CE News

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University of Canterbury

This issue

University Traffic Models
page 2

Professor Park Retires
page 12-13

Industry Advisory Group formed
page 12

Women in Engineering
page 16

UNIVERSITY OF CANTERBURY
CHRISTCHURCH • NEW ZEALAND

Departmental Staff

Academic

Larry Bennett	Engineering management
John Berrill	Geomechanics, Engineering seismology
Andy Buchanan	Timber engineering, Fire engineering
Des Bull	Structural concrete design, Earthquake engineering
Athol Carr	Structural dynamics, Finite element analysis
Bente Clausen	Hydrology, Impacts on ecology
Nigel Cooke	Structural design (bridges), Structural masonry
Rob Davis	Geomechanics, Continuum mechanics
Bruce Deam	Earthquake engineering, Timber engineering
David Elms	Civil engineering systems, Risk assessment
Charley Fleischmann	Fire engineering
Bruce Hunt	Groundwater flow, Analytical analysis
Kevin Mcmanus	Geotechnical engineering, Foundation engineering
Mark Milke	Solid waste management, Uncertainty analysis
Peter Moss	Structural dymanics, Timber engineering
George Mullenger	History of civil engineering, Continuum mechanics
Alan Nicholson	Transportation planning, Traffic safety
José Restrepo	Earthquake engineering, Structural concrete
Michael Spearpoint	Fire engineering
Alex Sutherland	Sediment transport, Coastal engineering
Warren Walpole	Structural steel design, Earthquake engineering
David Wareham	Biological nutrient removal, Waste treatment

Secretarial

Louise Fitzgibbon	Postgraduate enquiries
Denise Forbes	Accounts
Catherine Price	General and Fire engineering enquiries
Pat Roberts	Undergraduate enquiries

Technical

Computing	Peter Coursey Brandon Hutchison
Concrete Lab	Gary Harvey
Electronics Lab	Richard Newton Mike Weavers
Environmental Lab	David Macpherson
Fire Lab	Grant Dunlop
Fluids Lab	Ian Sheppard
Geomechanics Lab	Siale Faitotonu
Graphics	Melody Callahan
Highway Lab	Frank Greenslade
Model Structures	Alan Poynter
Stores & Purchasing	Nigel Dixon
Structures Lab	Russell Mcconchie John Maley Paul Murphy Stuart Toase
Workshop	Ray Allen

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www.civil.canterbury.ac.nz

Here you can just browse around, catchup with fellow alumni, see who's doing what research project, or contact staff

Credits:

Cover: Colombian Earthquake damage, see page 4.
Editors: Mark Milke & Bente Clausen
Layout and Design: Melody Callahan
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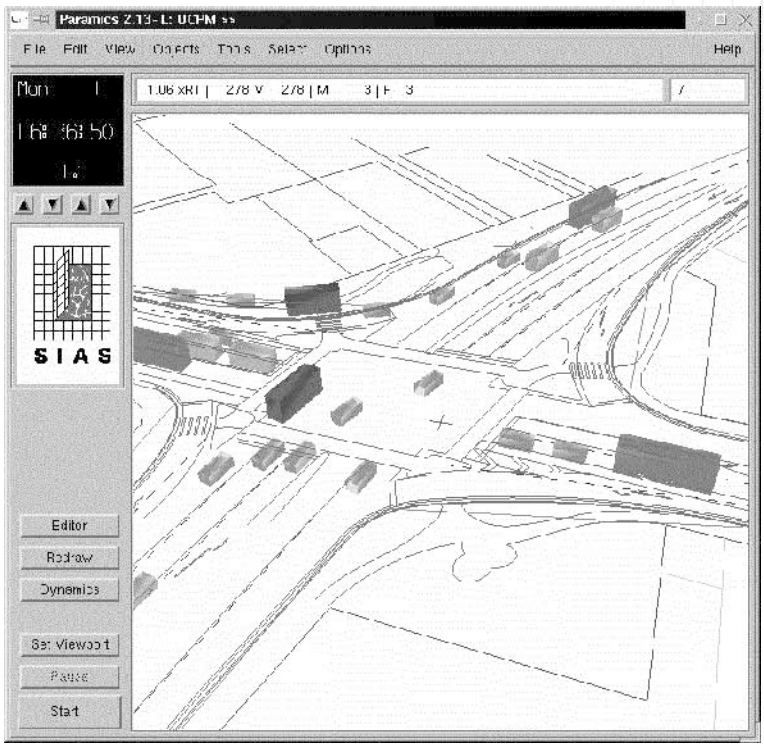
Many thanks to all those who contributed articles and photos in the making of CE News

Modelling Traffic About the University

For some years, residents of the area around the University have been concerned about the increasing kerbside parking and traffic flows associated with trips to and from the campus, and the Christchurch City Council has required the University to provide extra parking on the campus. There has recently been an upsurge of interest in encouraging the use of public transport for trips to and from the campus, with two new bus services having been established.

Departmental research completed some years ago showed that staff and students are more responsive to measures to discourage car use (e.g. charging for parking on the campus) than to measures to improve public transport. Staff and students, like most New Zealanders, are strongly inclined towards using cars. A subsequent study investigated the viability of a demand-responsive public transport service (e.g. dial-a-bus) between the University and the areas to the south (Addington, Riccarton and Upper Riccarton), and found that it was unlikely to prove viable.



Clyde/Fendalton/Memorial junction during the evening peak simulation. The simulation is superimposed onto a detailed engineering drawing of the junction.

Traffic on the streets around the campus is still growing, with considerable congestion at several of the intersections, resulting in three roundabouts being replaced by traffic signals. The effects of such changes on the pattern of flow in the network (e.g. link and intersection flows) and the performance of the network (e.g. travel times, fuel consumption, emissions, accidents, etc.) are difficult to predict, unless one does a detailed network analysis using a traffic modelling program. Both studies have been undertaken to develop a SATURN (Simulation and Assignment of Traffic in Urban Networks) model for the network around the University, and a TRACKS model

SATURN and other traffic management models in use around the world involve using approximate and macroscopic models of traffic flow. That is, the models have considered the movements of groups of vehicles, rather than individual vehicles. This approach has been necessary in the past because of computer memory and processor speed constraints.

A new breed of traffic model has recently emerged using microsimulation (i.e. the simulation of individual vehicles within a network). This provides much more accurate and detailed information for traffic planners than was previously possible. One such model is Paramics, developed by SIAS, Ltd.

Such models have only just started being used in a few countries overseas, the applications being very much a test of the practicality of using such models and the validity of the results they produce. The few applications to date show that such models are practical for many typical network analysis problems and they produce results that accord very well with the empirical data. Alan Nicholson has commenced redevelopment of a Paramics model for the University area network model. He is being assisted by James Laird, who has been working for SIAS Ltd for six years and helped set up a Paramics model for Edinburgh. SIAS Ltd is supporting the research, via the free supply of the program (for teaching and research purposes) plus free technical support and advice on the use of the program.

The primary purposes of this research are: (1) to compare the results for three models of the University network, (2) to predict the effects of implementing various traffic management measures to assist bus and cycle travel, and improve parking management, within the University-area network; (3) to estimate the worth of various "intelligent transport systems" techniques (e.g. dynamic and intelligent routing of vehicles, dynamic driver information systems) being adopted. The research also helps provide a platform for teaching postgraduate students about traffic modelling. ◆

For further information, consult:

Laird, J.J. and Nicholson, A.J. "The University of Canterbury Travel Survey 1993: A Stated Preference Approach to Modelling Modal Split." Dept. Research Report 94/6

Earthquake Reconnaissance Team: Colombia

José Restrepo and Hugh Cowan (IGNS, Wellington) visited the earthquake affected region of west-central Colombia in February. A shallow M 6.2 earthquake struck the coffee-growing region of Colombia on January 25, 1999. The earthquake killed 1186 people and left 159,000 homeless. Damage to infrastructure and homes resulted in an estimated $NZ4 billion cost. The New Zealand Society for Earthquake Engineering organised the reconnaissance mission to observe the effects of the earthquakes and to learn useful lessons for New Zealand.

▲ *Near total collapse of two storey houses in Nueva Brasilia, Armenia. (Courtesy of El Colombiano)*

◀ *Plaza de Bolivar in Armenia. Corner buildings suffered extensive damage or collapse. The folded- plate Cathedral escaped unscathed. (Courtesy of El Colombiano)*

The earthquake underlined the devastation that can occur when a relatively small, shallow quake strikes close to a population centre. The fault that ruptured during the earthquake was less than 10 km from Armenia, a city of 270,000. Armenia suffered the heaviest damage. Many buildings, weakened by the initial jolt, collapsed when a magnitude 5.8 aftershock struck just four hours later. At the time of the visit there were still large numbers of dazed, homeless, jobless people in the streets.

In Armenia the central police station, fire station, and council chambers were destroyed, seriously impairing the emergency response. Hospital services, reduced by 70 percent, were unable to cope in the immediate aftermath. The earthquake resulted in 45,000 buildings in Armenia and Pereira – an industrial city of 400,000 about 50 km from the epicentre - being either seriously damaged or destroyed.

by the impact of the earthquake on key individuals and their families, and a lack of redundancy in network knowledge among different utility operators. The Colombian emergency management system is constructed around regional and local emergency management groups, which suffered from inadequate national coordination and resourcing. The international response was rapid, but this too was impaired by inadequate coordination between foreign ministry officials and emergency managers.

Soft soil and typical ridge-and-gully topography amplified the ground-shaking in and around Armenia and Pereira. These two cities are west of the central volcanic region in Colombia. The soils are mainly of volcanic origin with significant depths of volcanic ash and lahars. Since the topography in the region is rugged, during this century, unconsolidated fills have been built.

The fault ruptured in the direction of Armenia, resulting in a focusing of seismic energy (a kind of Doppler shift) towards the city. The maximum horizontal ground acceleration of 0.6g was recorded in Armenia. The vertical acceleration was 0.4g.

Building damage was typical of what might be expected in pre-1970s buildings, where seismic design was not considered. Pounding between buildings was extensive due to the lack of seismic gaps; this had a severe effect on corner buildings. In modern building construction significant damage was observed as a result of the interaction of reinforced concrete frames and clay brick masonry infills.

