Innerspec

HIGH-PERFORMANCE NDT SOLUTIONS

CODA Application Brochure

Stress measurement for Steel Bridge Components

Equipment Highlights

Identifies and measures the magnitude and direction of the combined effect of live and dead loads as well as residual fabrication stress, to assess the remaining strength of steel bridge components. Tailored to provide stress assessment on specific bridge structures, including girders/beams, gusset plates, and pin-and-hanger assemblies.

Total Stress Measurement

Comprehensive assessment of all stress components, including live load, dead load, thermal stress, and residual stress from fabrication.

Non-Contact Ultrasonic Technique

Electro Magnetic Acoustic Transducer (EMAT) technique measures the velocity of waves propagating through the material without requiring mechanical or liquid coupling.

Customized for Steel Bridges

Custom-designed hardware and software for analyzing stress in different steel bridge component such as girders/beams, gusset plates, and pin-and-hanger assemblies.

Temperature Independent

Stress Measurements remain unaffected by temperature variations in the component.

Automatic Reports and Export Tools

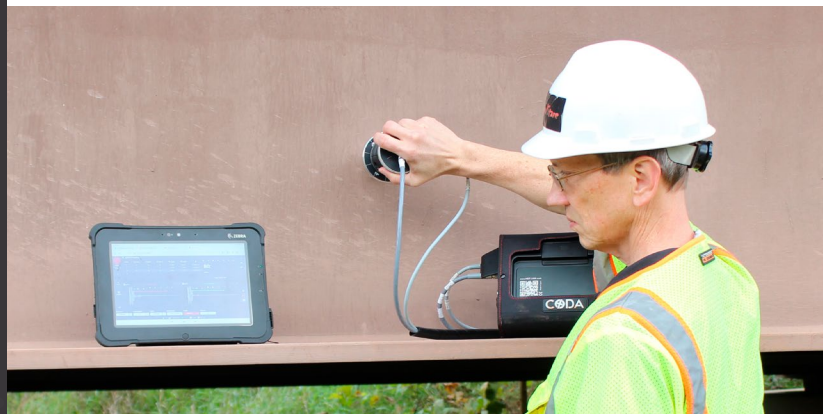
Custom reports featuring calculated measurements, snapshots and graphs used for the measurement of stress. Ability to export raw data to CSV.

CODA SM enables total stress measurement in bridge components by taking advantage of the acoustoelastic effect, which describes the influence of stress on the velocity of ultrasonic waves traveling through metallic components.

Unlike strain gauges, which must be attached to the component and measure only live-load stresses, CODA SM's non-contact ultrasonic technology measures the combined effects of all stresses, including dead load, live load, and residual fabrication stresses. By providing total stress data, CODA SM facilitates load distribution analysis in complex structures and determines the remaining strength of specific bridge components.

Developed in collaboration with highway-bridge non-destructive testing (NDT) experts from Thermalstare LLC, CODA SM incorporates a custom sensor and advanced software, utilizing cutting-edge measurement techniques and algorithms specifically optimized for analyzing girders/beams, gusset plates, and pin-and-hanger assemblies. This state-of-the-art instrument measures both tensile and compressive stress by detecting changes in the velocity of orthogonally polarized shear waves propagating through the material's thickness, leveraging the birefringence effect—a widely recognized and effective method for stress analysis. The custom sensor features two orthogonally polarized Electro Magnetic Acoustic Transducer (EMAT) coils and a 360° encoded rotator, enabling precise, multi-directional stress measurements on a wide range of components. By analyzing the Time-Of-Flight (TOF) of ultrasonic waves traveling through the same material volume in different directions, the instrument can accurately determine velocity changes without requiring prior knowledge of the material's thickness.

The patented pulser and receiver used in CODA SM and carefully tuned EMAT sensors provide TOF resolution <0.8ns (equivalent to 2.5µm-0.0001" in material thickness), ensuring unparalleled precision in quantifying birefringence and the associated remaining stress.



