A New Course Producing Professional Surveyors and Engineers for the Land Development Industry

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Abstract

In 2000 a new combined course commenced at The University of Melbourne known as the Bachelor of Geomatics Engineering/Bachelor of Planning and Design (Property and Construction). The course, to be offered jointly between the Department of Geomatics in the Faculty of Engineering, and the Faculty of Architecture, Building and Planning, has been designed specifically to provide a comprehensive and integrated educational program that delivers professional engineers and surveyors to meet the future needs of the land development industry. In addition to taking geomatics subjects in the areas of measurement science, geographic information science and land administration, students enrolled in the BGeomE/BPD course will also take subjects in property development (including shopping and retailing), construction technology, construction management, construction law, accounting and development management.

1. Introduction

The new combined degree of Bachelor of Geomatics Engineering (BGeomE) and Bachelor of Planning and Design (BPD) (Property and Construction), which commenced in 2000, builds on a long history of combined degrees offered by The University of Melbourne. While students now take a Bachelor of Geomatics Engineering with either of the generalist degrees of Bachelor of Science (BSc) or Bachelor of Arts in any specialisation, most students opt for a combined degree program which capitalises on the strengths of both degrees. When combined degrees were first offered by the Department of Geomatics in the mid-1980s, the first program was with a BSc in Computer Science. This offered an obvious synergy with all graduates being eagerly sought after by industry. This was followed by a BA with a major in Geography, a BSc in Environmental Science, and combined degree programs with the Bachelor of Information Systems and Bachelor of Laws. While most students undertaking a BGeomE with a BSc or BA take one of the combinations mentioned above, students are allowed to take any major in the generalist degree. For example, some students are taking archeology or take languages in the BA, while others are studying geology, mathematics or meteorology in the BSc. Typically, programs are for five years full-time with the BGeomE/LLB being six years.

We believe there are a number of reasons for the success of combined courses. Firstly, some students take them in order to enhance their professional skills in multi-disciplinary areas, for example in the BGeomE/BA where their specialisation in the BA may be environmental policy and management while the associated spatial information science and technology is the attraction in taking Geomatics Engineering. Secondly there is the appeal of multiple accreditation and employment prospects, and students taking the BGeomE/BSc (specialising in computer science) for instance not only obtain accreditation with the Surveyors Board of Victoria, the Institution of Surveyors Australia and the Institution of Engineers Australia, but also with the Australian Computer Society which is considered to be the peak body in its field. Finally, there are students who take a combined course simply in order to have extra employment options in case they find they are not attracted to one of the disciplines they are studying. Whatever the reason, these combined programs have been very successful in helping to attract bright young women and men to Geomatics Engineering around the nation. In summary the attraction is simply the increased career options that such a program offers in today's competitive job market.

Today about 70% of students studying Geomatics Engineering at the University of Melbourne take combined degree programs. However a combined degree program is not for everyone and it does take longer with added costs. As a result many capable students who wish to eventually proceed to postgraduate study in Geomatics Engineering undertake the four-year BGeomE option, which allows them to complete a masters degree in less than six years or

a doctorate in about seven years. In addition, there is a core of students who wish to pursue Geomatics Engineering for its own sake and are not interested to taking a second degree in another area. Many of them have a strong desire to become qualified cadastral surveyors because they see it as a profession offering the opportunity of an outdoor occupation, the possibility of establishing their own business and the chance to travel if they wish. This is an attitude that needs to be preserved and nurtured—more so today than ever before as professions come under increasing threat and competition. Although these students are well-served by the traditional 4-year Geomatics Engineering degree, there have always been limitations on the quantity and depth of course material that could be devoted to specialist land development and property subjects. This situation has become particularly acute in the past decade when new subjects such as GIS, remote sensing, spatial analysis and environmental investigation have been added to the core content of the BGeomE course to match local and international trends in the broader field of spatial information science and technology.

