

**AC 2007-1562: THE EFFECTS OF INTEGRATION OF INDUSTRY FACULTY
INTO A CONSTRUCTION MANAGEMENT POSTGRADUATE COURSEWORK
PROGRAM IN THE AUSTRALIAN ENVIRONMENT**

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The Effects of Integration of Industry Faculty into a Construction Management Postgraduate Coursework Program in the Australian Environment

Abstract

A postgraduate construction management program has been offered at Swinburne University of Technology in Melbourne, Australia continually for the last twenty nine years. The rationale for the program was to provide a transition from design to construction operations for Engineers who were interested in taking a role in construction operations. It was also used by immigrant Engineers who wanted to move into the Australian construction industry.

The subjects offered ranged across construction and project management, construction law, site safety, finance, site communication, risk and sustainability of the construction process. The courses were delivered in face-to face mode and also selections were offered by distance education. The programs were arranged on a “nested” basis with a progression of qualifications from Graduate Certificate, Graduate Diploma on to Master’s level.

Once the program began, it was found impossible to sustain without additional staff. The staff had to cover the range of subjects listed above and such a span of expertise was not readily available from within the full-time faculty. This situation resulted in the recruitment of part-time staff from industry to support the specialist subjects. The use of industry based staff has continued for thirty years.

The link between industry and the university has enhanced the program and contributed to its longevity. This paper examines the characteristics of the industry-based lecturing staff and their influence on the development of the program over the time span. It is argued that they have shaped the course significantly in content and style and in the direction of the research topics undertaken by the students.

An examination is made of the source of the students and the change of the pattern with time. The adaptation of the staff to such change is explored and it has been reflected in the changes to their teaching styles and approaches to the students.

The conclusion is made that the industry-based staff have influenced the program so that there is a close relation to industry philosophies instilled in the students. That because of this, the research topics undertaken by the students are closely aligned with practice. These factors have contributed to the continuing success of the program over the years.

Introduction

Construction engineering, as a discipline, can sit uncomfortably within a University faculty. The Construction industry is a legitimate path for engineering

graduates to follow and one that makes a significant contribution to the quality of life. However, within the faculty it does not generally display the same profile as other elements of engineering such as analysis, synthesis and modelling that attract research funding and produce research output by recognised publication.

A postgraduate program in Construction has been in place for almost the last thirty years at Swinburne University of Technology in Melbourne, Australia. The program has adapted over the years to accommodate industry changes and variability in the student profile.

This paper addresses the approach by the university to provide a postgraduate education in Construction over that time. It has utilised a mixture of tenured and adjunct staff to deliver the program. The program has responded to change in the student profile. It has relied upon tenured staff to keep a research element in the program. The adjunct staff have kept the program informed of the latest developments in the construction industry.

This paper examines the characteristics of the industry-based lecturing staff and their influence on the development of the program over the time span. It is argued that they have shaped the course significantly in content and style.

Issues with Construction Programs

Construction programs at universities need to display the same relevance to the profession they serve as other engineering programs provide to the areas of design and analysis. The acceptance of the program relates to the credibility of the faculty, the quality of the graduates, the acceptability of the subject range and the review of the industry.

The problem of the faculty credibility has been examined from two viewpoints. Firstly, tenured faculty generally lack construction experience and expertise¹. Faculty on the tenure track rarely come from a construction background if they are developing a publishing record. Faculty with construction expertise tend to be adjunct appointments with a part-time campus commitment as described by Gosink and Streveller². This can produce uneasy relationships between the two groups of staff, with tenured staff seeking opportunities for research and less teaching and adjunct staff taking on a teaching load but not often making a contribution to research.

Another problem has been the lack of funding to support for research in construction issues. This has been reported as a “chronically small amount”¹³. Tenured faculty see this as a restriction to developing a deep interest in construction related research.

All of these challenges were raised in the construction program at Swinburne. The approaches to address these are dealt with in the paper.

History of the Program

The program was first offered in 1978. At that time, Swinburne was a College of Advanced Education which had just been allowed to offer Bachelors degrees, following on from a successful history of providing tertiary education to Diploma (professional) level for many years. As part of the transition to the Bachelor’s degrees, it was decided to offer Graduate Diplomas in Civil Engineering to provide the opportunity for enhancement of the qualifications already held by the large number of Diploma holders in the Civil Engineering workforce. Specialities were offered in Structures, Hydraulics, Geomechanics, Urban Planning and Construction. The Graduate Diploma was designed to cater for part time students working as Engineers in consultants and government departments in the region. Faculty staff could provide the necessary teaching expertise in most of the specialities as the staff at that time had a background in practice before entering the tertiary environment and the College encouraged staff to continue consulting to keep their knowledge current. The specialty with the least depth was Construction and, consequently, help to teach the program was sought from industry.