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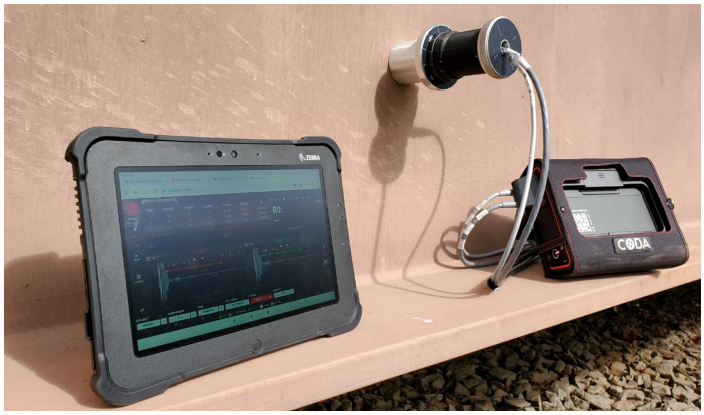
Hardware

CODA SM has been specifically designed for the measurement of stress on metallic components using Innerspec's patented pulser technology and proprietary EMAT sensors.

CODA SM for Steel Bridges includes the CODA instrument, a tablet connected to the instrument through WiFi, an EMAT sensor with two orthogonally polarized coils mounted on an encoded rotator. The encoded rotator includes permanent magnets on the base which affixes to the steel structure and permit one-had operation while taking measurements.

The EMAT sensor takes ultrasonic measurements without contacting the component, and can be used on rough, painted, and rusty bridge surfaces without surface preparation.

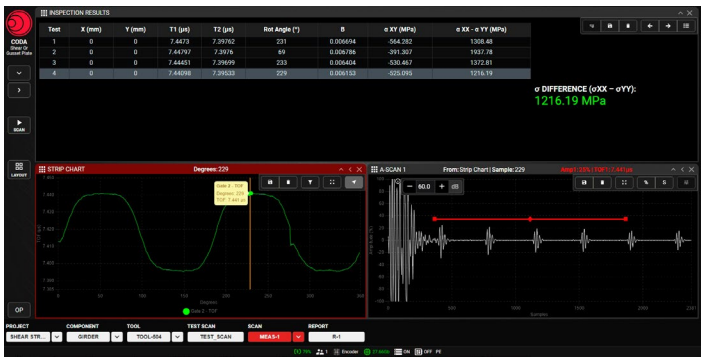


Software

Custom application for measurement of stress including unique procedures and algorithms for measuring tensile and compressive stress on girders/beams and trusses as well as specific bridge components like gusset plates and pin-and-hanger assemblies.

Built-in calibration procedure to determine the material-specific constat (B0) used to relate stress to changes in the velocity of orthogonally polarized shear waves.

Integrated reports providing calculated results, graphs and snapshots. Ability to export the underlying raw data used for the measurement of stress on each component.



CODA SM – STEEL BRIDGES	
Ultrasonic Channels	1:2 EMAT (Multiplexed)
Operating Frequency	1.5-5MHz
User Interface	Tablet (provided) WiFi connection to any device (no client software required)
Software	ITOP with NDT-WEB Stress Measurement Steel Bridges
Accessories	Stress Measurement EMAT Sensor Encoded EMAT Rotator for Steel Bridges
Operating temperature	0°C to 40°C (32°F to 105°F)
Rechargeable Battery	Li-Ion 14.4V, 49Wh, <10A@ 6.8Ah; up to 10 hours battery life
Dimensions	Instrument: 223mm W x 182mm D x 70mm H (8.8" W x 7.2"D x 2.6"H) Sensor (with rotator): 89mm D x 180mm H (3.5" D x 7"H)
Weight	Instrument (without battery and tablet): 1.58kg (3.49lbs) / 1.35kg (2.97lbs) Sensor (with rotator): 1.8kg (4lbs)