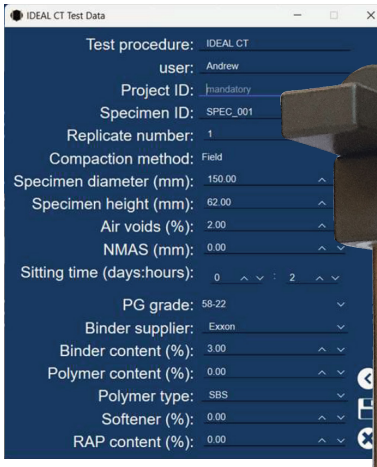
Testing Equipment for Construction Materials

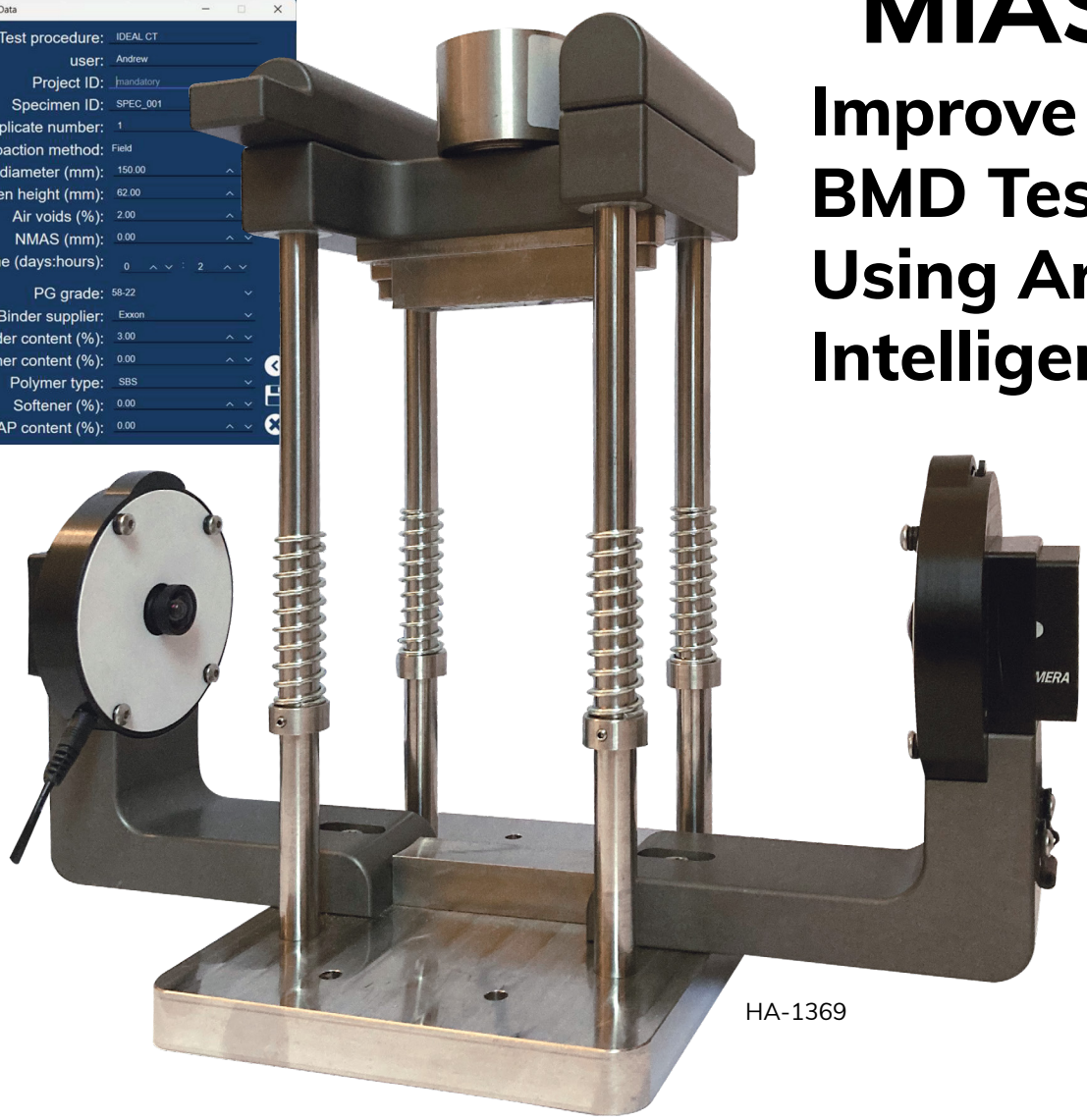
HUMBOLDT

MiAS™ Materials image Analysis System



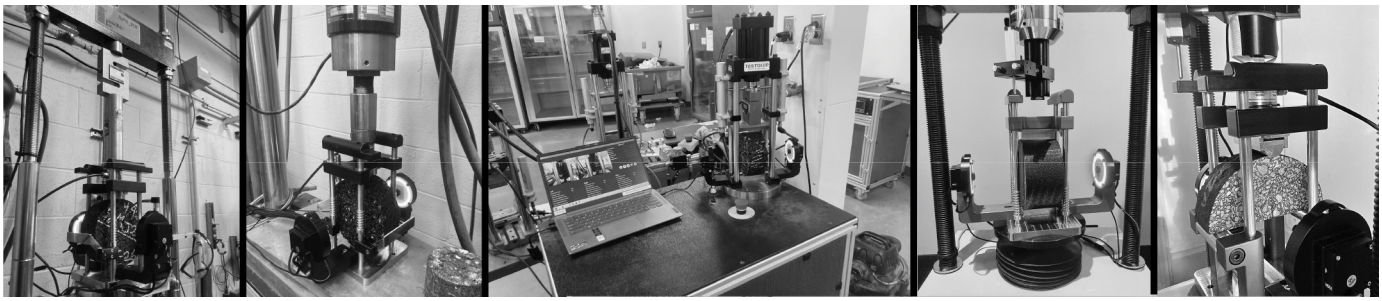
MiAS™

Improve your BMD Tests Using Artificial Intelligence



HA-1369

MiAS is an advanced image analysis system designed specifically to enhance monotonic BMD (Bulk Material Density) tests. Leveraging the power of Digital Image Correlation (DIC), MiAS offers an innovative solution for testing materials by integrating cameras, artificial intelligence (AI), and consistent illumination. MiAS improves upon traditional testing systems such as I-FIT, Ideal CT, and IDEAL RT by offering a more accessible, cost-effective, and efficient solution.



Suitable for all loading frames

The problems with BMD tests

Today asphalt mixtures are far more complex than they were 20 or 30 years ago. Once essentially a mixture of aggregate and bitumen, today's mixes can include RAP, plastic, rubber, fibers, and more. Balanced Mix Design (BMD) tests like IDEAL-CT and I-FIT are widely used — but when outcomes rely solely on the shape of the load curve, they don't always reflect the true performance of today's multi-component materials.

The Coefficient of Variation (COV) for BMD tests is high in many labs. This is due to a variety of factors, many of which are related to specimen preparation, but other factors such as true loading speed, specimen placement, deformation transducer placement and reliance on load curve alone also contribute to result variability. These factors can be detected and reduced with MiAS.

