Guidance Notes for Applicants Undertaking the Work Based Learning Route Towards Chartered Engineer Status

Introduction

The Engineering Council's recognised educational qualification for Chartered Engineers (CEng) is an accredited Bachelors degree with honours in engineering or technology, plus either an appropriate Masters degree accredited by a professional institution, or appropriate further learning to Masters level, **or** an accredited integrated MEng degree. CIWEM relies on the list of accredited programmes published by the Engineering Council (EC).

Applicants without the recognised qualification are considered by CIWEM's Qualifications Panel (QP). In some cases the QP, based on the applicant's submitted curriculum vitae, may decide that there is potential for the applicant to demonstrate that they have achieved the equivalent learning to the recognised qualifications through their experience. In such cases they may invite the applicant to undertake the Work Based Learning Route. Although we use the term 'work based learning', wider learning gained for example by voluntary work may also contribute to the learning process.

Outline of the Process

The individual assessments route for applicants is split into four key stages undertaken prior to submitting a standard application for Professional Review, the process is outlined in full in the flowchart in Appendix A:

1. Individual submit relevant qualifications and CV, QP determine the work based learning assessment route as appropriate for the applicant
2. Applicant submits work based learning plan (See Appendix B for example), this is reviewed by the QP
3. Applicant undertakes additional learning and submits a final version of their work based learning plan; this will be reviewed by the Qualifications Panel.
4. If satisfactory applicants will be invited to an initial interview to assess that you have achieved the required level of learning.

Upon initial submission of your qualifications and CV to CIWEM a decision on which route is applicable for applicants is typically confirmed within 1-2 weeks, subsequent review of applicants work based learning plans typically will be undertaken within 2-4 weeks. We endeavour to inform applicants of the outcome at each stage at the earliest convenience.

Eligibility

In order to undertake the Work Based Learning route you must already be a non-chartered member (MCIWEM)/Chartered member (C.WEM) or have applied for MCIWEM/C.WEM. This membership must be maintained throughout the process.

Learning Outcomes

Higher education qualifications are defined in terms of learning outcomes. You will need to demonstrate that your learning matches the learning outcomes expected from a Masters Level engineering degree. These have been agreed between the Qualifications Assurance Agency (QAA) and EC and fall into the following areas:

- Science, Mathematics and Engineering Principles
- Engineering Analysis
- Design and Innovation
- The Engineer and Society
- Engineering Practice

You need to demonstrate in your work based learning submission that you are able to do each of the following:

Science, mathematics and engineering principles:

M1: Apply a comprehensive knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems. Much of the knowledge will be at the forefront of your area of study and informed by a critical awareness of new developments and the wider context of engineering.

Engineering Analysis

M2: Formulate and analyse complex problems to reach substantiated conclusions. This will involve evaluating available data using principles of mathematics, statistics, natural science and engineering, and using engineering judgement to work with information that may be uncertain or incomplete, discussing the limitations of the techniques employed.

M3: Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed.

M4: Select and critically evaluate technical literature and other sources of information to solve complex problems.

Design and Innovation

M5: Design solutions for complex problems that evidence some originality and meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health and safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards.

M6: Apply an integrated or systems approach to the solution of complex problems.

The Engineer and Society

M7: Evaluate the environmental and societal impact of solutions to complex problems (to include the entire life-cycle of a product or process) and minimise adverse effects.

M8: Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct.

M9: Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular project or activity.

M10: Adopt a holistic and proportionate approach to the mitigation of security risks.

M11: Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion.

Engineering Practice

M12: Use practical laboratory and workshop skills to investigate complex problems.

M13: Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations.

M14: Discuss the role of quality management systems and continuous improvement in the context of complex problems.

M15: Apply knowledge of engineering management principles, commercial context, project and change management, and relevant legal matters, including intellectual property rights.

M16: Function effectively as an individual, and as a member or leader of a team. Evaluate effectiveness of own and team performance.

M17: Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used.

M18: Plan and record self-learning and development as the foundation for lifelong learning/CPD.

Several of the outcomes refer to "complex problems". You should take this to mean those having no obvious solution which may involve wide-ranging or conflicting technical issues and/or user needs that can be addressed through creativity and the resourceful application of engineering science.

An example partially completed initial work based learning plan, are given in Appendix B. The example evidence and reflection is intended to illustrate the style of statement that is required.

If you already hold an Bachelors degree in engineering at honours level, and CIWEM have advised you that this partially meets the educational requirements then you do not need to address learning outcomes M6, M8 to M15 and M16. If you are unclear on the status of such a Bachelors degree, please contact the CIWEM office for clarification.

Difference between Traditional and Work Based Learning approaches

Unlike traditional academic learning, work based learning often takes place shortly before its application is needed. Indeed, in many cases it takes place at the same time as its application and it is only on reflection that you appreciate that you have learnt something new.

What is the difference between demonstrating learning outcomes and competencies?