Accordingly, the new Bachelor of Geomatics Engineering/Bachelor of Planning and Design (Property and Construction) has been designed to meet the demand for specialised cross-disciplinary Chartered Professional Engineers and professional Land Surveyors in the land development industry. Prior to starting this combined degree program, the Department of Geomatics had discussions and received feedback from the Association of Consulting Surveyors Victoria (ACSV) on the focus for the program and the future demand for its graduates within industry. The ACSV confirmed the University's view that a large number of professional land surveyors work within the land development industry, yet there are few professional qualifications they can take to educate themselves further in this area. The ACSV also confirmed the desirability of the graduates working in the land development area being both Chartered Professional Engineers and professional Land Surveyors, in addition to having specialist experience in property and construction.

The remainder of this paper describes the course objectives, the property and construction syllabus in detail, and the progress of the course to date following the first student intake.

2. Course Content

The objectives of the BGeomE/BPD course are that upon graduating students will have:

- ?? in-depth knowledge and skills within Geomatics Engineering and Property and Construction to enable them to enter the land development, property and construction industries;
- ?? a sound fundamental understanding of scientific and engineering principles and methods;
- ?? analysis, problem solving and design skills;
- ?? a capacity to apply practical skills towards the development of mathematical and computer-based

solutions of problems in Geomatics Engineering, land development, land administration, and property and construction;

- ?? verbal and communication skills that enable them to communicate effectively in the context of defining and solving problems;
- ?? a sound understanding of the principles underlying the management of physical, human and financial resources;
- ?? developed skills, personal attributes and depth of knowledge which equip them for positions of leadership in basic and applied research, engineering and management of technology-intensive enterprises;
- ?? an appreciation of the roles and responsibilities of engineers, surveyors, architects, land developers and related professionals in society;
- ?? acquired the necessary educational, technical and professional standards of the Institution of Engineers Australia, the Institution of Surveyors Australia, and the Surveyors Board of Victoria; and
- ?? a firm understanding of the extent to which team work underscores the production of property and the construction of buildings, and have acquired an appreciation of the interpersonal, communication and management skills necessary for the successful practice of property and construction.

Students enrolled in the BGeomE/BPD combined course will take 300 points worth of Geomatics Engineering subjects in the areas of measurement science, the mapping sciences, spatial and geographic information systems, and land administration, as well as the fundamental areas of mathematics, computer science, and professional studies. They will also take 200 points of Property and Construction subjects in the fields of property development, construction technology, management of construction, construction law, accounting and construction cost management. Students completing the BGeomE/BPD course must accumulate a minimum of 500 points and normally 100 points are taken per year by full-time students.

While there is some flexibility in choosing subjects from the Property and Construction stream, the subjects in the Geomatics Engineering stream must be completed in order to meet the requirements of the Institution of Engineers Australia (so the graduate can become a Chartered Professional Engineer) and the Surveyors Board of Victoria (so the graduate may become a Licensed Surveyor). It should be noted that in this combined course the Bachelor of Planning and Design does not immediately lead to professional accreditation in Property and Construction—that status normally comes after a further year of professional practice followed by another year of academic study, when the student receives the additional Bachelor of Property and Construction (BPC) degree. The 5-year study program for the combined course is as follows:

1st Year

Introduction to Programming for Engineers and Scientists
Introduction to Computer Systems and Graphics

Geomatics Science 1B
Geomatics Science 1A
Mathematics A
Construction Technology 1B
Construction Technology 1A
Management of Construction 1

2nd Year

Geomatics Science 2
Introduction to GIS and Remote Sensing
Mathematics B
Experimental Design and Data Analysis
Shaping the Metropolis
OR
The City in History
Property 1
Construction Technology 2A
Construction Technology 2B

3rd Year

Environmental Visualisation and Mapping
Accounting Concepts
Computational Methods in Geomatics
Least Squares Estimation and Network Analysis
Professional Development
Introduction to Planning, Property and Surveying Law
Built Environmental Sciences
Introduction to Construction Cost Management

4th Year

Information Science & Programming
Imaging in the Geosciences
Cadastral Surveying and Land Development
Satellite Positioning and Geodesy
Application and Development of GIS
OR
Integrated Systems in Geomatics
OR
Photogrammetry
Property 2
Strategic Planning & Development Management
Shopping and Retailing

