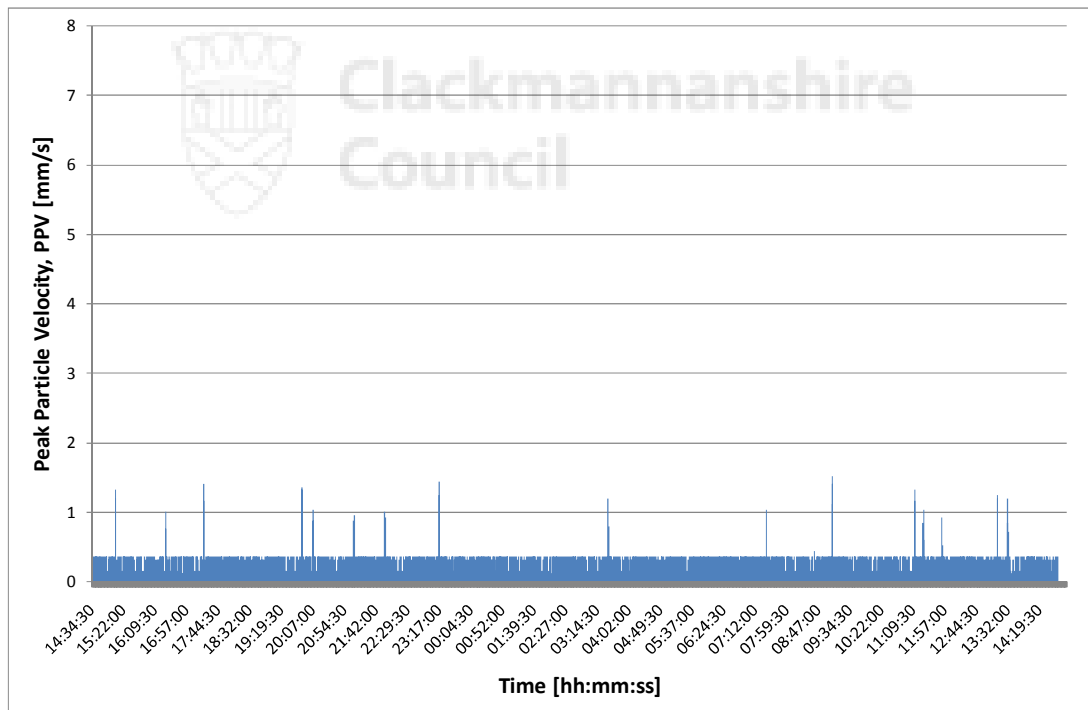


**Figure 5.55: Photograph of Vibration Monitoring Equipment at Station House, Station Road, Kincardine**



- 5.112 Winds of near gale force are likely to have occurred throughout the measurement period. There is unlikely to have been any precipitation.
- 5.113 Figure 5.56 shows the time history of the measured PPVs. Sixteen vibration events of significance can be observed. Each of these is expected to correspond with a train pass-by. It is notable that only 16 events rise above the noise floor of the measurement system. This may be related to various factors including the type, loading and speed of the trains and their direction of travel. Certain conditions evidently gave rise to higher vibration levels than others.

**Figure 5.56: Time History of 30-Second PPVs Measured at Station House, Station Road, Kincardine**



- 5.114 The highest measured PPV was 1.526 mm/s. This level occurred between 09:07:00 and 09:07:30 on Friday 19 November. This level is well below the criteria. It is therefore unlikely to give rise to cosmetic cracks in the dwelling, or any more serious structural effects.



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## 6 Summary and Conclusions

