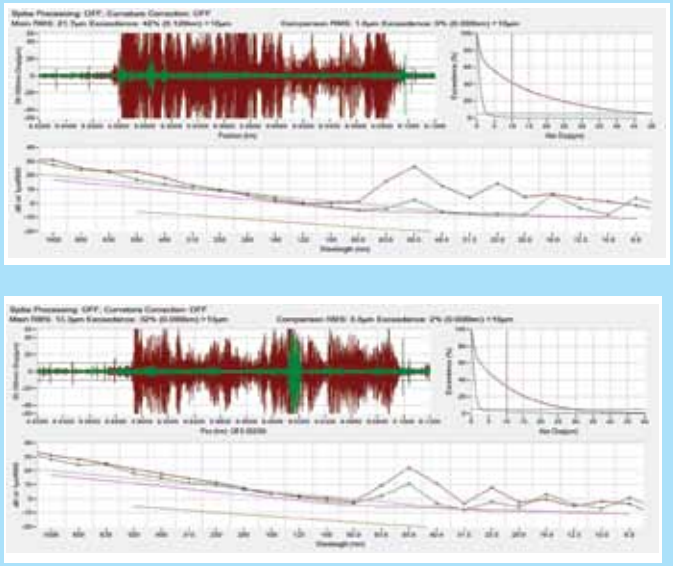
Manual Corrugation Measurement: CAT

CAT

RailMeasurement's CAT is suitable for embedded and flat-bottomed rails.

RailMeasurement's **CAT** (Corrugation Analysis Trolley) is an extremely versatile instrument. CATs are used worldwide for making accurate and reliable measurements of rail corrugation, irregularities and acoustic roughness. Clients include the full range of those working on railways: track workers, reprofiling contractors, equipment suppliers, universities, research workers and acousticians. The same equipment satisfies all requirements: it is sufficiently accurate for research work yet sufficiently robust and reliable to be used routinely by crew on a reprofiling train.

Quality assurance of reprofiling work remains one of the most common applications for the equipment.



*CAT measurements made **before** and **after** grinding on the left and right rails of an isolated section of severe corrugation on a metro system. Although the section has been finished well within the requirements of EN13231-3:2012, there is clearly a section of high residual irregularities on the right rail (below). The spectra highlight the effects of "grinding signature" at 16mm and 8mm wavelengths, and that there is residual corrugation at 50mm (particularly on the right rail). Grinding has relatively little effect at long wavelengths. Long wave irregularities are small.*

The CAT can be carried to site and used by one person. It is extremely portable, with all equipment packaged in a wheeled instrument case with a total weight of about 18kg. Some users have found a wheeled rucksack to be a convenient way of carrying the equipment during a measuring shift.

Measurements are typically made at a comfortable walking speed of 1m/s (3.6km/h). The CAT is powered by a USB lead to a laptop computer, so only the laptop needs to be charged to run the equipment. When the equipment is used for surveying a small railway system, an average of about 3km/h of rail (1.5km of track) can be measured by a single person. Files can be added together (concatenated) to make a single, continuous record for a line.

If a client has a routine requirement for survey work, the bi-CAT or RCA may be more appropriate.

