

# Skilled Shortage Sensible

Second review of the recommended  
shortage occupation lists for the  
UK and Scotland: Autumn 2009

Migration Advisory Committee Report

October 2009



## Chapter 5: **Engineering occupations**

### **5.1 Introduction**

5.1 In this chapter we discuss the evidence we received in relation to engineering-related occupations.

### **5.2 Our approach**

5.2 The engineering sector is diverse and there are a large number of specialisms. Many sectors have developed their own occupational titles and many employers have different names for similar roles. The sector told us that this presents them with a problem in respect of our requirement that the evidence we receive specifies which occupations and job titles, according to SOC2000 at the unit group (4-digit) level, the evidence relates to. This is because the job titles listed in SOC2000 do not cover many of the occupational categories used by the engineering sector.

5.3 We held an engineering stakeholder workshop in March 2009, involving Semta, Energy & Utility Skills (EU Skills), ConstructionSkills, Oil & Gas UK, Cogent SSC Ltd, the Engineering Construction Industry Training Board, Marshall Aerospace, AeroAcademy, the Institution of Civil Engineers, the Engineering Council UK, the Institution of Chemical Engineers (IChemE), GoSkills, the Ground Forum, the Recruitment and Employment Confederation, Skills for Logistics, e-skills, Lantra, CLAAS UK, the Scottish Council for Development and Industry (SCDI), Rolls-Royce and IMI Automotive Skills.

5.4 Before the workshop, Semta agreed to work across the sector to look at how the structure of engineering occupations could be unified to help alleviate the challenges of relating them to SOC categories. They prepared a paper about this, which they presented at the workshop.

5.5 At the workshop it was agreed that for this review the sector would provide us with occupations or job titles which were as closely mapped to SOC2000 as possible.

5.6 During June and July 2009, we held follow-up meetings with individual stakeholders to discuss our approach. We also attended a meeting organised by Semta which included attendees from the Engineering Council UK, ConstructionSkills, SummitSkills, the Engineering Construction Industry Training Board, EU Skills, IMI Automotive Skills and GoSkills.

5.7 We now discuss in detail the engineering-related occupations that we recommend, either totally or in part or not at all, for inclusion on the shortage occupation list.

### 5.3 Physicists, geologists and meteorologists

#### Box 5.1: Physicists, geologists and meteorologists

**Occupation(s) and SOC code(s):** Physicists, geologists and meteorologists – 2113

**Only the following job titles within this occupation are included on our recommended shortage occupation list:**

Engineering geologist, hydrogeologist, geophysicist, geoscientist, geophysical specialist, engineering geophysicist and engineering geomorphologist.

#### Top-down data

##### 2113 Physicists, geologists and meteorologists

Skilled	Skilled in top-down analysis						
SOC skill level classification	4			Median hourly pay for all employees	£18.16		
Percentage of employees with NVQ3+	91.8						
<b>Shortage</b>	<b>Excluding National Employers Skills Survey-based data, occupation passes 4 out of 8 valid indicators</b>						
Indicators	Sept 08	Mar 09	Sept 09	Indicators (continued)	Sept 08	Mar 09	Sept 09
P1 Annual percentage change of median hourly pay for all employees	-1.4	5.7	5.7	V2 Annual percentage change in employment estimates	-11.6	23.3	33.3
P2 Annual percentage change of mean hourly pay for all employees	-0.8	0.3	0.3	V3 Annual percentage change of median total paid hours	0.7	0.3	0.3
P3 Return to occupation, given NQF3, with age and region controls	0.77	0.99	*	V4 Absolute change in proportion working for employer under 1 year	0.03	0.06	0.04
I1 Absolute change in median vacancy duration	*	*	2.1	E1 SSVs as a percentage of all vacancies	42	42	*
I2 Live unfilled vacancies/unemployment by sought occupation	0.05	0.08	0.07	E2 SSVs as a percentage of hard-to-fill vacancies	95	95	*
V1 Annual percentage change in unemployment by sought occupation	-32.2	13.4	119.5	E3 SSVs as a percentage of total employment	1.61	1.61	*
Sensible indicators	Sept 08	Mar 09	Sept 09		Sept 08	Mar 09	Sept 09
Percentage of workforce born non-EEA	22	12	10	Percentage of workforce trained in past 13 weeks	42	30	28

#### Stakeholder evidence:

We received evidence from the Ground Forum, Oil & Gas UK and the SCDI.

