

## CURRICULUM VITAE OF STUART GRASSIE

1 **Name** GRASSIE, Stuart Liddle

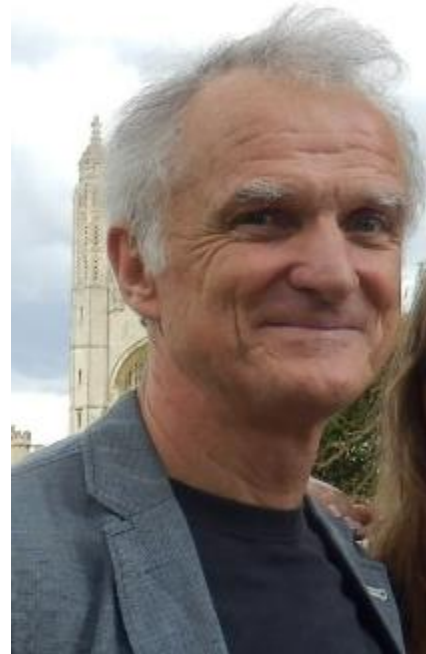
2 **Age** 63 years

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### 7 **Present position, areas of work and clients**

Self-employed engineering consultant

- expert witness
  - vehicle/track interaction, wheel and rail damage, wheel/rail interface
  - mechanical engineering and mechanics
- vehicle / track interaction and the wheel / rail interface
- rail and wheel damage
- reprofiling of rails
- development of rail corrugation measuring equipment
- development of software for rail monitoring and maintenance

Director, Stuart Grassie Engineering Ltd

Director, RailMeasurement Ltd

In my career as a consultant, I have worked on every continent (except Antarctica). Areas of interest and clients (2005-2017 unless stated otherwise) include the following.

### **Expert witness**

- Holman Fenwick Willan LLP re. derailment of freight train, UK, 2013
- Cunningham Lindsey Intl., insurance loss adjustors re. derailment of “heavy haul” train, Brazil, 2007-2009
- Herbert Smith LLP re. derailment of a passenger train at Hatfield, UK (“National Express litigation”), 2002-2003

### **Vehicle/track interaction and the wheel/rail interface**

- Bombardier Transportation
- CAF (re Line 12, Mexico City Metro; see, for example, <http://www.jornada.unam.mx/2015/01/29/capital/036n1cap> accessed 24 March 2016)
- Canadian National Railway
- Loram Maintenance of Way Inc
- Parsons Brinckerhoff Intl (for BART)
- Strathclyde Passenger Transport (Glasgow Underground)
- London Underground
- Wiener Linien GmbH (Vienna metro and tram system)
- SL Ban System, Stockholm

### **Rail grinding**

- Brookfield Rail, Australia
- Sydney Trains, Australia
- Transport for NSW, Australia (“best practice” manual)
- Canadian National Railway
- Loram Maintenance of Way Inc
- Parsons Brinckerhoff Intl (for BART)
- Railtrack plc / Network Rail Ltd
- Schweerbau GmbH
- SL Ban System, Stockholm
- Sheffield Supertram (via Corus Rail Technologies)
- Strathclyde Passenger Transport / Glasgow Underground
- Wiener Linien GmbH (Vienna metro and tram system)

### **Monitoring and management of rail maintenance**

- see Section 13

### **Rail corrugation, railway noise and vibration; dynamic behaviour of trackforms**

- CAF (re Line 12, Mexico City Metro; see, for example, <http://www.jornada.unam.mx/2015/01/29/capital/036n1cap> accessed 24 March 2016)
- CTCL, Taiwan (re TSL, Singapore)
- Mitsubishi Heavy Industries (for KVMRT, Malaysia)
- Jacobs Rail (for KVMRT, Malaysia)
- Parsons Brinckerhoff Intl (for BART)
- Loram Maintenance of Way Inc (for Sound Transit, Seattle)
- London Underground
- Hong Kong MTRC, “checking engineer” for noise, vibration and dynamic behaviour of trackforms, bridges and viaducts, Lantau and Airport Railway (1991-97)
- NRC, Canada

