

# Application for Measurement & Analysis of Brake Pad and Shoe Pressure Distribution

*This brief highlights the value of gathering pressure distribution data between brake pads and a rotor during the application of the brakes.*

Reducing brake noise, vibration and harshness are just some of the challenges facing brake design engineers. The I-Scan system enables designers to measure pressure distribution between mating surfaces and provides the diagnostic tools to measure, view and evaluate dynamic forces acting between a brake pad and rotor or brake shoe and drum.

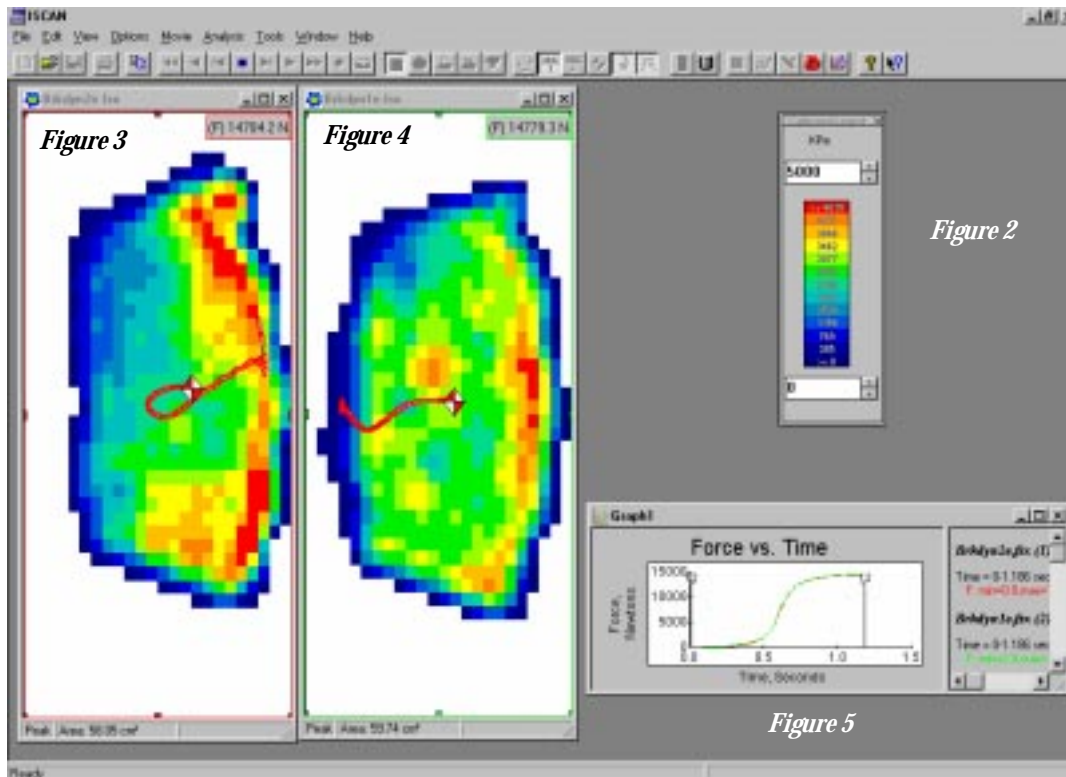
Two separate sensors were used in this study. One was placed between the inboard brake pad and the rotor and a second sensor was placed between the outboard pad and the rotor (*Fig. 1*). Brake pressure was then applied using a dynamic test machine without rotation. A recording of the clamping pressures over time was captured at a rate of 200 Hz. The images of the peak pressure distribution (*Fig 3 & 4*) clearly show the uneven application of pressure by the pad on the rotor during the entire clamping process. The legend (*Fig. 2*) shows the relation between color and pressure. Red indicates higher pressures and blue represents lower pressures. The different color patterns illustrate difference in pressure distribution between the inner (*Fig. 3*) and outer pad (*Fig. 4*). The piston created the higher pressure in the center and outer edge of the inner pad. Higher pressures caused by the caliper "fingers" on the outer pad are also clearly visible.



*Figure 1. An I-Scan sensor placed between a brake pad and rotor.*

The squiggly red line in the center of each window represents the movement or "path" of the *center of force (COF)* during application of the brakes. The total force versus time graph (*Fig. 5*) reveals separate traces for each sensor. As shown from the overlapping lines, the forces on each pad are balanced. However, because the pressure distribution is uneven, wear and stress are different for each pad.

I-Scan is a valuable tool for studying pressure distribution and provides information on the effectiveness of brake pad, piston, rotor and caliper designs. This technology is also helpful in similar applications such as aircraft, train brake and transmission friction plate design.



*Figure 5*