- 5.8 In our autumn 2008 report we included job titles relating to ground engineering professionals on our recommended shortage list. We placed some of the job titles under this SOC code and also under the occupation of civil engineers.
- 5.9 The Ground Forum stated that there are continued labour shortages in the ground engineering sector. We were told that the ground engineering professionals that fall within this occupation are engineering geologists.
- 5.10 Oil & Gas UK also said that there are labour shortages within the oil and gas industry.
- 5.11 We previously confirmed that physicists, geologists and meteorologists are skilled. We also received evidence that engineering geologists are required to have a first degree in geology and an MSc in engineering geology. Oil & Gas UK said that all occupations within the oil and gas industry require a minimum qualification of a degree level or above, which is equivalent to NVQ level 5.
- 5.12 Our top-down analysis of the data confirmed that physicists, geologists and meteorologists passed 4 out of 8 valid shortage indicators, a relatively high number satisfying our criteria for strong top-down evidence of shortage. The top-down data suggest that there have been significant increases in employment in the occupation and also increases in the proportion of new hires. In addition, vacancy durations are increasing but the ratio of Jobcentre Plus (JCP) vacancies to Jobseeker's Allowance (JSA) claimants is low, suggesting that the level of labour supply for vacancies is relatively high, although JCP data for highly skilled occupations need to be regarded with a degree of caution. The data also indicate that, like other occupations, the JSA claimant count in this occupation has increased considerably.
- 5.13 In terms of shortage, we received evidence from the Ground Forum that surveys carried out by them in 2004 and 2008 confirmed that there were vacancy rates of 12 to 15 per cent. We were also told that companies in the sector had reported that numbers in the industry have remained largely the same as in previous years, despite the economic downturn.
- 5.14 The Ground Forum told us that there is no evidence of a 'pool' of unemployed ground engineering professionals. They said anecdotal evidence suggests that emigration may have reduced the number of ground engineering professionals in the UK during the past 12 months.
- 5.15 We saw evidence that a Ground Forum survey, conducted in April 2009, indicated that the recession had affected hiring in the past 12 months; 50 per cent of respondents had reduced the number of ground engineering professionals they employ; 33 per cent had remained the same; and 17 per cent had increased the number. Nevertheless, the Ground Forum said that projections for the next 12 months indicated that 70 per cent of the respondents expected to employ the same number of ground engineering professionals as now, and that 23 per cent expected an increase.

*"The level of work in the construction sector has fallen significantly since autumn 2008, but the effect on ground engineering consultants has been less dramatic."*

Ground Forum response to MAC call for evidence

- 5.16 The Ground Forum told us that there is evidence of recruitment activity and that this is in part due to the industry's involvement in large infrastructure projects such as Crossrail, the Thameslink improvements and the nuclear waste programme. The Ground Forum said this activity indicates that the need for ground engineering professionals begins when projects are still in their planning stage.
- 5.17 We were also told that design staff are being placed in the clients' office for the duration of the contract, which could, in some instances, run for several years. We were told that this restricts the flexibility of staff deployment and resources and therefore increases the need for additional ground engineering professionals.
- 5.18 Oil & Gas UK told us that occupations in the oil and gas industry typically earn much higher than average salaries. They said that wages for shortage occupations within the industry have increased over recent years. We also received evidence that the annual Hewitt salary survey of oil companies operating in the UK shows that the annual salary increases within the oil and gas sector are continuing to rise, with increases above inflation each year.
- 5.19 In terms of sensible, it is notable that the proportion of non-EEA nationals employed in this occupation as a whole appears to have fallen substantially since our report in autumn 2008. Training activity has declined too. It was argued that there is a widely recognised shortage of UK civil engineering graduates, but that ground engineering is a small industry and does not have the resources to be able to influence take-up of civil engineering or geology first degrees as a precursor to specialist study.
- 5.20 The Ground Forum told us that while many of the difficulties faced by the industry are outside of its control, they continue to lobby government for financial support for students, and remain committed to improving communication between employers and universities.
- 5.21 We also received evidence of in-house training to give non-engineer employees sufficient knowledge to undertake some of the more routine jobs that would otherwise be done by ground engineering professionals. We also saw evidence of companies making greater use of independent, self-employed ground engineering professionals.
- 5.22 Oil & Gas UK said that the oil and gas industry has invested heavily in the training and development of employees. We were told that due to ongoing skills shortages within the industry, 'fast-track' promotion systems are now common within certain occupations, as companies intensively train less experienced employees in order to fill the senior-level vacancies across the industry. The industry has collectively invested around £6 million to set up the Oil & Gas Academy, which is working on identifying and tackling key skills gaps, as well as providing cross-industry training programmes and working with UK schools and universities to ensure a constant feed of new entrants to the industry.
- 5.23 The Ground Forum presented evidence to indicate that the shortage of ground engineering professionals is not only restricted to young engineers. Recruitment dropped sharply during the recession in the early 1990s and the industry lost a number of graduates. This resulted in a shortage of people with 15–20 years' experience.