### **Wheel and rail profile development**

- Sydney Trains, Australia
- Canadian National Railway
- Railtrack plc (“ATH” profile: this has been ground since 2001 as the primary treatment of RCF on the UK main-line network and is in large part responsible for a reduction in plain-line, non-weld or joint related rail breaks from > 900p.a. before 2000 to < 150p.a. in 2011.)
- Banverket (profile to alleviate RCF on “Malmabanan” railway, adopted 1997)
- Department of Infrastructure, Victoria, Australia (Regional Fast Rail Project; rail profile RFR101 adopted 2004)
- Wiener Linien GmbH (Vienna metro and tram system; rail profiles used for asymmetric grinding in curves to alleviate corrugation and for alleviation of hunting in straight track)
- SL Ban System, Stockholm (asymmetric profiles to alleviate corrugation and RCF in curves)
- Schweerbau GmbH, profile to alleviate hunting on Docklands Light Railway, London

### **Rail inspection, selection and damage**

- ArcelorMittal, Spain
- Brookfield Rail, Australia
- Canadian National Railway
- Bombardier Transportation, Germany
- London Underground
- Gautrain (for Bombardier Transportation and Corus Rail Technologies)
- Wiener Linien GmbH (Vienna metro and tram system)
- Railtrack plc / Network Rail Ltd (including International Peer Review of “NR RCF hypothesis”, 2003)
- Sydney Trains, Australia
- SBB, Switzerland

- Sheffield Supertram (via Corus Rail Technologies)
- Transit Cooperative Research Program (TCRP), USA, project D-1 1993 (“Rail corrugation mitigation in transit”), joint principal investigator (with JA Elkins of AAR), 1994-1996 (see refs [51] and [53], Section 13), undertaken with TTCl, USA

The proposals from this TCRP project (ref [53]) are the basis of a European “Brite Euram” research project, in which neither Dr Grassie nor TTCl was involved, for which funding of approximately €5 million was obtained.

### **Development and supply of equipment to measure rail corrugation and rail “roughness”**

- see Section 12

### **Education and training**

- International Heavy Haul Association (in collaboration with Indian Railways and the World Bank), Vehicle / Track Design, Maintenance, and Inspection Issues Workshop, New Delhi, India, 1-3 February 2013, contribution on rolling contact fatigue
- SouthWest Jiaotong University, Chengdu, China, invited lecturer, 2010 (rolling contact fatigue; bogie dynamics, curving and wheel/rail forces; corrugation and acoustic roughness)
- Voest Alpine: invited lecture, University of Leoben, 2008
- Originator, coordinator and principal contributor to annual Vehicle / Track Interaction Course. The Course was addressed regularly by colleagues of Dr Grassie from Europe and North America. The Course attracted up to 120 participants in the period 1999-2006
- Schweerbau GmbH: lead contributor to “Effective Rail Management” seminars, 2005-2009; contributor 2015
- Railway Accident Investigation Branch (RAIB): training courses on vehicle/track interaction for RAIB Inspectors

### **Standardisation**

- British Standards Institution (BSI) expert on CEN working group on track maintenance; author of the initial draft of European Standard for reprofiling rails, EN 13231-3:2006 (1997 to present)
- Contributor to the working group established to “road test” protocol proposed for rail roughness measurement in EN 15610:2009 (“Rail roughness measurement related to rolling noise generation”)
- Contributions to Australian Standards on rolling stock (2007 and 2011) and concrete sleepers (1987-88)

### **Review and evaluation of railway research and development**

- European Commission, Research Directorate-General, 2004-2005
- Railway Safety and Standards Board (RSSB), UK: expert to assist with 2004-2005 research review exercise in area of vehicle/track interaction

In addition to the above paid work, I have been the Guest Editor or joint Guest Editor on five occasions (1990, 2006, 2009, 2012 and 2015) of the Proceedings of the conferences on Contact Mechanics and Wear of Rail/Wheel Systems. I instituted publication of these proceedings as a Special Edition of the journal *Wear* in 1990. I regularly review academic papers (Institution of Mechanical Engineers, *Journal of Sound and Vibration*, *Wear* and others), and occasionally review proposals for funding from national research councils. I contribute to academic and professional journals (peer-reviewed and otherwise) and international conferences. In 1984, at the invitation of Prof KL Johnson FRS, I reviewed the entire text of his standard reference work, "Contact Mechanics", Cambridge University Press, 1985 (1<sup>st</sup> edition).

