

Bridge Crane Testing

using the ZonicBook/618E

Application Summary

IVC Technologies is a high tech service company offering customers route-based monitoring, field troubleshooting, commissioning, and various forms of multi-channel data acquisition. Since October 2004, IVC has been performing vibration analysis for NUCOR, a producer of hot-rolled carbon steel products. NUCOR's Steel Bar Mill Group in Jewett, Texas has three major production cranes in service, the charge, ladle, and billet bay cranes. These cranes are crucial for production. NUCOR had suffered a history of problems with wheel and shaft fits on these cranes. Inadequate tolerances between the wheel and shaft assemblies had led to premature wheel and keyway failures.

IVC Technologies was asked by NUCOR to determine if vibration analysis could aid them in determining which wheels were in jeopardy of failing unexpectedly, and to help them plan future wheel replacements based on their mechanical condition.

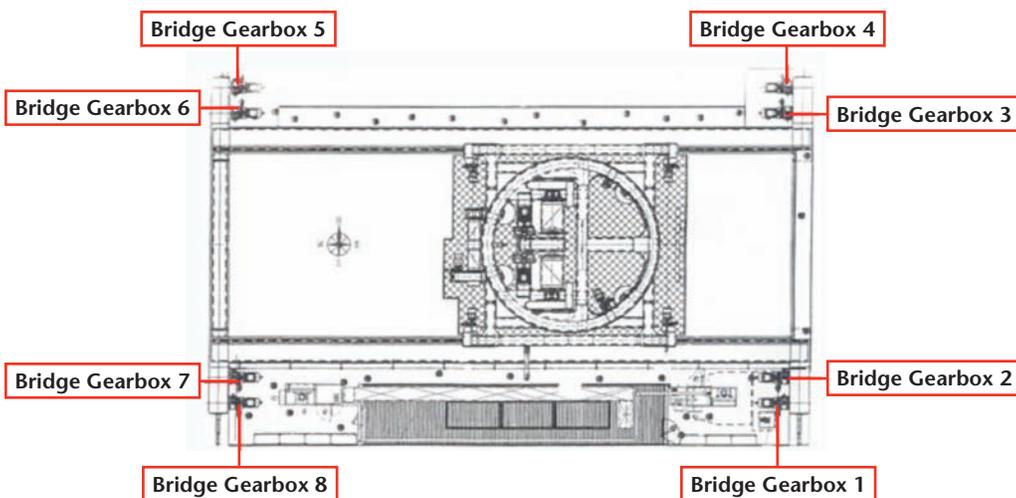
This issue was originally approached from a vibration analysis perspective. After thorough evaluation by Allen Bailey, IVC Technologies Regional Manager – Texas Gulf Coast, the issue was escalated to the IVC Advanced

Engineering Group (AEG). Directed by Bob Miller, a cohesive program was successfully developed through the collaborative efforts of this highly regarded team at IVC Technologies.

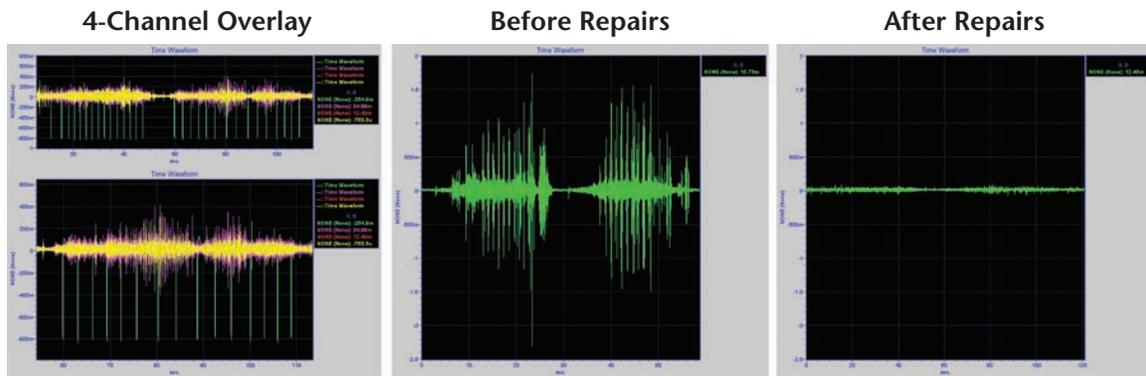
Industrial machines that are “identical” commonly vibrate differently, and cranes are no exception. Statistical analysis showed that though these cranes were the same make and model, built to the same manufacturing specifications, and perform the same jobs while in service, they would typically vibrate differently (both in amplitude and frequency).

Previous data collected with standard condition monitoring equipment was used to determine exactly what type of testing would be required to properly diagnose, predict, and set defect severities for these wheel assembly problems. The data was statistically analyzed, all known fault frequencies were then added to the database, and the wheels that were operating above the statistical alarm levels were analyzed for specific defect characteristics.

Typically, vibration data taken on cranes can show what appear to be transient events in the waveforms. Though transient events are commonly found in these



The Zonicbook/618E was used to take vibration data from each of eight bearing assembly locations and predict wheel assembly failures on NUCOR's billet bay crane.



Four channel overlay showing events correlating with shaft revolutions. Before repairs are made, over 4g peak to peak values are evident. Once repairs are made, peak to peak measurements made with the ZonicBook/618E are only .93g.



