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Professor Chris Baker CEng, FICE, FIHT, FHEA, FRMetS

Professor of Environmental Fluid Mechanics
Convenor of MRes Programme in Railway Systems Engineering and Integration

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About

Chris Baker graduated from his doctoral studies at the University of Cambridge, before beginning a Research Fellowship there at St Catharine's College and the Department of Engineering. In the early 1980s he worked in the Aerodynamics Unit of British Rail Research in Derby, before moving to an academic position in the Department of Civil Engineering at the University of Nottingham.

He remained there till 1998 where he was a lecturer, reader and professor with research interests in vehicle aerodynamics, wind engineering, environmental fluid mechanics and agricultural aerodynamics. In 1998 he moved to the University of Birmingham as Professor of Environmental Fluid Mechanics in the School of Civil Engineering.

In the early years of the present century he was Director of Teaching in the newly formed School of Engineering and Deputy Head of School. From 2003 to 2008 he was Head of Civil Engineering and in 2008 served for a short time as Acting Head of the College of Engineering and Physical Sciences. He was the Director of the **Birmingham Centre for Railway Research and Education (/research/activity/railway/index.aspx)** 2005-2104.

Qualifications

- Certificate in Theological and Pastoral Studies, University of Nottingham, 1988
- PhD, University of Cambridge, 1978
- MA, University of Cambridge, 1978
- BA Engineering, 1st Class with distinction, St Catharine's College, University of Cambridge, 1975

Teaching

Teaching Programmes – on Civil Engineering programmes

Prof Baker has teaching interests in the general field of fluid mechanics, and has in the past lectured on most aspects of Hydraulic Engineering to undergraduates and postgraduates.

He currently lectures on the first year course on Fluid flow, thermodynamics and heat transfer for Civil, Chemical and Mechanical Engineering students, the third year Civil engineering course on Environmental Risk Management and the fourth year Civil Engineering course on Environmental fluid Mechanics. He also supervises third year design projects and fourth year individual research projects.

Postgraduate supervision

- Tim Gilbert: Train slipstream and pressure effects in semi-confined environments
- Eleanor Yau: Oat lodging
- Dave Soper: Freight train aerodynamics
- Dominic Flynn: Computational Train Aerodynamics
- Martin Galagher: Full scale measurements of train aerodynamic phenomena
- Justin Morden: CFD calculations of train aerodynamic phenomena

Research

RESEARCH THEMES

- Transport and Climate Change
- Vehicle Aerodynamics
- Wind Engineering
- Agricultural Aerodynamics
- Environmental Fluid Mechanics

RESEARCH ACTIVITY

- Resilience through innovation – critical local transport and utility infrastructure. EPSRC Feasibility account (£250k), 2010-2011
- The measurement of train aerodynamic phenomena in operational conditions (Network Rail / EPSRC) (2011-2014) £550k
- Train underbody flow (2011 to 2012) - EPSRC 2010 Unspent balance Universityof Birmingham £13.5k
- Network Rail support for Birmingham University partnership (2011-2016) (£1.6m to University (£145k to investigator)
- Measurements and risk analysis of tunnel pressures on Midland Main Line(2012) Network Rail, £15k
- Measurements of train slipstreams for overhead electrification train (2012) Network Rail, £20k
- Mathematical model for wind induced forces on oats (2012) DEFRA, £12k
- MOWE-IT (2012-2014) EU FP7 research programme on cross-modal enhancementduring major disruption events – WP on Rail sector. (2.4M€ - 125k€ to University of Birmingham)
- Living RAIL (2012-2015) EU FP7 project exploring a vision of the future role of the environmentally friendly, electrified railways in 2050s Europe. (1.3M€ - 109k€ to UoB)
- REWARD (2012-2013) Network Rail sponsored project on integration of TRUST timing data and meteorological impacts to enable enhanced early warning of disruption (£85k)
- Barriers to Intermodality (2012-2013), EPSRC Bridging the Gap institutionalfunding (£40k)
- Aerodynamic measurements for HS2 (2013), Phase 1 Funding from HS2 via Arup. (£66k)
- Aerodynamic measurements for HS2 (2013), Phase 2 Funding from HS2 via Arup (£60k)
- iBUILD (2013 to 2017), EPSRC in collaboration with Newcastle and Leeds, £3.5m in total, around £1m to UOB (led byProf Chris Rogers, Civil engineering)
- Literature review on train aerodynamics for the FRA (2013), Contract through Arups (2013) £10k
- Expert Advice to Wakefield Coroner (2013), £8k
- TRACCA phase 1 (2013), RSSB, £16k
- Development of a model for lodging risk in oilseed rape (2013), DEFRA, £12k

Other activities

- Member of BSI Loading Committee 525 and Chair of the Climate Codes sub group
- Chair of the Scientific Advisory Committee of CISIT. International Campuson Safety and Intermodality in Transportation, Valenciennes, France
- CEN working group on structural codes of practice associated with climateeffects
- Chair, DfT committee on climate change in the Railway Industry