In Armenia the water supply system was heavily affected. Pressure in the system was partially restored after twenty thousand suburban PVC domiciliary pipes were connected.

An Erskine Fellowship allowed José to visit the region again five months after the earthquake to observe the recovery phase. He found the reconstruction process slow, mainly due to economic factors. Many people were still living in tents and shelters and the ongoing stress was damaging social relations there. ◆

Earthquake Reconnaissance Team: Turkey

Kevin McManus visited Turkey shortly after the devastating earthquake of August 17 as part of a reconnaissance team sponsored by the New Zealand Society for Earthquake Engineering and the Earthquake Commission.

The team arrived in Istanbul, a mere 80 km from the epicentre, to find life continuing as normal in this bustling city of 15 million inhabitants – former capital of the great Ottoman Empire. Driving from the airport little damage was evident apart from the odd dislodged roof tile. The many great relics of the Ottoman days such as the Blue Mosque, Topkapi Palace, and the famous Grand Bazaar were all seemingly undamaged. But then they have stood witness to many earthquakes in their time and have doubtless been damaged and repaired many times. The trained eye detects the subtle work of earlier earthquake engineers, after some previous incident no doubt, with steel rods tying many of the great masonry arches. Many lesser structures have presumably collapsed and vanished into antiquity.

One hour's drive down the Trans European Motorway the scene couldn't have been more different. The earth ruptured along 100 km of faultline scoring a "direct hit" on three cities: Adapazarri, Golcuk, and Yalova, and a "near miss" on another, Izmit – Turkey's industrial heartland. Some 20,000 apartment blocks in these cities and surrounding areas collapsed without putting up any serious resistance to the shaking. An uncounted number of people, perhaps as many as 30,000, died among the ruins. The scenes of devastation were difficult to comprehend, city block after city block reduced to tangled heaps of rubble like the aftermath of some terrible war, with hundreds of thousands of people reduced to living in tents and cardboard boxes amongst the ruins.

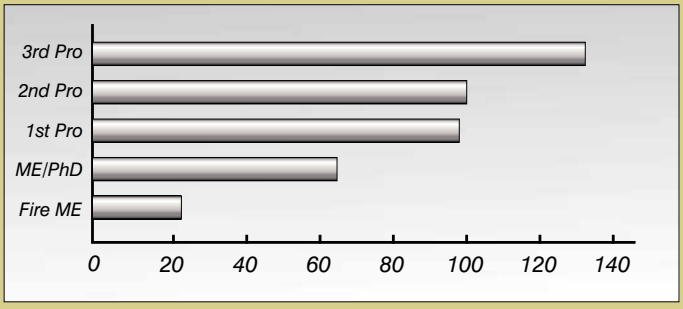
For Canterbury-trained engineers the technical reasons for the collapse were not difficult to understand: light concrete frames not detailed for ductility, hollow brick infill panels, soft storey ground floors, poor quality control. The failures were monotonous in their predictability Much harder to understand is the culture that allows six storey apartment blocks to be erected without proper building controls and sometimes using hand mixed concrete.

Extensive parts of Adapazzari were affected by soil liquefaction during the earthquake. Here fewer buildings collapsed but many suffered severe settlements of one metre or more with some becoming unstable and tipping over. Basic site investigations should have detected this risk and pile foundations would have mitigated the damage. This is an important lesson for New Zealand where we know that many urban areas, notably Christchurch, are prone to liquefaction.

Post earthquake reconnaissance is an invaluable experience and important reminder of how vulnerable our modern society remains to simple geologic events that we know are inevitable. ◆

Our Student Body

We had very strong demand for entry in 1999 with 135 applicants for 105 available places in first professional. We also teach a large number of students from other departments giving a grand total of 427 equivalent full time students (EFTS). There is a trend of growing student demand for places in civil engineering and we are assessing the need to expand the Department accordingly. However, we are having difficulty in recruiting enough suitable academic staff to cope with our present student body.



Prof. Henderson Honoured by Australian Water Engineers

In 1998 the National Water Committee of the Institution of Engineers, Australia, decided to mark the life-long achievements of Emeritus Professor Frank Henderson by naming an oration in his honour. A graduate of the Department (1943), Frank was a senior lecturer in the Department from 1952 to 1964, and Professor to 1968. While at the University of Canterbury, he made a significant contribution to obtaining New Zealand's first computer, and he also wrote his internationally renowned book on open channel flow.

The inaugural oration was presented on September 27th in Adelaide by Dr Martin Lambert of the Department of Civil and Environmental Engineering, University of Adelaide. Written by Frank, the oration allowed him the chance to reminisce, and an extended excerpt is provided here for the readers of CE News.

"I was born and raised in Christchurch, New Zealand, more years ago than I care to think about. I studied for the Bachelor of Engineering (Civil) at the University of Canterbury, whose Engineering School had been the first one outside Great Britain to have its degrees accepted as exempting qualifications by the U.K.'s Institutions of Engineering.

When I graduated we were in the middle of another war, and I was immediately seized by the manpower authorities and assigned to Wellington to work in radio development, work that largely involved the design and erection of radar aerials. My first taste of serious hydraulics came in mid-1944 when I was sent to Auckland to work under Tom Leech, an Australian, who was then head of the Auckland Engineering School, which offered the first three years of the B.E. degree (the students came to Canterbury for the fourth year).

He was an enormous enthusiast, as was apparent in the task he had set himself in Auckland— to develop means of generating, by explosives, waves large enough to inundate Japanese-held islands that were sufficiently low lying. He was inspired by Tarawa, an island taken by the Americans with enormous losses, no part of which was more than six feet above mean sea level.

We worked in a remote valley outside Auckland where an earth dam was built to impound a lake in which we conducted small-scale experiments— small explosive charges set at about water level. We were insufficiently knowledgeable on two matters: the exact mechanism by which an explosion could generate wave motion, and the law by which small-scale experiments could be scaled up to prototype size.

All of the wartime work I have described was within the New Zealand D.S.I.R., and after the war I chose to stay within the D.S.I.R. at the Dominion Physical Lab in Wellington, which appeared to offer an interesting variety of work. In 1949 I was fortunate enough to be chosen to spend the (Northern Hemisphere) summer at M.I.T. as part of their so-called Foreign Student Summer Projects. There, for the first time, I really learned some basic fluid mechanics, particularly on open-channel flow. When I returned to Wellington I was fairly well equipped to undertake a commission to the D.S.I.R. from the Ministry of Works, which was then deeply involved in the design and construction of hydro-electric schemes, mostly on the Waikato River in the North Island. They (M.O.W.) wanted physical model studies on spillways, aimed mainly at testing the head-discharge relation for the spillway; but they soon discovered that some other things needed testing as well. From then on I made a number of model studies of hydro-electric schemes, and they all proved interesting and with a certain number of surprises.

In 1951 the University of Canterbury advertised the position of Senior Lecturer in Civil Engineering, to specialise in hydraulics, and I applied for the position and was successful; I started at the beginning of 1952. At this point I really had to make a start learning the subject, as I never had to before. There is no doubt that teaching a subject is the best way not only to learn it yourself, but also to guide you into research by showing you the holes in the subject.

In my first year I had help from an unexpected source. It turned out that V.L. Streeter had applied for a one-year appointment to Canterbury under the then Fulbright scheme, so that 1952 provided a wonderful opportunity to meet and get to know Vic Streeter, one of the world's leading hydraulicians.

When Vic returned to the USA he invited me to spend a year at his university, the University of Michigan. I went there for the 1956-7 academic year, and that experience, too, was invaluable. Apart from teaching regular undergraduate courses, I worked on two specific projects. One was a model study of a pumping station for the City of Detroit water supply.

The second project was a computational project on the university's IBM650 computer. The project was to compute complex values of elliptic functions for a large range of complex arguments and plot them up for future reference.

When I returned to New Zealand, the country still had no computer, so I set about getting one for the University of Canterbury. Reaction was cool. Things became a little easier when I visited IBM in Sydney; there I met a top IBM man from the USA who told me that to get a start in New Zealand for the company he was prepared to offer a 60 % discount on the IBM1620, which by then had replaced the 650. We got the necessary donation from an oil company, and eventually the computer.

To do a competent professional job you must have all the necessary facilities. And the search for those facilities has taken up a great deal of my time. This came to a head when I gave one of my first lectures in 1961. The lecture went well, and when I got back to my study I said two things to myself: (1) it had been a good lecture, if I did say so myself; (2) it was a great pity I couldn't start writing the book "Open Channel Flow" right away. But that of course was impossible because I had so much else to do; my desk was piled high with umpteen kinds of rubbish relating to all these other jobs. Suddenly, I thought: to hell with all of it. I cleared a space for some sheets of paper and started writing. In that first day I wrote twenty quarto-sized pages of manuscript.

When the book was finally completed and published in 1966, I should have been able to settle down and relax, at least for a while. But at the beginning of 1964 I had been promoted to Professor, which led to some complications. It meant that I became involved in the administration of the Department, in co-operation with the Head of Department. I decided it was time to go, and I moved to Newcastle.

I became a Head of Department myself and spent my days at a desk coping with paperwork that administrators put there. This seems to be a universal problem in the academic and professional world: being good at one's job leads to promotion, which simply leads to one's removal from the professional into the administrative world." ◆

CAPTIF Update

In the first six months of 1999, research was undertaken at the Canterbury Accelerated Pavement Testing Indoor Facility (CAPTIF), to try to establish a relationship between the performance of the Australian accelerated testing facility (ALF), a linear accelerated testing facility owned and operated by ARRB Transport Research Limited, and CAPTIF. This involved a review of previous projects undertaken at both facilities and conducting a physical test at CAPTIF. Three container loads of Australian crushed rock were imported into New Zealand at the start of the year, and this material was used to construct one third of a test pavement, the remaining two thirds being constructed with New Zealand materials. At the conclusion of the project in June, the major findings were that CAPTIF is best suited to research work that requires controlled conditions, whilst work at the ALF facility is best suited to testing in-service pavements. This research was funded by Transfund New Zealand.

In July Transit New Zealand took over operational control of the facility from the University. The University is still involved with the research components of projects, with Bruce Steven (Research Fellow) working as Co-Principal Investigator.

In October construction started on a new test pavement for a project looking at the effect on New Zealand pavements, of increasing axle loads, and the development of a relationship between the performance of pavement materials in the laboratory and their in-service performance. This project, also funded by Transfund New Zealand, is scheduled to be completed in October 2000.