Like many similar programs, initial take up was enthusiastic, with Diploma holders seeking to ensure that their qualifications were competitive with the potential graduates who would hold Bachelors degrees. This placed a load on the full time staff to service the Graduate Diploma subjects and some difficulties were experienced with balancing staff workloads. However, as the demand backlog was addressed, the requirement for the Graduate Diploma teaching reduced and many of the classes were combined with the Bachelor’s subjects. The exception was the Construction stream.

The Construction program was unusual in that the subjects had little in common with the undergraduate Civil Engineering subjects, so classes could not be readily combined. The advantage of using adjunct staff for a substantial proportion of the program was realised in dealing with the fluctuations in the enrolments. As a decline occurred, the rates, at which the subjects were offered, were reduced to half and the adjunct staff could be employed at a lesser rate without affecting the tenured staff.

Eventually, in the mid eighties, the only Graduate Diploma program still being offered successfully was the Construction stream. It was supported by adjunct staff with a depth of experience in the Construction industry that was associated with some of the major road and bridge projects in the region. At this stage, there was only one other Construction postgraduate program in Melbourne. This was a Master’s degree at a leading university that had a restricted entry, whereas the Swinburne Graduate Diploma allowed entry from Diploma holders that had a larger pool of potential students.

In 1980-81, the program coordinator undertook a sabbatical program at Loughborough University of Technology in the UK, as a Visiting Fellow, to work with Professor Geoffrey Trimble. Professor Trimble was a rare senior academic who had considerable experience on major construction projects in Europe before joining the University and who headed up the Construction program at that University. He moulded the construction program at Loughborough based on his experience. He also maintained close contacts with the UK construction industry and incorporated adjunct staff into the teaching program.

This experience reinforced the view that a postgraduate program in construction lacked credibility for students if the connection between the lecture theatre and the construction process was not evident. From this point, efforts were made to appoint more adjunct staff at Swinburne. The original adjunct staff of two construction engineers was expanded to include a health and safety expert, a lawyer with expertise in construction contract law, an accountant experienced in dealing with construction projects and an architect who understood the communication process on site. This team remained in place throughout the 'eighties, until the early 'nineties.

In Victoria, the early 'nineties brought change in the way major infrastructure projects were handled by the state. Until that time, it had been traditional for the State Government to fund projects by engaging in debt, with much of the design and construction handled within Government departments. The concept of Public Private Partnerships (PPP's) to deal with major infrastructure projects was now embraced by the state. The government of the day sought to reduce the public service by downsizing the technical government departments, such as road authorities and water supply authorities. This led to "de-engineering" of a number of government departments and often a change of chief executive from a traditional professional engineer to appointments with a finance or human resources background. These changes influenced the construction management program to look for adjunct staff that could bring this new state of affairs to the attention of the students. New staff were introduced, including a former CEO of a state road authority (from a financial background), the principal of an engineering consulting firm and a distinguished senior engineer on the board of the largest infrastructure project in Australia.

This period coincided with a change in the mix of the students. The course had originally been established for local engineers who attended classes on a part-time basis. The intake gradually became a mix of part-time professionals, some final year students taking the subjects as electives in their undergraduate program, a few migrant engineers using it to gain knowledge of the local construction scene and the occasional international full-time student. The international student intake then increased significantly until they now make up the bulk of enrolments. The increasing proportion of international students caused a reconsideration of some of the subjects in the course. There was a new contract law syllabus to incorporate elements of international law. The subject of health and safety was redesigned to concentrate on principles rather than the local rules and regulations. Subjects in risk were introduced to the course at the request of the international students. A subject dealing with international projects replaced a subject concentrating on local management of construction projects.

In the late 'nineties, distance education was introduced to the university and the program moved to take advantage to service a wider student base. Distance education subjects in sustainability were introduced without employing any more adjunct staff for face-to-face delivery. These subjects were funded on the basis of copyright being retained by the authors for a period of time and for reimbursement of the authors based on enrolment.

Review of Current Construction Post Graduate Programs in Australia

Examples of the majority of the current Australian postgraduate construction-related programs are shown in Table 1. Most programs are “nested” in that a student can begin a Graduate Certificate; convert to a Graduate Diploma with advanced standing and then move on to a Master’s degree using the credits obtained from the lesser qualifications. Normally, the student is only awarded one degree which is the highest at which the student qualifies.

A Masters degree takes two to four semesters with the majority requiring three full time semesters. A Graduate Diploma normally takes two full time semesters to complete and a Graduate Diploma needs the equivalent of a full time semester before the qualification can be awarded.