I have also undertaken oral examinations of doctoral and MPhil candidates at Cambridge University, UK and of doctoral candidates at Chalmers University of Technology, Sweden and at ULB, Brussels.

## 8 Postdoctoral employment

- Director and joint founder, RailMeasurement Ltd 2005 to present
- self-employed engineering consultant 1988 to present
- Technical Manager, Loram Rail Ltd 1994-98
- Lecturer in mechanical engineering, Imperial College, London 1990-94
- Research and development engineer, Pandrol International Ltd, London 1984-87
- Research assistant, Cambridge University Engineering Department (collaborative research project with British Rail Research) 1980-84

## 9 Invited lectures, distinctions, prizes, scholarships

- Contributor to Chapter 5 of "Guidelines to best practices for Heavy Haul railway operations: management of the wheel and rail interface", published by the International Heavy Haul Association, ISBN 978-0-911382-63-1 2015
- Alfred Rosling Bennett/Charles Lake Award, awarded by the Railway Division of the Institution of Mechanical Engineers for the best paper published or presented by the Institution on a railway topic (joint with DI Fletcher, AE Gallardo-Hernandez and P Summers, reference [87] in Section 14). 2013
- India Rail / IHHA Track and Rail / Wheel Interaction Workshop, New Delhi, India: rolling contact fatigue of rails and wheels: 2013
- Opening presentation, 9<sup>th</sup> International Conference on Contact Mechanics and Wear of Rail / Wheel Systems, Chengdu, China 2012
- Chairman of the International Committee of the society that organises the conferences on Contact Mechanics and Wear of Rail/Wheel Systems (for period 2012-2018) 2012

## curriculum vitae of Stuart Grassie

- invited lecture, interdisciplinary patents workshop on “What is an invention?”, Centre for Intellectual Property and Information Law, Cambridge University, UK 2010
- lead presentation at workshop on rail corrugation, Manchester Metropolitan University 2010
- invited presentation on vehicle/track interaction on metro systems; appreciation of Prof Joostalker, 7<sup>th</sup> International Conference on Contact Mechanics and Wear of Rail / Wheel Systems, Brisbane 2006
- invited presentation on problems of vehicle / track interaction on metro systems organised by Bombardier Transportation, Qingdao, China 2005
- invited paper, 6<sup>th</sup> International Conference on Contact Mechanics and Wear of Rail / Wheel Systems, Goteborg (reference [66], Section 14) 2003
- co-author of invited “lead” paper on rolling contact fatigue for special issue of journal FFEMS on “Wheel/rail safety” (ref [64]) 2003
- Member of the International Review Panel for “Guidelines to best practices for Heavy Haul railway operations: wheel and rail interface issues”, published by the International Heavy Haul Association (only UK member of this Panel, and one of three in Western Europe) 2001
- One of 4 members of the Advisory Committee for the series of international conferences on Contact Mechanics and Wear of Rail/Wheel Systems 1990 – 2009
- member of the International Committee for the conferences on Contact Mechanics and Wear of Rail/Wheel Systems 1990 to present
- Invited “state-of-the-art” paper (with Prof Klaus Knothe, TU Berlin), 13<sup>th</sup> IAVSD Symposium on the Dynamics of Vehicles on Roads and Tracks (reference [32] in Section 14). This also won the “Best Paper” prize at the 13<sup>th</sup> IAVSD Symposium. 1993
- Alfred Rosling Bennett/Charles Lake Award, awarded by the Railway Division of the Institution of Mechanical Engineers for the best paper published or presented by the Institution on a railway topic (joint with Dr Joe Kalousek, reference [33] in Section 14). 1993
- George Stephenson Prize, awarded by the Institution of Mechanical Engineers (joint with Dr Joe Kalousek, reference [33] in Section 14). 1993
- Research Fellow, Gonville and Caius College, Cambridge 1980-84
- Senior Rouse Ball Research Studentship, Trinity College, Cambridge 1979-80
- Junior Research Studentship, Trinity College, Cambridge 1976-79
- Captain James Cook Travelling Scholarship, University of Queensland 1976-79
- Commonwealth of Australia postgraduate award 1975
- A J Dowrie Memorial Prize, University of Queensland 1973
- Queensland Government Open Scholarship 1971-74

