



# Fire Engineering

February 2003, Volume 9



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## Congratulations to...

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We seem to be celebrating a number of things this year.

Andy Buchanan, who was this year awarded the Queen's Service Medal for his contribution to fire engineering in New Zealand. Andy was also promoted to full professor this year.

Grant Dunlop, the fire laboratory technician, on the birth of his new baby son in August. We hope to see Grant's children coming through the programme in the years to come!

Tony Parkes, who got married this year. The guys from Sockburn Fire Station were also on hand to provide appropriate transportation for the groom.



*Tony Parkes, his Best Man and their "limo" arrive at the church.*

Jason Clement, who received his PhD degree at the December 2002 graduation ceremony. This title of his thesis is Experimental Verification of the Fire Dynamics Simulator, Hydrodynamic Model

Ee Yii, who passed his PhD oral exam in January 2003. His thesis title is Post-flashover Compartment Fire Modelling.

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## News

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The web-based distance-learning programme continues to attract new students from around the country and further a field. Currently we have students enrolled in Auckland, Wellington, Nelson, Invercargill, Dunedin, Melbourne and Brisbane.

This year we have been able to obtain a new laboratory and office space for our small-scale apparatus such as our Cone Calorimeter and ISO ignition apparatus. Currently the laboratory is being fitted-out and it will hopefully be on stream later

in the year. We would also like to welcome Russell Peoples, who has joined us in the fire lab.

A new student chapter of the SFPE has been started this year. A special thanks goes to Tony Parkes who did much of the work in getting this set up.



*Students in ENFE601 Structural Fire Engineering, carry out small-scale compartment fire experiments*

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## Visitors

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As usual we had a number of visitors to the department over the year. Dr John Bryan, emeritus professor from the University of Maryland gave a five-day workshop on human behaviour in fires to the ME students. Also from the University of Maryland, Dr Jim Milke gave a lecture on design fires. Roger Harrison from BRE gave a presentation on the smoke ventilation of fire-fighting shafts. Colleen Wade from BRANZ gave a seminar on using the BRANZFIRE software. Continuing the exchange schemes with Lund University in Sweden, Cecilia Persson attended classes at Canterbury.

Visitors to the department Dr Jim Milke, Mr Gordon Cooke and Mr Charles Clifton gave a hugely popular public lecture on the fire and structural engineering issues surrounding the World Trade Center collapse. Over 900 people came to hear the lecture and the presenters were interviewed on national television, radio and in the newspapers. In a separate public lecture, Dr John Bryan gave a talk on the behaviour of the people in the World Trade Center during the collapse and also during the 1993 bombing incident. Again interviews were aired on local and national television.

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**For more information on study, research, scholarships or publications, contact: Charley Fleischmann at [charley@civil.canterbury.ac.nz](mailto:charley@civil.canterbury.ac.nz) or Mike Spearpoint at [mike@civil.canterbury.ac.nz](mailto:mike@civil.canterbury.ac.nz)**

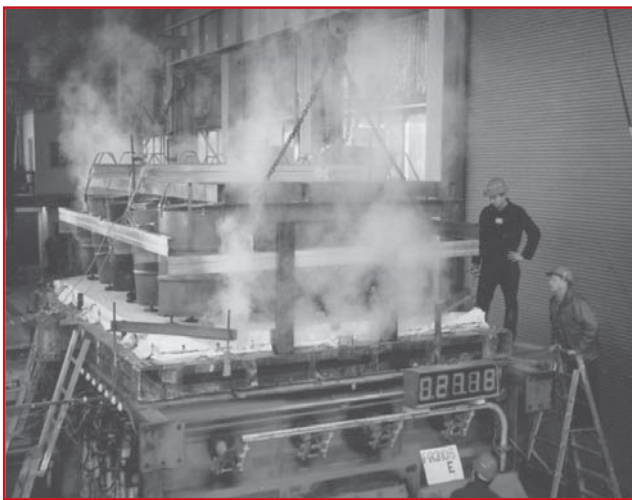
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## PhD Students

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**Linus Lim:** Linus is investigating the effects of compressive restraint and tensile membrane action on the fire behaviour of concrete floor slabs. Linus' research is financially supported by the *BHP NZ Steel Research Scholarship*. The study on the effects of compressive restraint was performed on one-way concrete slabs using a non-linear finite element program, SAFIR. The results of the analyses were presented at the *Structures in Fire (SiF'02)* workshop, held at the Civil Engineering Department in March 2002. The study on tensile membrane behaviour of two-way slabs under fire conditions was performed with full-scale fire tests and 3D finite element analyses. The fire tests were organised by the University of Canterbury in conjunction with BRANZ, HERA and a number of industry partners led by BHP NZ Steel. The fire tests were conducted at the BRANZ fire resistance furnace in mid 2002.



