meet the requirements even where a 30 minute Uninterruptible Power Supply (UPS) was used. This finding provided Network Rail with a clear answer to their research question, thus providing direction for a decision to be made with regard to procuring the Signet product for the upgrade of infrastructure on the WCML.

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