### 10 Academic qualifications

- PhD, Cambridge ("The Corrugation of Railway Track") 1980
- MEngSc, Queensland ("Solar Operated Absorption Air Conditioning") 1976

- BE with First Class Honours in Mechanical Engineering, Queensland 1975

#### 11 Membership of professional bodies etc.

- Member - Standing Committee on Transportation-Related Noise and Vibration - ADC40, Transportation Research Board, USA 2011 to present
- Chartered Engineer, Member of the Institution of Mechanical Engineers 1988
- Member of the Permanent Way Institution 1988

#### 12 Technology ([www.railmeasurement.com](http://www.railmeasurement.com) )

The equipment and software below are joint developments with Dr Martin Saxon (also of Railmeasurement Ltd). The wheel measuring equipment (TriTops) is a joint development with ISVR, University of Southampton.

- *Equipment to measure rail corrugation and acoustic rail roughness* 1987 to present

The CAT (Corrugation Analysis Trolley) is now a standard piece of measuring equipment, used by railway administrations, consultants, universities and contractors worldwide, to measure rail corrugation and acoustic roughness to the requirements of EN 13231-3:2006, EN ISO 3095:2005 and EN 15610:2009. A further development, the bi-CAT, was finalised in 2015 to measure two rails simultaneously with a single operator.

The Rail Corrugation Analyser (RCA) is supplied for reprofiling trains and other track-mounted vehicles. It is used to measure to the requirements of EN 13231-3:2006 at speeds in the range 0.5-50km/h. The equipment is supplied by Loram as standard corrugation measuring equipment on their rail grinders, unless alternative equipment is specifically requested. RCAs have also been supplied to Sumitomo Metal Technology Inc / Nippon Steel for use in Japan, to Schwebbau GmbH for use in Europe and to QR National / Aurizon Ltd in Australia.

The high speed rail corrugation measuring system (HSRCA) was supplied initially to Australian National (AN) in 1987 and was used by them for many years to schedule rail grinding and weld straightening on their network. These measurements are now being made using a hi-rail vehicle with a system that we supplied to measure corrugation to an accuracy of microns at 50km/h. The HSRCA has been proven in tests undertaken in 2009 with French railways (SNCF) to measure corrugation and acoustic roughness reliably at speeds of 90-160km/h (ref [82]).

- *TriTops* 2012  
RailMeasurement have developed, in collaboration with ISVR at Southampton University, the TriTops equipment for measuring acoustic roughness and irregularities of wheels, out-of-round and diameter.

- *Rail analysis utility* 2010  
The Rail Analysis Utility is software that processes transverse profile measurements from hardware (e.g. laser-based systems, supplied by others) and provides information such as rail wear, rail type and fit of railhead profile to a prescribed profile. These measurements are combined with measurements of corrugation (typically from the HSRCA) to give a summary “Grinding Compliance Index” (GCI) and “Rail Quality Index” (RQI), which can be used to plan rail maintenance and replacement. The software and HSRCA have been supplied for a measuring train developed by Serco Rail Technologies for Queensland National.
- *software to assist with management and monitoring of rail maintenance* 2006 to present  
Software has been developed for Metronet and Nexus (Tyne and Wear Metro) to assist with management of rail maintenance.
- *software to assist in design of railway track to carry dynamic loads* 1987-1995  
Software based on the models and proposals in refs [11,19 and 30] was supplied via Railways of Australia to Australian state railway administrations.

### 13 Languages

- English: fluent
- German, French, Spanish: conversational

### 14 Publications

In all publications except numbers 17, 56, 57, 64, 92 and 99 I was the principal or joint principal author or Guest Editor.