In October Bruce Steven presented a paper entitled *Accelerated Dynamic Loading of Flexible Pavements At CAPTIF* at the International Conference on Accelerated Pavement Testing held in Reno, Nevada, USA. ◆

Departmental Research Reports

99-1 Cement Bonded Steel Bars in Glue Laminated Timber
S. Eistetter, A.H. Buchanan

99-2 The Dynamic Behaviour of Drilled Shift Micro-piles
A. Chambers, K. McManus, J. Yang, J. Berrill

99-3 Two Dimensional Site Effects in Wellington and the Hutt Valley - Similarities to Kobe
B. Adams, R. Davis, J. Berrill, J. Taber

99-4 The Performance of Slender Precast Reinforced Concrete Cantilever Walls
A. McMenamin, D. Bull, J. Restrepo

Reports may be ordered by contacting Ms. Pat Roberts via email on a.roberts@civil.canterbury.ac.nz

People People People

Larry Bennett

"I arrived in Christchurch in July (1999), excited to be beginning two years as the "management person" in Canterbury's Civil Engineering Department. That excitement has continued, as I have become more acquainted with New Zealand engineering and construction and the program here. In 1997, I retired after 29 years on the engineering faculty at the University of Alaska Fairbanks. For most of those years, I was in charge of a master's degree program in Engineering Management. Most of our students were employed engineers who took evening classes on a part time basis and completed the degree in 3 or 4 years. For more than ten years, I was also involved in UAF's participation in the National Technological University, a satellite-TV-based master's degree-granting institution whose membership includes some 45 of the United States' leading schools of engineering.

Following my "retirement," my wife Margaret and I spent the next two years at Cornell University in Ithaca, New York. This experience was a true "homecoming," as we both grew up in Ithaca. At Cornell, I taught in a Master of Engineering program in Engineering Management, based in the School of Civil Engineering.

My undergraduate degree in civil engineering is from Rensselaer Polytechnic Institute in Troy, New York. After my postgraduate studies at Cornell, I worked for three years as a Planning and Scheduling Engineer for United (now Raytheon) Engineers and Constructors, in the management of both design and construction of power generation and industrial projects. In 1968, we went to Alaska for an intended three or four years, and stayed for twenty-nine! We still own a home in Fairbanks and expect to return there when our two years at Canterbury end.

I have tried to maintain an active contact with the engineering community throughout my career. In fact, I really consider myself an engineer who happens to be teaching rather than a professor who happens to be an engineer. Bennett Engineering has been involved in a variety of activities over the years, from network scheduling for contractors and expert witness work in contract claims to on-site residential water and wastewater system inspection and design and land surveying in the wilds of Alaska. I am both a registered engineer and land surveyor and have been active in such professional organizations as the American Society of Civil Engineers, the National Society of Professional Engineers and the American Society for Engineering Education. My three books and most of my professional papers are oriented toward the management of engineering, both generally and in the world's cold regions.

My primary research has focused on construction and engineering systems in cold regions, including highway construction, building technology, temporary protection and heating of buildings under construction, factors influencing construction productivity and logistics and transportation system planning. Also of interest are computer applications in such areas as project network scheduling, solid waste management, the management of engineering organizations, and investment analysis. I have also investigated such educational issues as engineering and management program design and evaluation, the incorporation of cold regions principles in the civil engineering curriculum, and satellite-based televised engineering education.

It is a great privilege to be a part of this exciting venture called Canterbury Civil Engineering. I look forward to a productive and fulfilling two years". ◆

Larry's book: *The Management of Engineering: Human, Quality, Organizational, Legal & Ethical Aspects of Professional Practice*. Wiley, 1996, will be used in 2000 for Civil Eng. Management

Mike Spearpoint

"I arrived in Christchurch in September (1999) to take up the five-year New Zealand Fire Service Commission Lectureship in Fire Engineering.

In 1987 I obtained my undergraduate degree in physics from the University of Nottingham but I realised by the end of my studies that I wanted to do something more practical. I was offered a position at the Fire Research Station (FRS) which is part of the UK's Building Research Establishment and spent ten years working on many different projects.

The last two years were spent at the University of Maryland in the United States where I had the privilege of studying and working with the staff in the Department of Fire Protection Engineering. During that time I continued to work for FRS by 'commuting' across the Atlantic each summer and Christmas.

Like many fire engineers, I have been involved in a whole range of diverse building and fire related activities. Burning motor cars as part of the safety design of the Channel Tunnel, using virtual reality systems to visualise fire, assessment of fire detection systems and the development of integrated data models for the description of buildings are among the list.

Coming to Canterbury has two additional attractions. Since I have arrived from the northern hemisphere I get two summers in a row and being in New Zealand I will be one of the first people on the planet to experience the Y2K bug". ◆

People People People

Bruce Deam

"I took up a five-year term as the Leicester Steven EQC Earthquake Engineering Lecturer in September. This new position was set up to both build up the department's earthquake engineering knowledge and experience and to honour the outstanding contribution Leicester Steven made as commissioner of the Earthquake Commission (EQC). Both of these goals present a formidable challenge! To start, I hope to extend the range of earthquake engineering courses offered at masters level to include aspects of lifeline systems, disaster management and economic modelling to complement the existing structural and geotechnical courses.

Prior to this position, I was a structural research engineer at the Building Research Association of New Zealand (BRANZ) in Wellington for seven years. My primary responsibility was investigating the seismic response of light timber-framed buildings. Recently, this has involved commissioning a new shaketable and developing a new form of pseudo-dynamic testing. During my time at BRANZ, I was also involved with projects that ranged from developing test methods for building components and systems to developing equipment to monitor storm pressures on building claddings.

I completed my doctoral thesis on the seismic design and behaviour of multi-storey plywood sheathed timber framed shearwalls (supervised by John Dean and Andy Buchanan) while working at BRANZ. This isn't a career path that I will be recommending to my own students but the ability to continue to work in the same field in New Zealand wasn't an opportunity that I could let pass by. Fortunately I had completed the experimental work – testing five, nine metre high three-storey test specimens – before leaving Christchurch.

I have been a member of the Timber Design Society's management committee for almost two years, assisting with the organisation of a successful international timber engineering conference earlier this year. I set up and managed (until September) the web sites for both the Structural Engineering Society and the Earthquake Engineering Society.

The move back from Wellington has also been of personal benefit. My wife, Fay, and I both grew up in Canterbury, Fay in Christchurch and myself in Timaru, and our two boys (now 6 years and 18 months) are both enjoying being closer to grandparents and other family". ◆

The department also welcomes Research Fellows, Flo Cassassuce pictured on the left and Nathalie Robert on the right.

Flo Cassassuce: 'Bonjour, I am French and ……WE WON !…… Bad start, I'm not going to make any friends like this!!!!!!! Seriously, I come from Grenoble in the French Alps, not far from Italy. My university is the University Joseph Fourier… I know, the terrible Fourier series… I've done four years of study and have the equivalent of a BE.'

Flo arrived early June 1999 to do a three month research project on the 'Piezocone' project with John Berrill as her supervisor. Most of the three months was spent to program the software for recording and processing the data of the Seismic Cone Penetration Test. Invaluable assistance was received from Mike Weavers, who constructed the electronics interface for the recording system of the piezocone. The first seismic cone penetration test was carried out at QEII Golf Course to 12 meters depth.

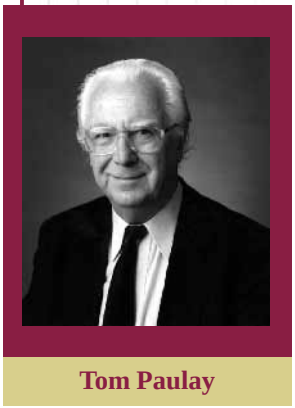
After the three months in the Department, Flo decided to stay another six months with the Christchurch City Council. There she has been testing potential liquefaction sites in Christchurch as part of the Lifelines project.

Nathalie Robert: 'Bonjour! I am a French Canadian from Montreal. I know we did not do well in the rugby world cup but at least France did not beat us!'

Montreal is located in the east part of Canada near the St Lawrence River. The Province of Quebec is mostly French speaking. Nathalie tells us that in winter the weather gets really cold (-20°C) with lots of snow. She says: 'This is really good to practice winter sports such as: skiing, snowmobile, ice-skating and moose riding (just kidding!).'

Last year Nathalie completed her Masters Degree in Structures (MSc Civil Engineering) at the Ecole Polytechnique of Montreal, Canada, researching the earthquake forces induced in the members and connections of braced steel frames under severe seismic conditions. She arrived in Christchurch in July, to work as a HERA Research Fellow here at the University in the Civil Engineering department. ◆

People Retirement People



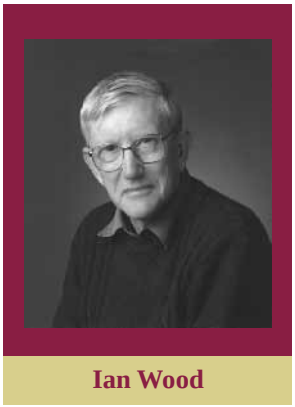
Tom Paulay

In this his 11th year of retirement, Tom Paulay still turns up daily in the department to engage in dialogues with his colleagues and some graduate students, and to attend to the upkeep of his connections to earthquake engineers all over the world.

In May he addressed structural engineers in Santiago, Chile and visited a number of high rise buildings under construction in that earthquake prone city. Then, bypassing Mount Aconcagua in the Andes (6860 m), he landed in Mendoza (Argentina) to deliver three lengthy evening lectures during a three day seminar attended by over 300 engineers. With considerable interest he also inspected activities in this most famous wine growing district of Argentina. During a brief visit to Buenos Aires he addressed the Academy of Engineering on the occasion of being elected the third foreign fellow of the academy. The National University of Cuyo bestowed him an honorary doctorate.

In June he addressed engineers from many countries who gathered at the Middle East Technical University in Ankara, Turkey, to honour a great pioneer of earthquake engineering and of the design of reinforced concrete structures in that country, Professor Ugur Ersoy.

