RDI TECHNOLOGIES

# Uncover the Invisible: How **Motion Amplification®** Transforms Reliability & Condition Monitoring Programs

## For the Cement Industry

SCAN TO LEARN MORE

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## FROM HOURS TO MINUTES:

# Seamless Machinery Vibration Data Capture, Viewing and Analysis

For years, leading cement industry organizations have harnessed the transformative power of RDI's **Motion Amplification®** technology. These pioneering partners have not only embraced this innovative solution but have also been instrumental in shaping its evolution, driving advancements in features, innovations, and add-ons. Today, RDI Technologies® stands as a respected global leader in Motion Amplification within the challenging world of cement production.

In an industry defined by colossal machinery, relentless dust, harsh environments, and the critical demand for uninterrupted production, **Motion Amplification** offers an unparalleled advantage. It's a game-changer, providing a dramatically more efficient and effective approach to diagnosing complex problems. Imagine being able to visually monitor the dynamic behavior of motors, dust collectors, fans, mills, rotary kilns, and conveyors, pinpointing the precise root cause of vibration issues and thermal growth with unprecedented clarity.


**IRIS M™ with Motion Amplification**

**Motion Amplification,** coupled with full-field vibration analysis, delivers an extraordinary perspective. It captures an immense amount of data in a remarkably short timeframe, offering an unparalleled view of a target asset. This wealth of information goes beyond the specific equipment being imaged, revealing crucial insights into surrounding and often impacting elements, empowering informed decision-making and proactive maintenance.


## WHAT IS MOTION AMPLIFICATION?

**Motion Amplification** is a patented camera-based technology developed by RDI Technologies that allows users to see - in real time - motion that is invisible to the human eye or can be difficult to measure with traditional sensors. **Motion Amplification** technology turns every pixel in the camera's view into a sensor capable of measuring vibration or motion with unparalleled levels of accuracy. It can resolve motions as small as <0.01 mils (0.25 Microns) at 1 meter and can be performed live and in real-time on even a modest laptop, making it suitable for a range of applications from product design and testing to field-based machinery fault diagnosis and structural testing. By amplifying and visualizing these small movements, **Motion Amplification** can provide cement Industry engineers with insights into the health and performance of cement manufacturing equipment including identifying potential issues before they become critical problems.

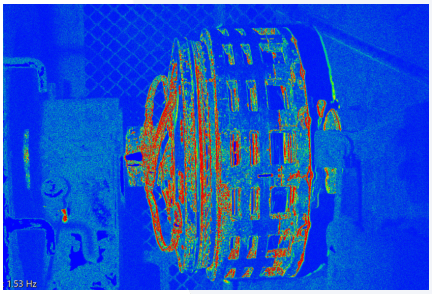
# HOW MOTION AMPLIFICATION® WORKS:

## Unveiling Hidden Motion, Mastering Machine Performance.

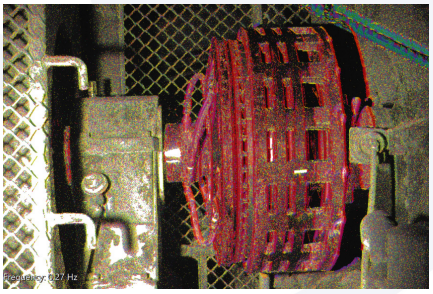
**Motion Amplification** works by using high definition and high dynamic range video cameras where every pixel becomes an independent point sensor creating millions of continuous data points in an instant. This essentially turns a high-definition camera into a full-field vibration acquisition device with over 2.3 million independent sampling locations. This makes it a great troubleshooting tool, a quick and effective alternative to traditional ODS, an effective decision making and communication tool between technical and non-technical personnel.

With **Motion Amplification** software you can quickly analyze and understand the vibration frequencies, amplitudes, and waveforms in the scene. **Motion Amplification** videos can be immediately analyzed by applying Frequency Filtering, Motion and Phase Color Maps, and Vectors. The Frequency-based Filtering feature enables filtering the video data sets to show motion only at a particular frequency. Motion and Phase Color Maps allow for a rapid way to analyze the motion and relative phase in a field to quickly understand the dynamics and motions present along with relationships of motion. Vector overlays are a useful way in which to visualize complex motion across a full-field of view.