The details of the fire tests are presented in a report by Lim and Wade (Fire Engineering Research Report 02/12) shown in the list of Fire Engineering Research Reports. 3D finite element analyses with SAFIR showed very good agreement with the test results and SAFIR is now used to model slabs with other geometries and support conditions. A paper on the fire tests and the computer modelling was recently published in the *Structural Engineering Society of New Zealand (SESOC)* journal, and the PhD Thesis was submitted in January 2003.

**Tony Parkes:** Tony is continuing his research into radiation compartment effects and is currently developing a global equivalence ratio ( $\phi$ , phi) meter for use in his upcoming experimental study. The Phi meter will help determine the actual fuel/oxygen ratio compared with the stoichiometric fuel/oxygen ratio, and does this based upon the oxygen consumption method. This is an important parameter as it allows for determination of the oxygen level available for combustion, e.g. fuel-rich or fuel-lean combustion. This can be a significant life safety consideration as the production of CO is increased by a low oxygen concentration (under-ventilated fire), and as CO is favoured by the human body the threat to life increases as the CO concentration increases.

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## Fire Service links

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A number of fire visits were made this year as part of the course. These visits included Christchurch Polytechnic, a fish processing factory, several domestic properties, a pharmaceutical storage facility and retail premises. Two students, Michael Huynh and Ben Hume, attended the two-day Breathing Apparatus training course run by the Fire Service. In addition, a group of students took part in a house burn in Rakaia for the local volunteer firefighters. The support from the New Zealand Fire Service is appreciated in particular Gary Luff, Alan Taylor and Alan Merry for organising these visits.



*Michael Huynh and Ben Hume in BA prepare to enter the Rakaia house burn.*



*Craig MaGhie and Raj Prasad get to use a hose line while Bob Nelligan looks on at the NZFS Woolston training facility.*

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## SiF '02 - Second International Workshop Structures in Fire

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In March the University hosted the highly successful Second International Workshop on Structures in Fires (SiF '02) with the help of Dr Jean-Marc Franssen from the University of Liege, Belgium. During the two days, nearly 30 papers were presented on a variety of topics. Over 45 experts attended the workshop representing 13 countries. A full set of conference proceedings, edited by Dr Peter Moss are available on CD-ROM for \$NZ 20.00.

*Right: SiF'02 participants taking in the view of the Banks Peninsula in Christchurch*



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## Conferences and visits

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Mike Spearpoint attended the International Construction Information Society (ICIS) Congress in Auckland during March and also gave a presentation to the FPANZ annual meeting during October.

Andy Buchanan attended the 7<sup>th</sup> World Conference on Timber Engineering in Kuala Lumpur in August, where he gave a keynote presentation on fire safety in timber buildings. Andy also attended the 7<sup>th</sup> IAFSS Symposium on Fire Safety Science in Worcester, Mass. USA in June.

Charley Fleischmann attend the invitation only workshop on Fire Growth and Spread on Objects hosted by NIST in Gaithersburg, Maryland, USA. The workshop brought together fire experts from all over the world to discuss the current understanding on modelling fire growth of burning objects. Charley also attended the 7<sup>th</sup> IAFSS Symposium on Fire Safety Science where he presented his invited poster on Assembling Heat Release Rate Curves.

Charley Fleischmann hosted our end user advisory group meeting during June in which representatives from the industry provided feedback into our FRST funded research programme.

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## Graduate Profiles

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What have you been doing since leaving Canterbury? Two of our recent graduates let us know...