- 5.24 Physicist, geologist and meteorologist is a diverse occupation and, when taken in combination with the relatively strong top-down evidence of shortage, and also in light of the fact that we only received evidence on specific job titles, we believe there is sufficient evidence to justify retaining some job titles within the occupation on our recommended shortage list, as set out in Box 5.1. We accept that the ground engineering occupation comes into play when projects are still in their planning stages. However, the industry needs to take steps to ensure that it has a sufficiently robust strategy in place to increase the stock of UK workers in the longer term.
- 5.25 We reviewed civil engineers in our autumn 2008 report and included all job titles within this occupation on our recommended shortage list.
- 5.26 For this review, we received very little evidence from the engineering sector as a whole arguing that there is a labour shortage in this occupation. However, we did receive evidence in support of shortages within the ground engineering, electricity generation, and oil and gas industries.

## 5.4 Civil engineers

### Box 5.2: Civil engineers

Occupation(s) and SOC code(s): Civil engineers – 2121

**Only the following job titles within this occupation are included on our recommended shortage occupation list:**

Geotechnical engineer, geotechnical design engineer, geotechnical specialist, reservoir panel engineer, rock mechanics engineer, soil mechanics engineer, geomechanics engineer, tunneling engineer; petroleum engineer, geoenvironmental engineer, contaminated land engineer, drilling engineer, completions engineer, fluids engineer, reservoir engineer, status resource engineer, offshore and subsea engineer, control and instrument engineer, process safety engineer, planning drilling engineer, subsurface engineer, project civil engineer in the electricity generation industry.

### Top-down data

#### 2121 Civil engineers

Skilled	Skilled in top-down analysis						
SOC skill level classification	4			Median hourly pay for all employees	£16.13		
Percentage of employees with NVQ3+	82.2						
Shortage	Excluding National Employers Skills Survey-based data, occupation passes 5 out of 9 valid indicators						
Indicators	Sept 08	Mar 09	Sept 09	Indicators (continued)	Sept 08	Mar 09	Sept 09
P1 Annual percentage change of median hourly pay for all employees	5.1	6.8	6.8	V2 Annual percentage change in employment estimates	0.8	13.3	15.8
P2 Annual percentage change of mean hourly pay for all employees	3.4	9.0	9.0	V3 Annual percentage change of median total paid hours	2.4	-0.1	-0.1
P3 Return to occupation, given NQF3, with age and region controls	1.08	0.65	0.82	V4 Absolute change in proportion working for employer under 1 year	0.00	0.03	0.03
I1 Absolute change in median vacancy duration	-11.3	8.5	1.6	E1 SSVs as a percentage of all vacancies	60	60	*
I2 Live unfilled vacancies/unemployment by sought occupation	1.35	0.72	0.25	E2 SSVs as a percentage of hard-to-fill vacancies	88	88	*
V1 Annual percentage change in unemployment by sought occupation	-9.2	144.1	436.5	E3 SSVs as a percentage of total employment	2.10	2.10	*
Sensible indicators	Sept 08	Mar 09	Sept 09		Sept 08	Mar 09	Sept 09
Percentage of workforce born non-EEA	10	14	11	Percentage of workforce trained in past 13 weeks	31	36	33

#### Stakeholder evidence:

We received evidence from the Ground Forum, Construction Skills, EU Skills, Oil & Gas UK, SCDI and a leading employer of petroleum engineers.