- 1 “The use of planar reflectors for increasing the energy yield of flat plate collectors”, *Solar Energy*, 1977, 19, 663-668 (with N R Sheridan)
- 2 “Modelling of a solar operated absorption air conditioner system with refrigerant storage”, *Solar Energy*, 1977, 19, 691-700 (with N R Sheridan)
- 3 “The dynamic response of railway track to high frequency vertical excitation”, *J mech Engng Sci*, 1982, 24, 77-90 (with R W Gregory, D Harrison and K L Johnson)
- 4 “The dynamic response of railway track to high frequency lateral excitation”, *J mech Engng Sci*, 1982, 24, 91-95 (with R W Gregory and K L Johnson)
- 5 “The dynamic response of railway track to high frequency longitudinal excitation”, *J mech Engng Sci*, 1982, 24, 97-102 (with R W Gregory and K L Johnson)
- 6 “The behaviour of railway wheelsets and track at high frequencies of excitation”, *J mech Engng Sci*, 1982, 24, 103-111 (with R W Gregory and K L Johnson)
- 7 “Probing the origins of corrugation”, *Railway Gazette International*, September 1982, p739
- 8 “The dynamics of railway track”, *Track Report*, Autumn 1982, 10-11
- 9 “Dynamic loading of rails at corrugation frequencies”, in “*Rail technology*”, C O Frederick and D J Round (eds), Derby, UK, 1983 (with R W Gregory and K L Johnson)
- 10 “The dynamic loading of rails at corrugation frequencies”, *Intl Symposium on Contact Mechanics and Wear on Rail/Wheel Systems*, University of Waterloo Press, Canada, 1983 (with R W Gregory and K L Johnson)
- 11 “The dynamic response of railway track with flexible sleepers to high frequency vertical excitation”, *Procs. Of I mech E*, 1984, 198D, 117-124 (with S J Cox)



- 12 "Dynamic modelling of railway track and wheelsets", *2<sup>nd</sup> Intl Conf on Recent Advances in Structural Dynamics*, M Petyt and H F Wolfe, (eds), ISVR, University of Southampton, 1984, 681-698
- 13 "The dynamic response of railway track with unsupported sleepers", *Procs of I mech E*, 1985, 199D, 123-135 (with S J Cox)
- 14 "Periodic microslip between a rolling wheel and a corrugated rail", *Wear*, 1985, 101, 291-305 (with K L Johnson)
- 15 "An investigation into the generation of corrugation by transient spin creep", *Wear*, 1985, 103, 161-174
- 16 "Progress in the development and testing of resilient railpads", *Sixth Intl Rail Track Conference*, Melbourne, 1986 (with S J Cox, G G Leeves and D Rhodes)
- 17 "Understanding dynamics as an aid to developing track", *3<sup>rd</sup> Intl Heavy Haul Railways Conf*, Vancouver, 1986 (with S J Cox)
- 18 "Development of railpads: the need for in-track testing", *Rail Track Journal*, August 1986, pp7-8
- 19 "The response of railway track to discrete irregularities", *Vehicle Systems Dynamics*, 1987, 17, 86-89 (with S J Cox)
- 20 "Cutting the strain with railpads and ballast", *Rail Track Journal*, July 1987, pp5-7
- 21 "Measurement and attenuation of load in concrete sleepers", *Conference on Railway Engineering, Publication NCP 87/11*, Instn of Engrs Australia 1987
- 22 "Corrugation: steps to recovery", *Track Report*, Autumn 1988, 14-15
- 23 "Resilient railpads: their dynamic behaviour in the laboratory and on track", *Procs of I mech E*, 1989, 203F1, 23-32
- 24 "Behaviour in track of concrete sleepers with resilient railpads", *Procs of I mech E*, 1989, 203F2, 97-101
- 25 "Corrugation on Australian National: cause, measurement and rectification", *4<sup>th</sup> Intl Heavy Haul Railways Conference*, Brisbane, Instn of Engrs Australia, 1989
- 26 "Generation of noise on overhead railway viaducts", *Workshop on Rolling Noise Generation*, TU Berlin, 1989
- 27 "Corrugation: variations on an enigma", *Railway Gazette International*, July 1990, pp531-533
- 28 "Allowable impact loading and wheel irregularities", *Eighth Intl Rail Track Conference*, Sydney, October 1990
- 29 "*Mechanics and fatigue in wheel/rail contact*", Elsevier Science Publishers, Amsterdam 1991 (editor)
- 30 "A contribution to dynamic design of railway track", *Vehicle System Dynamics*, 1991, 20, 195-209
- 31 "Dynamic models of railway track and their uses", in "*Rail Quality and Maintenance for Modern Railway Operation*", JJ Kalker, DF Cannon and O Orringer (eds), Kluwer Academic Publishers, 1993, pp165-183
- 32 "Modelling of railway track and of vehicle/track interaction at high frequencies", *Vehicle System Dynamics*, 1993, 22, 209-262 (invited "state-of-the-art" paper, with K Knothe)
- 33 "Rail corrugation: characteristics, causes and treatments", *Journal of Rail and Rapid Transit, Procs of I mech E*, 1993, 207F, 57-68 (with J Kalousek)
- 34 "Dynamic loading of a novel trackform", *Procs of Intl Conference on Speedup Technology for Railway and Maglev Vehicles*, Yokohama, 1993
- 35 "Rail corrugation: characteristics, causes and treatments", *Jnl of Japan Railway Civil Engineering Association*, 1994, 32, 6, 439-442 (in Japanese, translation by Drs M Ishida and T Nagafuji)