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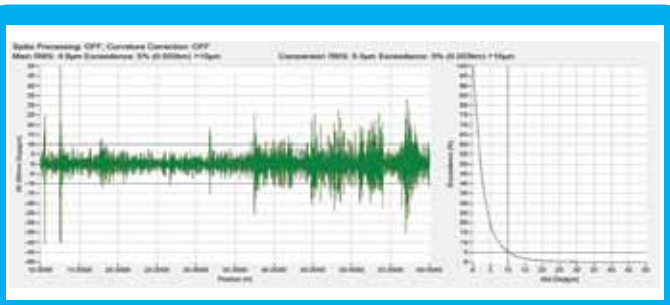
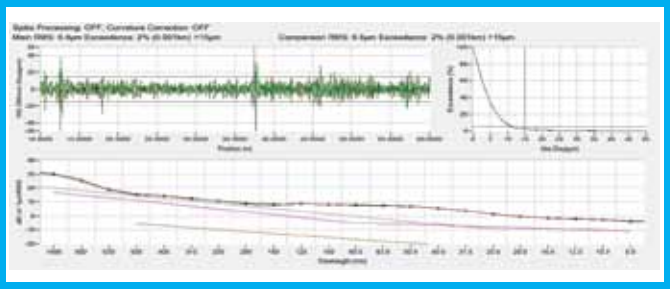
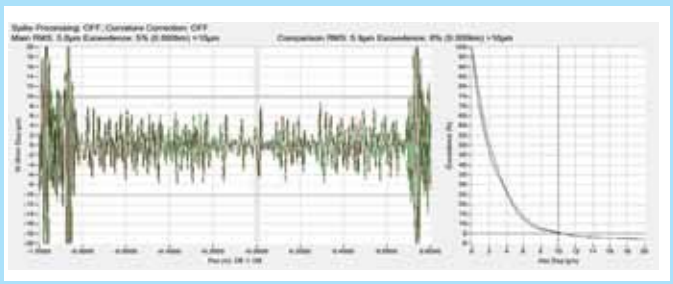
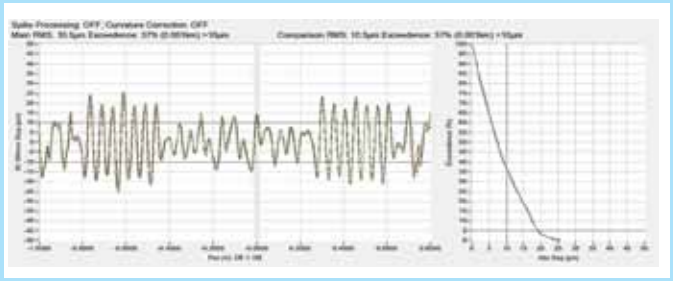
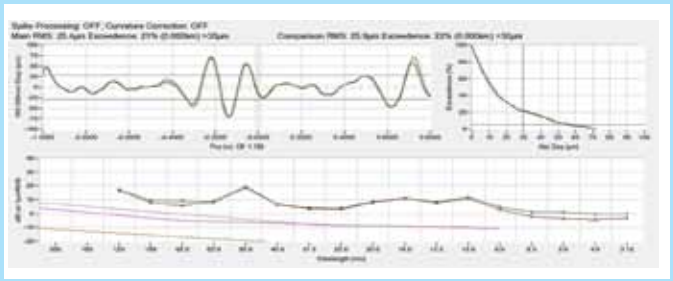




The CAT is exceptionally repeatable. Consecutive measurements of 50m of rail are shown here: 30-100mm and 100-300m filtered displacements, with the one-third octave spectra at the bottom. RMS amplitudes of irregularities differ from one run to the next by 0.1µm and 0.2µm in the two wavelength ranges.







*Typical calibration curves: **CAT** and **CMM** measurements of a 1.8m section of a calibration beam.*

RailMeasurement takes great pride not only in producing excellent equipment but also in ensuring that it is validated. We developed and published a validation technique in the 1990s when none existed. This is the basis of the validation for datum instruments contained in EN13231-3. Our equipment is widely used by universities, consultancies and research workers, who publish their results openly. We also publish research openly based on measurements from users of RailMeasurement equipment worldwide. Clients use our equipment not only because it works but because it continues to work.

CATs can be purchased or hired from RailMeasurement Ltd. We also provide a service to undertake corrugation surveys and measurements to EN15610:2009 / EN ISO3095:2013. Please contact us to discuss your requirements.

Technical Data: CAT			
interval at which data are saved	1mm or 2mm	Output compatible with requirements of	• EN 13231-3:2006 and 2012 • EN ISO 3095:2013 • EN 15610:2009
Measuring speed (within +/-25%)	• 0.5m/s (1mm interval) • 1m/s (2mm interval)	Output	• raw and filtered displacements • moving average amplitudes (RMS and peak-to-peak) • percentage exceedences • one-third octave spectra • exceedence reports (to assist grinding) • difference between two measurements • ASCII data • graphs to cut-and-paste directly in reports
Precision of measurements (displacement)	0.01µm		
Data storage requirements	< 2MB per kilometre of rail		
Accuracy (measurement of 2.5m calibration beam)	Better than • 0.2µm RMS 10-30mm • 0.5µm RMS 30-100mm • 2.0µm RMS 100-300mm	Filters, built-in	• 10-30mm, 30-100mm, 100-300mm, 300-1000mm, 1000-3000mm • 30-300mm, 300-3000mm • 30-150mm, 150-1500mm • 150-1000mm, 1000-1500mm
Options	• measurement of track with different gauge • software to concatenate data files • training course	Filter, user-selectable	• band-pass, high-pass or low-pass • zero phase delay • wavelength of 5-5000mm
		Weight	• 18kg in carrying case • 8kg for instrument with laptop on rail

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