- 5.27 We received evidence from the Ground Forum that the ground engineering professionals that fall within this occupation are geotechnical engineers. This job title requires a first degree in civil engineering, plus an MSc in soil mechanics. We were also told that engineers in the oil and gas industry are qualified to National Qualifications Framework (NQF) level 3 or above. Our analysis of the top-down data confirms that civil engineers are skilled.
- 5.28 Civil engineers passed on 5 out of 9 shortage indicators, which suggests that this occupation may be in shortage. The top-down data indicate that there have been significant increases in employment in the occupation and also increases in the number of new hires. Pay in the occupation has also increased considerably although it is based on the Annual Survey of Hours and Earnings (ASHE) 2008, so pre-dates the current recession. On the other hand, large increases are observed in the unemployment claimant count. The data also indicate that the ratio of JCP vacancies to claimant count is low, although similar caveats apply here as to the data for physicists, geologists and meteorologists, discussed earlier.
- 5.29 We received evidence from Ground Forum that the recession has had an impact on the value of new orders received by its members, for example a drop in orders in the fourth quarter of 2008. However, they also told us that developers are continuing to prepare for the upturn by undertaking all the preparatory work that would allow a quick start when funding becomes available. We are told that this includes ground engineering activities.
- 5.30 We were told that ground engineering professionals make their contribution at the very start of the project. For example, contaminated land specialists are likely to be active when a site is purchased by a developer and other geotechnical work is done at the first stage of the building project. Therefore, ground engineering can expect to be among the very earliest sectors to experience any upturn.
- 5.31 The Ground Forum told us of reported tender activity, which suggests a number of projects ready to start as soon as the economic climate changes.
- 5.32 We were presented with evidence from a leading employer of petroleum engineers that it is becoming increasingly problematic to recruit EEA national graduates who have undertaken degree courses in relevant disciplines for petroleum engineer roles. We saw evidence that the number of UK engineering students that chose to pursue a career in engineering has fallen. We were told that up to 40 per cent of UK engineering students choose not to pursue a related career. This has shrunk the available pool of skilled recruits.
- 5.33 Evidence was provided showing that, by 2010, there will be a 10–15 per cent shortfall in the numbers of petroleum engineers in relation to global demand.
- 5.34 We saw evidence that the average length of time between first advertising a UK vacancy and subsequently filling that vacancy is six to seven months and that the duration period is increasing. We were also told of higher than average salary increases in the industry.
- 5.35 EU Skills told us that around 26 power stations, representing approximately 25 per cent of the UK's electricity generating capacity, are scheduled to close by 2018. EU Skills said the UK must construct new power stations and other energy infrastructure at a time when there will

be very high demand for engineering construction resources from other sectors. EU Skills said the increasing role of renewable energy in the UK's energy mix will be an additional draw on an already stretched labour market.

*"The employer-led Power Sector Skills Strategy Group recognises the issue of global demand for power engineering skills and the fact that much of the infrastructure around the world is of a similar age to that of the UK's. Also, with demand for power output increasing the world over, the UK will have to work hard to gain the quantity and quality of skills it needs and even harder to keep it. Consequently, there is strong global demand for skilled workers with experience of the electricity generation industry, and it is likely to increase considerably in the coming years."*

EU Skills response to MAC call for evidence

the Labour Force Survey (LFS) and the sectors for which ConstructionSkills has responsibility, that its evidence is relevant to just over half of those employed as civil engineers. Therefore we give heavy weight to it.

- 5.39 ConstructionSkills said that the recession continues to impact, despite some signs that the rate of decline has slowed.