The programs are offered mostly within engineering, technology and built environment faculties. One is provided, unusually, in the humanities faculty at Curtin University of Technology.

The Swinburne program is similar to the other construction-related listed in the table. A full-time student can take out a Masters degree in three semesters or can choose to leave the course earlier with a lesser qualification.

Table 1: Some Current Australian Postgraduate Construction-related Programs

No.	University	Faculty/Department	Programs	Duration
1.	Adelaide	Engineering, Computing and Mathematical Sciences	Master of Engineering (Civil & Environmental) (Elective choice to bias subjects towards construction) and Advanced Masters	Masters-2 Semesters; Advanced Masters-4 Semesters
3.	Curtin University of Technology	Humanities	Master of Science (Project Management), Graduate Diploma, Graduate Certificate	Masters-3 Semesters; Grad Dip-2 semesters; Grad Cert-1 semester (equivalent full time)
6.	Melbourne	Architecture, Building and Planning	Master of Property and Construction (by coursework)	2 to 4 semesters, depending on admission qualifications
8.	Queensland	Built Environment	Master of	Masters-3 Semesters; Grad Dip-2 semesters;

No.	University	Faculty/Department and Engineering	Programs	Duration
	University of Technology		Project Management; Graduate Diploma of Project Management; Graduate Certificate of Project Management	Grad Cert-1 semester (equivalent full time)
10.	Swinburne University of Technology	Engineering and Industrial Sciences	Master of Technology Management (Construction Management); Graduate Diploma of Technology (Construction Management); Graduate Certificate of Technology (Construction Management)	Masters-3 Semesters; Grad Dip-2 semesters; Grad Cert-1 semester (equivalent full time)
12.	University of New South Wales	Built Environment	Master of Construction Project Management in Professional Practice; Master of Construction Project Management; Graduate Certificate in Construction Project Management	Masters (PM in PP)- 3 Semesters; Masters- 2 Semesters; Grad Cert- 1 Semester

Structure of the Swinburne Program

The completion of the Master's program requires passing subjects totalling 150 credit points in three full time semesters. 100 credit points are needed for the Graduate Diploma and 50 credit points for the Graduate Certificate. The majority of the subjects available to the students are equivalent to 12.5 credit points with the exception of the "Research Project" subject.

The program is taught mainly face-to-face with the students being permitted to take one distance education or on-line subject per semester. The classes are held in the late afternoon and evening to provide opportunities for participation by local part-time students.

As can be seen from Table 2, the subjects cover a range of themes. The expertise to teach this spread is not generally available within the University, and adjunct staff fill the gap. Of the fifteen subjects on offer, five are presented by University staff, seven by Adjunct staff and three, offered in distance education mode are supported by off-campus staff.

Table 2: Subjects in the Swinburne Construction Program

Subject Title	Staff Responsible		
	Tenured	Adjunct	Dist. Ed
Construction Law		√	
Engineering Project Control		√	
Environmental Sustainability in Construction			√
Infrastructure Management	√		
Project Management		√	
Project Costing		√	
International Construction		√	
Sustainable Buildings			√
Research Project (37.5 credit points)	√		
Research Design & Methodology			√
Financial Risk Management	√		
New Venture Development and Management	√		
Risk Perception and Analysis		√	
Risk Management Principles		√	
Quantitative Risk and Modelling	√		

Change in Staff Profiles

The staff profiles have changed over the years. The original adjunct staff of the seventies were sourced from major construction companies and the subjects being offered reflected their strengths. A typical adjunct staff profile was that of middle to upper level manager in a major local construction company, with about ten years or more of experience, some of which was gained on iconic major projects. The “70’s” band of Table 3 reflects the use of this staff in the course and the consequent range of subjects offered. The work load was shared equally between tenured and adjunct staff.

The eighties were an era of expansion of the program reflecting the increasing complexity of the tasks of construction engineers and the size of the construction projects. The adjunct staff expanded to include an eminent lawyer and barrister, an industrial health and safety professional from a major building association, and an architect who was both an academic and a practitioner. A very experienced engineer in bridge design and construction from the state road authority joined the adjunct staff to support the need for knowledge about major infrastructure projects. As can be seen from the “80’s” band of Table 3, the burden of teaching was taken over by the adjunct staff. A research subject was introduced into the program by the tenured staff.

As the tenured staff expertise in construction technology evaporated due to staff changes, they developed their own expertise in understanding the management and deterioration of

infrastructure systems such as road networks and pipeline systems in the nineties. This subject area was introduced into the program in the nineties, in response to a perceived need for engineers who could deal with the operation and maintenance of infrastructure systems.

