Appendix C

Skills outlook

Introduction

Increased flood-risk management will not only need finance but will also require human skills. As the drivers of increased flood vulnerability take effect, there will be more need for innovative and cost-effective solutions to protect a population that could become more risk averse. Providing this improved protection from flood risk will require a cohort of experts to create a regime of flood-risk reduction.

Flood defence has traditionally been within the domain of the civil engineer. A more holistic view of flood-risk management – to include flood warning, development control, planning liaison and so on – will need a wider range of skills and professionals with different specialities and training.

Of key significance will be the increasing engagement with communities that are vulnerable to flooding. We are likely to see an approach to flood management that is dominated more by people than by artefacts. Nevertheless, the expertise of the civil engineer will still be important in improving existing flood defences and creating new flood defences, together with certain aspects of flood forecasting.

Engineering skills requirement

Maintaining existing flood defences is a considerable challenge. The floods of 1998 and 2000 highlighted the role of the existing infrastructure and its uncertain condition to deliver the protection for which it was originally designed many years ago. In addition to a significant effort to maintain the existing defences, there will be an accelerating need for additional and innovative civil engineering structures or systems to give high standards of protection against floods.

Looking towards the 100-year horizon of the Foresight project, the annual spend on engineered defences is likely to be between 3 and 7 times current levels, depending on the scenario. This level of activity could require a significant increase in the numbers of civil engineering professionals who can develop and design appropriate schemes and in the workforce for construction, maintenance and operation.

Satisfying the engineering skills requirements: a key issue

The UK's strategy for skills is set out in the White Paper 21st Century Skills, Realising Our Potential. This highlights the key problems faced in the general workforce. It acknowledges that we have particular skills gaps for employability, including:

- Literacy, numeracy and the use of information technology
- Intermediate skills at apprenticeship, technician, higher craft and associate professional level
- Mathematics
- Management and leadership.

The principal challenge is to improve intermediate skills at the apprenticeship, skilled craft and technician levels. The percentage of the workforce in the UK qualified to this level is about half of that in France or Germany. It is here that the foremost training effort will be focussed.

Steady growth in construction in the next 5 to 10 years, and expected changes in process and technology, will increase the demand for skilled workers (Construction Skills Foresight Report 2003). However, construction of flood defences occupies only a small percentage of the total workforce, and requires specific skills rather different from the traditional craft skills. Such skills are not formally taught but are acquired through on-the-job training and experience, building on the abilities of operatives with suitable aptitude.

In view of the relatively small size and specialism of this sector, a sufficient supply over a long time scale is likely to depend more on the presence of a continued, steady demand for flood defences than the behaviour of the rest of the construction sector.

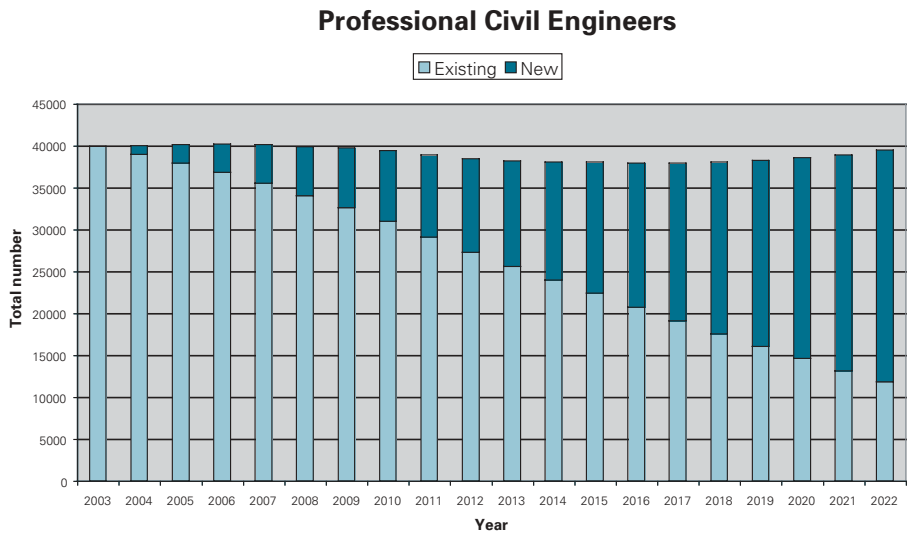
In higher education, however, there is an additional problem. The White Paper Realising Our Potential shows that we compare well with our European neighbours at the higher education level, but this comparison is across the board. Other recent reports have highlighted particular problems at this level in science, engineering and technology, for example, Set for Success, Engineering Skills for Flood-Risk Management.

The number of applicants for courses in many areas of engineering has been falling for years: civil engineering is no exception. The number of home graduates has fallen from a high of 2500 in 1997 to fewer than 1500 in 2002, against a long term average of about 2000. The number of new home graduates will fall until about 2005 when it is expected to stabilise at about 1300 per year.

Over the 100-year period of the Foresight project, it will be important to reverse this decline in civil engineering graduates to fulfil the essential roles in flood-risk management, not to mention many other roles in renewing and developing ageing but valuable infrastructure. The provision of qualified professionals with leadership and management expertise is needed, not only to develop schemes but to act as intelligent clients to make best effective and efficient use of the entire supply chain.

