The Shortage of Ground Engineers
Survey of Universities providing MSc courses in Ground Engineering

Introduction

Difficulties in the recruitment of suitably qualified geotechnical engineers and engineering geologists in the UK have been well known for several years. A survey conducted among AGS and FPS Members in 2004 produced sufficiently compelling data to have Ground Engineers entered on the Shortage Occupation List for work permit purposes, where they have remained ever since. The list was reformulated in 2008 as part of the move to a points based visa system and a further survey was undertaken and reported to the Migration Advisory Committee as part of a successful application for ground engineering occupations to be included on the new list.

A consequence of the inclusion of Ground Engineers on the list is the need to confirm at regular intervals that the shortage continues to exist, and to explain what measures are being taken to mitigate the shortage of UK personnel. This requires examination of recruitment to the sector, qualification requirements, and retention measures.

Traditionally, a Ground Engineer (whether a Geotechnical Engineer, or an Engineering Geologist), has a first degree in a relevant subject (e.g. civil engineering, geology/applied geology), followed by a second degree (MSc or PhD) in soil mechanics, geotechnical engineering, or similar ground related subject. For Geoenvironmental Engineering, because of the wide skill set required there are a number of different entry routes at first degree level, with further discipline-specific education being provided by a number of Universities which offer specialist MSc courses in contaminated land.

Informal discussions among AGS Members before this study commenced indicated that there was limited knowledge among geotechnical and geoenvironmental consultants concerning available post graduate MSc courses in ground engineering, although a small number of companies were making concerted efforts to build relationships with particular departments in universities near to them. In addition, Ground Forum and AGS members were being lobbied by academic staff from certain universities about the withdrawal of Government funding from their MSc courses.

The present study, therefore, was a first attempt to try to understand the availability of post graduate MSc courses and the factors that influenced both their availability and the number of students, with the ultimate intention of facilitating better communication between universities and employers in order to address the skills shortage. A clearer understanding of the extent and impact of the changes in Government funding of MSc courses was also sought.

The Sample

The questionnaire was sent to the named contact for courses appearing in the list of MSc Courses which is published in Ground Engineering every February. The 2007 list was used, supplemented by the 2008 list which was published in the course of the survey. Courses specifically in Marine and off-shore engineering were excluded.

Responses were received from nine of the fourteen universities contacted – three of which sent separate questionnaires for each of the two courses they offered – making a total of 12 questionnaires. One of the universities replied on the basis of a course which had closed at the start of the 2007-08 academic year.

How many students are there?

There is a perception in industry that the number of students is declining. This did not appear to be borne out in the number of enrolments reported for 2007-08 compared to previous years. Completion of the questionnaire required respondents to research the number of graduates in previous years, and

some of the data is therefore incomplete. Reasonably complete data exists, however for the last four years. This does not suggest any particular change in the numbers enrolling.

Table 1: Number (and nationality) MSc Graduates

	No of Courses	UK	Other EU	Non-EU	Total
2007-08 (enrolments)	8	106	19	28	153
2006-07	10	77	23	22	122
2005-06	10	76	21	20	117
2004-05	10	85	26	23	134

Of the 106 UK students enrolled for the current year, a little over half (53%) were studying part time on two year courses; the 2007-08 enrolment figures are therefore broadly equivalent to the numbers graduating in the previous three years (ie: they do not indicate any increase in up-take of MSc courses). 80% of the part time students were at the same University. The response from this University included the comment:-

> 'Part time has boosted numbers but at a cost. It's a lot of administrative work both before they come and when they are here.'

It was also clear that teaching on the part-time courses at this university is very intense, eg in one block, two weeks of instruction is condensed into a single week – involving extraordinary effort from both students and staff, and additional effort from the student in the following weeks in order to consolidate what they have covered.

The point was made also that Employers are not always sympathetic to the pressures faced by part time students:

> "(Employer) Support for students is normally (but not always) for part-time study. Some of these students are treated appallingly by their employers. This includes, but is not limited to, employers phoning students while in lectures, and/or on field courses to discuss jobs they are involved in."

How many graduates come from the UK?

Although some non-UK graduates will remain available for employment in the UK after graduation, UK students are the real focus of this study. There have been suggestions in some quarters that courses are only viable because of the number of non-UK students. However it appears that only one course has a disproportionate number of non-UK students; and overall the proportion of UK to non UK students has remained fairly stable over the past few years.

Table 2: Nationality of Graduates

	UK	Other EU	Non-EU
2007-08	69%	12%	18%
2006-07	63%	19%	18%
2005-06	65%	18%	17%
2004-05	63%	19%	17%

Fees and Funding

Reported fees in 2007-08 ranged from £3,000 to £8,100 (median £4,200; mean £3,714).

