

Dr Michael Griffith

- **Biography/Background**

Dr Griffith is a Professor in the School of Civil, Environmental and Mining Engineering at the University of Adelaide where he has been since completing his PhD at the University of California at Berkeley in 1988. He has authored or co-authored 2 book chapters and over 140 refereed papers in the field of earthquake engineering and structural dynamics and has attracted over \$4 million competitive funding since 1990 for his research. His professional interests are in the field of earthquake engineering and include training practising engineers to work with Urban Search and Rescue (USAR) teams throughout Australia.

His current research activity is on trying to develop improved methods for seismic assessment of unreinforced brick masonry buildings and the non-linear dynamic response of reinforced concrete frames and seismic retrofit of concrete columns using composite plating techniques. He is also currently involved with specialist consultant work for engineering firms in the field of earthquake engineering, is a member of the joint Australia-New Zealand Standards Earthquake Loading committee, and previously worked as a structural engineer in Berkeley, specialising in the earthquake analysis and design of piping systems in nuclear power plants.

- **Qualifications**

1988 – Ph.D. in Engineering – University of California, Berkeley

1983 – M.Sc. in Civil Engineering – Washington State University (WSU), Pullman, WA

1982 – B. Sc. in Civil Engineering – Washington State University (WSU), Pullman, WA

- **Awards & Achievements**

2012 – Telford Medal, Best Paper across all ICE Journals in 2012, UK

2011 – TMS Journal Outstanding Paper Award, The Masonry Society (USA)

2010 – Awarded Honorary Life Membership to Australian Earthquake Engineering Society

2000 – Adelaide University PGSA, nominated for Postgraduate Supervisor of the Year

1995 – Master Builders Association Commendation for Excellence in R & D

1992 – The University of Adelaide PGSA, Post-Graduate Supervisor of the Year Award

- **Teaching Interest**

During my 21 years at Adelaide, I have taught subjects to students at all year levels of the BE(Civil) degree course as well as some subjects in the Bachelor of Architecture degree course. I take great pride in my teaching and regard this aspect of university work to be very important. Indeed, I enrolled in and completed the ACUE (as it was then) course for new university lecturers in 1988 long before it was a requirement for newly appointed lecturers. I believe that students consider me to be a very good teacher –

as evidenced by the anecdotal feedback I receive from them and from the “scores” I receive from them on the SELTs. For example, only once since 2002 have I received less than 6 out of 7 for their response to “All things considered, how would you rate Dr Griffith’s effectiveness as a university lecturer”.

While my teaching has been primarily in the area of structural engineering, I have also taught Construction and Surveying to our students and regularly assist with the running of group projects in the 1st year introductory subject Engineering Planning and Design.

Significantly, I was invited to give the “Seismic design of masonry buildings” course to the post-graduate students at the European School for the Reduction of Seismic Risk at the University of Pavia in northern Italy, in January 2007. This is a very high honour as the lecturers for all the courses in this programme are international experts from highly regarded universities around the world (see school website: http://www.roseschool.it/index.php?option=com_lecturers&Itemid=84).

Outside of the classroom I have served as a course advisor to undergraduate students since 1997 and have been heavily involved with curriculum development for the department’s two existing degree programmes as well as implementation of the new Architectural Engineering and Mining Engineering degrees. A list of the administrative activities related to my undergraduate teaching as well as a partial list of the civil engineering subjects which I have taught is given below.

- **Research Interest**

Associate Professor Griffith has nearly 20 years research experience in the area of earthquake resistant design and analysis of structures, beginning with his PhD research at the University of California at Berkeley. During this time he has published over 140 refereed papers in this area and attracted over \$4 million dollars in competitive research funding in Australia. In the field of earthquake engineering, Dr Griffith has been closely involved with the development of new technologies to improve the seismic resistance of both new and existing structures. His initial work in this field, based on his PhD research, was to demonstrate experimentally and theoretically the feasibility and reliability of seismic isolation as an effective seismic design strategy for a wide range of building heights and earthquake ground motions. His research at the University of Adelaide has focussed on developing methods to prevent earthquake induced damage, including collapse, of unreinforced masonry buildings and non-seismically designed reinforced concrete frames. Recent outcomes and progress in these areas are described below.