What MiAS Does

MiAS uses two high-resolution cameras, integrated lights, and AIpowered software to film, measure, and interpret physical changes in asphalt concrete specimens as they are tested. MiAS can be used with all standard BMD frames — including those produced by Humboldt — adding visual analysis to the load curve data.

Digital Image Correlation (DIC) has been used in research for many years and is well regarded. However, it is impractical for routine BMD testing, is generally used only on one specimen surface, test setups are not standardized, and the software is not dedicated to BMD tests. BMD specimens develop cracks on both sides. MiAS recordsand analyzes both sides, outputting BMD specific analysis and high-resolution video for each test.

Product Features

Compatibility:
MiAS is designed to replace standard I-FIT, Ideal CT, and IDEAL RT frames, seamlessly integrating with any testing machine capable of running monotonic BMD tests.

Direct Integration:
Specifically integrates with **Humboldt's HM-5125A** testing machine.

Dual-Camera Setup:
Cameras provide comprehensive monitoring by recording both sides of a specimen during testing,

Integrated Lighting System:
Built-in microscope lighting ensures consistent and reliable illumination throughout the testing process, eliminating potential variables caused by external lighting conditions.

Expanded Test Metadata:
The software allows the user to input extended metadata, improving test record-keeping and analysis.

Video and Image Linkage:
Videos and images are timestamped with date, time, and embedded metadata for each specimen, ensuring traceability.