- 36 “Unravelling the threads of rail corrugation”, *Rail Bulletin*, August/September 1994, pp84-89
- 37 “Interaction of railway vehicles with the track and its substructure”, *Vehicle System Dynamics Supplement*, K Knothe, SL Grassie and JA Elkins (eds), Swets and Zeitlinger, 1995, vol. 24
- 38 “Track deflections and macroscopic movement of railway embankment”, *op cit*, 154-163
- 39 “Benchmark tests for models of railway track and of vehicle/track interaction at relatively high frequencies”, *op cit*, 355-362
- 40 “Review of Workshop: aims and open questions”, *op cit*, 380-386
- 41 „Riffeln – Gründe und Gegenmassnahmen“, *Der Eisenbahn Ingenieur*, 1995, 46, 714-723 (in German, translation by Dr Klaus Hempelmann)
- 42 “Dynamic modelling of concrete railway sleepers”, *Jnl of Sound and Vibration*, 1995, 187, 799-813
- 43 “Short wavelength rail corrugation: field trials and measuring equipment”, *Wear*, 1996, 191, 149-160
- 44 “Measurement of railhead profiles: a comparison of different techniques”, *Wear*, 1996, 191, 245-251
- 45 “Discussion: Corrugation, wear and wheel/rail contact problems”, *Wear*, 1996, 191, 277-280
- 46 “Models of railway track and vehicle/track interaction at high frequencies: results of benchmark test”, *Vehicle System Dynamics Supplement*, 1996, 25, 243-262
- 47 “Rail grinding: equipment and purpose”, *Procs of UIC User-Producer Interaction Programme, Phase I*, New Delhi, 1996, pp275-276
- 48 “Fatigue failure is often the hidden hazard”, *International Railway Journal*, February 1997, pp29-30
- 49 “Rolling contact fatigue of rails: characteristics, causes and treatments”, *Procs of 6<sup>th</sup> Intl Heavy Haul Railway Conference*, Cape Town, 1997, pp381-404 (with J Kalousek)
- 50 “Requirements for transverse railhead profile and railhead roughness following grinding”, *Procs of 6<sup>th</sup> Intl Heavy Haul Railway Conference*, Cape Town, 1997, pp549-564
- 51 “Corrugation on North American transit lines”, *Vehicle System Dynamics Supplement*, 1998, 28, 5-17 (with JA Elkins)
- 52 “Measurement of irregularities underpins grinding criteria”, *Railway Gazette International*, March 1998, pp163-166 (with MJ Saxon and JD Smith)
- 53 “Rail corrugation mitigation in transit”, Research Results Digest, Transit Cooperative Research Program, National Research Council, USA, number 26, June 1998 (with BJ Brickle, JA Elkins, SJ Handal)
- 54 “Measurement of longitudinal rail irregularities and criteria for acceptable grinding”, *Journal of Sound and Vibration*, 1999, 227, pp949-964 (with MJ Saxon and JD Smith)
- 55 “Appropriate specification of grinding requirements for heavy haul railways”, *Procs of Intl Heavy Haul Association specialist technical session on the wheel/rail interface*, Moscow, 14-17 June 1999
- 56 “Perspectives on metallurgy and contact mechanics”, *Procs of Intl Heavy Haul Association specialist technical session on the wheel/rail interface*, Moscow, 14-17 June 1999 (invited paper, with J Kalousek and E Magel)
- 57 “Track settlement prediction using computer simulation tools”, *Vehicle System Dynamics Supplement*, 2000, (with S Iwnicki and W Kik)