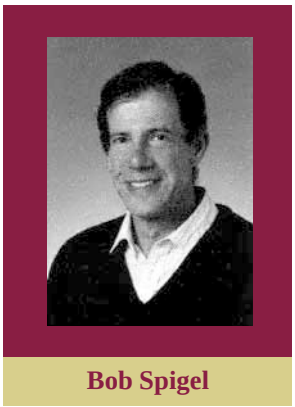
He participated in September, for the 12th time, in a weeklong discussion with the earthquake engineering research team at the Swiss Federal Institute of Technology in Zürich. During this time, traditionally referred to by his colleagues as "the Paulay week", he was particularly involved, as a co-supervisor, with two PhD projects. Arrangements for this visit were made in such a way that he could also travel to Istanbul to attend a workshop on irregular structures. This was sponsored by one of the task groups of the European Association of Earthquake Engineering. He offered an extensive presentation on his recent work in this area. The hosts at the Technical University of Istanbul enabled participants to inspect some of the devastation from the recent Marmara earthquake. ◆



Ian Wood

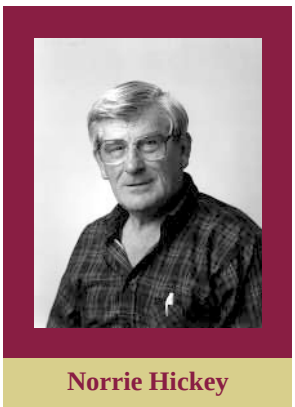
Professor Emeritus Ian Wood has had an active year in Fluid Mechanics. He spent three months of 1999 at the Nanyang Technological University in Singapore as a Visiting Professor. He gave a series of lectures there on stratified flows, and interacted with Adrian Law and his group. From there he went to Hong Kong for two weeks where he held the William M W Wong Visiting Research Fellowship in Engineering at the Hong Kong University. He worked with Joseph Lee on a research paper that he hopes to see published in 2000. While in Hong Kong he also visited Mark Davidson at the Hong Kong University of Science and Technology. Following this he went on to England and gave a seminar research into plumes to the Department of Applied Maths and Theoretical Physics.

While in Christchurch, Ian comes to the department a few days each week. He keeps current on research by reading journal papers in the library, reading manuscripts and theses that come his way, and being involved in discussions with researchers worldwide. "Research has been my hobby over the years, and I'm glad to say, it still is." He comments that he enjoyed greatly teaching the first year Fluids students and providing them with a foundation for later learning and also a few intellectual "surprises". ◆



Bob Spigel

After more than 20 years in the Department, Bob Spigel will be moving on to new challenges as a researcher and consultant with the National Institute for Water and Atmosphere (NIWA). Bob started in the department in 1978, and over the years taught various courses in fluid mechanics and hydrology, and developed an active research programme into the hydraulics and hydrology of lakes. While Bob intends to remain in Christchurch, he will be missed around the Department for his easy going manner, his thoughtfulness, and his thoroughness. Bob hopes to be able to devote more energy to advancing research in environmental fluid mechanics and foresees co-operating in joint research projects with the Department and others. ◆



Norrie Hickey

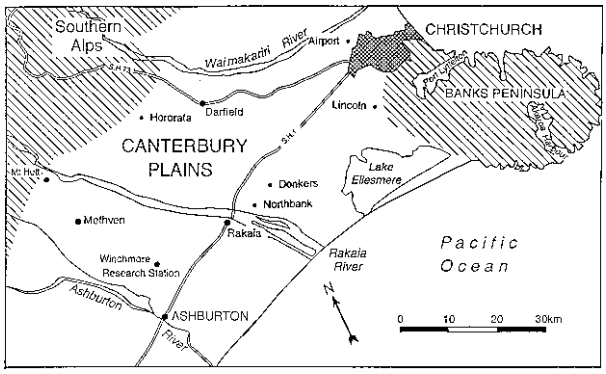
Norrie Hickey retires after 25 years of service in the department. Norrie had exceptionally good working relationships with all the students and worked extensively with the postgraduates. He came to us from Gore as an electrician and worked for Southland Power prior to joining the department. He has vast experience in the manufacturing and testing of concrete specimens and therefore worked in the model structures as well as the concrete laboratories. In his youth, as well as playing rugby, he represented Southland as a Boxer. Now his days will be filled with relaxation and fishing, and we wish him all the best. ◆

Natural Ground Water Recharge In Canterbury

As part of Public Good Science funded research a new lysimeter network has been installed at several points in the Canterbury Plains. This is a cooperative project between Hugh Thorpe (Departmental Research Fellow), Geological and Nuclear Sciences Ltd. and the Canterbury Regional Council.

The immediate objective of the network is to measure the recharge from rainfall through the major soil types of the Canterbury Plains over a range of climatic zones. The longer-term plan is to use these data to calibrate a regional predictive model of rainfall recharge, as a management tool for regional councils. It has evolved from previous work done at the AgResearch Winchmore Research Station.

The network incorporates the original cluster of lysimeters at Winchmore with five new sites at Christchurch International Airport, Hororata, Northbank, Donkers, and Lincoln University. The soils at the six sites represent about 60% of the plains area and the locations cover the typical range of rainfalls.



At each site, two identical lysimeters have been constructed to a design used by the Soil Science Department at Lincoln University. They are 500mm diameter and 700mm deep, containing a cylinder of undisturbed soil. This design is used because it is proven, easy to construct with modest equipment, and can be duplicated without undue expense. Having two lysimeters at each site allows a check against faulty construction and also allows for different soil treatments or management at a site in the future. The instrumentation at each site is set in an access pit alongside the lysimeters. It consists of a tipping bucket rain gauge for each lysimeter and a third one set at ground level to record rain. There is also a plastic check gauge. Data are logged at 5-minute intervals.

A meteorological station is associated with each site to provide data for calculating evapotranspiration, and a bore is available so that the response of the water table to recharge can be recorded.

Lysimeters such as these should be considered a necessary component of hydrological networks where ground water resource management is important. ◆

For further information consult:

H. Thorpe & D. Scott, "An evaluation of four soil moisture models for estimating natural ground water recharge", Journal of Hydrology, v38, p179-209, 1999

2000 VISITORS

Prof. Richard Fenwick
University of Auckland,
Stuctures

Prof. Nigel Priestly
University of California, San Diego,
Structures

Dr Hiroyasu Sakata
Japan,
Structures

Dr Jean-Marc Franssen
University of Leige, Belgium,
Fire Resistance of Structures

Prof. Andrei Reinhorn
University of Washington, Buffalo,
Structural Dynamics

Dr Il Won Seo
University of Korea,
Fluids

Prof. Peter Hills
University of Newcastle, UK,
Transport Engineering

Dr Mario Rodriquez
UNAM Mexico,
Structures

Prof. John Stanton
University of Washington, Seattle,
Reinforced/Precast Concrete

If you wish to get in touch with any of the visitors during their time here, please contact us:
By post at: Dept. of Civil Engineering, Univ. of Canterbury, Private Bag 4800, Christchurch, New Zealand
by telephone on 03 364-2396, by fax on 03 364-2758, or by email: enquiries@civil.canterbury.ac.nz

Concrete Pioneer, Canterbury Stalwart Retires

Professor Bob Park, a doyen of seismic engineering, and respected internationally for his work, retired from official university duties in 1999, after being a student or academic with the Department of Civil Engineering for 40 years, including 30 as professor, 15 as head of department and 6 as deputy vice-chancellor of the university.

It is difficult to know where to start to chronicle Professor Park's contributions. In the past five years alone he has received an OBE (1995), has been Executive Vice-President for the International Assoc. for Earthquake Engineering, and Chair of the Concrete Design Committee of the Standards Association of New Zealand.

Last year in his citation to Bob for receiving the University's Research Medal, Professor Bob Kirk noted that, in New Zealand, most of the bridges we cross and many of the buildings we work in have been made much more resistant to strong earthquake motions as a result of Prof. Park's research. This is also true in parts of Asia, Europe, Central and South America, where the pioneering work of his research teams have been taken up in one form or another.

Professor Park is quick to credit the whole of his research group, including Emeritus Professor Tom Paulay and his first PhD student, Nigel Priestly, now Professor at the University of California, San Diego, but equally the diligence and dedication of the department's technical staff, and the insight and inspiration of his 22 PhD and 40 ME students over the years.

Professors Park and Paulay wrote what is generally regarded as a seminal book, *Reinforced Concrete Structures* (Wiley, 1975), which has been reprinted through 10 editions in English, and also translated into Spanish and Chinese. Over his career (so far!) he has also co-authored the book *Reinforced Concrete Slabs*, written 7 invited chapters for books, and co-authored more than 280 technical papers published in journals and conference proceedings.

Not many academics in New Zealand have been professors for as long as Bob Park, but he is modest about his achievement of becoming a professor at the age of 35. "I only had a dozen papers under my belt at the time; that would be about sufficient now to be promoted to senior lecturer."

Bob started teaching while at Canterbury for his ME in 1956-8. He was enticed back for his ME studies by the late Professor Harry Hopkins, then head of the department, who offered Bob a position as a temporary assistant lecturer.

Being a student and lecturer at the old town site and, before that, an undergraduate resident of Rolleston House, was a great experience for Prof. Park. "One had a real affection for the cloisters and the very graceful old buildings. But it was excessively cramped with so many engineering students jammed into just one block, laid out like a rabbit warren."

Industry Advisory Group Formed

A number of distinguished industry leaders have agreed to form an Industry Advisory Group which will act as a "bridge" between the Department and the wider civil engineering community. The group will help the Department to understand the changing world outside the University while simultaneously receiving insight into developments within the Department. Formation of the group provides important recognition of the Department as a key part of the civil engineering industry. Any concerns about our teaching and research programmes can be readily aired and partnerships fostered.

The group evolved from early discussions between Wellington consultant Peter Smith and former Head of Department Kevin McManus. Membership of the group has been made as widely representative as possible as follows:

Kieran Devine	Corporate Development Manager, Beca Consultants
Chris Ellis	General Manager Fletcher Engineering
John Hare	Director, Holmes Consulting Group
Gretchen Kivell	Former President of IPENZ
Ian Robertson	Director, Montgomery Watson
John Rutledge	Chief Executive, Opus Consultants
Peter Smith	Director, Spencer Holmes Limited

An inaugural meeting of the group took place on 24 August followed by a meeting with the Vice-Chancellor, Daryl LeGrew, and dinner with the academic staff. A large range of issues was raised at the meeting, which will be worked through and incorporated into the Department's evolving strategic plan. It is envisaged that the group will continue to meet approximately twice a year. The commitment of the individual members who have agreed to give up their time in support of the Department is gratefully acknowledged.