Specimen Position Verification:
Before testing begins, MiAS software checks whether specimens are correctly positioned by the technician, reducing potential errors or misalignment during the test.

Versatile Specimen Size:
MiAS is optimized for 150mm dia. specimens, though it can also be used for Hamburg and OT specimens.

QR Code Integration:
QR codes can be generated and scanned for tracking both the frame and the specimen, simplifying inventory and test management.

Measurement Capabilities:
The system measures and records changes in the specimen's height and horizontal diameter during the test, offering precise data for analysis.

Verification Tool:
MiAS can serve as a verification tool to assess BMD machine performance under actual test conditions, providing valuable insights into equipment accuracy.

Dispute Resolution:
Images and associated metadata can be used in disputes and to investigate unexpected test results.

Advantages Over LVDTs

The use of on-specimen LVDTs or extensometers could enhance BMD tests, but they are difficult to set up — particularly for cracking tests. They also measure only between two fixed points.

With cameras, it is possible to measure between any two points on the surface of the specimen, either during the test or subsequently. Even in the short time MiAS has been under development, it has become possible to develop increasingly advanced measurements and analysis.

Initially, MiAS only measured horizontal deformation at the specimen edge. Over time, movement detection improved, and the number of possible detection points increased. It is now possible to measure vertical and horizontal deformation, speed, and strain for every selected point. These additional measurements can be used to enhance standard BMD tests.

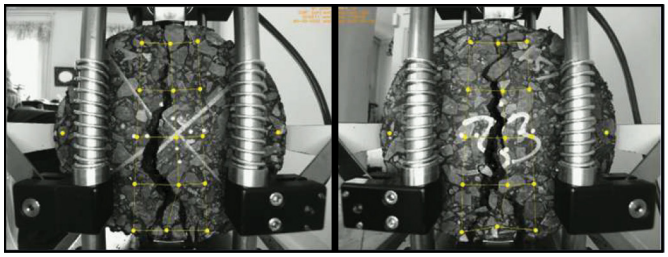
AI-Enhanced Strain Mapping

It is now possible to produce high-density strain field visualizations that resemble Finite Element Model (FEM) outputs. These can help bridge the gap between empirical BMD testing and computational analysis by visualizing where and how strain develops throughout the specimen during the test.

While not derived from FEM simulation, this overlay gives researchers and engineers a more intuitive understanding of deformation zones.

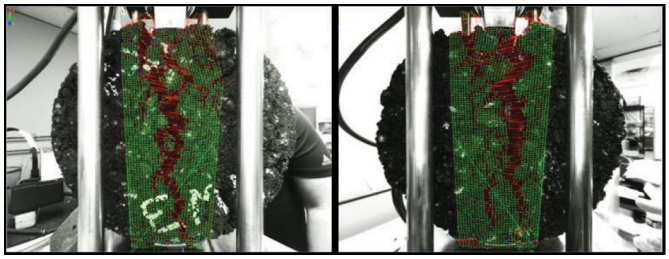
Zoomed-In Failure Analysis

A telephoto lens allows filming the notch and crack tip at very high resolution, enabling the application of a dense deformation mesh. This offers routine insight into local strain concentrations, aggregate interlock, and crack tortuosity — offering a clearer picture of how cracks initiate and evolve within the mix.