**Hamish Denize:** I completed the Master's of Fire Engineering Degree in 2000. Since then I have been working in Australia for Lincolne Scott Consulting Engineers on a structured graduate programme. The programme involves a two-year period of professional development to assist in the successful transition from University into the professional working environment.

My first 10 months were spent in Adelaide before transferring to Melbourne. During this time I have worked under the guidance of internationally experienced engineers, encompassing all building fire safety issues from concept through

to construction and commissioning. I have been able to expand my theoretical knowledge with practical experience in all disciplines, including Mechanical Engineering, my undergraduate degree. Principally however, I have been involved in Fire Engineering design, incorporating specialised fire and smoke modelling, occupant evacuation modelling, coupled with Building Code consultancy.

The Master's of Fire Engineering Degree has enabled me to step into a dynamic specialist field where boundaries are not fixed. This allows me to be a major contributor to the design philosophy of building developments, including many high-rise towers, typical of the Melbourne property boom. As such, I consider the Master's degree has significantly enhanced my responsibilities and opportunities.

I am passionate about my work and feel I am a valuable element in the community achieving acceptable fire and life safety goals. Consequently I have never regretted my decision to stay on at Canterbury to complete a Master's of Fire Engineering and as such, highly recommend this profession.

**Ross W. Parry:** I completed my Master's of Fire Engineering in 2002. I'm working in Wellington for Holmes Fire & Safety, a consulting firm specialising in fire engineering and part of the Holmes Group of companies. I've faced a steep learning curve since graduating and have worked my way through an extraordinary number of projects. I've moved from doing nothing but site visits and building consent reports to filling my days with fee proposals, design reports, specifications, design meetings and queries. Compared to most other engineering disciplines, fire engineering involves a rapid turnover of projects and doesn't involve a lot of detailed design. Instead fire engineers spend more time writing reports, talking to clients and authorities and developing designs at a more conceptual level.

The best things about my job are the excitement of being involved in people's building projects and working with a small but smart team of three engineers back at the office.

There are plenty of challenging aspects to my work, from technical challenges to human challenges. Keeping track of all of the projects I'm involved with is challenging too.

## Fire Engineering Publications

The group published a number of journal and conference papers this year. In addition, several articles were printed in more general literature. These included an article on the research into the impact of realistic fires on drywall construction in the BIA newsletter and an article on the research into fires in the hospitality industry in the NZFS Star magazine.

Analytical Methods for Determining Fire Resistance of Concrete Members. Chap 10, Sect 4, SFPE Handbook of Fire Protection Engineering, 3rd Edition, 2002. (pp 4-239 to 4-256). C.M.Fleischmann & A.H.Buchanan. Society of Fire Protection Engineers, USA.

Post-flashover Fires for Structural Design. R.Feasey and A.H.Buchanan. *Fire Safety Journal*. Vol 37, 83-105, 2002.

Modelling Gypsum Plasterboard Assemblies Exposed to Building Fires and Standard Fire Tests. H.Gerlich, B.Jones and A.H.Buchanan. *Proceedings, Interflam 2001 Conference*, Edinburgh, UK, 1389-1394.

Effects Of Wood Fuel Geometry On Post-flashover Fires (poster). A.H.Buchanan, J.Yii and E.H.Yii. *Proceedings, Interflam 2001 Conference*, Edinburgh, UK, 1331-1336.

Modelling the Performance of Gypsum Plasterboard Assemblies Exposed to Real Building Fires and Standard Furnace Tests. B.Jones, H.Gerlich and A.H.Buchanan. *Proceedings, 4th International Conference on Performance-Based Codes and Fire Safety Design Methods*, Melbourne, March 2002.

Effect of Support Conditions on the Behaviour of Steel Beams in Fire. P.J.Moss, A.H.Buchanan, J.Sepuro and R.Welsh. *Proceedings of 17th Australasian Conference on the Mechanics of Structures and Materials*, Gold Coast, Australia. June 2002.

Fire Behaviour of Slender Precast Concrete Walls. Linus Lim and A.H.Buchanan. *Proceedings, Seventh International Symposium on Fire Safety Science*, Boston, USA. June 2002. *In press*.

Facts and Fallacies in Structural Fire Resistance. A.H.Buchanan. *Proceedings, 5th Asia-Oceania Symposium on Fire Science and Technology*. Newcastle, Australia, December 2001. (invited lecture).