5th Year

(Geomatics) Research Project
Land Administration
Residential Subdivision Design
Professional Development & Research Methods
Property 3
Construction Cost Planning & Control
Construction Law

The Bachelor of Property and Construction is the second tier of the two-tier program. The first tier is the BPD (Property and Construction) a pre-professional degree. The second tier (the BPC) is undertaken after an industry year. It is the professional degree that leads to full accreditation by the Royal Institution of Chartered Surveyors, arguably the leading international organisation representing the landed professions. It also leads to accreditation by the Australian Property Institute, the Australian Institute of Building and the Australian Institute of Quantity Surveyors depending upon the stream which

has been selected. The three streams are:

?? Building construction management,
?? Building economics/quantity surveying, and
?? Property development and investment.

The BPC year is outlined below. Subjects from the property development and investment stream only are illustrated in this paper.

The BPC Year

Advanced Construction Law
Transport and Land Use Planning
Property development and Investment
Advanced Services
Planning Law
Asset Management
Electives (2 subjects)

Cognate electives include Advanced Quantity Surveying, Project Administration, Project Development and Management, Advanced Construction, Investigation Program and Research Project but students may seek other electives from the wide range of subjects available at the University of Melbourne.

3. Property and Construction Course Content in Detail

While the contents of the Geomatics Engineering subjects are consistent with that of other Australian courses in this field, the property and construction subjects deserve further description.

3.1 Construction Technology Subjects

There are four subjects in the construction technology group. In *Construction Technology 1A* students are required to independently visit a site regularly during the semester and undertake a major report-based project introducing construction practice at a domestic scale. They also study the modes of structural action and the behaviour of materials for a range of simple structural systems, techniques for approximating the size of structural members, the purpose of structures in buildings, the taxonomy of elements of structural systems, load paths in structures, and analysis and conceptual structural design.

In *Construction Technology 1B*, students are taught construction principles, materials, and techniques commonly used in residential construction. Lectures follow the construction sequence and cover excavations, footing systems, ground slabs, brickwork, sub-floor wall and roof framing, flooring, roof coverings and drainage, windows, internal linings, fitouts, joinery, staircases, floor and wall tiling and finishes, electrical and plumbing services, and external site works. They are also introduced to building regulations and compliance with Australian Standards for construction.

In the second year, *Construction Technology 2A* introduces students to construction methods, materials and detailing commonly used in commercial factories,

warehouses and office buildings up to 3 storeys in height. The lecture series again follows the construction sequence and includes site establishment, footing systems, basements, ground slabs, tilt slab and pre-cast walls, drainage, steel framing, fasteners, mezzanine floors, composite construction, facades, roof and wall cladding, roof drainage, partitions and false ceilings, windows and joinery, stairs, wet areas and services.

Similarly, following on from first year studies, *Construction Technology 2B* focuses in more detail on structures including the design of elements and of determinate structures and an introduction to indeterminate structural analysis, deflections, structural design and the role of the consultant engineer, and the application of structural design codes including loading codes. Students are introduced to soil mechanics and the characteristics and physical properties of rocks and soils, and their influence on the design of building footings and building behaviour.

3.2 Property Subjects

The property group consists of three subjects. In *Property 1* students commence their studies by examining the concept of real property and improvements to and on land. They are introduced to the critical link between property and the economy, and are educated in property markets and sub-markets, the concepts of investment and yield, basic financial mathematics, the principles of valuation and appraisal, property planning, location theory and property development. Practical work is focussed on the residential property market.

The *Property 2* subject continues with study of the application of financial mathematics to property valuation and analysis, further investment theory, and property market analysis in commercial, retail, industrial, and multi-unit residential markets. More detailed material is taught in the area of property investment analysis and discounted cash flow, valuation theory and practice, the income, cost and market comparison approaches, property management, statutory costs and building operating costs.