Masonry Research

His research on masonry walls has led to the development of a displacement-based analysis technique for assessing the earthquake resistance of existing and the design of new masonry walls in vertical bending. Currently he is working with colleagues to extend this innovative design technique to walls subject to bi-axial (two-way) bending. In addition, some of his results from shaking table tests on typical wall connections in masonry buildings have already been incorporated into the Australian Masonry Structures Code in the form of amendments to allow friction to be considered as part of the seismic load path. Two projects that are currently in progress involve (1) establishing deemed-to-comply design guidelines for masonry buildings under 15m tall with respect to earthquake loading; and (2) developing an innovative technique for earthquake strengthening of masonry walls using fibre reinforced polymers in such a way that it does not alter the normal, aesthetic appearance of masonry.

Concrete Frame Research

Earthquake related research on concrete structures at Adelaide has focussed on the seismic performance of concrete frames whose design is dominated by gravity-load considerations and methods for their seismic upgrade. Experimental research has consisted of shaking table tests of 1/5-scale concrete frame structures, quasi-static cyclic testing of ½-scale concrete frames with and without masonry infill panels, and monotonic static and quasi-static cyclic testing of concrete columns. Non-linear dynamic modelling procedures have now been developed that can accurately model the dynamic behaviour observed during experiments. Current research is focussed on developing practical methods to improve the strength and ductility of such concrete columns and frames using composite plating techniques that fully accounts for the partial-interaction behaviour between the concrete sections and the plates.

- **List of Publications (2002 Onwards)**

Books/Monographs/Symposia

Oehlers, DJ, Griffith, MC and Seracino, R (editors) (2009). "Proceedings of the 9th International Symposium on fiber-Reinforced Polymer Reinforcement for Concrete Structures," 13 – 15 July, Sydney, Australia, 287p.

McCue, K, Griffith, MC and Butler, B (editors), (2004). "Australian earthquake engineering in the new millennium – where to from here?" Proceedings of the 2004 Australian Earthquake Engineering Society Conference, held at Mt. Gambier, South Australia, AEES publisher.

Griffith, MC, Love, D, McBean, P, McDougall, A and Butler, B (editors), (2002). "Total risk management in the privatised era," Proceedings of the 2002 Australian Earthquake Engineering Conference, held at the University of Adelaide, South Australia, Australian Earthquake Engineering Society publisher.

Journal Articles

Restrepo-Velez, L.F., Magenes, G. and Griffith, M.C. (2014). "Dry stone masonry walls under lateral loading – Part I: Static tests," *International Journal of Architectural Heritage*, 8(1):1-28.

Vaculik, J., Griffith, M.C. and Magenes, G. (2014). "Dry stone masonry walls under lateral loading – Part II: Analysis," *International Journal of Architectural Heritage*, 8(1):29-48.

Dizhur, D., Griffith, M.C. and Ingham, J.M. (2013). "In-plane shear improvement of unreinforced masonry wall panels using NSM CFRP strips," *ASCE Journal of Composites for Construction*, 17(6) , 04013010.

Derakhshan, H., Griffith, M.C. and Ingham, J.M. (2013). "Airbag testing of unreinforced masonry walls subjected to one-way bending," *Engineering Structures*, 57(Dec.):512-522.

Griffith, M.C., Kashyap, J. and Mohamed Ali, M.S. (2013). "Flexural displacement response of NSM FRP retrofitted masonry walls," *Construction and Building Materials*, ASCE, 49(Dec.): 1032-1040.

Derakhshan, H., Griffith, M.C. and Ingham, J.M. (2013). "Out-of-plane behavior of one-way spanning unreinforced masonry walls," *Journal of Engineering Mechanics*, ASCE, 139(4): 409-417.

Aghdamy, Sanam, Wu, Chengqing and Griffith, Michael (2013). "Simulation of retrofitted unreinforced concrete masonry unit walls under blast loading," *International Journal of Protective Structures*, 4(1): 21-44.

Chakrabarti, A., Sheikh, A.H., Griffith, M.C. and Oehlers, D.J., (2013), "Dynamic response of composite beams with partial shear interactions using a higher order beam theory," *Journal of Structural Engineering*, ASCE, 139(1): 47-56.

Chakrabarti, A., Sheikh, A.H., Griffith, M.C. and Oehlers, D.J., (2012), "Vibration and buckling of composite beams with partial shear interactions using HBT," *International Journal of Structural and Civil Engineering*, 1(1): 23-42.

Rahimah, M, Mohamed Ali, M.S., Oehlers, DJ and Griffith, MC (2012). "The tension stiffening mechanism in reinforced concrete prisms," *Advances in Structural Engineering*, 15(12): 2053-2069.

Mohamed Ali, M.S., Oehlers, D.J., Haskett, M. and Griffith, M.C. (2012). "The discrete rotation in reinforced concrete beams," *Journal of Engineering Mechanics*, ASCE, 138(11): 1317-1325.