After identifying the wheel assembly with above average vertical amplitudes, the assembly was disassembled, revealing an excessive wheel-to-shaft tolerance. Feeler gauges were used to measure the tolerance which was almost 1/8 of an inch. A visual inspection of the key found that it was loose in the shaft and wheel fit, both vertically and horizontally.

systems, one must be able to mathematically link any vibration signal change to process or mechanical anomalies before assuming that an event is transient. The incorporation of process and crane operation data may need to occur in order to properly catalogue all waveform events.

IOtech's Solution

Once the initial test data was collected, it became clear that transient vibration data collection would be best suited for this application. This was determined because of the limits on time involved with the data collection process and the many transient events that were occurring in the vibration data as the crane was being operated. IVC Technologies began investigating which type of collection device and software would best fit this scenario, and eventually decided to use the IOtech ZonicBook/618E. The ZonicBook/618E offered eight direct accelerometer inputs (IEPE) along with four dedicated tachometer inputs. In addition to being lightweight and portable, the ZonicBook/618E's included eZ-Analyst software was easy to operate.

As with any vibration analysis based test, one should always take enough data at a high enough resolution to resolve any defect signature that might be in the system. On most cranes, many critical components have slow shaft speeds with limited run times. Because of this, a person limited to conventional vibration analysis methods (i.e. route-based data collectors) will have a difficult time collecting enough raw vibration data to perform adequate post processing analysis on the back end to offer definitive fault diagnosis. The high-speed ZonicBook/618E let IVC capture high-speed, transient data on multiple inputs which allowed them to accurately predict wheel assembly failures.

Conclusion

Since the implementation of these tests (which have been performed quarterly since 2007), no wheel failures have occurred requiring NUCOR to slow or cease production. Multiple wheels have been changed during this time frame, and an engineering spec change was implemented to further lengthen the life span of these wheel assemblies.

ZonicBook/618E

Vibration analysis and monitoring has never been easier than with the ZonicBook/618E and eZ-Series analysis and monitoring software. The ZonicBook leverages 30+ years of experience providing vibration measurement solutions. The ZonicBook hardware is the signal conditioning and acquisition engine, while the eZ-Series software in the PC defines the specific analysis and monitoring features of the

system. The ZonicBook's architecture makes expansion beyond the eight built-in channels less expensive than other suppliers. You can expand the ZonicBook in 8-channel increments up to 56 channels, and each additional 8 channels are approximately one third the cost of the first 8 channels. All channels in a ZonicBook system are measured synchronously, providing 1 degree phase matching between channels.

Features

- 8 dynamic input channels, expandable up to 56 channels
- 4 tachometer channels for rotational measurements
- High-speed Ethernet connection to for continuous recording
- eZ-Series software packages address a wide variety of vibration monitoring and analysis applications
- TEDS support for accelerometers

Software Overview

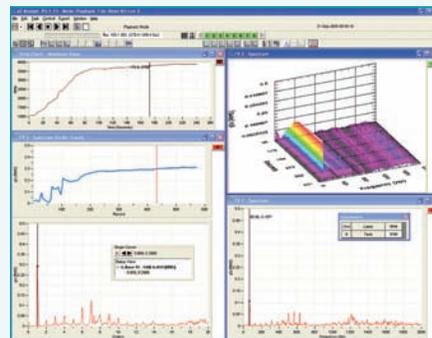
Four software packages are available for the ZonicBook, each tailored to a particular vibration measurement and analysis application. Choose the package that suits your application now, and upgrade to additional packages as your requirements evolve.

- **eZ-Analyst** provides real-time multi-channel vibration analysis, including overlay of previously acquired data while acquiring new data, strip charts of the throughput data files, cross channel analysis, and direct export to the most popular MODAL analysis packages, ME Scope and Star Modal.
- **eZ-TOMAS & eZ-TOMAS Remote** are highly sophisticated, yet easy-to-use tools for the monitoring and analysis of single or multiple machines, which allows the user to assess the reliability and operation of his process, and the critical machines pertaining to his process. Notification of faults are displayed locally, but can also be sent via text message or email, allowing the user to be notified of any problem regardless of his location.
- **eZ-Balance** is used to balance rotating machinery with up to seven planes. A balance toolkit, including Split Weight calculations, supports the balance process. The balance vectors are displayed on a polar plot so the user has a visual indication of the improvement. Time and spectrum plots show detailed vibration measurement during the balance process.
- **eZ-NDT** package is exclusively used in production applications to determine the quality of composite-metal products at production rates of 1 part per second.

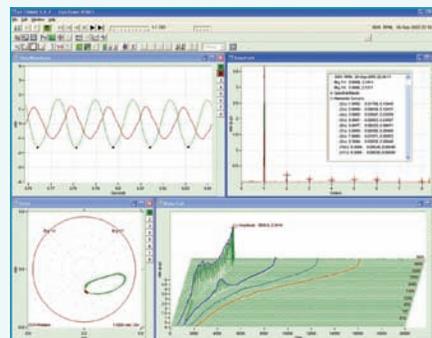
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The ZonicBook/618E with eZ-Series software and your PC makes a real-time, portable vibration analysis monitoring system



eZ-Analyst adds real-time continuous and transient data acquisition in the time, frequency, or order domain



View Time-Domain, Spectrum, Waterfall, and Trend simultaneously on one screen with eZ-TOMAS