Finally, in *Property 3* students learn asset valuation and financial analysis, the concepts of price and worth, valuation for statutory purposes, compulsory acquisition and compensation, property finance and taxation, property market analysis, and the relationship between property and business. Property law is also covered in this subject, including the concept of property and ownership in Australia, the General Law and Torrens land registration systems, and the nature, creation, acquisition, disposal, enforceability, priority and registration of property interests, including possession, easements, restrictive covenants, fixtures and chattels, licences and leases.

3.3 Construction Management Subjects

The construction management group includes five subjects. In *Accounting Concepts* students are taught the basic balance sheet and income statement concepts of assets, liabilities, owners' equity, revenue and expenses. They also cover the measurement of profit, the balance sheet and income statement relationship, the nature of

depreciation, methods of calculating depreciation, job costing and project accounting, profit measurement in relation to projects, cost/volume/profit analysis as a short-term decision tool, discounted cash flow analysis as a tool for long-run decisions and basic taxation.

The *Management of Construction 1* subject gives a broad overview of the Australian Construction Industry, the parties involved in the construction process including the owner, contractor, consultant, regulator and site staff, an introduction to project procurement, mathematical concepts of time management, manual calculation of small critical path networks, and the tendering and bidding process.

Introduction to Construction Cost Management overviews cost management issues and the preliminary techniques of cost planning. Lectures are also given in understanding the Australian Standard Method of Measurement including measurement techniques for bills of quantity preparation, builders estimating and bidding practice, and introductory approaches to construction cost control.

The *Construction Cost Planning and Control* subject continues examination of financial management of the construction process and the practice of the professional quantity surveyor. The subject concentrates on preparing cost plans, construction price forecasting, and construction cost control techniques.

Finally, in *Construction Law* students are provided with an introduction to both theoretical and practical aspects of the law relating to construction. Fields of study include legal processes and the legal system, statute and common law, contract law including building contracts and implied terms, tendering, an introduction to building dispute resolution, insurance law including project insurance and professional indemnity insurance, land law and site surveys, regulatory constraints and business law.

3.4 Planning and Development Subjects

The final group relating to planning and development consists of five subjects. In *Shaping the Metropolis*, students analyse the processes of urban development and the means by which the factors of production, land, labour and capital are brought together in the development of the built environment. It covers the role of various individuals, groups, organisations, governments, and government departments and agencies in urban development and their relative influence in the process. It also analyses the rationale for urban planning and the means by which it occurs in Victoria. Noteworthy topics include: the role and significance of real estate and its ownership in urban development, the social implications of urban development and the built environment, the effects of urban development and the rationale for planning and regulation, the concept of urban planning and its role in the process of urban development, the origin and evolution of planning in Australia, the status and scope of planning in Victoria, the components of a 'planning scheme' under Victoria's Planning and Environment Act, administrative procedures for Victoria's planning schemes, and regulation of use and development under Victoria's planning schemes.

The *City in History* subject provides students with an introduction to the history of architecture, building construction, urban planning and design, and landscape architecture, in the context of social, technical and environmental settings. It focuses on the integration and interdependence of architectural, constructional, social, geographical and landscape factors in the development of a selection of major cities and territories during the past, and it introduces the role of historical analysis in the understanding of physical and cultural artifacts in their environmental context.

In *Built Environmental Sciences* students cover topics under the following headings - Thermal: human comfort, heat flow, transmission, infiltration, control of solar impact, building envelope performance, heating and cooling loads, energy efficiency; Day lighting: perceptions, measurement and control; Artificial lighting: concepts, design calculations; Modelling: use of technical data; Acoustics: concepts and measurement of sound and noise, reverberation time, sound absorption and transmission, electro-acoustics; and Materials: embodied energy and sustainable resources.

The *Shopping and Retailing* subject analyses the interplay between private sector developers and public sector planners for the provision of shopping and retailing opportunities. It covers the theory, practice and techniques for the planning of shopping facilities and compares the USA, UK and Australia. Appropriate survey and analytical techniques are introduced and other topics include theories and practices of retail distribution, planning for retailing and planning processes, market analysis and forecasting demand for goods and services, the ABS household expenditure survey, introduction to psychographic segmentation, translation of consumer demand into floorspace need and provision, trends in shopping and shopping facilities, government policies on retailing and shopping centres, microeconomic order in shopping districts and shopping centres, planning and development of corporate shopping centres, and revitalisation of traditional shopping streets.