*"The industry is experiencing the most severe contraction in over 30 years, and despite the Government's and industry's best efforts to lessen the impact its effect on jobs and employment is evident. Indeed, the situation has progressively deteriorated since the beginning of the economic slowdown and appears to have accelerated after crisis in the financial markets in September and October 2008."*

EU Skills response to MAC call for evidence

- 5.36 We received evidence that in the electricity generation industry there is an ageing workforce. For example, we were told that approximately 59 per cent of the current generation workforce is expected to retire within the next 15 years.
- 5.37 Oil & Gas UK told us that companies within the oil and gas industry have vacancies, particularly in the engineering and science/technology fields, which they find difficult to fill. We were told that these vacancies were taking from 3 to 12+ months to fill, with an average of around 6 months. We were told that several of the companies reported vacancies in the engineering and science/technology fields that, even after a year, they had been unable to fill.
- 5.38 With regard to the construction industry, ConstructionSkills told us that there is no strong evidence of any shortage of civil engineers. We note from examining
- 5.40 We were told that the majority of major contractors have reported a steep decline in activity and there are signs that the current situation will worsen throughout the remainder of 2009.
- 5.41 Figures from the Office for National Statistics (ONS) show that orders in the three months to April 2009 fell by 9 per cent compared with the previous three-month period.
- 5.42 We received evidence of job losses. For example, we saw estimates that suggest the construction industry has lost around 10 per cent of its workforce, around 250,000 people, in less than 18 months. We received evidence that the redundancies have affected all occupational groups from the unskilled to managers and professionals. It is plausible that the large increases in claimant count observed for civil engineers in the top-down data to some extent reflect

- job losses in the construction industry. However, the top-down data show that the civil engineer workforce continues to grow strongly. It is therefore unclear whether the downturn in construction is impacting on civil engineering as a whole.
- 5.43 Turning to sensible, the Ground Forum said that it is a financial sponsor and regular contributor to a magazine which aims to stimulate interest in civil engineering. We were also told that, individually, a number of Ground Forum members visit schools and interact with students in order to promote the sector.
- 5.44 However, we were told that the recent changes in first degree civil engineering and earth sciences courses is believed to adversely affect the take-up of ground engineering MSc courses, because they do not contain sufficient ground engineering content for someone to be considered to be a geotechnical engineer or engineering geologist on graduation.
- 5.45 We also saw evidence of training and upskilling of the potential workforce. For example, we were told of energy companies that operate a number of internal engineering academies to ensure that petroleum engineers are at the forefront of technology changes.
- 5.46 With regard to mechanisation, EU Skills told us that the electricity generation industry is already capital intensive and such technological changes would take many years to develop and implement. They said that, in the short term, there are no alternatives to using labour and if there is not enough labour to undertake the required workload the implications are that the work may not be completed within agreed timescales and investment plans may be pushed back. EU Skills also said that the power sector cannot contemplate
- a future where it is forced to operate with sub-critical staff numbers and if that were to happen it would be forced to close plants, leading to supply interruptions with damaging impact across the economy. We were also presented with evidence that the oil and gas industry has made considerable investment over the last few decades in developing cutting-edge technology and efficient production and operating systems.
- 5.47 In conclusion, despite apparently strong top-down evidence of shortage, rapidly rising unemployment and substantial numbers of redundancies and evidence from a highly relevant Sector Skills Council telling us there is not an overall shortage means that we cannot justify the inclusion of the whole civil engineer occupation on our shortage list. We note from the Points Based System (PBS) data that employers have made use of the shortage occupation route to bring in civil engineers, but we also note that they have also used other routes within Tier 2 of the PBS.
- 5.48 Civil engineering is a diverse occupation and therefore it is plausible that there will be shortages in relation to some job titles and not others. We believe we have received sufficient evidence to justify retaining some job titles relating to the ground engineering, oil and gas and electricity generation industries on our recommend shortage list as listed in Box 5.2.
- 5.49 This occupation is not on the current shortage occupation list. Oil & Gas UK and the SCDI argue that there is a shortage of electrical engineers in the oil and gas industry. Our analysis of the data confirms that electrical engineers are skilled.

## 5.5 Electrical engineers

### Box 5.3: Electrical engineers

**Occupation(s) and SOC code(s):** Electrical engineers – 2123

**Only the following job titles within this occupation are included on our recommended shortage occupation list:**

Electrical engineer in the oil and gas industry and (discussed later in this chapter) power system engineer, control engineer, protection engineer, project control engineer, control and instrumentation engineer, assistant engineer, electrical engineer in the electricity transmission and distribution industry.