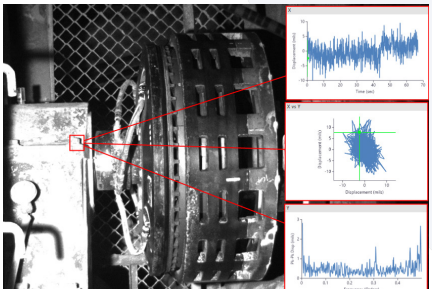
**Motion Amplification** visualization provides a unique communication channel when reviewing and sharing test results with technical and nontechnical personnel.



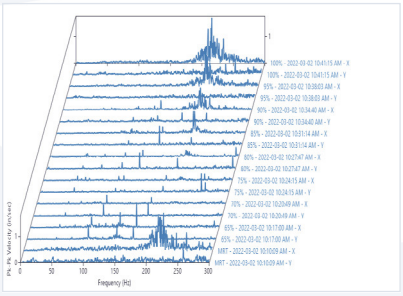
**Motion Map** Motion Map in RDI software uses color to draw attention to where motion is present.



**Phase Map** in RDI software uses color to convey the phase relationship between the different components of an asset.



**Annotation** feature in RDI software enables you to plot and incorporate vibration data into **Motion Amplification** videos.



**Repeated Measurements** in RDI software allow you to compare data across different datasets and leverage Motion Amplification as **a route-based predictive maintenance tool.**

## 100% COVERAGE OF MACHINE AND STRUCTURES

RDI's **Motion Amplification®** is used for a wide range of non-contact and non-destructive measurement applications in condition monitoring, predictive maintenance, and vibration troubleshooting. There is no painting, gluing, or surface modification required, which makes Motion Amplification a good fit for testing.

The technology produces full-field data vs. single point measurements, provides 100% coverage, allowing you to test the entire asset.

Videos and data are produced within seconds of data collection, saving you time and money while accelerating your condition monitoring workflows.

**"Thank you RDI Technologies Inc. I appreciate how you took the time to personally answer my questions and help me get the most out of Motion Amplification.® The level of service and customer care we've experienced with all of our contacts at RDI is consistently second to none."**

—DENNIS WILLIAMS
*Reliability Engineer*

### VISUALIZE

Detect subtle displacement (as small as 0.25 Microns) with RDI's propriety video processing software; converts movement to a level visible to the naked eye.

### MEASURE

Measure and quantify mechanical or structural assets that a camera can see with the same accuracy as a industry-standard accelerometer.

### COMMUNICATE

Enhance your understanding through helpful videos and provide a communication tool between technical and nontechnical resources.

### TROUBLESHOOT

Filter data and visualize motion at specific or overall frequencies to find the real source of a problem and position your team to fix it.

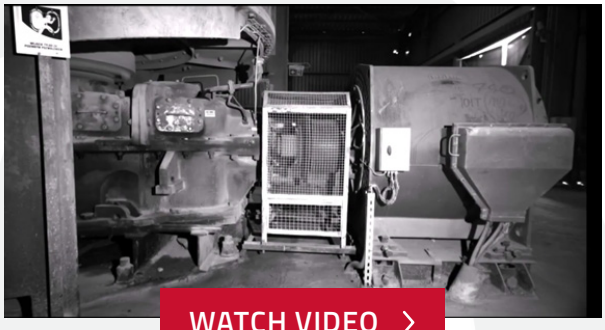
# MOTION AMPLIFICATION® IN THE CEMENT INDUSTRY

## MONITOR ALL YOUR ASSETS

- Material Handling Conveyors
- Crushers
- Preheater Towers
- Rotary Kilns
- Mills
- Gearboxes
- Structures
- Motors
- Couplings
- Shafts
- Trunnion Bearings
- Pumps
- Compressors
- Blowers
- Fans

## EASE OF USE. POINT-AND-CLICK WITHOUT TOUCHING THE STRUCTURE.

- Millions of pixels are converted to non-contact virtual sensors that measure vibration amplitude and frequencies.
- Camera setup, recording measurements/videos and data processing usually take less than 10 minutes.
- Full-Field vibration testing (100% asset coverage)
- Visualize the entire asset in one collection
- Every point is measured and quantified. No guessing between points



WATCH VIDEO ›

### CONDITION MONITORING

Visualize and troubleshoot entire preheater tower, material handling conveyors, mills, rotary kilns, motors, pumps, fans and structures.


WATCH VIDEO ›

### NON-CONTACT VIBRATION TROUBLESHOOTING

Record millions of data points and drill down to regions of interest (ROIs) for a detailed look at vibration frequency, amplitude, phase, orbit plots, and time waveforms.

