Reliable and Resilient Switches

What is the situation?

fig. 1

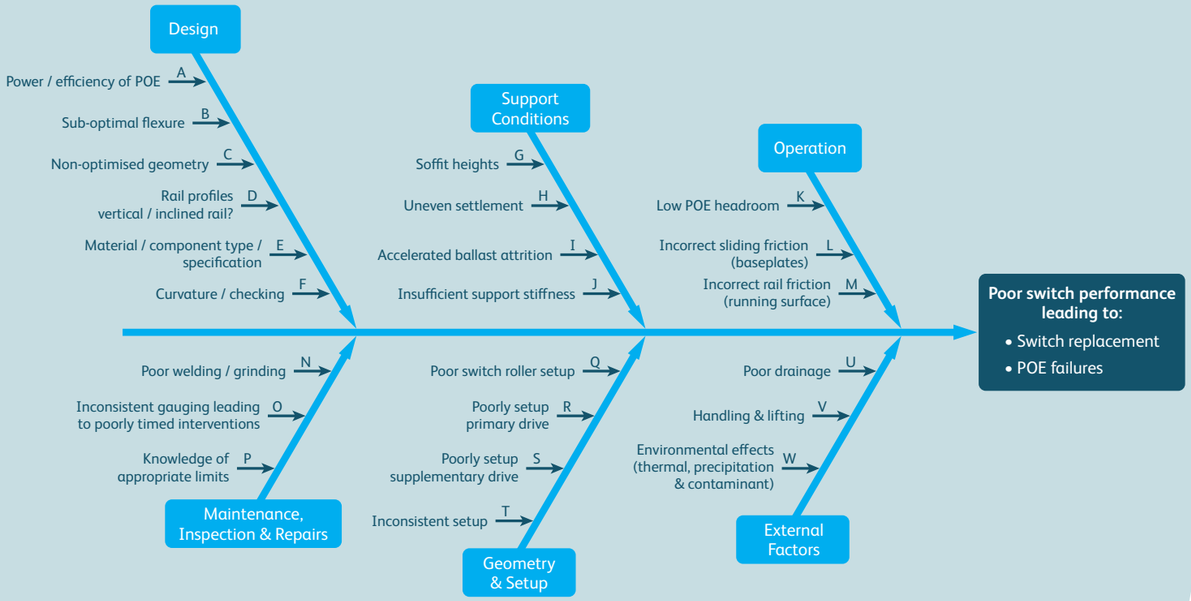
Switch failures can create major safety risks and generate huge annual costs.

Switch and Points Operating Equipment (POE) represent one of the most safety critical aspects of our infrastructure. Failures often expose workers to hazardous live railway environments or risks managed with safeguards such as caution speeds and driver observations.

Switch failures are a contributor to poor network performance. Switches and POE that wear rapidly or enter a deteriorated state must be maintained and replaced more frequently. This increases the whole life cost of the asset, making the challenge of improving and increasing infrastructure capacity more complicated.

Track access to carry out essential works is a premium commodity and the need for switches and POE to operate safely and reliably with less hands-on maintenance is greater than ever before.

Analysis of causes



Priority problems

Specific priority problems	Related goals	Benefits
• Unreliable switches and POE systems.	• Build in resiliance to temperature and environmental variations.	• Consistent performance of assets, year round.
• Poor control of alignment/ geometry/maladjustment.	• Self-adjusting S&C. Automated inspection.	• Performance, safety and cost reduction (fewer boots on ballast).
• Lack of access for maintenance with increased capacity (i.e. Digital railway).	• Link to self-adjusting. Higher MTBSAF.	• Realisation of increased capacity.
• Information management for S&C - myriad of analysis/data sytems.	• Align with a joined up asset management approach.	• Greater knowledge of asset condition and life leading to better maintenance/renewals plans.
• Lack of resiliance in modular S&C.	• Develop alternative bearer tie systems.	• More (and more reliable) modular S&C, driving down cost of renewals
• Inadequate training and competency.	• Improve access to training resource & asset knowledge. Information Hub.	• Greater trackside.
• Complexity & human factors.	• Simpler design, less hands-on maintenance/installation.	• Reduces strain on competence development - human errors are difficult to predict.

To address these challenges it is expected that R&D actions will need to address the following aspects:

- How can alternative materials or coatings be utilised to enhance the performance of switches? Improvements will prolong life, reduce whole-life cost and reliance on maintenance. Weld repair processes should be considered for any alternatives.
- Optimise switch-profile and geometry to minimise wear/damage whilst reducing derailment risk. Consideration of manufacturing methods should be given.
- How can improved inspection methods, both automated and manual, help predictive maintenance whilst furthering our understanding of precursors to switch wear/damage?
- Improved understanding of the principles behind UIC716R and how it can be applied to UK switch designs.
- A fundamental understanding of switch design, flexure and drive forces is key to optimising point operating equipment and supplementary drives.
- What improvements to wheel/rail and slide plate friction management can be made? Considerations should be given to new plate materials, coatings, lubricants and roller technologies.
- How can alternative and innovative actuation, locking and detection systems improve reliability, reduce whole life cost and result in a reduction in maintenance?
- How can enhancements to existing actuation, locking and detection technologies improve reliability, reduce whole life cost and result in reductions in maintenance?
- What improvements can be made to monitoring and maintenance of switches including Remote Condition Monitoring (RCM)? How can we use existing data to improve understanding of failures?