

Assuring an Innovative Switch Design

On the 19th October 2003, a northbound train derailed on the approach to Platform 3 at Camden Town station on the London Underground.

VAMPIRE® was used as a key tool to demonstrate the derailment mechanism, and then as a means of developing and assuring the redesign of the junction concerned. This enabled the line to re-open in a safe and timely manner.



The Incident

The derailment occurred as the underground train traversed a set of facing points and the front bogie of the last car in the rake became derailed. DeltaRail's Incident Investigation Service attended site to gather evidence shortly after the derailment. This confirmed the derailment was a result of wheel flange climb at the points.

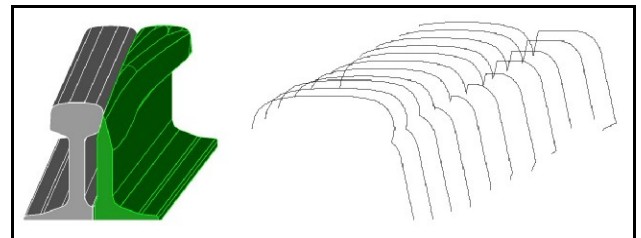
The investigation found that the switches (which had recently been replaced) were of an industry standard design and had been supplied and installed within the appropriate standards. Therefore simply replacing the switch would not prevent re-occurrence.

DeltaRail discussed various options with London Underground and Tube Lines (the company responsible for maintaining the infrastructure) and the preferred option selected was to redesign the switch blade.

An Innovative Solution

As part of the on-site investigation into the derailment, DeltaRail carried out a VAMPIRE® simulation of the derailment based on the detailed survey made on-site. This simulation clearly demonstrated the derailment mechanism and provided London Underground and Tube Lines with confidence in the modelling process.

Working with London Underground, DeltaRail drew up a new switch blade design that included a reduced switch entry angle and reduced topping profile. As the design had been developed using a 3D CAD package, this meant it could be sectioned to provide 2D slices that were incorporated into further VAMPIRE® simulations.



The results from VAMPIRE® predicted a significantly reduced risk of derailment for the revised switch blade design. The VAMPIRE® simulations formed part of the case for safety submission presented by Tube Lines to the governing safety body. This was subsequently accepted and a new switch blade was produced in preparation for installation.

Testing

The case for safety included a test plan, which involved taking high-speed video of the wheels of a test train as it traversed the new switch blade design. This enabled a comparison to be made between the actual position of the wheel as it traversed the switch versus that predicted by VAMPIRE®.



A close match was observed between the actual wheel position and that predicted by VAMPIRE®. Shortly after testing, the junction was reopened for operation.

Customer Benefits

The use of computer simulation resulted in the following benefits to London Underground and Tube Lines:

- the VAMPIRE® simulations clearly illustrated the derailment mechanism and provided a detailed understanding of the causes and mechanisms involved
- the associated 3D animations enabled the derailment mechanism to be explained in a clear and accessible manner to all interested parties
- the use of VAMPIRE® enabled a large number of "what if" scenarios to be evaluated in order to provide a high level of confidence in the revised switch blade design



- the simulations were validated on-site by means of high speed cameras
- this innovative approach enabled the junction to be re-instated to end disruption
- it has also allowed derailment risk on other switches to be mitigated

Follow-On Work

Following the successful reinstatement at Camden Town, DeltaRail were asked to undertake further assessments for similar sites across the London Underground network. This entailed further site surveys, constructing a library of switch and vehicle designs and an exhaustive battery of VAMPIRE® simulations for each and every site.

The library of vehicle models developed has subsequently proven useful for investigating other issues on the underground network.

Further Information

For further information please contact the VAMPIRE® Helpdesk:

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