Park Retires cont.

It was thanks to Professor Hopkins, who was a "concrete man through and through", that Bob became a convert. With his new-found passion, Professor Park headed off to the University of Bristol in 1959 where he joined the academic staff while also carrying out his doctoral studies. "When I got there I found I was the only 'concrete person' in the department— most of the others were interested in steel or aluminium. The professor wondered why I was doing my doctorate in concrete and tried to convince me there was much more of a future in metals, but I wasn't going to change."

Professor Park returned to Canterbury University in 1965 as a Senior Lecturer. "At that time in New Zealand structural steel was wholly used for important or tall buildings. There was a lot of uncertainty then about the use of concrete and the 1956 loadings code recommended the use of steel. That was a call to action…." The attractive thing about concrete was it could be made from New Zealand-produced materials; very little structural steel was being manufactured here. It was also wonderfully versatile and able to be made in any shape or form, he said.

In the 1970s he chaired a discussion group of the New Zealand National Society for Earthquake Engineering investigating the seismic design of ductile frames of reinforced concrete structures. Reports from this group led to the pioneering code, NZS 3101, published in 1982. More recently, Professor Park chaired the committee that published the revised code in 1995. His most recent work has been on the seismic assessment of older reinforced concrete buildings and bridges, and their retrofit.

The department's DARTEC compression machine has played a leading role in Professor Park's testing programme. The $300,000 price tag for the machine in 1978 was raised from external sources around the country, each source realising the worth of the rigorous testing of concrete structures. A more up-to-date compression machine is now needed and while these sources all have a vested interest in seeing the equipment upgraded, Professor Park thinks it will be a big job to try to raise the $2 million needed.

1933 Born in Suva, Fiji

1951 Moves to Christchurch, New Zealand

1955 Graduates from Canterbury University College with a BE
1956 Works at the Christchurch Drainage Board
Starts ME Study at Canterbury

1958 Graduates as ME (Civil) with Distinction
1959 Begins PhD study at University of Bristol

1965 Appointed Senior Lecturer in Civil Engineering at Canterbury

1967 Graduation of first PhD student, Nigel Priestley

1969 Promoted to Professor in Civil Engineering

1975 *Reinforced Concrete Structures* (Park and Paulay) published

1977 Chosen as Head of Department
1978 Co-ordinates purchase of DARTEC testing machine

1980 *Reinforced Concrete Slabs* (Park and Gamble) published

1982 NZ Standard 3101 for the Design of Concrete Structures Published

1991 Introduces undergraduate course in Reinforced Concrete
1992 Steps down as Head of Department
1993 Appointed Deputy Vice-Chancellor

1995 Receives OBE

1999 Retires and Appointed Professor Emeritus

His appointment to Deputy Vice-Chancellor in 1993 brought his organisation and energy in support of the Vice Chancellor on topics as diverse as research, buildings, labour contracts, staffing, and car parks. He served as key link in the transition that went with the appointment of Daryl Le Grew as Vice-Chancellor in 1998.

One of the things Professor Park most treasures about his time at Canterbury is the friendly, supportive collegial atmosphere in the Department of Civil Engineering. Much of that was due to Professor Hopkins' early work, turning what was more of a technical college department into a first-rate university department. "It was a pleasure to pick up the headship from him. Staff and students have always worked together closely and enjoyed good relations, and we all try to keep up with our former students."

Professor Park has had to endure major health problems this year along with the change in work demands. The great strength of his family and the support of his friends became all the more important to him during these difficult times. In retirement, Professor Park is looking forward to a chance to relax and recuperate, while still leaving some time for research and writing. ◆

Fire Engineering

New Zealand Fire Service Commission

The Fire Engineering programme at the University of Canterbury was established in 1993 with the financial assistance of the New Zealand Fire Service Commission through a five-year contract. Since then the University has established a Masters Degree in Fire Engineering producing over 50 graduates and almost 20 current students. The University has also provided a state-of-the-art laboratory and has established a continuing full-time position for Charley Fleischmann. The New Zealand Fire Service Commission continues its investment in the programme, with a second five-year contract funding the new lecturer, Michael Spearpoint, and research scholarships to assist the Commission in its efforts to reduce fire deaths and fire property losses in New Zealand.

Foundation for Research Science and Technology

In addition to the Fire Service support, the fire engineering programme relies heavily on research funding from other sources; including the Foundation for Research, Science and Technology (FRST). A major six-year research contract with FRST, titled "*Improving Fire Safety in New Zealand Residential Buildings*" is ongoing. There are three inter-related objectives: 1. Fire hazard of residential furniture, 2. Modelling smoke movement in residential buildings, and 3. Severity of post-flashover fires. The application was strongly supported by the New Zealand Fire Service and the Building Industry Authority, who will help to establish an End User Advisory Group to ensure relevance of the research projects.

Demand for graduates

The demand for graduates from the M.E.(Fire) degree at Canterbury continues to be very high. As fire engineering becomes a more recognised discipline, there are an increasing number of job opportunities throughout New Zealand, Australia, and beyond. The degree involves twelve months of full-time intensive study, consisting of six courses between March and September, followed by an individual research project from October until February. The courses include Fire Dynamics, Structural Fire Engineering, Risk Assessment, Human Behaviour, Fire Safety Systems and Fire Engineering Case Study. The entry requirement is an engineering degree in any discipline, or a science degree with appropriate experience.

1999-2000 M.E. projects

There are a large number of current research projects. They focus on the following areas:

Fire behaviour
Structural fire engineering
Domestic fire safety
Fire risk assesment

Visitors

Continuing the exchange scheme with Lund University in Sweden, Erik Grahn attended classes at Canterbury in 1999. Greg North carried out research at Lund as part of his University of Canterbury degree.

Laboratory

The furniture calorimeter in the new fire laboratory has been used to burn many armchairs and couches as part of the domestic fire research programme funded by FRST. The cone calorimeter has also been used extensively for testing domestic furniture and for ignition studies on wood based products.

Conferences

Several members of the Fire Engineering Programme attended the following major international conferences:

Interflam99 Conference	Edinburgh
The Sixth Symposium of the International Association for Fire Safety Science	Poitiers, France
The World Conference on Timber Engineering	Montreux, Switzerland
The Pacific Timber Engineering Conference	Rotorua, New Zealand
The Australasian Structural Engineering Conference	Auckland, New Zealand
The National Fire Protection Association - World Fire Safety Congress and Exposition	Baltimore, Maryland, USA
The Third International Conference on Fire Research and Engineering	Chicago, Illinois, USA

Jennifer Yii, finding out how to fight fires, as part of the ME(Fire) programme.

For more information on study, research, scholarships or publications, please contact:

Charley Fleischmann or Michael Spearpoint
University of Canterbury, Private Bag 4800,
Christchurch, New Zealand.
Phone 64-3-364-2250, or Fax 64-3-364-2758
email: Charley@civil.canterbury.ac.nz or
M.spearpoint@civil.canterbury.ac.nz

Please visit our web site at www.civil.canterbury.ac.nz

Ph.D. projects

Jason Clement is studying the flow of smoke and hot gases through door openings between rooms, using experimental and analytical methods, in order to better understand smoke hazards from fires in houses. He is making a comparison between his own salt-water modelling experiments and the NIST large eddy simulation model. Full scale room fire experiments will follow shortly. This programme is funded by FRST under the supervision of Charley Fleischmann.

Ee Yii is continuing to develop an improved computer model to predict the gas temperatures in post flashover compartment fires, to provide better input for analysis of structural members exposed to fires. Under the supervision of Andy Buchanan, he is extending existing models to improve the prediction of heat release rate and to allow multiple vent openings in the walls and ceiling.

Tony Parkes is continuing the investigation of the fire hazard of domestic furniture in a major project funded by FRST. Tony is a previous graduate who has returned to the university after three years in industry. He will be extending the work in Tony Enright's recently completed thesis, under the supervision of Charley Fleischmann. ◆

Fire Engineering Research Reports

99/1	Fire Safety and Security in Schools	Rachel Carter
99/2	A Review of the Building Separation Requirements	Jim Clarke
99/3	Effect of Safety Factors in Timed Human Egress Simulations	Kenneth Crawford
99/4	Fire Response of HVAC Systems in Multistorey Buildings	Michael Dixon
99/5	The Effectiveness of the Domestic Smoke Alarm Signal	Christine Duncan
99/6	Post-flashover Design Fires	Roger Feasey
99/7	An Analysis of Furniture Heat Release Rates by the Nordtest	James Firestone
99/8	Design for Escape from Fire	Ian Garrett
99/9	Class A Foam Water Sprinkler Systems	Dave Hipkins
99/10	Review of the New Zealand Standard for Concrete Structures Exposed to Fire	Michael Inwood
99/11	Load-Bearing Light Timber Framed Walls at Elevated Temperatures	Kim Liew
99/12	An Analytical Model for Vertical Flame Spread on Solids	Greg North
99/13	Should Bedroom Doors be Open or Closed While People are Sleeping?	Debbie Palmer
99/14	Peoples Awareness of Fire	Sarnia Rusbridge
99/15	Smoke Explosions	Brent Sutherland
99/16	Reliability of Structural Fire Design	John KS Wong

The above reports are available for purchase at NZ$25 each, postage included. If interested, please contact Catherine Price at c.price@civil.canterbury.ac.nz.

Women in Engineering

For the last few years, the Women in Engineering (WIE) group has been increasingly active on campus. Kate McCarroll provides an overview of WIE and a summary of their recent activities.

"Generally speaking, WIE is a social and a networking group. It is not for everyone. Some just want to get on and study and that's fine, although I think that some who joined us later on had such a good time they were sorry they hadn't joined earlier. We have 80 members including staff, students and working engineers, not all women, but all interested in what we do. It is a good opportunity to meet students from other departments, and our affiliation with the Young Engineers of Christchurch provided us with the opportunity to meet working engineers, also increasing our network. One of the tangible benefits of this has been some firm job offers!