Prof Baker was awarded the title of Fellow of the Wind Engineering Society in 1996. He has been a Keynote speaker at a number of recent Wind Engineeringconferences including:

- “Wind effects in the urban environment – considerations for human health, comfort and safety”, Keynote lecture, ISWE Tokyo, Japan, (2004)
- “The overturning of road and rail vehicles in high winds”, Keynote Address Italian Wind Engineering Conference (2004)
- “Wind Engineering – past, present and future”, Keynote lecture, Proceedings 4th European and African Regional Conference on Wind Engineering, Prague (2005)
- “The overturning of road and rail vehicles in high winds”, Invited lecture, Asia Pacific Regional Conference on Wind Engineering, Seoul (2005)
- “The flow field around trains”, Keynote Address, Bluff Body Aerodynamics and its Applications Conference, Milan (2008)
- “Cross wind effects on road and rail vehicles”, IAVSD Symposium, Stockholm, Sweden, Keynote lecture (2009)
- “The rail sector”, UNECE-UNCTAD Workshop on Climate Change Impacts on International Transport Networks, Geneva (2010)
- The design process for wind effects around simple buildings Keynote lecture, International Conference on Wind Engineering, Amsterdam. (2011)
- The first international conference on wind engineering – a retrospective, European and African Conference on Wind engineering, Keynote lecture,Cambridge (2013)

Publications

Journal publications from 2010 onwards

M. Sterling, A. Quinn, D. Hargreaves, F. Cheli, F. Sabbioni, G. Tomasini, D.Delaunay, C.J. Baker, and H. Morvan, 2010 “A comparison of different methods to evaluate the wind induced forces on a high sided lorry” Journalof Wind Engineering & Industrial Aerodynamics 98 10–20

C.J. Baker, 2010 "The simulation of unsteady aerodynamic cross wind forces on trains”, Journal of Wind Engineering & Industrial Aerodynamics98, 88-99

A.D. Quinn, M. Hayward, C.J. Baker, F. Schmid, J. Priest, W. Powrie, 2010 “A full-scale experimental and modelling study of ballast flight under high speed trains”, Journal of Rail and Rapid Transit 224, 61- 74 (in thetop three most downloaded papers from JRRT in 2010)

C.J. Baker, 2010 “The flow around high speed trains” Journalof Wind Engineering and Industrial Aerodynamics 98, 277-298

M. Sterling, C.J. Baker, A. Bouferrouk, H. O’Neil, S. Wood, E. Crosbie, 2009 “An investigation of the aerodynamic admittances and aerodynamic weighting functions of trains” Journal of Wind Engineering and IndustrialAerodynamics 97, 512–522

C.J. Baker, 2010 “The calculation of cricket ball trajectories”. Journal of Mechanical Engineering Science, Proceedings of the IMechE C, 224, 1947-1958, DOI: 10.1243/09544062JMES1973. Awarded SAGE prize in 2011 forbest paper in Journal in 2010

P. Martinez-Vazquez, C.J. Baker, M. Sterling, A.D. Quinn, P.J. Richards, 2010 “Aerodynamicforces on fixed and rotating plates”, Wind and Structures, 13, 2 127-144

B. Kakimpa, P. Martinez-Vazquez, D. Hargreaves, J. Owen , C.J. Baker, M. Sterling, A.D. Quinn, 2010 “CFD modelling of plate free-flight and auto-rotation”,Wind and Structures, 13, 2 127-144

H. Hemida, N.Gil, C.J. Baker, 2010 “LES of the slipstream of a rotatingtrain”, ASME Journal of Fluids Engineering 132 051103-1

N. Gil, C.J. Baker, C. Roberts, 2010 "Passenger Train Slipstream Characterization Using a Rotating Rail Rig," ASME Journal of Fluids Engineering 132,6

H. Hemida, C.J. Baker, 2010 , “Large-Eddy Simulation of the flow around a freight wagon subjected to a crosswind”, Computers & Fluids39 1944–1956

Tomlinson C, Chapman C, Thornes J, 2010, “Derivation of Birmingham’s summer surface urban heat island from MODIS satellite images”,International Journal of Climatology, 10.1002/joc.2261

P. Martinez-Vazquez. M. Sterling, C. J. Baker, A. D. Quinn, P.J. Richards (2010) “Autorotation of Square Plates, with Application to Windborne Debris”, "Wind and Structures, An International Journal" Vol. 14, No. 2,2011.