Three of the Universities had EPSRC bursaries and three received NERC funding (representing a total of 12 EPSRC and 15 NERC bursaries). Camborne School of Mines provided 3 scholarships and one other student had a university provided bursary covering the fees. A further 11 students (at 4 institutions) received employer funded assistance. (Note: This doesn't rule out the possibility that

other students had individual private arrangements with their employers that were not known to the university.)

The conclusion, however is that in 2007-08 only 41 students received substantial assistance via the university, leaving 65 students (60%) from the UK arranging their own funding either privately through their employer or from their own resources.

Respondents were asked to comment on the availability of funding, industry support and anything else relevant to funding. Responses included:

> "Our graduates are in demand both nationally and internationally and have excellent employability prospects. Additional funding would increase the numbers of students studying on the programme. The question is not, 'Should industry support the programmes' but 'How much should they be providing.' My answer would be: far more than they are currently doing."
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> "Industry has been quick to complain that there are insufficient MSc students coming out but slow to provide any meaningful financial help to facilitate students to take MSc's. The Government withdrew studentships from most courses in the late 1990s saying that it was Industry's job to fund, but very little has been forthcoming."
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> "Industry doesn't pull its weight. We get occasional project funding: grudgingly given, that in no way covers the costs of the work if it was commercially priced. We need regular support for project and sponsorship of individuals."

The Importance of Government Funding

Those Universities that receive Government funding consider it essential:-

> "Funding should only be available to kick start or revise courses; at Masters level if the courses are not producing what 'industry' wants/needs then they should not exist." (Note: this course had a received EPSRC IGDS grant to kick start it, 'Without which', the respondent says, 'It would not exist today'.)
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> "NERC funds are essential in keeping a minimum number of students on the course. Our break even number is about 18 students. If we consistently recruited less than this, the MSc course would close."
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> "We need a minimum of round 12-14 students per year to run the course successfully. We will be at some risk of dropping below this number if we do not get any support from NERC in the next NERC Masters review. Numbers could also drop in the longer term if the demand for hydrogeologists decreases or if a number of other new MSc courses in hydrogeology are started."
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> "In order for the course to survive we need to have a consistent minimum of 18 or so students. NERC has consistently reduced its support for Engineering Geology since 2000 at each MSc course review. In 2000 Engineering Geology course were supported with 7 NERC studentships at Imperial College, Newcastle and Leeds (there was also support for Mining Geology at Camborne School of Mines). In 2001 this dropped to 6 studentships at Leeds and Newcastle. At the 2005 review, this dropped again to 5 awards at Leeds and Newcastle. There will be another review c2010."

In response to the question, 'What other funding/support could the UK Government provide?' one respondent replied:

> "Increased bursaries. There is a skills shortage which is affecting UK infrastructure. Government is the main client. There is a serious threat that Government policy will not be delivered because of the skills shortage. The majority of construction is public sector. The failure of Government to link clients' needs with skills shortages rather than expect industry to fund training is a threat."

What factors affect student numbers?

During the 1990's the number of students doing their first degree in Civil Engineering dropped dramatically, to the point where some projections showed that enrolments would fall to zero in the middle of the first decade of the 21st century. This was avoided through a variety of means which included rising salaries, active efforts to promote the profession, and the restructuring of civil engineering degrees.

Since Ground Engineering often starts with a degree in Civil Engineering, changes in that sector have had a knock-on effect in ground engineering recruitment. Other changes during the same period have also been influential in recruitment and in the willingness of graduates to undertake a post graduate qualification in a Ground Engineering related subject.

Respondents were offered a list of recognised factors and asked to consider whether or not they affected enrolments and whether the effect was positive or negative.

Those elements considered to have a positive influence (often related to the choice of a particular institution) were:-

Availability of bursary/grant or other funding
Geographical location of course
Availability of modular course
Availability of part-time option
Reputation of Course/Institution
Quality of teaching

Factors considered to discourage students:-

Levels of debt following 1st degree
Lack of support from Employer
Good availability of employment without MSc

Respondents were slightly more ambivalent about the importance of the cost of the course – probably because there is relatively little difference between the costs at different institutions. Therefore the effect is closely bound to the overall cost of studying and related to other factors, particularly the availability of funding, which is considered to be of prime importance.

Respondents generally considered the introduction of four year Civil Engineering and Earth Science degrees to be either not important or to have a negative effect. This is an aspect that requires further investigation.

Do Universities need more help from Industry?

All except two Universities in the survey had asked for help from Industry – with mixed results. Three Universities had been particularly disappointed with the response and a further two had received less help than they needed, and felt it had been given grudgingly. The final four reported that they had received financial support in the form of bursaries, fees, and prizes and 'in kind' support (e.g. visiting lecturers, provision of projects, and software).