Our Engineering in Schools programme was our major initiative. We visited schools in pairs to promote Engineering to fourth formers, with so many students volunteering (40) that, sadly, not everyone got a turn.

Kids haven't got a clue about engineering so we tried to show them, especially the girls, that engineering is an option. We encouraged them to keep up maths and science and tried to get the message across that if you liked playing with Lego when you were a kid then you have probably got what it takes to do engineering.

The kids liked the fact that we were not much older than they were and the teachers were most enthusiastic too. Two teachers (both male) said that if they had heard people like us when they were fourth formers they would have done engineering instead of teaching.

For the future, I really think there is a need for a staff member, as there is in many other universities including Auckland, to co-ordinate the programme. I have also been very impressed by Mentor Programmes, available for both male and female engineering students, which I have heard about in other universities. I would love to see something like that at Canterbury.

I could not possibly conclude this without paying tribute to our *incredibly* supportive Dean, Alex Sutherland. He has been a true friend to WIE.

From my immediate male peers I often hear the whinge: *Why isn't there a Men in Engineering Group?* After 102 years they still don't get it. ENSOC is the Men in Engineering Group! Don't get me wrong, I love ENSOC and I am to be found at most ENSOC jollies but that doesn't mean that we don't need a group of our own as well.

I was thrilled to hear that first year engineering enrolments this year were 19 per cent women. That's good news."

Kate concludes that until it increases to 50% we still need a Women in Engineering group. ◆

Mercury, Amid the High Tech

While sophisticated pressure and flow measurement instruments are available, mercury manometers continue to provide an ideal *first principles* view of what's happening to the water flow in the pipes for the undergraduate lab classes.

Ian Sheppard with a bottle of stored mercury. He is alongside a mercury filled manometer used in undergraduate laboratories.

Last year on 22 April, the department held its annual dedicated Hazard Assessment Day. Mr Perry, the University Safety Manager, said there was a great deal of merit in this technique rather than the more *ad hoc* approach to safety favoured by some other departments. Mr Perry was pleased to find the mercury stored in the Fluids laboratory was done so in compliance with current safety requirements.

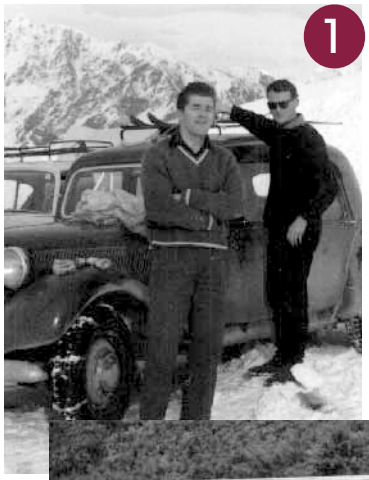
To maintain a safe working environment safety is given a high priority in the department with regular meetings of the Safety Committee. Along with the annual hazard checks of work areas, all equipment is also tested yearly. Training in safe practices is provided for all staff and all are encouraged to attend first aid training. ◆

Orienteering: a change of pace from engineering studies

Aaron Prince (1st Pro) has had a hectic 12 months. At the completion of his intermediate year Aaron headed down to Queenstown to compete in the 1998 Southern Traverse, a 5 day nonstop multi-sport race. Aaron's team finished 9th out of 41 teams who started the race. In February this year Aaron competed in the two day Speights Coast to Coast race where he finished 2nd in the open men's category. During the mid year break Aaron travelled to Bulgaria to represent NZ at the Junior World Orienteering Championships where he achieved the best results of the NZ team, in a sport traditionally dominated by the Scandinavian and European countries. After completing his 1st pro exams, Aaron teamed up with Steve Gurney, Kathy Lynch and Nathan Faavae to win this year's Southern Traverse race. The race was held in the Nelson region and involved sea kayaking, mountain biking, mountain running, abseiling and white water rafting over four days. ◆

Last year BRANZ (Building Research Association New Zealand) awarded the Student Work Experience Scholarship for the first time. It was awarded to Richard Gardiner, then a 3rd year civil engineering student. The award is sponsored by BRANZ in association with Queen's University in Northern Ireland. Richard spent 10 weeks working at Queen's University. The aim of the scholarship is to provide students with course-related practical experience abroad, which in turn allows a better understanding of foreign techniques and markets.

Where are they now? Can you identify these alumni? (Hint: Some are current academics)



1) 1960's - John Berrill found time for some skiing with friends
2) 1967 - Peter Moss working hard
3) 1962 - John Berrill and Athol Carr at survey camp - can you find them?

University of Canterbury represented in the Olympics

New Zealand will have a coxless four team in the Sydney 2000 Olympics. Half the team are Canterbury graduates: Scott Brownlee (ME 1995) and David Schaper (BSc 1995). Along with Toni Dunlop and Rob Hellstrom, these four recently placed third in the semifinals, and fourth overall in the finals, at the Rowing World Championships held in St. Catherines, Canada. To qualify for the Olympics, the team had to place within the top ten teams, which they did with room to spare. We wish them the best of luck in this endeavour.

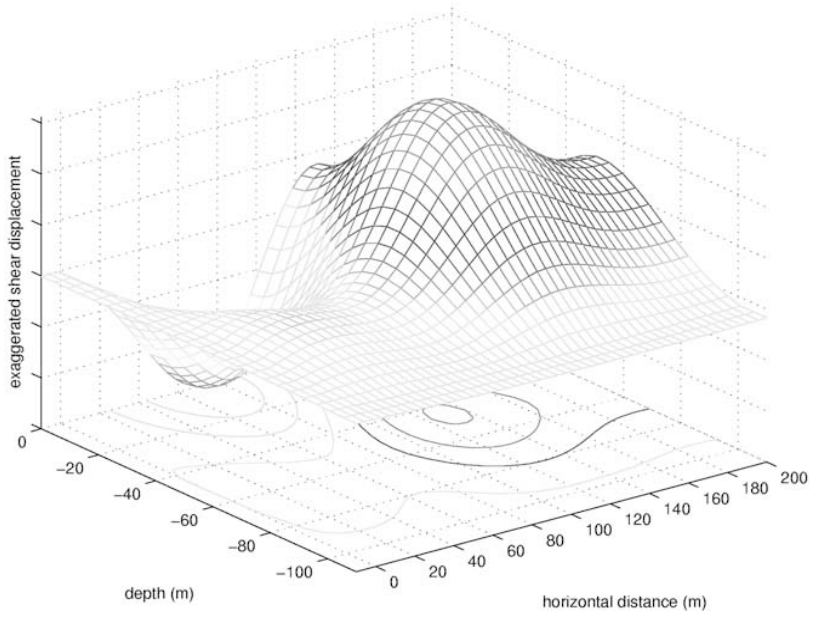
Ground Shaking in Wellington

How strong could the ground really shake in Wellington? Brian Adams, a PhD student in the Department of Civil Engineering, has been using computer-modeling techniques to start answering that question.

Recent overseas earthquakes such as in Kobe, Japan and Northridge, California have shown us the devastating effect that local geology, especially sedimentary basins, can have on the intensity of shaking. Noted in both these earthquakes were bands of damage on deep sedimentary sites close to the edge of adjacent hills. The bands of damage – indicative of strong localised shaking – appeared to be caused by constructive amplification between waves trapped within the sediments.

Brian's project, funded by the NZ Earthquake Commission (EQC), started out to investigate the possibility of such a large amplification within the highly populated sedimentary basins of Lower Hutt and Wellington. Here the potentially active Wellington Fault forms a sharp edge to the deep tectonically-formed basin, providing ample motivation for the study.

Working with geologists from the Institute of Geological and Nuclear Sciences (IGNS) in Lower Hutt, Brian was able to develop a suitable model of the greywacke basement rock and the soft alluvial and marine sediments forming the Wellington Basin. Finite-element techniques were then used to model the propagation of seismic waves through the geological layers. Simulations were carried out on one of the department's DEC Alpha workstations, taking up to 20 hours of computing time.



A graphical representation of a shear wave propagating through a finite-element model. The mesh has been constructed to show out-of-plane displacement in the cross-section of a 100 metre-deep sediment-filled basin, bounded to the left and below by stiff bedrock. The large negative displacement seen on the surface (depth = 0) at a horizontal distance of 70 metres from the edge is an example of constructive amplification.

The software used was a package called Archimedes, developed under NSF funding by computer scientists and engineering seismologists at Carnegie Mellon University in Pittsburgh, Pennsylvania. In 1997, Brian spent two months at Carnegie Mellon, learning the technique before installing it on a computer in our department.

The presence of strong constructive amplification near the basin-edge was indeed evident in some of the modeling. It has been estimated that ground accelerations may exceed 1.3g in Lower Hutt Central, and 1.1g in Wellington City. Certain frequencies may be amplified up to 18 times that expected on nearby rock sites.

John Taber, a seismologist at Victoria University in Wellington who has been co-supervising Brian's project along with Civil Engineering lecturers Rob Davis and John Berrill, is currently processing a set of weak motion records from an array of seismographs across the basin edge in Lower Hutt. It is hoped that these will provide some real experimental evidence to verify the computer modeling.

Another source of data to validate modeling techniques will come from South America. Brian travelled to Colombia for two weeks in August with the aim of comparing a computer model with existing earthquake records. He was aided by Professor Juan Jaramillo – a recent visitor to this department from the EAFIT University in Medellin, Colombia – who oversees a large seismograph network in the city. Before finishing his PhD in July 2000, Brian hopes to use his techniques to model several other sedimentary sites in New Zealand, in order to assess their vulnerability to such strong localised seismic amplification. ◆

For further information please consult:

Adams, B.; Davis, R.; Berrill, J.; Taber, J. (1999) "Two-Dimensional Site Effects in the Hutt Valley - Similarities to Kobe" Civil Engineering Research Report 99-3. University of Canterbury

Hydrological Training Course in Kathmandu

Bente Clausen was one of six instructors who along with fifteen participants gathered for a hydrological training course at the International Centre for Integrated Mountain Development (ICIMOD) in Kathmandu, Nepal, during the (unusually warm) period 19-24 April 1999. The training course and the workshop were one of the first activities of the Hindu Kush Himalayan (HKH) FRIEND project, which is one of the seven projects under FRIEND.

Bente reports: 'I was so fortunate to be one of the teachers of the course, which was both challenging and interesting because of the participants' different cultural backgrounds.'