Effect of Support Conditions on Fire Behaviour of Steel and Composite Beams. P.J.Moss, A.H.Buchanan, J.Sepuro, C.Wastney and R.Welsh. *Proceedings, Second International Workshop on Structures in Fire*. Christchurch, New Zealand, March 2002. pp 175-192.

Behaviour of Restrained Concrete Slabs in Fire. Linus Lim, A.H.Buchanan and P.J.Moss. *Proceedings, Second International Workshop on Structures in Fire*. Christchurch, New Zealand, March 2002. pp 61-82.

Fire in Modern Timber Building Design. A.H.Buchanan. *Proceedings, 7th World Conference on Timber Engineering*, Kuala Lumpur, August 2002. Vol 3, pp 1-13. (invited lecture).

Elevated Temperature Mechanical Properties of Timber for Use in Fire Simulations. Y.Bin, A.H.Buchanan, and P.J.Moss. *Proceedings, 7th World Conference on Timber Engineering*, Kuala Lumpur, August 2002. Vol 3, pp 1-13. (invited lecture).

Kuala Lumpur, August 2002. Vol 3, pp 243-250.

Radiant Ignition of Upholstered Furniture, C.M.Fleischmann and F.Chen *Proceeding of the International Conference on Engineered Fire Protection Design*, 2001, 243-252.

Experimental Data For Computer Model Comparison, C.M.Fleischmann, *INTERFLAM 2001 - Proceeding of the ninth international conference*, 2001, 999-1009.

The development of a web-based database of rate of heat release measurements using a mark-up language. M.J.Spearpoint. *Proceedings, 5th Asia-Oceania Symposium on Fire Science and Technology*. Newcastle, Australia, December 2001.

Experimental Verification of the Fire Dynamics Simulator Hydrodynamic Model J M Clement and C M Fleischmann, *7th International Symposium on Fire Safety Science*, Boston, USA, June 2002, In press.

Assembling the Heat Release Rate Curve for Fire Modeling, (invited poster) C M Fleischmann, *7th International Symposium on Fire Safety Science*, Boston, USA, June 2002, In press.

CBUF Model II Applied to Exemplary NZ Furniture (NZ-CBUF), *Fire and Materials*, P A Enright, C M Fleischmann, and P. Vandeveld, Vol 25, 2001.

## Research Reports

2002/1	Performance of expanded polystyrene insulated panel exposed to radiant heat	G Baker
2002/2	Comparison between predicted & actual behaviour of domestic smoke detectors	D Brammer
2002/3	Development of bench-scale testing of sprinkler & smoke detector activation/response time	K S Chin
2002/4	The effect of door angle on fire induced flow through a doorway	L R Clark
2002/5	Implementation of a glass fracture module for the BRANZFIRE compartment fire zone modelling software	R Parry
2002/6	Assessing the feasibility of reducing the grid resolution in FDS field modelling	N Patterson
2002/7	Fire safety design of Ferrymead Heritage Park	M Rangi
2002/8	Experimental results for pre-flashover fire experiments in two adjacent ISO compartments	L Rutherford
2002/9	Measurement of magnitude and direction of hot gas flow in a fire compartment with a five-hole probe	J Schulz
2002/10	Assessment of the current false alarm situation from fire detection systems in New Zealand and the development of an expert system for their identification	Y F Tu
2002/11	Performance of unprotected steel and composite steel frames exposed to fire	C Wastney
2002/12	Experimental fire tests of two-way concrete slabs	L Lim/C Wade
2002/13	Equivalent fire resistance ratings of construction elements exposed to realistic fires	J Nyman

The most recent Fire Engineering Research Reports are listed above. Previous reports are listed on our website at [http://www.civil.canterbury.ac.nz/fire/fe\\_resrch\\_reps.html](http://www.civil.canterbury.ac.nz/fire/fe_resrch_reps.html), with many available for download as PDF files. You may purchase a hardcopy at NZ\$50 each, postage included. If interested, please contact Catherine Price at [c.price@civil.canterbury.ac.nz](mailto:c.price@civil.canterbury.ac.nz).