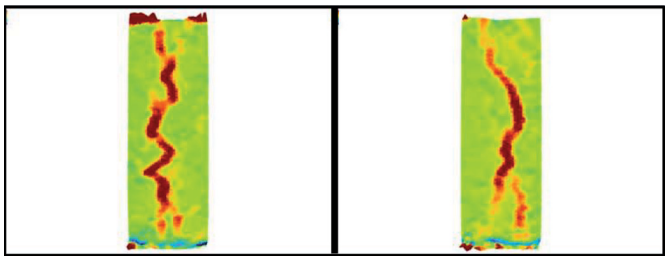


Standard DOT configuration for IDEAL-CT

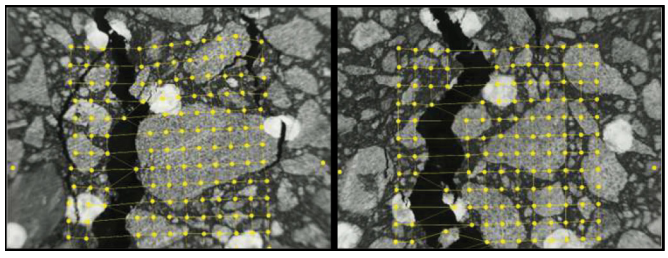
Standard DOT configuration for I-FIT



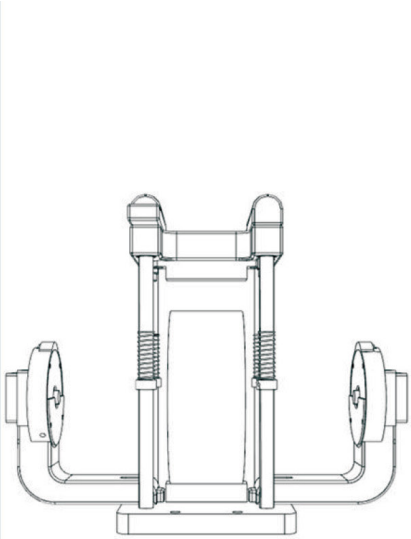
Fine mesh for Crack Analysis



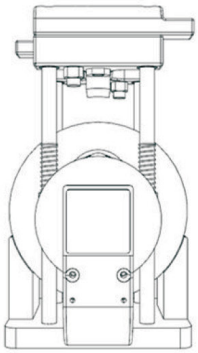
AI-enhanced Visual Strain Overlay



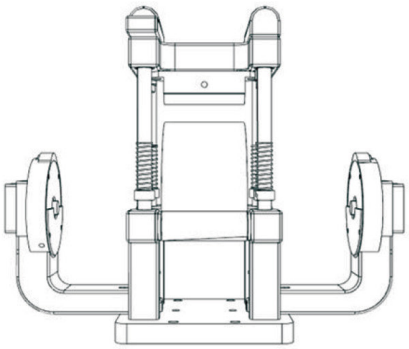
Zoomed-in Analysis, 37.5 x 28mm



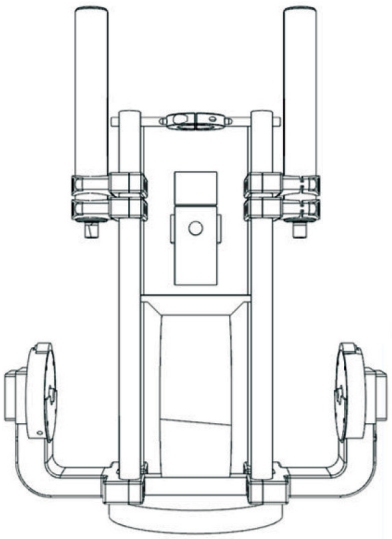
MiAS in IDEAL-CT configuration



MiAS in IDEAL-RT configuration



MiAS in I-FIT configuration



MiAS for servo-hydraulic in IDEAL-CT configuration

Specifications	
Cameras	2 x 16MP (5V)
Lights	2 x LED ring (12V)
Load Cell	50kN button
Signal Conditioning	Internal resolution 16 million
USB Hub	4 x USB 3.2 Ports Switchable
Software platform	Windows 10 or higher
Dimensions	35 x 28 x 16cm (WxHxD)
Weight	7.2kg

Servo hydraulic Specification	
Cameras	2 x 16MP (5V)
Lights	2 x LED ring (12V)
USB Hub	4 x USB 3.2 Ports Switchable
Software platform	Windows 10 or higher
Dimensions	20 x 20 x 16cm (WxHxD)
Weight	4kg

Technical Specifications	
Compatible Testing Machines	Any machine capable of monotonic BMD tests (integrates directly with **Humboldt HM-5125A**).
Specimen Size	Suitable for 150mm diameter specimens; adaptable for Hamburg and OT specimens.
Camera System	Dual-camera setup (filming both sides of the specimen).
Lighting	Integrated microscope lights for consistent illumination.
Tracking	QR code support for specimen and frame tracking.
Measurements Recorded	Height and horizontal diameter changes.
Software Functionality	Specimen positioning verification before testing begins.
Data Storage	Links videos, images, and metadata to the specific test date and time.

Testing Equipment for Construction Materials

HUMBOLDT

Humboldt Mfg. Co.
www.humboldtmfg.com
875 Tollgate Road
Elgin, Illinois 60123 U.S.A.

U.S.A. Toll Free: 1.800.544.7220
Voice: 1.708.468.6300
Fax: 1.708.456.0137
email: hmc@humboldtmfg.com