- 6.1 AECOM was commissioned by Clackmannanshire Council to undertake the measurement and assessment of vibration from rail traffic along the Stirling-Alloa-Kincardine (SAK) railway line.
- 6.2 Vibration measurements were undertaken at eighteen properties in close proximity to the SAK railway line in Stirling, Alloa, Clackmannan, Kennet and Kincardine between Wednesday 17 November and Thursday 25 November 2010.
- 6.3 The measurements and assessment concern the effects of vibration on the condition of the property. Criteria are given in BS 7385-2:1993 *Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration*.
- 6.4 The measurements indicate that groundborne vibration from trains meets the criteria in all but one case. This exception occurred at 16 Ochil View, Kincardine, where PPVs up to 7.51 mm/s were measured on the ground adjacent to the dwelling. Where the dynamic behaviour of the building structure might cause amplification of the ground vibration, cosmetic cracks could result, since the most onerous criterion of 7.5 mm/s is exceeded.
- 6.5 In all other cases, train-induced PPVs were found to be no greater than one third of the criterion. Levels were found to be below the range of the measurement system (0.3 mm/s) in several cases
- 6.6 It should be borne in mind that the threshold criteria for cosmetic/structural damage to buildings are normally orders of magnitude higher than those for human perception ('feelability').
- 6.7 It is understood that a condition survey was carried out by Hardies Property & Construction Consultants in 2005 prior to the SAK railway line being reopened. Where subsequent investigations were to indicate cosmetic cracks, train-induced vibration is unlikely to have been responsible in all cases except one. This exception is the dwelling at 16 Ochil View, Kincardine.

# Appendix 1 – Glossary of Vibration Terminology

**Peak Particle Velocity PPV**

A measure of the strength of vibration. Specifically the highest instantaneous zero-peak vibration velocity measured over a certain period of time.



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# Appendix 2 – Instrumentation Certification

## A2.1 Calibration Certificate for Vibrock V901 with Serial Number 887

<b>CERTIFICATE OF CALIBRATION</b> ISSUED BY: <b>CALIBRATION MAINTENANCE &amp; REPAIR LTD</b>		 
DATE OF ISSUE: 18 October 2010    CERTIFICATE NUMBER: <b>130925</b>		
	Home Farm Industrial Park Norwich Road Marsham Norfolk NR10 5PQ Tel: +44 1603 279557 Fax: +44 1603 278008	
	Page 1 of 3 Approved Signatory  P.K.Clark M.A.Frost R.J.Wade	

<b>CUSTOMER</b>	<b>MANUFACTURER</b>	<b>VIBROCK LIMITED</b>
CAMPBELL ASSOCIATES SONITUS HOUSE 5B CHELMSFORD ROAD INDUSTRIAL ESTATE GREAT DUNMOW ESSEX CM6 1HD UNITED KINGDOM	<b>DESCRIPTION</b>	<b>DIGITAL SEISMOGRAPH</b>
	<b>MODEL</b>	<b>V901</b>
	<b>SERIAL No.</b>	<b>887</b>
	<b>IDENT No.</b>	<b>VIB-V901 # 1.887</b>
	<b>DATE RECEIVED</b>	<b>15 OCTOBER 2010</b>
	<b>DATE OF CALIBRATION</b>	<b>18 OCTOBER 2010</b>
	<b>ORDER No.</b>	<b>9501</b>

### INSTRUMENT CONDITION

Adjustments were not required to return the instrument to a calibrated condition.  
Repairs were not carried out.

### ENVIRONMENT

The instrument was placed in the Laboratory environment for a minimum period of 4 hours prior to calibration.

The ambient conditions were: 22°C ± 3°C and 45% RH ± 15% RH.  
The instrument was operated from the Laboratory's mains supply of 230V ± 10V.

### STABILITY


The results contained in this Certificate refer to the measurements made at the time of test and not to the instrument's ability to maintain calibration.

### PROCEDURE

Measurements were performed in accordance with the in house Laboratory procedure No. 0689

The reported two part expanded uncertainty is in each case based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to recognised national standards, and to units of measurement realised at the National Physics Laboratory or other recognised national standards laboratories. This certificate may not be produced other than in full, except with prior written approval of the issuing laboratory.

<b>CERTIFICATE OF CALIBRATION</b> ISSUED BY: <b>CALIBRATION MAINTENANCE &amp; REPAIR LTD</b>  UKAS ACCREDITED CALIBRATION LABORATORY No. 0654	 CERTIFICATE NUMBER <b>130925</b> Page 2 of 3
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**INSTRUMENTS USED**

<b>EQUIPMENT</b>	<b>SERIAL No</b>	<b>CERTIFICATE No</b>	<b>CAL DUE</b>
DACTRON LASER PCB 301A11	11633408 1934	M1754 M1811	05 Jan 2011 15 Jul 2011

**Additional Non Accredited Uncertainties:**

Display values are not assigned an uncertainty, as they are an indication only.

Time: +/- 1.007 seconds  
Distortion: +/- 1.4 mVolts



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