Table 3: Deployment of Tenured and Adjunct Staff

Era	Staff	T (1)	M (2)	L (3)	H&S (4)	F (5)	R (6)	S (7)	C (8)	R (9)	I (10)	Σ
70's	Tenured	√										1
	Adjunct		√									1
80's	Tenured	√	√							√		3
	Adjunct	√	√	√	√	√			√			6
90's	Tenured									√	√	2
	Adjunct	√	√	√	√		√	DE	√			6
00's	Tenured									√	√	2
	Adjunct	√	√	√	√		√	DE	√			6

Legend

DE: Distance education author.

Subject Themes:

- 1) Technology
- 2) Management
- 3) Law
- 4) Health and Safety
- 5) Finance
- 6) Risk
- 7) Sustainability
- 8) Communications
- 9) Research
- 10) Infrastructure

Characteristics of Industry-based Staff

The present adjunct faculty are all current or recent practitioners in their own professions. The range includes Engineers, construction and consulting, a lawyer, an architect, an accountant and a Cost Engineer. Each have at least twenty years plus experience. At least three have been or are chief executive officers of major authorities, construction organizations and consulting firms of national and international standing. Most have been associated with the program for ten years and more.

All have professional qualifications but none have doctorates. None have written papers for refereed journals and none have applied for research funding.

Influence of Adjunct Staff Profiles

Originally, the focus of the program was technology with management as a subsidiary element. This arose out of the expertise available in the tenured staff augmented to a small extent by some

adjunct appointments from local construction companies. Discussions with the staff at this time revealed some areas of the program that needed reinforcement. Some of these points were raised in McManus⁵.

The visit to Loughborough in the early eighties indicated that the range of subjects needed to be expanded and discussion with the existing adjunct staff following that visit confirmed that view. The staff from the construction industry advised that technology and management subjects alone were not sufficient to prepare young engineers for a career in a construction industry that was dealing with more complex projects that placed a higher level of risk on the contractor. These points were developed in a number of articles^{3,4,6,7,8,9,10,11}.

The program ran successfully throughout the eighties, but by the early nineties was in need of review. The review was encouraged by a number of factors such as the bulk of the student body being international students, the shortage of engineering skills available for major projects, the increasing emphasis on sustainability in the Construction Industry and an increasing interest in the subject of risk in the industry. The need for adjunct staff was again given priority and discussed in McManus, Young and Duffield¹². New subjects were introduced dealing with international project management, international contract law with emphasis on Asia, and distance education subjects in sustainability were written.

Development of Research Interests

One disadvantage of a high proportion of adjunct staff is the lack of support for research activities. Few papers with an association with the postgraduate program have been published. However, some graduates of the program have gone on to doctoral studies with the program credited with stimulation of their interests. There have been six postgraduate research enrolments in the last ten years from graduates of the Construction program.

Change in Student Profile

In the seventies, the intake was from the local Melbourne-based Engineers, who held professional diplomas. They sought knowledge about managing construction projects and about local issues in construction. As the course developed, it was used by migrant Engineers to familiarise themselves with the local construction industry and through the adjunct staff to make contact with the industry. These students gradually became a significant proportion of the class. The course concentrated on preparing these students for a place in the local construction industry.

By the mid eighties, inquiries from international students increased and their proportion in the classes grew. These students came from the Peoples Republic of China, Taiwan, Malaysia, Indonesia and Thailand. A small group came from the Middle East. The international students were initially interested in the local construction industry and what it could teach them but then began to apply that knowledge to their home country's environment. Many of the research projects were based on the comparison of Australian practice with their national construction processes. The staff adapted to make their subjects more relevant to the international students.

This was also accepted by the local students who were looking for opportunities to take part in offshore construction projects.

Indian and Pakistani students became the major proportion of the class in the nineties and through to the current time. Initially, most of the students saw themselves as staying in Australia and took the opportunity to learn about the local construction industry. However, with time, the students in the later part of the nineties sought to take their knowledge back to their home country to take advantage of the growing economy, particularly in India. Most of the students sought information about construction processes that could be utilised at home to give them a commercial advantage.

As the student demands changed, the adjunct staff in particular responded by restructuring their courses. The tenured staff supported the new thrust in research by encouraging the comparison of Australian and offshore construction processes as a research theme.

Conclusions

A postgraduate construction program has remained in demand at Swinburne University of Technology for almost thirty years. Over that time, the student profile has changed from local part-time students to full-time overseas students. The perspective of the students has changed from an interest in the local construction industry to a commitment to international construction.

The adjunct staff have allowed the University to respond quickly and with flexibility to the student's needs. They have also kept the program current with construction industry processes and procedures. The tenured staff have kept an interest in research in the program that has yielded some few publications but has produced a steady flow of students into research degrees.

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