Visintin, P., Oehlers, D.J., Wu, C. and Griffith, M.C. (2012). "The reinforcement contribution to the cyclic behaviour of reinforced concrete beam hinges," *Earthquake Engineering and Structural Dynamics*, 41(12): 1591-1608..

Chakrabarti, A., Sheikh, A.H., Griffith, M. and Oehlers, D.J. (2012). "Analysis of composite beams with longitudinal and transverse partial interactions using higher order beam theory," *International Journal of Mechanical Sciences*, 59(1): 115-125.

Kashyap, J., Willis, C.R., Griffith, M.C., Ingham, J.M. and Masia, M. (2012). "Debonding Resistance of FRP-to-Masonry Joints," *Engineering Structures*, 41(8): 186-198.

Lucas, W., Oehlers, D.J., Mohamed Ali, M.S. and Griffith, M.C. (2012). "Shear friction behaviour in FRP reinforced concrete," *Advances in Structural Engineering*, 15(4): 615-623.

Chakrabarti, A., Sheikh, A.H., Griffith, M.C. and Oehlers, D.J. (2012). "Analysis of composite beams with partial shear interactions using a higher order beam theory," *Engineering Structures*, 36(2): 283-291.

Oehlers, D.J., Mohamed Ali, M.S., Griffith, M.C., Haskett, M. and Lucas, W. (2012). "A generic unified reinforced concrete model," *Proceedings ICE, Structures and Buildings*, 165(SB1): 27-49. The Telford Medal was awarded by the Institution of Civil Engineers, U.K. to recognise this as the best paper across all ICE journals for 2012 (<http://www.icevirtuallibrary.com/info/awards2013>).

Dizhur, D., Ingham, J., Moon, L., Griffith, M., Schultz, A., Senaldi, I., Magenes, G., Dickie, J., Lissel, S., Centeno, J., Ventura, C., Leite, J., Lourenco, P. (2011). "Performance of masonry buildings and churches in the 22 February 2011 Christchurch earthquake, New Zealand Society for Earthquake Engineering Bulletin, 44(4): 279-296.

Kashyap, J, Griffith, MC, Mohamed Ali, M.S. and Oehlers, D.J. (2011). "Prediction of Load-Slip Behaviour of FRP Retrofitted Masonry," *Journal of Composites for Construction*, ASCE, 15(6):943-951.

Moon, L., Dizhur, D., Griffith, M. and Ingham, J. (2011). "Performance of clay brick masonry buildings during the 22nd February 2011 Christchurch earthquake," *Journal of the Structural Engineering Society of New Zealand*, 24(2): 59-84.

Ingham, J. and Griffith, M. (2011). "Damage to unreinforced masonry structures by seismic activity," *The Structural Engineer*, The Institution of Structural Engineers, 89(3): 14-15.

Ingham, J.M. and Griffith, M.C. (2011). "Performance of unreinforced masonry buildings during the 2010 Darfield (Christchurch, NZ) earthquake," *Australian Journal of Structural Engineering*, Engineers Australia, 11(3): 207-224.

Dizhur, D, Derakhshan, H, Griffith, M and Ingham, J. (2011). "In-situ testing of a low intervention NSM seismic strengthening technique for historic URM buildings," *International Journal of Materials and Structural Integrity*., 5(2/3): 168-191.

Su, Y., Wu, C. and Griffith, M.C. (2011). "Modelling of the bond-slip behaviour in FRP reinforced masonry," *Construction and Building Materials*, 25(1): 328-334.

Dizhur, D., Derakhshan, H., Lumantarna, R., Griffith, M.C. and Ingham, J.M. (2010). "Out-of-plane strengthening of unreinforced masonry walls using near surface mounted fibre reinforced polymer strips," *Structural Engineering Society of New Zealand (SESOC) Journal*, 23(2): 91-103.

Oehlers, D.J., Haskett, M., Mohamed Ali, M.S. and Griffith, M.C. (2010). "Moment redistribution in reinforced concrete beams," *Proceedings ICE, Structures and Buildings*, 163(3): 165-176.

Derakhshan, H., Dizhur, D., Lumantarna, R., Cuthbert, J., Griffith, M.C. and Ingham, J.M. (2010). "In-field simulated seismic testing of as-built and retrofitted unreinforced masonry partition walls of the William Weir House in Wellington," *Structural Engineering Society of New Zealand (SESOC) Journal*, 23(1): 51-61.

Griffith, MC, Ingham, JM and Weller, R (2010). "Earthquake reconnaissance – forensic engineering on an urban scale," *Australian Journal of Structural Engineering*, Engineers Australia, 11(1): 63-74.