Finally, *Strategic Planning & Development Management* analyses the theories, practices and techniques applicable in the preparation of strategic plans. It also covers the implementation of strategic plans primarily, but not exclusively, through development regulation. Whilst the subject relates specifically to the Victorian planning system, it also makes comparisons with other planning systems, especially those of the UK and USA. Key topics include theories, practices and techniques of strategic planning, implementation, public interests and goal setting, decision making, monitoring, evaluation and assessment, issues of location and spatial structure, concepts of development management, managing urban development, use regulation and the practice of zoning, development regulation, the use of revenue generation and spending powers of government, and planned comprehensive development including major projects in Victoria. A number of case studies are provided by guest lecturers, such as: 'Heritage: a case study in planning and regulation', 'Victoria's coast: a case study in coastal management',

'Urban consolidation: a case study in medium density housing', and 'Docklands: a case study in planned comprehensive development'.

3.5 Bachelor of Property and Construction Year

The Bachelor of Property and Construction year contains subjects from all four groups. *Advanced Services* is a construction technology subject and it specialises in the technical services installed in buildings with particular reference to indoor air quality and environmental comfort. Topics covered include refrigeration, heating and air handling plant, air distribution, energy efficiency and electrical, telecommunications, transportation and intelligent building systems. Students will be involved in the documentation of systems designs and will conduct post-occupancy evaluations of building air quality.

The property group has two subjects. First, *Property Development and Investment* looks at investment and development in the property industry. The investment component covers the valuation and analysis of investment property including quantitative methods and financial analysis. The development component requires students to investigate a real development site and to formulate a major development proposal and undertake a feasibility study into that proposal. Also discussed are residual valuation techniques, the effect of town planning on land values, the property cycle and property market research.

The second subject in the property group is *Asset Management* in which are discussed corporate property, building as an economic process, financial analysis of capital works, life cycle cost analysis and cost-benefit analysis, strategic planning and accommodation decisions. Students are required to undertake a number of comparative financial studies of options available in property and construction such as accommodation choice (rent vs buy) and building component choice.

The construction management subject group is represented by *Advanced Construction Law*. This subject selects a number of legal aspects affecting property and construction that are presented by legal and professional practitioners in their respective fields. Included are contracts and contractual disputation, insurance, accident compensation, occupational health and safety, professional liability, taxation, remuneration, building regulations, arbitration, mediation and conciliation. Industrial relations is of particular importance in this subject.

Finally, the planning and development group has two subjects. *Transport and Land Use Planning* examines the theory and practice of these activities in urban areas. Students will be made aware of procedures used in transport and land use planning as well as international trends and debates. Secondly, *Planning Law* covers the process for preparing and amending planning schemes, and their structure and content, using a municipality in Melbourne as a case study. The planning permit process is discussed with particular reference to the factors affecting the exercise of discretion by planning authorities. Also examined is the appeal process and heritage controls.

The elective subjects referred to previously are taken mainly from the construction management group. Two research subjects are available, one of which would be required for students wishing to take the Bachelor of Property and Construction with Honours. These are *Investigation Program* and *Research Project*. These subjects involve research training, the completion of a research project and the writing of a report under supervision.

4. Progress of the New Course to Date

As with any new course, there are always doubts about whether the marketing and promotion of the course have been sufficient and timely enough for information to have reached not only prospective students, but also school careers advisors and parents—with the latter two groups playing a particularly important role in influencing school leavers in the career they should follow. With the first enrolments in the combined course having just been taken for the year 2000, the course has thus far attracted 11 local students and one overseas student for entry into the first year of the program. The entry score was 86.7 based on the nationally adopted ENTER system.