The emphasis within learning outcomes is generally the demonstration of knowledge and understanding. Competency is what you can do in a satisfactory way. It is sometimes possible to perform competently without the knowledge and understanding. However, a professional engineer's competence must be underpinned by sound knowledge and understanding and it is the latter that you need to demonstrate in your Work Based Learning submission.

Mentoring

We suggest that you obtain a mentor to support you in the process of preparing your Work Based Learning submission. In selecting a mentor, you might consider the need for them to provide you with information, support and challenge. The first suggests that someone who has successfully negotiated a similar process themselves might be a useful mentor. The need for challenge indicates that you need someone who is not afraid to offer criticism. Because you are attempting to match academic outcomes, someone experienced in higher education might be appropriate. A further useful characteristic of the mentor is knowledge of what you have done, someone who could perhaps say "I remember you did … - hasn't that taught you …?" In practice you will be extremely lucky to find a mentor who has all these attributes, so you will need to compromise a little. You might like to take advantage of the Mentor Platform available on the CIWEM website.

Where are you now?

Your first step with your mentor will be to see the extent to which your experience has already contributed to achievement of the outcomes. Engineering Council guidance states that the emphasis should be on a holistic assessment of the totality of information you provide, rather than a box-ticking approach to every aspect of the learning outcomes. You are trying to identify what you have learnt from engineering work on significant engineering tasks or projects that have required independent thought or deliberation, application of engineering knowledge, and responsibility.

Having looked at what you have already achieved you will need to compile an action plan to fill in the gaps. This may involve taking on different responsibilities at work or undertaking training. If the Qualification Panel's initial judgement that you are a suitable applicant for the Work Based Learning Route is correct, then the amount of gap filling should be limited.

Your action plan needs to be submitted to CIWEM for consideration by the Qualifications Panel which may approve it without amendment, require amendments, or decide that the route is not feasible for you.

Your completed submission

Once you have completed the additional learning identified in the approved action plan you will need to submit your final work based learning document. This will take a similar form to your original documented, supplemented by similar commentaries on both the agreed additional learning and any other additional work based learning since your original submission. A statement from your mentor confirming the authenticity of your submission will be required.

It is important to remember that the evidence you include will form the basis of your subsequent work based learning interview. You should therefore be careful to include only learning that you would be comfortable discussing at interview.

Assessment of your final submission

Your final submission will be reviewed by a panel of generally 3 assessors. As the intention is to match your work placed learning against the outcomes of an academic programme, at least one of the assessors will have an academic background and one will be a Chartered Engineer in the same or closely related discipline to yourself. If the panel consider that this is not satisfactory you will be given guidance on what you are required to do in the way of re-submission.

If your submission is satisfactory you will be invited to an interview with the assessors to confirm that you have achieved the required level of learning. This is a separate interview to the subsequent Professional Interview.

The interview will usually last between 90 and 120 minutes with questioning aimed at:

