CASE STUDY:
UNDERGROUND MASS TRANSIT

SNAPSHOT:

Challenge
Identify the root cause of asset failures.

Solution
From data collected from enDAQ sensors, develop a customized plan to damp the vibration levels and resolve repeat asset failures.

Results
Engineers are able to diagnose and remediate vibration issues causing asset failure and are collecting the data needed to move toward condition-based monitoring.

10,000
CUSTOMER HOURS SAVED

Using enDAQ Sensors to Monitor Track Vibration, an Underground Mass Transit System in the UK Saves Time and Money on Repairs and Decreases Lost Customer Hours

Challenge

For many aging transportation systems with assets such as track and signaling equipment that can be over 100 years old, breakdowns occur and reactive repairs are to be expected. The client's challenge was that despite the reliability of the transportation system, one of the major threats to efficient service is failure of points, train stops, and position detectors that lead to trains being taken out of service and a rise in Lost Customer Hours (LCH).

In this instance, faults on points (the movable section of track allowing trains to switch lines) in a section of the underground resulted in them being scotched, clipped, and removed from service. Despite remedial work, there were challenges returning the points to service, with concerns being raised over the cause of fluctuating voltages as trains traversed the points.

Engineers were tasked with the short-term goal of returning the "point machines" to service by investigating and proving the root cause of the asset failure was due to high levels of vibration. According to the engineering team, vibration was doing a lot of damage to their equipment. The team's long-term goals were to transition away from a reactive maintenance model and develop a spec for manufacturers that would guide equipment designs to accommodate the harsh environment in which the points operate.

Mounting an enDAQ sensor track-side to monitor track vibration

Solution

In an effort to characterize the environment, engineers used enDAQ's configurable S4 sensors to identify, diagnose, and understand the vibration issues. The sensors could be configured off-site and then given to maintenance crews to easily install track-side during early morning maintenance hours to monitor and collect data over the course of peak morning hours. After the data collection period ended, the maintenance crew could simply upload and send the data back to the engineers for analysis.

> **"We're able to give the sensors to the guys who are going to be on these assets and they can install them. And the beauty is, with a few monitors, we can cover hundreds of miles worth of track and thousands of assets depending on what we decide we want to be monitoring."**
>
> *-Project Lead*

What the data revealed was that, not only were the vibration levels concerning, but that they were also causing the fluctuating voltages and point failures. Because vibration is caused by the interaction between trains and track, all the asset areas are impacted. Vibration issues can cause any asset to fail.

By analyzing the data and collaborating with Signal Maintenance, Signal Engineering, Track Maintenance, and Track Engineering, a customized plan was developed and deployed to damp the vibration levels and resolve repeat failures.

enDAQ sensor affixed track-side to monitor track vibration

Results

Through accurate and reliable data provided by enDAQ's sensors, the rail system's engineering team is able to diagnose and remediate vibration issues causing asset failure.

After determining that high vibration levels were causing failures on a set of points in a high traffic area, a speed limit was instated through the impacted section. Engineers were then able to show through further monitoring with the sensors that the speed limit was working and reducing the vibrations leading to service outages. Prior to these mitigation efforts, there were multiple failures with 10,000 Lost Customer Hours (LCH) attributed to this particular asset. There have been no failures on this asset since putting mitigations in place.

> **"Using the enDAQ Sensors, we could see that while improvements had been made, the vibrations seen through the points had not been fully eradicated. With the help of Track Engineering, Signals Engineering, Point Care and the Line Signals and Track teams, we were able to analyze the data and tailor the solution to damp the vibration levels to an acceptable level which resolved the repeated failures."**
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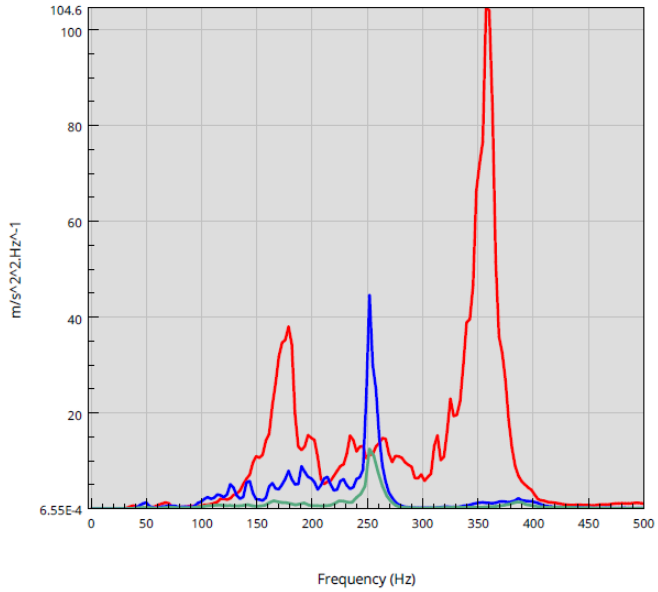
> *- Project Manager*

Additionally, by moving toward implementing a more preventative maintenance system that reduces the number of service outages and repairs, the rail system will be able to keep ridership costs from increasing and ensure that taxpayer money is spent more on improvements rather than repair.



The red trace shows the frequency content of the signal with the trains at full speed. The blue trace is the frequency content immediately after imposing a 40 KPH speed limit (note the frequency shift because of the lower speed) and the green trace is followup monitoring a few months later.

Though engineers are still performing reactive maintenance, the data they have been collecting and analyzing from enDAQ sensors has enabled them to better understand how vibration is affecting assets. They're also able to use the data to build an effective maintenance team. According to the project's lead, "We now know what is out there in terms of vibration and we're not always putting out fires. We're getting an idea of what is good -- what is normal. And from that, really long term, I'd like to develop a spec that we can give to our manufacturers to say that this is what we see, this is our environment, these are the levels we see. Can you design your equipment to meet 10 years of service at these levels?"

With the data rail system engineers have collected, they are now able to look at the data and see recurring problems and apply known solutions or identify new problems and develop solutions that can be applied in the future. This data is also enabling them to and move closer to being able to perform condition-monitoring and intervene before issues occur and ensuring that time, money, and customer hours are saved.

Contact

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