# CONDITION MONITORING

RDI Technologies transforms condition monitoring and troubleshooting efforts by making the invisible, visible. Using patented Motion Amplification® technology, we go beyond traditional vibration analysis capturing full-field motion and vibration data in real-time, across entire machines and systems. Our visual approach uncovers hidden problems with unprecedented clarity. Whether you're troubleshooting legacy equipment or validating new installations, this is diagnostics you can see, understand, and act on — instantly.

Explore key condition monitoring applications below and discover how video-based diagnostics can empower your maintenance and reliability teams.

## LOOSENESS

Looseness is a common yet notoriously elusive issue in industrial equipment often misdiagnosed as unbalance, misalignment, or bearing faults due to ambiguous vibration data. Whether it's a loose bolt or structural instability in a machine base, identifying the real source of unwanted motion is critical to avoiding downtime and ineffective repairs. This page demonstrates how high-resolution, non-contact motion analysis cuts through diagnostic confusion, turning vibration noise into clear visual insights. Discover how directly visualizing motion eliminates guesswork and enables rapid, accurate detection of looseness at any scale.

WATCH VIDEOS ›

## MISALIGNMENT

Misalignment silently erodes mechanical health by damaging couplings, increasing energy consumption, and accelerating wear. Yet, vibration signatures from different misalignments often overlap with other faults, leading to drawn-out diagnostics and ineffective fixes. This page shows how visualizing actual machine motion removes the ambiguity from misalignment detection. See how capturing real-world movement provides precise insight into the type and severity of misalignment, supporting faster, more targeted corrective actions that restore reliability and performance.

## STRUCTURAL VIBRATION

Structural vibration in cement plants poses a persistent and often underestimated risk to operational reliability, contributing to premature fatigue, cracking, and costly downtime. From support structures beneath crushers and mills to access platforms near vibrating screens and fans, these dynamic forces are difficult to measure and diagnose using traditional methods. The constant impact, heavy rotating machinery, and flow of materials generate complex vibrations that can gradually degrade structural integrity. This page presents compelling visual evidence of how advanced, non-contact measurement techniques expose these hidden structural issues—transforming vague symptoms into actionable insights that help ensure the long-term safety and performance of your cement plant infrastructure.

## NATURAL FREQUENCY/RESONANCE

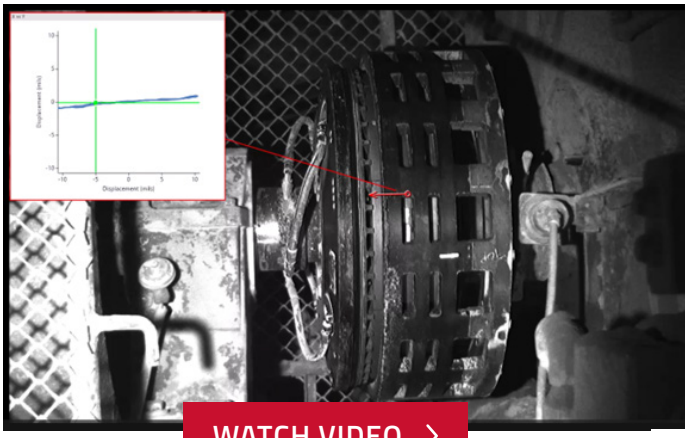
Resonance is one of the most destructive forces in industrial equipment, capable of rapidly inducing fatigue, cracks, and catastrophic failures when operating frequencies align with a system's natural frequencies. Identifying these critical mode shapes and understanding a system's dynamic response can be incredibly challenging with traditional vibration analysis, often requiring complex modeling or extensive sensor arrays. This section demonstrates how directly visualizing the resonant behavior of components, from turbine blades to entire blower systems and piping, transforms this complex diagnostic into a clear, actionable insight. Discover how easily you can detect and understand these critical phenomena to safeguard structural integrity and enhance predictive maintenance.

# ADVANCED TROUBLESHOOTING

Simplify the process—from capture, to analysis, to action—for faster maintenance planning and scheduling before and after new equipment installations.

## ROTATING COMPONENTS INSPECTION

The camera can be put in a special mode that accounts for the turning speed of the rotating components and images in the scene at a rate that allows the rotating component to be visible and non-blurred despite the rate of rotation being much faster than the camera frame rate. This allows for a visual inspection of a shaft, coupling, rotating object. This can be advantageous when the machine cannot be stopped at a convenient time, or the inspection needs to be done during operation as the element that could indicate a fault only does so during operation.