The participants, twelve men and three women, came from Nepal, Bangladesh, Pakistan, India and China. Most held a Masters or PhD degree, and the age ranged from approximately 25 to 45 years. Some were teachers at universities, some came from hydrological operating agencies and ministries, and some were from private consultancies.

The course can be regarded as assistance to the region by trying to enhance the understanding of hydrology. All teachers had obtained their own travel funding, whereas participants were sponsored by the FRIEND project through the Institute of Hydrology in the UK. 'I am most grateful to the Department of Civil Engineering for making my time available and for other support, and to the NZ National Commission for UNESCO and the NZ Hydrological Society for travel support. Without these supports my contribution to the course would not have been possible'.

WHAT IS FRIEND?

FRIEND stands for Flow Regimes from International Experimental and Network Data and is an international collaborative study in regional hydrology, now designated Project 1.1 of UNESCO's fifth International Hydrological Projects (IHP). A core element of the programme is the development of international flow databases across political boundaries and the exchange of hydrologic analysis methods and techniques.

The FRIEND programme was initiated as a research project in Northern Europe in 1985 and has since then expanded considerably and now involves research institutes, universities and operational agencies from more than 90 countries. A key element of FRIEND projects in developing countries is capacity building through technical training and scientific workshops. The Hindu Kush Himalayan (HKH) FRIEND project involves eight countries of the HKH region: Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan.

THE TRAINING COURSE

The training course was organised and taught by members of FRIEND Low Flow groups. The level at which the teaching was aimed seemed to match the backgrounds of the participants surprisingly well.

Along with four days of intensive classroom training, the course included a field day. This included hands-on experience in flow measurement using appropriate equipment such as current meters and dilution gauging with tracers. The measurements were made in Sundarijal, a hilly stream near Kathmandu. The flow was measured as 135 l/s. Mean annual flow in the stream is about 300 l/s. Given that Sundarijal delivers approximately 50% of Kathmandu's water supply, these data illustrate the need for low flow studies in the region. In Nepal there are only 43 automatically gauged stations while the WMO recommendation is 150-500.

As a result of the established connections between FRIEND members, two 3rd year Civil Engineering students, Jared Petterson and Ann-Marie Mulligan, are now doing their practical

work experience in this part of the world. Jared is going to stay four weeks with the Department of Hydrology and Meteorology in Kathmandu, Nepal. In January and February 2000 both he and Ann-Marie are going to spend about a month at the Alternate Hydro Energy Centre at the University of Roorkee, India.

'I believe that connections with the developing part of the world are essential for understanding the global hydrological problems', Bente concludes. She hopes to be able to take part in other courses and research projects within the FRIEND regime in the future. ◆

Out and About

Study Leave Report - Mark Milke

The first three weeks of his leave were spent at the Pontificia Universidad Católica de Chile in Santiago, which Mark calls "the other leading University in Chile" (see John Berrill's report). While a visiting lecturer at the Department of Hydraulic and Environmental Engineering, he gave a short course in Spanish to post-graduates on landfill design and operation.

"At the time, landfills were a red-hot topic in Santiago. An old dump was being closed, and a new, engineered, sanitary landfill had just opened. I had discussions with some government officials, and it was clear that there was a great deal of work in store for engineers in upgrading disposal facilities throughout the country." He also was interviewed on the topic for the local equivalent of '60 Minutes' while there.

Reporting on the University, Mark notes that "The University has among the best students in the country, but was struggling to find funds to pay its best staff, equip laboratories, and support post-graduate research." On the social side, he was impressed by the speed of modernisation, and how people worked longer hours there than anywhere else he had lived.

From January to May, 1999, Mark was a visiting scholar at the University of Iowa, where he had dealings with both the Department of Civil and Environmental Engineering and the Center for Global and Regional Environmental Research. There he worked on a textbook for our Department's course *Environmental Analysis*, finishing about one-third of it during the year. Why Iowa? "I found that an Iowa winter is conducive to book writing. It was a very friendly community. If you can imagine Southland multiplied by 20, you get a good idea of what Iowa was like."

While overseas he also visited a few other places and gave a few seminars. He visited the County Sanitation Districts of Los Angeles for half a day and discussed new technologies in land disposal of solid wastes. "There I touched base with perhaps the leading practitioners in the world". While overseas, he also visited Florida International University in Miami, and the University of Missouri.

Mark is back and trying to be active in the Canterbury landfill debate without being buried by it. He has been writing to the Christchurch Press, and has been active in the Center for Advanced Engineering's team that is writing National Landfill Engineering Guidelines. He also gave a lecture on Solid and Hazardous Waste Management to Canterbury's elected councillors.

Doctoral Examination Athol Carr

Athol travelled to Trondheim, Norway in November to be a member of the examination panel for a doctoral examination on *Estimation of Earthquake-Induced Response*, by Simon Olafsson. Several days were spent in discussion with colleagues on the changes in the teaching of structural engineering and on research in dynamic analysis and finite element analyses.

Keynote Speaker Bruce Hunt

Bruce was the invited Keynote speaker at the International Conference on Water, Environment, Ecology, Socio-Economics, and Health Engineering from 18 - 21 October in Seoul, Korea. He gave a paper entitled "Variable Dispersion Coefficients in One-Dimensional Contaminant Transport Problems." With the address he tried to explain why dispersion coefficients measured in pipe flow, open-channel flow and groundwater-flow sometimes increase with the first power of distance downstream from the point of contaminant release. The conference had about 200 participants from many different countries.

Study Leave Report John Berrill

While on study leave in South America last year, John Berrill found that Chile was somewhat ahead of us in the Market-Forces game. Here is an excerpt from his Leave Report:

"The University of Chile is the leading university in the country and draws its students from the top 4 percent of high school graduates. It has high academic standards, and its graduates are found in leading posts throughout the world. However, with the adoption of Chicago economics during the Pinochet dictatorship, tertiary funding from the government was opened to competition from new institutions and something like forty new universities sprang up in Santiago alone. These taught the easy subjects, leaving the expensive, laboratory-intensive ones to the two or three established institutions. While the old universities are still the first choice of top students in all disciplines, their government funding has dropped enormously, and their vitality has suffered. The effects are felt particularly in staff salaries, library purchases, and in laboratory equipment. Many staff, often the most able, have left, so that those remaining are greatly overloaded. Most have second jobs to bring in money for family and department, compounding the problem. There is a clear warning there for us."

The department has come a long way since we were in this building.

Interested in finding out a bit more about our history? Then please visit our website's 'About Us' area and download the pdf file Our History.

Our website address is:
www.civil.canterbury.ac.nz

Unbonded Prestressing in Precast Walls

Amar Rahman and Paul Murphy (Structural Lab Technician) setting up testing

A series of half-scale quasi-static tests of precast walls are currently underway in our structures lab. These tests are investigating the use of a novel connection mechanism for precast wall units incorporating unbonded prestressing tendons. "Existing building codes for construction in earthquake zones aim at life preservation. This project's aim is to go further, to lessen structural damage and post-earthquake rehabilitation, ultimately minimising the economic impact of reconstruction." said Amar Rahman, a postdoctoral fellow in the department.

The experiment will establish design criteria for this connection mechanism in precast wall construction. Since the aim of this type of connection mechanism is to maintain integrity of the precast wall unit under large lateral displacement, additional energy dissipation mechanisms (such as "dogbones") will also be examined. Without them, nonlinear response can occur due to the development of gaps at the end of the wall.

An analytical study on this construction alternative is being carried out by visiting scholar Mario Rodriquez, of the National University of Mexico (UNAM). He is investigating the effects of the reduced energy dissipation characteristics on the overall structural response.

The research project is funded by the Foundation for Research Science and Technology. José Restrepo, the project leader, said the hope was to construct new commercial and industrial buildings using this technology in the next 10 years. ◆

The Department's structural lab is an internationally recognised centre of excellence for research into reinforced concrete.

Thinness of Precast Concrete Walls Tested

In New Zealand, structural reinforced concrete walls have been recognised as one of the most efficient earthquake resisting systems for low to mid-rise buildings. A recent research project in the department examined the thinness of these walls.

A special characteristic of such walls is their relative slenderness that helps to minimise lifting weights and construction costs. Designers have wondered if it would be advisable to use even thinner wall panels than currently permitted under NZS3101, the Concrete Structures Standard.

The Cement and Concrete Association of New Zealand (CCANZ) funded Methee Chiewanichakorn, a ME student in Civil Engineering, to research the performance of thinner walls. To do so, a number of slender precast concrete 1:2.5 scale walls were tested to failure under reversed cyclic loading with increased displacement level.

Overall, the thin single precast concrete performed better than had been expected under seismic and gravity forces, when compared with other recent tests. With one exception, the relevant displacement ductilities for design reached 2.5 without significant strength degradation.

The one exception was for a test unit experiencing an additional, eccentric vertical load. Two test specimens, both with a lap splice length (ie, the overlapping distance of the foundation's reinforcing bars and the wall's) of 300 mm, were tested in the Department's laboratory, one with the eccentric vertical load and one without. The eccentric vertical load represented the gravity load of a roof at the top of a thin wall.

The unit with the eccentric vertical load experienced lateral buckling failure, while the one without it did not. The failure occurred due to significant cracking in the lower half of the wall. This behaviour indicates that thin concrete walls with realistic gravity loads may not be as capable of deforming inelastically as designers might have assumed.