Taking account of the demographics of chartered civil engineers, it is estimated that to maintain the present number of chartered civil engineers we need a growth of at least 3% per year, every year, for the next 20 years in the numbers of new entrants. Any increase in the number of civil engineers will require a greater growth rate. Figure C1 shows the decline in total numbers of chartered civil engineers in 2003, supplemented by newly chartered civil engineers at a rate of 1100 per year in 2004, rising by the above growth figure of 3% per year until 2022.

Figure C1 **Growth in numbers of new chartered civil engineers to maintain 2003 levels**



The reasons for the decline of civil engineering as a subject of choice for young students revolve around issues of image, salary and career progression, amongst others. Industry and education providers must address and solve these issues. Particularly serious is the rejection of mathematics and science-based career paths at school due to the difficulty, perceived or real, of these subjects. 'Realising Our Potential' acknowledges and seeks to address this issue. Civil engineering shares this problem with most of the rest of engineering and, indeed, with all those employment sectors that use people with skills in Science, Technology, Engineering and Maths. An integrated approach is therefore needed to address the problem. Approaches such as the Science and Engineering Ambassadors programme offer relatively low cost structured ways to seek to engage young people of all levels of potential and could therefore play a useful role.

Another difficulty to be overcome is the mismatch between university investment in education in science, engineering and technology, and the national need for a healthy cadre of professionals in this area. This is in part because engineering degrees are more expensive to provide, and that the student demand is for other subjects, despite the national need for an increased number of science, engineering and technology professionals to drive economic growth. Stimulation of student demand may be raised by bursary schemes such as recently launched by the Institute of Physics. Civil engineering interests could usefully monitor the success of this and may wish to consider a similar initiative.

Requirements for other skills

It is clear that flood-risk management requires more than just engineering skills, important though these are.

We can get some idea of the training requirements by looking at the qualifications and subject expertise of a sample of staff who have joined the Environment Agency in the past few years to work on flood defence. While this is not necessarily a representative guide to what will happen decades from now, it does indicate the types of expertise that are considered important in this area.

The evidence shows that while engineers are undoubtedly important to flood and coastal defence, they do not numerically dominate recruitment (see Table C1). This may indicate a problem in recruiting engineers in a period of shortage, but whatever the cause the broader disciplines of environmental sciences and geography dominate recruitment. Staff with these specialisms work in the Agency on non-engineering aspects of flood defence, which have been growing in importance recently. The evidence also shows that while graduates dominate the intake, non-graduates with a range of more basic qualifications are also being recruited (see Table C2).

Exploring this matter further, with information from the Chartered Institution of Water and Environmental Management and the Royal Geographical Society, shows no current shortage of environmental scientists and geographers. The output from universities in these subjects is generally stable. There is broadly no excess of demand over supply, and therefore there is no reason to conclude that there is likely to be a major skills shortage in this area in the future. The same applies to members of the Royal Town Planning Institute and its graduate entry. At present it is not therefore foreseen that there will be a significant shortage in the future in the non-engineering professional specialisms required for flood-risk management.

Table C1 **The degree subjects of those joining the flood-risk management staff of the Environment Agency in 2000-2002 (sample size 92)**	
Geography, etc	41.3%
Environmental Sciences, etc	29.3%
Engineering	19.6%
Other degree subjects	4.3%
Zoology, etc	3.3%
Humanities	1.1%
Art and Design disciplines	1.1%

Table C2 **The non-degree qualifications of those joining the flood risk management staff of the Environment Agency in 2000-2002 (sample size less than 50)**	
HNC/HND	29.7%
GCSE or 'O' Level only	24.3%
None cited	21.6%
'A' Level only	13.5%
NVQ	8.1%
BTEC	2.7%

Requirements for multidisciplinary (lifelong) skills

Flood-risk management has facets of engineering construction, environmental protection, land-use planning and the mobilisation of public goodwill and co-operation. As with any problem of this character, it is necessary to develop a workforce with multi-disciplinary leadership qualities.

Indeed, under nearly all scenarios in this report, the drive for sustainability in flood-risk management will require professionals with skills that enable them to move freely in the entire economic, social and environment domain. This mix is part of the complete engineer's outlook and training. Many civil engineers should be well able to rise to this challenge.

The unique mix that will be required for flood-risk management – and the rapid pace of change posited in many of the Foresight scenarios – will increasingly demand specific life-long 're-education' and continuous professional development (CPD) at all levels, focused on the field's multi-disciplinarity. CPD is inadequately developed for the enhanced flood-risk management that this Foresight project shows that we may need.

Conclusions

- Flood-risk management will continue to require skills over a range of disciplines.
- Some key functions will continue to depend upon civil engineers.
- The present declining number of civil engineering graduates, and an increasing workload, will inevitably lead to skill shortages, which can only be remedied in the long term by action in schools, higher education, and the industry, to encourage more candidates to enter this discipline.
- There is no evidence of a shortage, now or in the foreseeable future, of the other disciplines presently used to in the management of flood risk.
- Flood-management professionals, both civil engineers and others, will need to broaden their skills base to address more integrated and multidisciplinary issues.