When asked what additional support they need from Industry, there was a universal plea for additional financial support: bursaries for students; better support for employees undertaking courses; payment of fees; increased amounts for existing bursaries; help for non-employees. The consistency of the responses was particularly noteworthy.

Additionally, two universities indicated that staff difficulties had endangered the future of their courses.

Future Trends

The continuation of most courses depends on student numbers, and to a lesser extent, the availability of staff. Student numbers in turn depend on the factors set out above, of which funding is considered to be the most influential.

Several courses expect to see increased part time enrolments, and one predicted the growth of distance learning. Course content continues to develop in response to student abilities (at least one sees a need for a conversion course for geologists), staff availability, and industry needs.

Conclusions

Three very strong threads ran through all responses:-

- There is a serious skills shortage in the ground engineering sector
- There is a shortage of post graduate MSc students, which affects the viability of courses
- There is a shortage of resources, most particularly funding for students, which (in the absence of sufficient Government funding) Universities look to Industry to provide

The skills shortage is perceived to have both positive and negative effects. On the positive side, it has led to an increase in salaries (and by implication made the industry more attractive) and provided a driver for increased Employer investment in training. This is offset, however, by a reluctance of Employers to release employees for training, and a perception that encouraging staff to obtain an MSc will make them more attractive to other Employers. Evidence from other surveys indicates that Employers are adopting various training strategies to actively plug knowledge gaps and recruiting people with less relevant qualifications to use as support staff, which may be diverting funding from MSc support.

It is clear that some Universities have been more responsive to Employer requirements that others. Over half of the students enrolled in 2007-08 were studying part-time. Only one University indicated that they did not offer a part-time course. There are indications, however, that part-time study is a hard option and there was criticism of some Employers for making it harder still by a failure to give sufficient time for study – sometimes requiring the student to use annual leave for the purpose.

A number of factors are considered to adversely influence Student enrolment. These include the high debt levels of new graduates; lack of support from Employers; lack of grant funding; and the good availability of employment without an MSc. There can be little doubt that the combination of reductions in Government funding of MSc courses since the 1990s, together with the level of debts many graduates now have at the end of their first degree, has been a significant contributor to the current skills shortage in the ground engineering sector.

There is undoubtedly room for closer collaboration between Universities and Employers. Universities vary in their ability to proactively seek links with industry; and further research is needed to understand how to build better links. The responses suggest that when Universities communicate their requirements effectively, employers (most likely those with established contact with the University) are willing to provide assistance in kind.

All Universities however, highlight the need for financial support – and overwhelmingly for bursaries to fund student fees (at a minimum) and living costs. There are indications that students already in employment are more likely to get financial help and several Universities have highlighted a need to support (and recruit) those students who come to the course without employment. However, The Ground Forum believes that students get much more benefit from the courses if they have one or two years experience of working in the industry before undertaking an MSc course. Industry is therefore unlikely to support students on MSc courses without prior industry employment,

The unanswered question in the study is the effect of the introduction of 4 year first degree courses in civil engineering and earth sciences leading to an MEng or MSc. A separate survey would be necessary to ascertain the amount of ground engineering offered as options in these courses. Informal enquiries suggest that few, if any, contain sufficient for a someone to be considered to be a

geotechnical engineer and engineering geologist on graduation. It is not difficult to see however, how graduates would see no need for further study in order to obtain a second degree at an apparently similar level.

Further Action

Further study is required in order to ascertain:

- Student perceptions of post graduate MSc course provision and the barriers to uptake
- Employers perception of the help they already give to Universities and the barriers to further assistance
- The amount of ground engineering offered as an option in 4 year first degrees and the impact of those courses on post graduate MSc applications.

Every effort should be made to open direct dialogue between University Departments and Industry. There needs to be frank discussion and better understanding concerning the help that Universities require and how to unlock Industry resources. The possibility of greater ground engineering content options in 4 year Civil Engineering and Earth Science degree courses also needs to be explored, as a matter of urgency, with a view to producing a supply of graduates who are better equipped to work in the ground engineering sector and to opening the door for the establishment of an engineering degree leading to a Ground Engineering qualification in the long term.

Further effort is required to demonstrate to Government how the reduction of funding of post graduation MSc degrees has contributed to the skills shortages in the ground engineering sector.

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The Ground Forum
Forum Court
83 Copers Cope Road
Beckenham
Kent BR3 1NR

Tel: 020 8663 0947
Fax: 020 8663 0949
email: gforum@ground-forum.org.uk

www.ground-forum.org.uk