International attention has also been focussed on the new combined course and Professor Peter Dale MBE, Past-President of the International Federation of Surveyors, is enthusiastic about the new initiative. He has for a long time recognised the need for more multi-disciplinary education and training in the fields of planning and development and, in particular, he considers that:

"The issues surrounding sustainable development are now so complex that no single profession has a monopoly of wisdom in this field. A primary need is to combine the skills of the spatial information manager with those of the property and construction developer. Students also need to understand the techniques that are involved in what have traditionally been two separate activities, as well as the environment within which planning and development takes place. This new course should achieve both goals. It is timely and relevant and should lead to improvements in the management of both the social and physical environments". (Dale, P.F., personal communication, November 1999)

5. Conclusion

There is no doubt that our cities will continue to grow with a consequent continual demand for professionals who can design, build and manage land and property development. This development will spread across the whole spectrum of residential, commercial and industrial projects. The land development area, and particularly residential development, has traditionally been an important area of expertise for professional Land Surveyors. However as all professions have become more specialised, it has been increasingly difficult for Land Surveyors to continue to play an important role in land development. This combined degree offers the opportunity for young people obtain both an engineering degree and a land surveying

degree with specialist expertise in land development. The career options and possibilities are obvious.

References

University of Melbourne Handbooks on the internet at:

<http://www.arbld.unimelb.edu.au/visitors/undgrad/undbuil.html>

<http://www.geom.unimelb.edu.au/>

Biographical Notes

Gary J. Hunter BSurv(Hons) MSurvSc Phd (Melb) LS

Gary came to academia in 1988 after 17 years in industry, and his experience includes engineering construction, cadastral and topographic mapping projects in Australia, Indonesia and Papua New Guinea. In 1990 he was the first lecturer appointed in Geographic Information Systems (GIS) at the University of Melbourne, and is now Senior Lecturer and Deputy-Head of the Department of Geomatics. In 1994 he gained his PhD from the University of Melbourne on the subject of managing uncertainty in spatial databases. He has been awarded the Horwood Critique Prize for the best papers at the URISA '93, '95 and '99 conferences in Atlanta, San Antonio and Chicago, and the Gerald McCalden Prize for the best papers at the AURISA '90 and '94 conferences. He is a section editor for the *URISA Journal*, and serves on the editorial boards of the *International Journal of Geographical Information Science* and *GeoInformatica*. In 1996 he served as President of AURISA and is currently a member of the Surveyors Board of Victoria.

Ian Williamson PhD (NSW) DrHC (Olsztyn) FTSE FISAust FIEAust HonFMSIAust LS CPEng

Ian has worked in government and the private sector as a professional land surveyor in Australia and the USA. He is a Fellow of the Academy of Technological Sciences and Engineering, Australia, a Fellow of the Institution of Surveyors Australia, a Fellow of the Institution of Engineers Australia, and an Honorary Fellow of The Mapping Sciences Institute, Australia. His teaching and research is concerned with cadastral, land and geographic information systems in both developed and developing countries. He has published extensively on these topics. He has undertaken research or consultancies world-wide including agencies such as AusAID, the United Nations and the World Bank. He was Chairperson of Commission 7 (Cadastral and Land Management) of the International Federation of Land Surveyors 1994-98. At the University of Melbourne he has been President of the Academic Board and Pro-Vice-Chancellor, and is currently Head of the Department of Geomatics.

Jon Robinson BSc (R'dg) MLEc (Syd) BArch MBldg FRICS FRAIA FAIB FAPI FAIQS

Jon is a graduate of Melbourne, Sydney and Reading (UK) Universities. He was a lecturer/senior lecturer at the University of Melbourne in the 1970s and 1980s and resigned to return to private practice. He was appointed to the Chair of Building in 1996 and teaches in the new

Property stream in the Property and Construction program. He was twice awarded the Peter Barrington Gold Medal for research in real estate. He serves on the National Education Committees of the AIQS and the AIB, and on the Editorial Boards of the *Journal of Property Investment and Finance*, the *Journal of Real Estate Valuation and Investment* and the *Journal of Property Management*. Jon is the author of *Property Valuation and Investment Analysis* (Law Book Co, 1989) and over 40 papers in international conferences and journals. Jon's research interests include property development and investment, valuation and appraisal, sustainable development, life cycle costing, facilities planning and property management.

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