Mohamed Ali, M.S., Oehlers, D.J. and Griffith, M.C., (2010). "Residual strength of confined concrete," *Advances in Structural Engineering*, 13(4):603-618.

Lumantarna, E., Lam, NTK, Wilson, JL and Griffith, MC (2010). "Inelastic displacement demand of strength degraded structures," *Journal of Earthquake Engineering*, 14(4): 487-511.

Willis, CR, Seracino, R, Wu, C and Griffith, MC (2010). "Out-of-plane strength of brick masonry retrofitted with horizontal NSM CFRP strips," *Engineering Structures*, 32(2): 547-555.

Oyarzo-Vera, C. and Griffith, M.C. (2009). "The MW 6.3 Abruzzo (Italy) Earthquake of April 6 2009: on-site observations," *Bulletin of the New Zealand Society for Earthquake Engineering*, 42(4): 302-307.

- Willis, C.R., Yang, Q., Seracino, R., and Griffith, M.C. (2009). "Bond behaviour of FRP-to-clay brick masonry joints," *Engineering Structures*, 31(11): 2580-2587.
- Lawrence, SJ, Willis, CR, Melkounian, N and Griffith, MC, (2009). "Earthquake design of unreinforced masonry residential buildings up to 15 metres in height," *Australian Journal of Structural Engineering*, 10(1): 85-99.
- Oehlers, DJ, Griffith, MC and Mohamed Ali, MS (2009). "Ductility components and limits of FRP plated RC structures," *Construction and Building Materials*, 23(4): 1538-1543.
- Willis, CR, Yang, Q, Seracino, R and Griffith, MC (2009). "Damaged masonry walls in two-way bending retrofitted with vertical FRP strips," *Construction and Building Materials*, 23(4): 1591-1604 .
- Su, Y., Wu, C. And Griffith, M (2008). "Mitigation of blast effects on aluminum foam protected masonry walls," *Transactions of Tianjin University*, DOI 10.1007/s12209-008-0096-5, Vol. 14: 558-562.
- Sorrentino, L, Masiani, R and Griffith, MC (2008). "The vertical spanning strip wall as a coupled rocking rigid body assembly," *Structural Engineering and Mechanics*, 29(4): 433-453.
- Daniell, J.E., Oehlers, D.J., Griffith, M.C., Mohamed Ali, M.S. and Ozbakkaloglu, T. (2008). "The softening rotation of reinforced concrete members," *Engineering Structures*, 30(11): 3159-3166.
- Oehlers, D.J., Mohammed Ali, M.S., and Griffith, M.C. (2008). "Concrete component of the rotational ductility of reinforced concrete flexural members," *Advances in Structural Engineering*, 11(3): 293-303.
- Mohamed Ali, MS, Oehlers, DJ and Griffith, MC, (2008), "Simulation of plastic hinges in FRP plated RC beams," *ASCE Journal of Composites for Construction*, 12(6): 617-625.
- Mohamed Ali, MS, Oehlers, DJ and Griffith, MC (2008). "Shear transfer across cracks in FRP strengthened RC structures," *ASCE Journal of Composites for Construction*, 12(4): 416-424.
- Morandi, P, Magenes, G and Griffith, MC, (2008). "Second order effects in out-of-plane strength of URM walls subject to bending and compression," *Australian Journal of Structural Engineering*, Institution of Engineers, Australia, 8(2): 133-144.
- Lawrence, SJ, Willis, CR and Griffith, MC, (2008). "Earthquake performance of unreinforced masonry residential buildings designed to Australian standards," *Australian Journal of Structural Engineering*, Institution of Engineers, Australia, 8(1): 49-62.
- Mohamed Ali, MS, Oehlers, DJ, Griffith, MC and Seracino, R, (2008), "Interfacial stress transfer of near surface mounted FRP-to-concrete joints," *Engineering Structures*, 30(7): 1861-1868.
- Griffith, MC and Vaculik J, (2007). "Static tests of unreinforced brick masonry walls in 2-way bending," *TMS Journal*, The Masonry Society, Boulder, Colorado, September, pp. 53-68. Received 'TMS Journal Outstanding Paper Award, The Masonry Society (USA)

Griffith, MC, Vaculik, J, Lam, NTK, Wilson, J and Lumantarna, E (2007). "Cyclic tests of brick masonry walls in bending," *Earthquake Engineering and Structural Dynamics*, John Wiley and Sons, 36(6): 801-821.

Willis, CR, Lawrence, SJ and Griffith, MC, (2006). "Moment capacities of unreinforced masonry sections in bending," *Australian Journal of Structural Engineering*, The Institution of Engineers, Australia, 6(2): 133-146.