The varying modes of failure of thin precast walls, as seen in this and earlier work, have caused concern among structural designers. There is growing realisation that an expanded testing programme is required due to the wide range of variables involved in the design of these walls. As a result, there are ongoing discussions between the Departments of Civil Engineering (Canterbury and Auckland), the CCANZ and the Building Research Association of New Zealand on a comprehensive collaboration on testing and resolution of design issues of thin walls. ◆

M.E. By Examination 1999/2000

Name	Supervisor(s)	Project Title
Burdon, N	McManus/Bull	Earthquake Resistance of Shallow Foundations
Kueh, H	McManus	Pile Lateral Displacement During Earthquakes
McDonald, M	Clausen	Investigation into Velocity-Area Method Calculations for Streamflow Measurement
McLean, A	Sutherland	Coastal Erosion
Whiteside, M	Bull	Seismic Performance of Slender Precast Reinforced Concrete Walls with Steel Fibres

M.E. By Examination and Thesis 1999/2000

Name	Supervisor(s)	Project Title
Bishay Girges, N	Carr	Damping Models for Inelastic Structures
Chen, Y	Milke	Improving Methods for Estimating Landfill Settlement
Chey, M	Carr/Moss	Structural Control Using Tuned Mass Damper System
Chu, K	Carr	Soil Interaction of Masonry Infilled Frame With Openings
Holman, J	Wareham	Aerobic Denitrification in Sequencing Batch Reactors
Hou Ming	Carr	Base Isolated Bridges
Jacka, M	Berrill	Seismic Lateral Spreading
Jiang, N	Moss/Cooke	Steel Plated Shear Walls
Ling Hung H	Carr	Finite Element Analysis of Shell Structures
Lyons, C	McManus	Liquefaction Effect on Pile Foundations
Malan, P	Berrill	Directional Effects in the 1994 Arthur's Pass Earthquake
Milligan, A	Elms	Safety and Risk Management Using Indicator Diagrams
Plew, D	Spigel	Sediment Transport Model for Urban Streams
Simmons, P	Bull	Seismic Performance of Single Storey Straight Stair Flights with Mid-height Landings
Stockman, M	Restrepo/Park	Pre-1975 Building Columns' Lap Splice Regions Under Seismic Loads - Repair & Retrofit
Strang, T	Wareham	Optimization of Rock Filter Design for Maturation Ponds
Thompson, N	Carr	Curved Reinforced Concrete Shells
Toranzo, L	Carr/Restrepo	Partially Infilled Reinforced Concrete Frames Under In-Plane Lateral Load
Tsuno, K	Park	Seismic Design of Reinforced Concrete Bridge Piers
Weir, J	Hunt/Clausen	Stream Depletion from Groundwater Pumping
Wong Ka Leung	Buchanan	Steel Rod Tests in Glulam Timber Connection

Fire Engineering M.E. By Examination 1999/2000

Bryne, P	Buchanan	Domestic fire safety in New Zealand
Bong, NP	Fleischmann	Fire spread up exterior walls
Collier, P	Buchanan	Fire resistance of light timber frame walls
Davis, S	Fleischmann	Water supply for fire fighting
Denize,H	Fleischmann	The combustion behaviour of upholstered furniture materials in New Zealand
Feeney, M	Buchanan	Probabilistic assessment of fires in steel buildings
Girges, N	Fleishcmann	Full-scale compartment fire experiments of upholstered furniture
James, M	Buchanan	Fire resistance of seismic gaps
Lewis, K	Buchanan	Performance design for fires in NZS3404
Lim, L	Buchanan	Stability of Precast Concrete Tilt Panels in Fire
Mason, J	Buchanan	Computer software for thermal analysis of fire exposed structures
Nielsen, A C	Fleischmann	CFD modelling of vent flows
Teo, P	Buchanan	Implementation of performance-based codes
Weaver, S	Fleischmann	Experimental data reduction techniques for
Yii, HW	Buchanan	Fire load surveys

Ph.D. Students 1999/2000

Name:	Supervisor(s)	Topic
Adams, B	Berrill/Davis	Wellington Fault (Two-dimensional Site Effects - Similarities to Kobe)
Allington, C	Bull/Park	Ductility Performance of Structural Light-weight Concrete Subject to Seismic Loading
Arampamoorthy, H	Nicholson	Analysis of Spatial Distribution of Accidents
Bakir, S	Elms	Risk Management and Life Line Engineering
Chambers, A M	McManus	The Seismic Response of Drilled Shaft Foundations
Charng, P H	Carr	Base Isolation for Building Structures
D'Adamo, N	Spigel	Seasonal Dynamics of Cockburn & Adjacent Coastal Waters, Western Australia
Dong Ping	Carr	Seismic Damage Analysis for Reinforced Concrete Ductile Framed Structures
Ellis, M	Wareham	Biological Denitrification of Potable Water Using Coconut Shells in a Fluidised Bed
Hou, S-L	Milke	Bioremediation of Petroleum Contaminated Soils and Oil Sludges
Lin Cheng-Ming	Restrepo/Park	Seismic Design of Moment Resisting Frames with Distributed Reinforcement
Liu, A	Carr/Park	Seismic Assessment of Pre-1970s Existing Reinforced Concrete Building Frames
Matthews, J	Restrepo/Bull/Park	Floor Diaphragm Forces Following Seismic Damage to the Supporting Beams
Presland, R A	Park	Seismic Performance of Reinforced Bridge Structures
Rocco, G	Nicholson	Origin-Destination Matrix Estimation: The Choice of Traffic Count Location
Saunders, D	Restrepo/Carr	Pushover Analysis for Reinforced Concrete Frames' Inelastic Performance
Steven, B	Davis	Pavement Performance Model Suitable for Use with New Zealand Materials
Walls, A	Elms	Achieving Quality Environmental Solutions
Wang, J	Carr/Cooke/Moss	Non-linear Seismic Response of Highway Bridges with Pile Foundations
Wang, Y	Restrepo/Park	Seismic Retrofitting of Reinforced Concrete Elements Using Advanced Composites
Zaghlool, B	Carr/Moss	Modelling of Multi-Storey 3D Structures Under Orthogonal Seismic Excitation
Zhang, J	Carr/Moss	Seismic Soil Structure Interaction

Ph.D. In Fire Engineering 1999/2000

Name	Supervisor(s)	Project Title
Clement, J M	Fleischmann/Spigel	Verification of the hydrodynamic model within the large eddy simulation fire code
Parkes, A	Fleischmann	Compartment fire growth histories
Yii Ee H	Buchanan/Fleischmann	Severity of Post-Flashover Fire

Closing Note:

We welcome Andy Buchanan as the incoming Head of Department, beginning a three year term on 1 March 2000. Andy takes over from Nigel Cooke, who assumed the role of Acting HOD in September 1999, and Kevin McManus who served as head from 1997 to 1999.

Postgraduate Courses Available In 2000

Semester 1 (March - July)

RISK ASSESSMENT - M Milke & M Spearpoint
Probability theory revision, risk communication, fault and event tree analyses, capacity demand problems, reliability index, Monte Carlo methods, civil and fire engineering applications.

STRUCTURAL DYNAMICS - A J Carr & A Reinhorn
This course will cover such topics as active control and dynamic experiment measurements.

TRAFFIC MANAGEMENT - A J Nicholson
Traffic management and transport policy; goals and procedures; policy formulation; traffic management model calibration.

CONSTRUCTION OPERATIONS ANALYSIS AND MANAGEMENT F L Bennett
Improving the management of construction organisations, projects and operations with emphasis on the utilization of information technology. The topics will be of interest to those intending a career in construction as well as those who will be less directly involved through roles with project designers and owners.

FIRE ENGINEERING - Franssen & A H Buchanan
Introduction to specific fire engineering design of buildings. Fire resistance of structures. Active and passive fire protection. Fire spread calculations. Fire risk assessment. People and fires.

FIRE DYNAMICS - C M Fleischmann
Fire Science and Combustion. Heat transfer. Ignition and spread of flame. Pre-flashover and post-flash over compartment fires. Production and spread of smoke.

ADVANCED TOPIC IN STRUCTURAL ENGINEERING J Stanton & J Restrepo
Introduction to precast concrete systems. Seismic design of walls, frames and low and high rise buildings. Design of fastenings.

GEOTECHNICAL SEMINARS - J B Berrill and Visitors
Geotechnical case studies and research projects will be presented by staff of the Geotechnical Group and visitors. Students will submit brief summaries of each seminar and present one major case study themselves.

WATER CHEMISTRY - D G Wareham
Applications of principles of physical chemistry to the description and composition of natural waters and engineering treatment of drinking water and wastewater. Studies of acid/base chemistry, complexation, precipitation, and oxidation-reduction potential chemistry.

Semester 2 (July - October)

INTRODUCTION TO CONTINUUM MECHANICS G Mullenger & R O Davis
The study of deformation, stress, and strain in deformable bodies. Elasticity, fluid dynamics.

GROUNDWATER FLOW - B Hunt
The physics and analysis of flow and contaminant transport in groundwater.

STRUCTURAL CONCRETE - D K Bull & J I Restrepo
Insitu concrete seismic design and analysis; retrofit of bridges; forensic engineering.

FINITE ELEMENT ANALYSIS - A J Carr & P J Moss
Direct stiffness method; triangular and quadrilateral finite elements in two dimensions; three dimensional elements; plate bending; shells; hybrid stress finite element; mesh generation & result presentation; use of software such as ABAQUS

FIRE SAFETY SYSTEMS - M Spearpoint & C Fleischman
Fire detection and alarm systems. Automatic sprinkler systems. Fire extinguishment and water supplies. Smoke control systems. Integration of fire safety systems with building services. Escape route planning.

HYDRAULIC HABITAT MODELS - B Clausen & Visitors
Theory and application of hydraulic habitat models for assessing the habitat of a particular species in streams and rivers, and for predicting the change in habitat as a result of changes in flow regime. Hydraulic and biological modelling.

TRANSPORT AND THE ENVIRONMENT - P J Hills and A J Nicholson
Resource depletion and energy consumption; identification and measurement of environmental disturbances; vibration; traffic noise, alternative fuels and thermal efficiencies. Perception and measurement of pollution and visual intrusion. Assessment and valuation of environmental impacts including the greenhouse effect.

ROAD ACCIDENT ANALYSIS, REDUCTION AND PREVENTION A J Nicholson
Impact on society, data analysis and interpretation, problem diagnosis, selection of treatment, economic appraisal and evaluation.

ENVIRONMENTAL IMPACT - H Thorpe, D G Wareham, & N J Peet
Environmental issues at global and local levels, ecology, system principles, environmental legislation, environmental assessment techniques, case studies.

The department offers postgraduate courses as part of study for the Diploma in Engineering and the Masters in Engineering. These courses can be taken by part-time or full-time students. The courses listed above will be offered by the Civil Engineering Department staff in 2000. All course offerings are subject to sufficient student numbers. For more information, contact Postgraduate Secretary, Department of Civil Engineering, University of Canterbury, Private Bag 4800, Christchurch, New Zealand. (phone: 03-364-2380, fax: 03-364-2758)