- 58 “Grinding to alleviate leaf fall problems”, *Procs of seminar, “Adhesion – money on the line”*, Instn of Mech Engrs, London, 1<sup>st</sup> June 2000 (with PR Baker)
- 59 “Routine maintenance extends rail life and offers long-term savings”, *Railway Gazette International*, February 2000, pp88-90 (with PR Baker)
- 60 “Rail corrugation: causes and treatments”, *International Railway Journal*, July 2000, pp24-26 (with J Kalousek)
- 61 “Preventive grinding controls RCF defects”, *International Railway Journal*, January 2001, pp13-17
- 62 “Alleviation of rolling contact fatigue on Sweden’s Malmbanan”, *Wear*, 2002, 253, pp42-53 (with P Nilsson, K Bjurstrom, A Frick and L-G Hansson)
- 63 “Alleviation of rolling contact fatigue by grinding the worn rail profile”, *Procs of 7<sup>th</sup> Intl Heavy Haul Railway Conference*, Brisbane, 2001 (with P Nilsson)
- 64 “Rail defects – an overview”, *Fatigue and Fracture of Engineering Materials and Structures, special issue on wheel / rail interface*, 2003, 26, pp865-886 (invited paper, with D Cannon, K-O Edel and KJ Sawley)
- 65 “Rolling contact fatigue on the British railway system: treatment”, *Wear*, 2005, 258/7-8, 1310-1318, (also *Procs. of 6<sup>th</sup> International conference on Contact Mechanics and Wear of Rail/Wheel Systems*, A Ekberg, JW Rinsberg and R Lunden (eds))
- 66 “Tractive effort, curving and surface damage of rails, Part1: forces exerted on the rails”, *Wear*, 2005, 258/7-8, 1235-1244 (also *Procs. of 6<sup>th</sup> International conference on Contact Mechanics and Wear of Rail/Wheel Systems*, A Ekberg, JW Rinsberg and R Lunden (eds)), (with JA Elkins)
- 67 “Rail corrugation: advances in measurement, understanding and treatment”, *Wear*, 2005, 258/7-8, 1224-1234, (also *Procs. of 6<sup>th</sup> International conference on Contact Mechanics and Wear of Rail/Wheel Systems*, A Ekberg, JW Rinsberg and R Lunden (eds))
- 68 “Accurate measurements extend monitoring scope”, *International Railway Journal*, December 2004, pp22-25
- 69 “Benchmark testing of equipment to measure rail roughness”, *Procs of the 8<sup>th</sup> International Workshop on Railway Noise*, Buxton, September 2004 (with JW Edwards, CJC Jones and E Verheijen)
- 70 “The role of rail grinding in improving safety of the railway”, *IPWE national technical seminar*, New Delhi, January 2005, pp122-129
- 71 “Traction and curving behaviour of a railway bogie”, *Vehicle System Dynamics*, 2006, volume 44 supplement, 883-891 (also *Procs of the 19<sup>th</sup> IAVSD Symposium, Dynamics of vehicles on roads and tracks*, Milan, September 2005), (with JA Elkins)
- 72 “Development of corrugation as a result of varying normal load”, *Procs. of 7<sup>th</sup> International conference on Contact Mechanics and Wear of Rail/Wheel Systems* Brisbane, September 2006, *Wear*, 2008, 265/9-10, 1150-1155 (with JW Edwards)
- 73 “Roaring rails: an enigma largely explained”, *International Railway Journal*, July 2007, pp31-33 (with JW Edwards and J Shepherd)
- 74 “Procs. of 7<sup>th</sup> International conference on Contact Mechanics and Wear of Rail/Wheel Systems”, *Wear*, 2008, 265/9-10 (Guest Editor; guest editorial p1149)
- 75 “Comments on ‘Short wavelength rail corrugation and non-steady-state contact mechanics’”, *Vehicle System Dynamics*, 2008, volume 46, 1-2, 67-70
- 76 “Drowning in data and seeking a solution”, *Railway Gazette International*, November 2008