C. Baker, H. Hemida, S. Iwnicki, G Xie, D. Ongaro (2011) ”The integration of cross wind forces into train dynamic modelling”,Journal of Rail and Rapid Transit 225, 2, 154-164, DOI 10.1177/2041301710392476

C J Tomlinson, L Chapman, J E Thornes and C J Baker (2011) “Including the urban heat island in spatial heat health risk assessment strategies:a case study for Birmingham, UK”, International Journal ofHealth Geographics. **http://www.ij-healthgeographics.com/content/10/1/42 (http://www.ij-healthgeographics.com/content/10/1/42)**

M An, Y Chen, C Baker (2011) “A fuzzy reasoning and fuzzy-analytical hierarchy process based approach to the process of railway riskinformation: A railway risk management system”, Information Sciences 181,3946–3966

C D F Rogers, C J Bouch, S Williams, A R G Barber, C J Baker, J R Bryson, D N Chapman, L Chapman, J Coaffee J, I Jefferson and A D Quinn (2011) “Resistance and Resilience – Paradigms for Critical Local Infrastructure”,accepted for publication in Municipal Engineer

Tomlinson C J, Chapman L, Thornes J E, Baker C J (2011) “Remotesensing land surface temperature for meteorology and climatology: a review”,Meteorological Applications 18, 296-306

Baker C J (2013) “A unified framework for the prediction of cricket ball trajectories in spin and swing bowling”, IMechE Proceedings P – Journalof Sports Engineering, 227, 1 31 – 38, DOI: 10.1177/1754337112440793

Blenkinsop S., Zhao Y., Quinn J., Berryman F., Thornes J., Baker C., Fowler H.J. (2012) “Downscaling future wind hazard for SE London using the UKCP09 regional climate model ensemble”, 53: 141–156,doi: 10.3354/cr01091

P. Martinez-Vazquez, B. Kakimpa, M. Sterling, C.J. Baker, A.D. Quinn,P.J. Richards, J.S. Owen (2012) “Pressure field of a rotating square plate with application to windborne debris" Wind and Structures,15, 6 527-547

Charlie J. Tomlinson, Lee Chapman, John E. Thornes, Christopher J. Baker,Tatiana Prieto-Lopez (2012) “Comparing night-time satellite land surfacetemperature from MODIS and ground measured air temperature across a conurbation”, Remote Sensing Letters
Vol. 3 8, 2012. Awarded "The Taylor & Francis Remote Sensing Letters Award" 2013 for the best letter published in the RemoteSensing Letters publication during the previous calendar year.

F. Dorigatti, M. Sterling, D. Rocchi, M. Belloli, A.D. Quinn, C.J. Baker,E. Ozkan (2012), “Wind tunnel measurements of crosswind loads on high sided vehicles over long span bridges”, Journal of Wind Engineeringand Industrial Aerodynamics 107–108, 214–224 **http://dx.doi.org/10.1016/j.jweia.2012.04.017 (http://dx.doi.org/10.1016/j.jweia.2012.04.017)**

M. Anyala, J.B. Odoki and C.J. Baker (2012) “Hierarchical asphaltpavement deterioration model for climate impact studies”, InternationalJournal of Pavement Engineering, 1–16

Baker C J, Jordan S J, Gilbert T, Sterling M, Quinn A, Johnson T, Lane J (2012) “Transient aerodynamic pressures and forces on trackside and overhead structures due to passing trains. Part 1 Model scale experiments”, Journalof Rail and Rapid Transit DOI: 10.1177/0954409712464859

Baker C J, Jordan S J, Gilbert T, Sterling M, Quinn A, Johnson T, LaneJ (2012) “Transient aerodynamic pressures and forces on trackside and overheadstructures due to passing trains. Part 2 Standards applications”, Journalof Rail and Rapid Transit DOI: 10.1177/0954409712464859

Hemida H, Baker C J, Gao G (2012) “The calculation of train slipstreams using Large-Eddy Simulation”, Journal of Rail andRapid Transit 25, DOI: 10.1177/0954409712460982

Tomlinson C J, Prieto-Lopez T, Bassett R, Chapman L, Cai X-M, ThornesJ E, Baker C J (2013) “Showcasing urban heat island work in Birmingham – measuring,monitoring, modelling and more”, Weather 68, 2

C J Baker, A Quinn, M Sima, L Hoefener, R Licciardello (2013) Full-scale measurement and analysis of train slipstreams and wakes: Part1 Ensemble averages. Proceedings of the Institution of Mechanical Engineers, Part F: Journalof Rail and Rapid Transit 0954409713485944, doi:10.1177/0954409713485944

C J Baker, A Quinn, M Sima, L Hoefener, R Licciardello (2013) Full-scale measurement and analysis of train slipstreams and wakes. Part2 Gust analysis, Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit 0954409713488098, doi:10.1177/0954409713488098

Gilbert T, Baker C, Quinn A (2013) “Aerodynamic pressures around high-speed trains: the transition from unconfined to enclosed spaces”,Journal of Rail and Rapid Transit DOI: 10.1177/0954409713494947

Gilbert T, Baker C, Quinn A (2013) “Gusts caused by high speed trains in confined spaces and tunnels”, accepted for publication in the Journal of wind Engineering and Industrial Aerodynamics

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