Griffith, MC, Lam, NTK and Wilson, JL, (2006). "Displacement-based assessment of the seismic capacity of unreinforced masonry walls in bending," *Australian Journal of Structural Engineering*, The Institution of Engineers, Australia, 6(2): 119-132.

Griffith, MC, Lawrence, SJ and Willis, CR, (2005). "Diagonal bending of unreinforced clay brick masonry," *Masonry International*, 18(3): 125-138.

Griffith, MC, Wu, YF and Oehlers, DJ, (2005). "Behaviour of steel plated RC columns subject to lateral loading," *Advances in Structural Engineering*, 8(4): 333-347.

Willis, CR Griffith, MC and Lawrence, SJ, (2004). "Horizontal bending of unreinforced clay brick masonry walls," *Masonry International*, 17(3): 109-121.

Wu, YF, Oehlers, DJ and Griffith, MC, (2004). "Rational definition of the flexural deformation capacity of RC column sections," *Engineering Structures*, Elsevier Publishers, 26(5): 641-650.

Wu, YF, Griffith, MC and Oehlers, DJ, (2004). "Numerical simulation of steel plated RC columns," *Computers and Structures Journal*, Elsevier Publishers, U.K., 82(4-5): 359-371.

Griffith, MC, Lam, NTK, Wilson, JL and Doherty, K, (2004). "Experimental investigation of URM walls in flexure," *Journal of Structural Engineering*, ASCE, 130(3): 423-432.

Griffith, MC, (2003). "Australian earthquake engineering: achievements, challenges and obstacles," *Bulletin of the New Zealand Society for Earthquake Engineering*, 36(2): 117-124.

Griffith, MC, Magenes, G, Melis, G and Picchi, L, (2003). "Evaluation of out-of-plane stability of unreinforced masonry walls subjected to seismic excitation," *Journal of Earthquake Engineering*, 7(S11): 141-169.

Lam, NTK, Griffith, MC, Wilson, JL and Doherty, K, (2003). "Time-history analysis of URM walls in out-of-plane flexure," *Engineering Structures*, 25(5): 743-754.

Wu, YF, Griffith, MC and Oehlers, DJ, (2003). "Improving the strength and ductility of rectangular RC columns through composite partial-interaction: Tests," *Journal of Structural Engineering*, ASCE, 129(9): 1183-1190.

Jaksa, MB, Griffith, MC, and Grounds, RW, (2002). "Ground vibrations associated with installing enlarged base driven cast-in-situ piles," *Australian Geomechanics*, The Institution of Engineers, Australia, 37(1): 67-73.

Doherty, K, Griffith, MC, Lam, NTK and Wilson, JL, (2002). "Displacement-based analysis for out-of-plane bending of seismically loaded unreinforced masonry walls," Earthquake Engineering and Structural Dynamics, John Wiley and Sons, 31(4): 833-850.

Griffith, MC, Kawano, A and Warner, RF, (2002). "Towards a direct collapse-load method of design for concrete frames subjected to severe ground motions," Earthquake Engineering and Structural Dynamics, John Wiley & Sons, 31(10): 1879-1888.

Wu, YF, Oehlers, DJ and Griffith, MC, (2002). "Partial interaction analysis of composite beam/column members," Mechanics of Structures and Machines, 30(3): 309-332.

Other Technical Publications and Reports

Ingham, J.M. and Griffith, M.C. (2011). "The performance of unreinforced masonry buildings in the 2010/2011 Canterbury Earthquake Swarm: Report to the Royal Commission of Inquirey," Christchurch, new Zealand: Canterbury Earthquakes Royal Commission.

Ingham, J.M. and Griffith, M.C. (2011). "The performance of earthquake strengthened URM buildings in the Christchurch CBD in the 22 February 2011 earthquake." Addendum report to the Royal Commission of Inquire, Christchurch, New Zealand, Canterbury Earthquakes Royal Commission.

Willis, C, Griffith, MC and Lawrence, SJ, (2006). "Earthquake performance of unreinforced masonry residential buildings up to 15 m in height," The University of Adelaide, School of Civil and Environmental Engineering, Research Report R178, 34p.

- **Professional Associations**

Board of Directors, International Association for Earthquake Engineering, Tokyo, Japan

Fellow, Institution of Engineers, Australia (CPEng and NPER-3)

Member, Australian Earthquake Engineering Society (National President 2002 - 2004)

Member, Earthquake Engineering Research Institute (USA)

Member, New Zealand Society for Earthquake Engineering