- 77 “Maintenance of the wheel/rail interface”, Chapter 20 of “*Wheel/Rail Interface Handbook*”, Roger Lewis and Ulf Olofsson (eds), Woodhead Publishing Ltd, 2009
- 78 “Rail corrugation”, Chapter 11 of “*Wheel/Rail Interface Handbook*”, Roger Lewis and Ulf Olofsson (eds), Woodhead Publishing Ltd, 2009
- 79<sup>1</sup> “Rail corrugation: characteristics, causes and treatments”, *Journal of Rail and Rapid Transit, Procs of I mech E*, 2009, 223F, 581-596 (Review Paper, update of ref [33])
- 80 “Control of wheel/rail noise and ground-borne vibration: the role of rail maintenance”, Session 365, 89<sup>th</sup> TRB Annual Meeting, Washington DC, 10<sup>th</sup>-14<sup>th</sup> January 2010 (with RW Harris)
- 81 “Controlling irregularities in rail to reduce noise”, *International Railway Journal*, April 2010, 38-42
- 82 “Noise mapping’ of a railway network: validation and use of a system based on measurement of axlebox vibration”, *NNFM*, 118, 2011, 511-517 (Procs of IWRN10, Nagahama, Japan, 18-22 October 2010), (with E Bongini and M Saxon)
- 83 “Rail corrugation”, section 4.5 of handbook, “*Best practice in wheel-rail interface management for Mixed Traffic Railways*”, Felix Schmid et al (eds.), University of Birmingham Press, First Edition, September 2010
- 84 “Procs. of 8<sup>th</sup> International conference on Contact Mechanics and Wear of Rail/Wheel Systems”, *Wear*, 271, 1-2, 2011 (joint Guest Editor with E Magel and P Mutton)
- 85 “‘Squats’ and ‘Studs’ in Rails: Similarities and Differences”, IHA conference, Calgary, June 2011 (with DI Fletcher, AE Gallardo-Hernandez and P Summers)
- 86 “Squats and squat-type defects in rails: the understanding to date”, *Journal of Rail and Rapid Transit, Procs of I mech E*, 2012, 226F, 235-242 (Review Paper)
- 87 “‘Studs’: a squat-type defect in rails”, *Journal of Rail and Rapid Transit, Procs of I mech E*, 2012, 226F, 243-256 (with DI Fletcher, AE Gallardo-Hernandez and P Summers)
- 88 “Telling the difference between studs and squats”, *Railway Gazette International*, August 2012, pp36-38 (with DI Fletcher)
- 89 “Rail irregularities, corrugation and acoustic roughness: characteristics, significance and effects of reprofiling on different types of railway system”, *Journal of Rail and Rapid Transit, Procs of I mech E*, 2012, 226F, 542-557
- 90 “Traction, curving and surface damage of rails, Part 2: rail damage”, *Procs of 9<sup>th</sup> Intl Conference on Contact Mechanics and Wear of Rail/Wheel Systems*, Chengdu, China, 27-30 August 2012, paper 1.1, pp1-8
- 91 “Rail irregularities: characteristics, significance and effects of reprofiling”, *Procs of 9<sup>th</sup> Intl Conference on Contact Mechanics and Wear of Rail/Wheel Systems*, Chengdu, China, 27-30 August 2012, paper 19.1, p402
- 92 Monitoring of corrugation growth on tracks with Cologne egg fastening system, The International Symposium on Speed-up, Safety and Service Technology for Railway and Maglev Systems (STECH’12), Seoul, Korea, September 17-19, 2012 (with Hengyu Wang, Yongquan Deng, Heji Zhang, Wenjian Wang, Zefeng Wen, Xuesong Jin)
- 93 “Defects, dynamics and contact mechanics”, *Procs of 10<sup>th</sup> International Heavy Haul Association conference*, New Delhi, India, February 2013, pp363-369

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<sup>1</sup> I was advised in March 2014 by JRRT that this “is one of the top five most cited articles in the last 5 years” for the journal.

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