Rail Accident: Case Study

Signal post collapse caused by corrosion damage

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Company
UK's Rail Accident Investigation Branch (RAIB)

Industry
Transportation - public rail

Region
United Kingdom

Intertek Solutions
Corrosion analysis - visual examination, microscopy, chemical and energy dispersive analysis of X-rays.

"The outcome could have been much more serious if the first train to encounter the fallen signal had been travelling at speed[...]

Network Rail has [now] commissioned a retrofit design to strengthen any weak assets."

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On Monday 17th November 2014, a railway signal post which had corroded at the base collapsed and fell near Newbury, UK, completely obstructing one rail track and partially obstructing another. A train travelling at 110mph (177 km/h) struck the top of the collapsed signal on the partially obstructed track. The train did not derail and no human injuries were reported. The train car sustained exterior damage. Intertek was commissioned to evaluate the cause of corrosion and the findings were published in a report composed by the Rail Accident Investigation Branch (RAIB) and published in September 2015.

The fallen signal post after the accident - image from official RAIB report, supplied by Network Rail.

The Challenge

Intertek's corrosion services were sought by the RAIB to ascertain which failure mechanism caused damage to the signal post, the rate of corrosion, the susceptibility of the post to corrosion and whether any coatings had been applied to it in the past.

The Solution

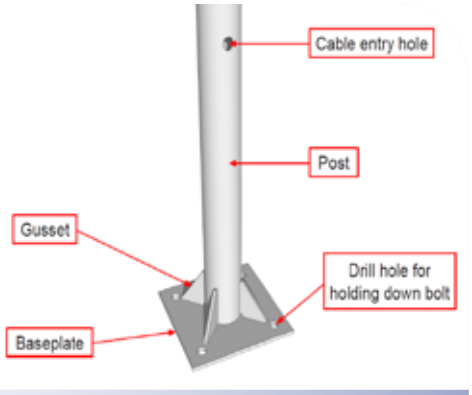
Intertek performed laboratory analyses on the relevant sections of the damaged post and submitted a report of its findings.

Visual analysis, hardness testing, optical and scanning electron microscopy, energy dispersive analysis of X-rays and chemical analysis were all performed on the corroded post section.

The Result

Our findings consisted of several key points, which are included in the official RAIB report on page 18 to 21, paragraphs 43 to 51.

- Both internal and external corrosion had occurred around the base of the post, resulting in severe metal wastage.
- Traces of a coating system were detected, most likely to have been originally applied to prevent atmospheric corrosion. Very little of this was found remaining on the corroded section of the post.
- Corrosion was focused at ground-level. Ballast and holding water concentrated around this area were likely to have affected the integrity of the coating system originally applied and increased the posts' susceptibility to corrosion.
- Rainwater was able to seep through the open top of the post. As no drainage system was implemented, it was able to pool internally at the bottom.
- The bottom section of the post critically affected by corrosion was buried in ballast and the visible section (above ground level) remained relatively unaffected. This may explain why the damage was not detected by routine visual examinations.



Schematic of post and baseplate - image from official RAIB report

RAIB's Report Conclusions

Intertek's analyses were taken into account by the RAIB and contributed to the conclusions made by the body as to the cause of the corrosion and the evaluation of the circumstances that occurred in the run-up to the incident.

The RAIB concluded that the signal collapsed because the base of the post had corroded.

It also found that the corrosion was not detected by the routine examination regime, by additional inspections carried out during a resignalling project or during maintenance.

The RAIB made several recommendations in its report to prevent a similar incident happening again in the future.

- The asset management strategy should be reviewed in order to improve examination and maintenence processes.
- A risk assessment process should be developed and implemented that specifically addresses partially buried hollow ancilliary structures and their susceptibility to corrosion.
- Examination maintenance regimes for ancilliary structures should be reviewed and an additional five key steps added. These were developed following the Newbury post incident and were designed to consider aspects that may have been overlooked previously and enabled the corrosion of the hollow post to go undetected.
- Competence management processes for personnel involved in structure examinations should be reviewed and revised.

Close-up of corrosion damage at the base of the signal post - Intertek was commissioned to understand the failure mechanism, the progression of corrosion in the post and the nature of the post material.

Actions Taken or in Progress

Since the incident, several actions have been taken by both Network Rail, the infrastructure's owner and maintainer and Amey plc, the company commissioned to carry out structure examinations.

The actions were implemented to ensure damage to signal posts is unlikely to remain unnoticed during inspection processes in the future.

Network Rail has since assessed 1,754 signal posts and installed ballast boards to mitigate similar issues where necessary.

In addition, Network Rail commissioned a retrofit design to strengthen weakened assets.

A new examination methodology and report form affecting ancilliary assets that receive visual exams is being developed for future use.

Changes were also made to examining and reporting methods that require examiners to provide more detailed information in their reports, such as a greater number of images. They are also required to examine parts of the structures that were previously omitted from report forms.

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