

Vehicle-mounted corrugation measurement: **RCA**

RCA



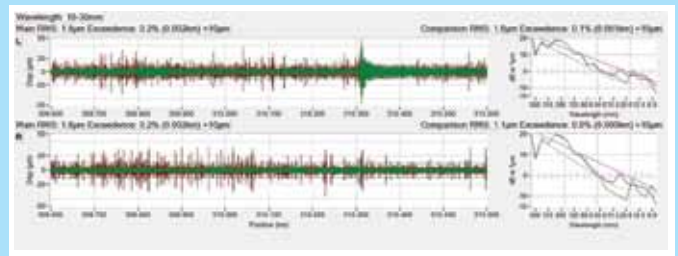
RCA fitted to the bogie of a main-line grinding train.

RailMeasurement's **RCA** (Rail Corrugation Analyser) was originally developed to monitor the results of reprofiling and to assess reprofiling requirements. The standard equipment is made to a fixed gauge "gullwing" design, but we also supply gauge-adjustable RCAs. RCAs have been supplied for a wide variety of reprofiling trains and in other configurations, including self-contained measuring trolleys. RCAs measure tiny irregularities on rails and have been made for speeds as low as 0.5km/h (on a milling train) and as high as 50km/h (on a hi-rail vehicle). The typical speed range is 3-20km/h.

The RCA was initially designed for quality assurance of reprofiling work. Most RCAs are supplied for this use. RCA measurements have been used in calculation of wheel/rail noise and ground-borne vibration for HS2 in the UK. In 2017 RailMeasurement won a contract with Transport for London (TfL) in the UK to provide an RCA for their Infrastructure Monitoring Vehicle on the Elizabeth Line. The equipment will be used to manage irregularities and demonstrate compliance with Information Paper D10 (IPD10) of the Crossrail Act 2008. These requirements are similar to a need to demonstrate routine compliance with the limit on irregularities in EN ISO3095:2005 extrapolated to a wavelength of 2m. To the best of our knowledge, no other equipment is available for a railway vehicle, let alone a reprofiling train, with this performance. Indeed, very little hand-held equipment could produce these measurements: a RailMeasurement CAT has been used to date to demonstrate compliance with IPD10.

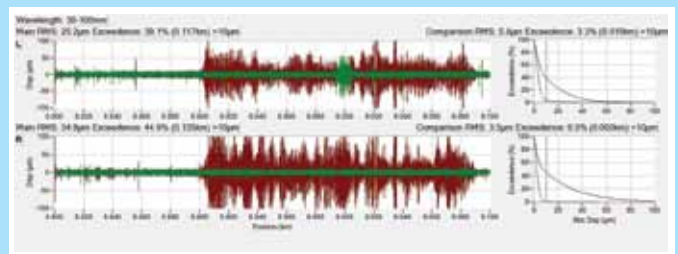


Gauge-adjustable RCA on a small metro grinder.



The RCA gives excellent measurements of irregularities over the full wavelength range that is commonly treated by reprofiling trains. Successive measurements are superposed above of a 1km section of high speed line **before** and **after** grinding. Filtered displacements are well within limits in EN13231-3:2012. One-third octave spectra demonstrate that the ground track is almost compliant with EN ISO3095:2013.

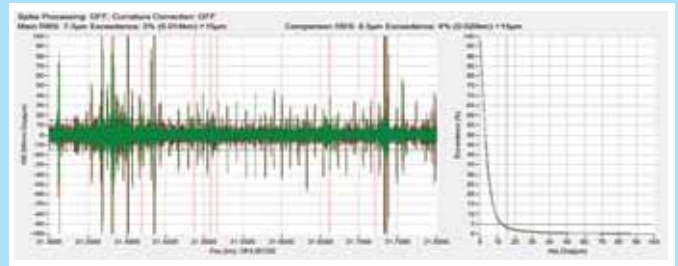
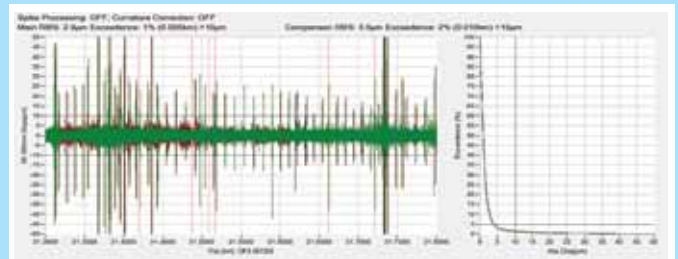
RCAs are relatively easy to fit: mechanical installation usually takes less than a day; electrical and pneumatic connections and initial checking, are made the following day. The equipment is extremely reliable. When we service an RCA or supply parts, this is usually after a few years of use and several thousand km of measurements. This is an enviable historical record of reliability that clients and users find extremely attractive.



RCA measurements **before** and **after** reprofiling over an initially heavily corrugated section of track. Irregularities on both rails have been brought well within the standard for Class 1 reprofiling in EN13231-3:2012.



The RCA measurements above have been used in a survey of a metro system to show where reprofiling is required: see the purple shaded areas and the table to right of main graphs. Measurements for the 30-100mm wavelength range are above and 100-300mm wavelength range below. The main reason for reprofiling is to treat corrugation ("rutting") in the 100-300m wavelength range. This is prominent on the low rail in two left-hand and two right-hand curves. These measurements suggest only 950m of 6.8km (14%) requires reprofiling.



Every RCA is thoroughly validated. **CAT** and **RCA** measurements are shown above for 500m of track. The graphs are of filtered displacements in the 30-100mm and 100-300mm wavelength ranges.

Technical Data: RCA

interval at which data are saved	2mm	Output compatible with requirements of	<ul style="list-style-type: none"> EN 13231-3 and equivalents IPD10 (Crossrail Act, 2008)
Measuring speed (typical)	<ul style="list-style-type: none"> 3-20km/h (typical) 0.5-50km/h (variants) 	Output	<ul style="list-style-type: none"> raw and filtered displacements moving average amplitudes (RMS and peak-to-peak) percentage exceedences tabular output of areas exceeding prescribed limits, for planning of grinding ASCII data ASCII data
Precision of measurements (displacement)	<ul style="list-style-type: none"> 0.1µm (0.0001mm) 		
Measurement of	<ul style="list-style-type: none"> plain line switch and crossing work 		
Minimum curve radius	<150m		
Repeatability (over site of >50m length reprofiled within requirements of EN13231-3:2006)	Better than <ul style="list-style-type: none"> 1µm RMS 10-30mm 1µm RMS 30-100mm 2µm RMS 100-300mm 4µm RMS 300-1000mm 	Reproducibility grinding and not grinding (over site of >50m length within requirements of EN13231-3:2006)	Better than <ul style="list-style-type: none"> 1µm RMS 10-30mm 1µm RMS 30-100mm 2µm RMS 100-300mm 4µm RMS 300-1000mm
Accuracy c.f. CAT (over site of >50m length reprofiled within requirements of EN13231-3:2006)	Better than <ul style="list-style-type: none"> 2µm RMS 10-30mm 2µm RMS 30-100mm 4µm RMS 100-300mm 	Filters, built-in	<ul style="list-style-type: none"> 10-30mm, 30-100mm, 100-300mm, 300-1000mm, 1000-3000mm 30-300mm, 300-3000mm 150-1500mm, 1000-1500mm
Data storage requirements	<ul style="list-style-type: none"> 30MB per kilometre of track 	Options	<ul style="list-style-type: none"> gauge-adjustable measuring system detection and quantification of discrete defects hydraulic actuation training course