WATCH VIDEO >

## COMMISSIONING

Many persistent vibration and equipment reliability problems originate during new asset installation due to subtle design flaws or improper setup. These hidden issues can lead to escalating mechanical looseness, bearing defects, misalignment, and even structural failures over time. Commissioning is the critical phase to proactively identify and rectify such faults before they impact operations. This page showcases how advanced visual analysis transforms traditional acceptance testing, allowing for immediate detection and repair of issues like tank vibrations, piping design mismatches, and installation-related looseness. Discover how this proactive approach ensures your new assets performs as intended on day one, reducing future maintenance costs and maximizing uptime.

## VISUALIZE THERMAL GROWTH

Motion Amplification and subsequent measurements can also be applied to thermal growth measurements taken on a longer timescale, such as hours. By leveraging a high-speed camera to take data over a much longer and usually less sparsely sampled time period, long-term recordings can be acquired. Here, the goal is to capture motion that is generally not periodic but may happen only once per recording. Thermal growth measurements can be made and, perhaps more interestingly, can be seen in Motion Amplification videos, allowing for a better understanding of the thermal growth itself, as well as which elements of an asset are affected and by how much.

## MODAL ANALYSIS

With **Modal Amplified**, our Modal Test and Analysis solution, you can leverage simultaneous measurement of the force input with the response measured directly from the camera. This allows you to use the camera and impact hammers to quickly acquire data to detect bending modes, natural frequencies and resonances.

Uses can immediately visualize the resulting modes shapes, and they can place an unlimited number of modes across the structure through virtual regions of interests. Virtual sensor measurements include waveform, spectrum, coherence maps, FRF, phase, and force input. Stability plots also show where mode shapes are stable in frequency and damping.

This approach allows users to have modal results in a matter of minutes, from capture to visualizing the modes shapes, complete with dozens, even hundreds of sensors measured across the structure.

WATCH VIDEO >

# CASE STUDY

RDI TECHNOLOGIES

# From Shake to Steady: A Mill's Transformation

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Buzzi Unicem

Location: Festus, Missouri

Industry: Construction Material Manufacturer

## THE CHALLENGE

Buzzi Unicem USA, a leading cement manufacturer, faced foundation concerns with a raw mill at their Festus, Missouri, site and contacted RDI Technologies. Their proactive approach highlights their commitment to informed decision-making, ensuring operation reliability and safety.

## THE SOLUTION

Buzzi Unicem USA, contacted RDI Technologies for a Motion Amplification® service visit to assess the raw mill's vibration and movement. Scott Burkhart, Director of Services, and Jim Bricco, Senior Service Engineer, utilized the Iris M™ System, Motion Amplification, Shaft Inspection, and Motion & Phase Map. They identified vibration frequencies of interest, mainly related to mill and motor speeds (23 CPM and 896 CPM, respectively).

Significant base movement, primarily associated with the mill speed, led to heightened displacement near the mill's top, reaching 57 mils across the coupling. Additionally, some pedestals exhibited noteworthy movement, partly linked to mil speed but primarily attributed to random vibration.

With this data, RDI Services recommended to:

- Secure all hold-down bolts on all pedestals.
- Schedule Motion Amplification follow-up recordings after the scheduled foundation repairs were performed for commissioning and baselining purposes.

## 73% REDUCTION IN VIBRATION LEVELS

### THE RESULTS

After completing the recommendations, RDI Service Advisors observed:

Total Displacement Reduction from 57 mils to 15.5 mils.

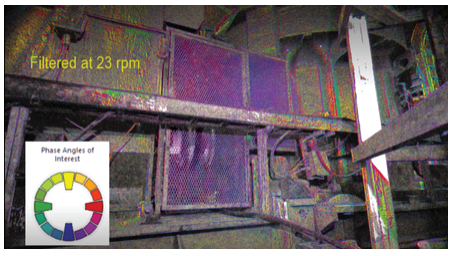
Disappearance of south side mill vibrations.

Disappearance of west side mill vibrations.

Similar Relative Phase among the motor and gearbox of the raw mill.

**Click or Scan to View the Video Results**

Jim Bricco takes non-contact data with the Iris M™ system to diagnose vibration issues.