### Top-down data

#### 2123 Electrical engineers

Skilled	Skilled in top-down analysis						
SOC skill level classification	4			Median hourly pay for all employees	£18.25		
Percentage of employees with NVQ3+	76.0						
<b>Shortage</b>	<b>Excluding National Employers Skills Survey-based data, occupation passes 4 out of 9 valid indicators</b>						
Indicators	Sept 08	Mar 09	Sept 09	Indicators (continued)	Sept 08	Mar 09	Sept 09
P1 Annual percentage change of median hourly pay for all employees	0.9	5.6	5.6	V2 Annual percentage change in employment estimates	-1.2	-5.6	-4.0
P2 Annual percentage change of mean hourly pay for all employees	1.1	4.8	4.8	V3 Annual percentage change of median total paid hours	-0.6	1.8	1.8
P3 Return to occupation, given NQF3, with age and region controls	1.06	1.03	1.19	V4 Absolute change in proportion working for employer under 1 year	-0.01	0.01	0.02
I1 Absolute change in median vacancy duration	-8.9	-6.5	-8.7	E1 SSVs as a percentage of all vacancies	39	39	*
I2 Live unfilled vacancies/unemployment by sought occupation	1.52	1.27	0.64	E2 SSVs as a percentage of hard-to-fill vacancies	86	86	*
V1 Annual percentage change in unemployment by sought occupation	-21.4	52.5	170.9	E3 SSVs as a percentage of total employment	0.46	0.46	*
Sensible indicators	Sept 08	Mar 09	Sept 09		Sept 08	Mar 09	Sept 09
Percentage of workforce born non-EEA	7	8	7	Percentage of workforce trained in past 13 weeks	27	32	31

#### Stakeholder evidence:

We received evidence from Oil & Gas UK, SCDI and EU Skills.

- 5.50 This occupation passed on 4 out of 9 valid shortage indicators, which is a significantly higher proportion than average. Pay is increasing, although the increase in mean pay falls short of the threshold for shortage. There remains a high ratio of JCP vacancies to JSA claimants seeking work in the occupation, indicating that a limited pool of unoccupied workers may be available to fill posts.
- 5.51 In terms of shortage, Oil & Gas UK told us that in 2009, with the support of SCDI, they undertook a data collection exercise through their membership to identify the key shortage occupations within the industry. They said a total of 30 member companies responded to their request. Due to the ongoing difficulties with recruitment in key oil and gas occupations, companies are investing increasingly large amounts of money and effort into recruitment. Oil & Gas UK said over 90 per cent of respondents reported having to re-advertise vacancies or hire recruitment agencies after initial recruitment campaigns failed. This, they said, included recruitment agencies that search for and recruit talent from overseas, including outside of the EEA.
- 5.52 In addition, we were told that over one-third of companies who responded to Oil & Gas UK's survey reported that they have increased the already generous remuneration and benefit packages offered after initial advertising failed. Oil & Gas UK said those who did not increase remuneration reported other initiatives, such as employee referral schemes, where current employees are paid a bonus for each successful candidate referred. Over 50 per cent of companies reported that outstanding vacancies have created a situation where current employees had to work overtime to compensate for the shortages in these key occupations.
- 5.53 Turning to sensible, we were told that the oil and gas industry is one which requires very specialist skills, which are not easily transferable from other sectors. We also saw evidence of the industry investing in training and up-skilling its potential workforce. For example, we were told that the industry had collectively invested approximately £6 million to set up the Oil & Gas Academy.
- 5.54 In terms of the broader market situation, Oil & Gas UK told us that due to the continued demand for energy in the UK, activity levels will continue to remain high within the oil and gas industry, as will the demand for specialist skilled labour. They said if efforts are not made to ensure that organisations are able to access migrant labour to fill these shortage occupations, costs will continue to rise, and productivity levels may be adversely affected. Oil & Gas UK said the UK is one of the most expensive oil and gas provinces in the world, and any further pressures on the supply of skilled workers risks reducing its attractiveness to larger multinationals and ultimately affecting the long-term sustainability of the industry.
- "It is vital therefore that the UK encourages continued investment by promoting an environment in which industry can access the skilled labour it needs from the EEA, and beyond if necessary, and consequently help in delivering the conditions for business success within the UK."*
- Oil & Gas UK response to MAC call for evidence
- 5.55 Overall, we believe that we have received sufficient evidence to justify including electrical engineers in the oil and gas industry on our recommended shortage occupation list. Electrical engineers employed in the electricity transmission and distribution industry are discussed later in this chapter.