

CASE STUDY

Industry: Rail Industry
Customer: Rail operator in Israel

OFF-HIGHWAY
POWERTRAIN SERVICES

▶ Off-Highway Powertrain Services solves a systemic problem impeding the customer for past 6 years!

▶ Case Description

A rail operator in Israel had a systemic problem with the powertrain that drives the backup power pack (BPP) on their entire train fleet. They would incur cardan shaft breakdowns every 6–9 months when the BPP was disengaged. The service provider for the rail operator struggled with this problem for the past 6 years.

Off-Highway Powertrain Services (OHP Services), who was the product supplier, offered to investigate the problem. Our service experts performed vibration analysis on the diesel engine and torque measurement on the BPP for two trains and compared the results to calculate the operating loads on the cardan shaft.

The torque measurements had very high variances on the alternating torque amplitude, significantly above the allowable limit for the cardan shaft being used. Therefore the lifetime of the cardan shaft was limited.

▶ Technology Snapshot

Torque Measurement:

A telemetry unit is used for torque measurement on a rotating transmission shaft. The torque telemetry has a rotating element on the shaft that obtains the torque-induced strain from a strain measurement electronic device. The torque signals can be provided to the vehicle control network (e.g. CANBUS) or directly to a data acquisition system (depending on the existing infrastructure and the project requirement).

The torque signals can then be analysed and interpreted by OHP Services experts on a regular basis. The customer receives a regular report containing the recorded torque

Also, the vibration analysis clearly indicated non-uniform speed output of cardan shaft caused by misalignment. This would increase wear and accelerate breakdowns.

The following measures were suggested based on the findings:

- ▶ To shift the natural frequency out of the current operating range; redesign and recalculate the cardan shaft to the measured loads and conditions of the train
- ▶ To reduce the second order excitation; realign the BPP to the diesel engine so that the deflection angle of the cardan shaft is brought down to <1 degree
- ▶ A follow up torque measurement was also recommended to verify the new design

OHP Services is currently implementing the recommendations and working on the redesign.

signals, the torque events, the torque statistics (mean -, max torque, torque amplification factor, load spectrum) and damage indicators (as required and technically possible). To get a more detailed view of the powertrain condition, torque measurement can be combined with other measurement technologies like temperature, vibration and speed sensors.

The torsional natural frequencies for this application were evaluated by our experts.

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▶ **Challenge:**

- ▶ Find the root cause for the systemic problem
- ▶ Increase lifetime of the cardan shaft and improve passenger safety

▶ **Solution:**

- ▶ Realign the BPP generator with the diesel engine
- ▶ Redesign the cardan shaft to shift the natural frequency out of the operating range of the trains
- ▶ Follow up torque measurement to verify the redesign

▶ **Customer Value:**

- ▶ Resolving a systematic problem which was unsolved for the past 6 years
- ▶ Ensuring passenger safety
- ▶ Minimising operational interruptions for the train
- ▶ Increase in expected lifetime of cardan shaft of more than 4 times; reduced spare part costs

▶ **What's special?**

- ▶ OHP Services as a reliable service partner is also realizing the suggestions and working on redesign of the cardan shaft.



Multi Channel Measurement