Phase Map in RDI Motion Explorer® uses color to convey the phase relationship of different asset components

# MOTION AMPLIFICATION® SOLUTION SUITE

**Iris M™ Video-based Sensors**

**Continuous Monitoring**


**Frequency**

**Modal Test & Analysis**

**Iris M + Spot™ Robotics**

**Stereo Vision Simultaneous, 3-dimensions/axes**

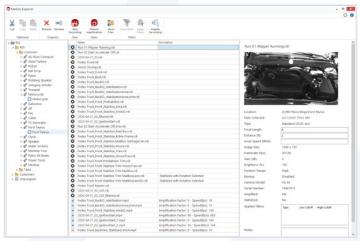
**External Laser Tachometer**

**Iris M Traveler™ Rugged On-the-Go**


**Color Camera Iris M™ Add-on**

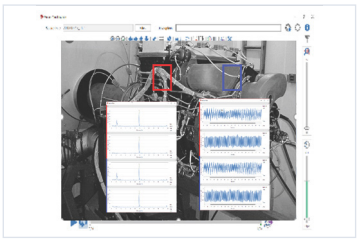

**Fastec™ High-speed Cameras**

# MOTION AMPLIFICATION SOFTWARE SUITE

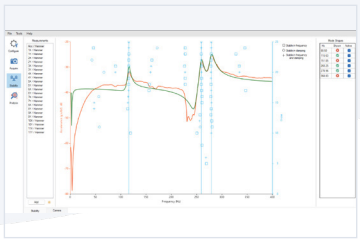


**MOTION EXPLORER**
Database set-up and file management

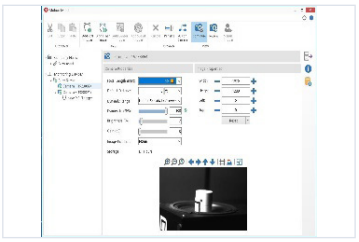

**ACQUISITION**
Camera configuration, live MA, initiate new recordings



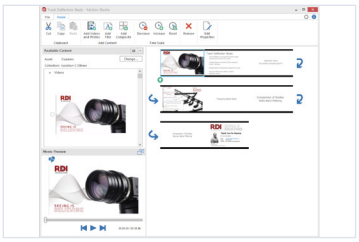
**MOTION AMPLIFICATION**
Motion Amplification tools for analysis of recordings



**MODAL AMPLIFIED**
Modal test and analysis with impact hammers and shakers



**MOTION MONITOR**
Iris CM set up and configuration for continuous monitoring



**MOTION STUDIO**
Easy to use video editor to enhance communications and reporting

# RDI TECHNOLOGIES® HERE TO SERVE YOU

**RDI offers a wide range of support and services necessary to meet the needs of every customer – from daily operation, routine and scheduled maintenance to outage services and R&D/Service Modal Testing. We're to help you inspect more assets in less time, reduce risk, improve workflow, and stay focused on your critical assets and core business.**

- Certified **Motion Amplification®** Training (Basic, Advanced, Remote)
- Consulting - POC, **Motion Amplification** Implementation
- Machinery Performance, Diagnostics, and Troubleshooting
- **Motion Amplification** Facility Audit/Assessment
- Modal Testing and Analysis Services
- Software/Hardware Upgrade and Support (Software/hardware updates, Continuous Training)
- Responsive Support (Technical and domain expertise on-demand; remote and in-field)

## How can we help?

**For a more detailed look at our service offerings visit www.rditechnologies.com/services/**

**Or email us at services@rditechnologies.com**

# SEE MOTION AS IT REALLY IS...
# Seeing is Believing®

## ABOUT RDI TECHNOLOGIES®

As a leading global vibration technology and visualization solutions innovator, RDI Technologies enables reliability and test and measure programs to make faster, safer, and more informed decisions through intelligent vibration equipment, data analytics, robotics, and services, driven by its proprietary **Motion Amplification®** measurement platform. With 200 years of reliability and test and measurement industry experience, RDI Technologies helps clients in more than 60 countries and 40 industries gain greater speed to insight while reducing risk and cost. Over 700 corporate and government global customers including Buzzi Unicem, Google, Nissan, Duke Energy, Newmont, Amazon, Chevron, and US Navy rely on RDI's breakthrough **Motion Amplification** platform to see and measure motion previously impossible to visualize by contacting sensors.

Follow us on **LinkedIn**, **Twitter**, **Instagram**, and **YouTube** for the latest news, or visit our website **www.rditechnologies.com** for more information.



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