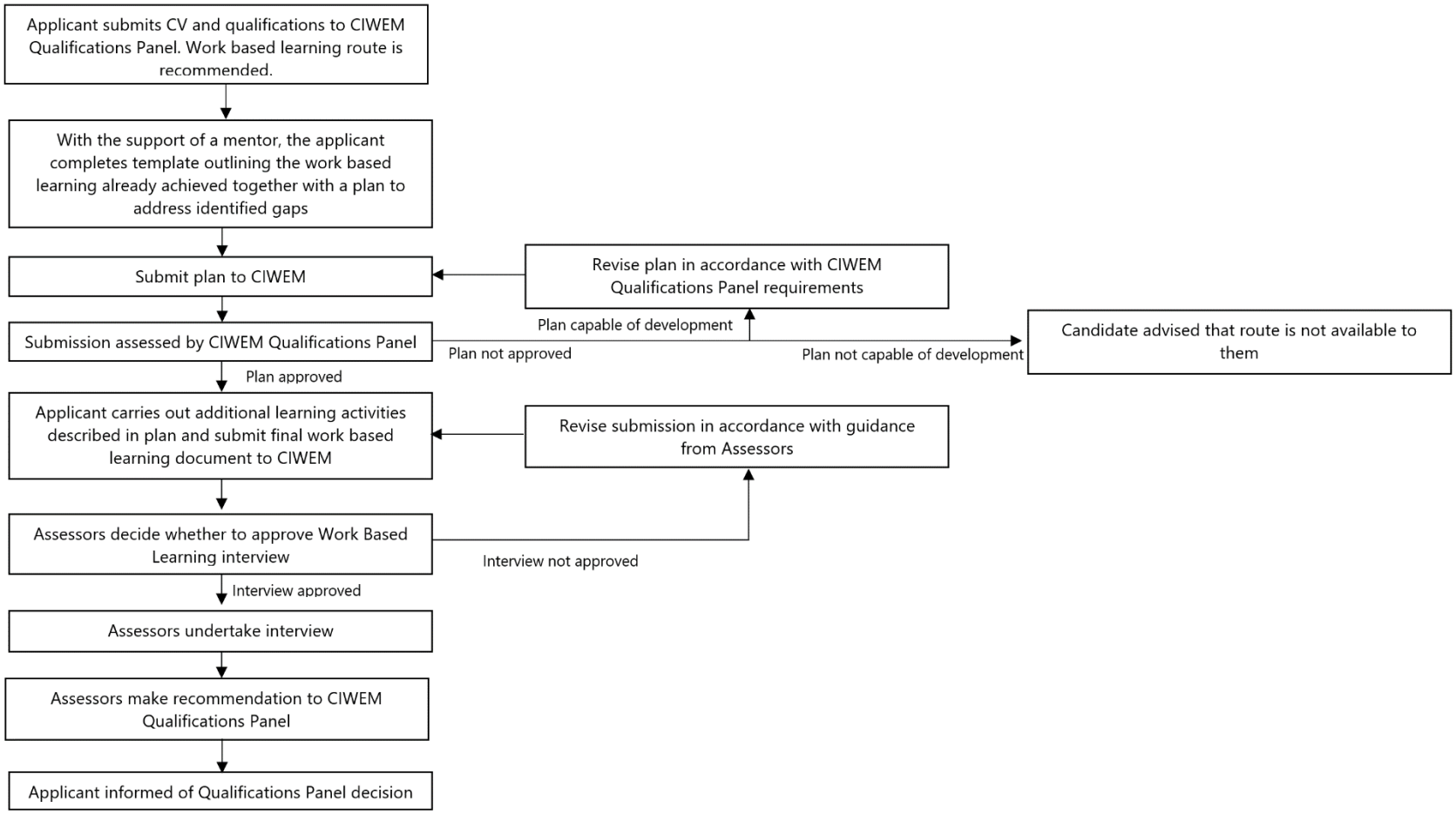
- Clarifying any areas of ambiguity or uncertainty;
- Establishing that you have an appropriate understanding of the principles, concepts and theories covered in your submission; and
- Examining how you have applied and evaluated these principles, concepts and theories.

Although you can expect the questioning to be challenging, it is intended that the interview will be conducted in a cordial and non-confrontational manner. The agenda for the interview will be as follows:

- Welcome and introduction
- General "ice-breaking" questions
- Confirmation by the panel of the aims of the interview
- Formal questioning on your submission
- An opportunity for you to ask any questions or add anything missed
- A reminder of the next steps and when you can expect to hear the outcome (no indication of the outcome is given at the interview)
- Close of interview

The assessors will reach an agreement on whether or not you have demonstrated the required learning outcomes and make a recommendation for approval to CIWEM's Qualifications Panel. The Qualifications Panel's decision will be passed to the Professional Standards Committee for ratification. If the Qualifications Panel's decision is that you have successfully demonstrated that you have achieved the learning outcomes, you will then enter the normal Professional Review Process.

Appendix A Flow Chart of Work Based Learning Route for Engineering Council Registrations



Appendix B Example Partially Completed Initial Work Based Learning Plan

Background Statement

You should give a summary of your background in terms of previous academic studies and experience to date
After completion of a computer science degree at ●●● University, I obtained a hydraulic modelling post at ●●●, a firm of consulting engineers. Following in-house training in the use of ●●● for 1D and 2D models, I worked under the supervision of the senior hydraulic modeller. As my experience of modelling increased I realised that to progress further I needed to expand my area of expertise and took the opportunity to become involved in the firms wider activities within its work for clients such as lead local flood authorities. This allowed me to develop my technical and managerial knowledge and I now manage a small team of hydraulic engineers.

Matching of Work Based Learning with QAA Outcomes

Science and mathematics

The study of engineering requires a substantial grounding in engineering principles, science and mathematics

Outcome	Example Evidence	Example Reflective Statement
M1 Science, mathematics and engineering Apply a comprehensive knowledge of mathematics, mathematics, statistics, natural science and engineering principles to the solution of complex problems. Much of the knowledge will be at the forefront of the particular subject of study and informed by a critical awareness of new developments and the wider context of engineering.	In designing a retro-fit surface water management scheme at ●●●, I needed to extend my knowledge of the statistical basis of return periods. By study of the Flood Estimation Handbook I was able to appreciate the differences between the Maximum Annual Flood and Peak over Threshold approaches and became aware of the issues associated with extrapolation. At ●●● I was investigating the effects of high flows on river bed stability. By reading and discussion with our geomorphologist, I gained an appreciation of the influence of particle size on the erodibility of river bed materials.	I now know about the Shield's diagram. I appreciate that particle movement, especially at small particle sizes is also a function of the bed material's adhesion. I have since undertaken further reading to improve my knowledge of forces acting on sea bed materials which I hope to employ if we are successful in our bid for the ●●● offshore study.

Engineering Analysis

Engineering analysis involves the application of engineering concepts and tools to analyse, model and solve problems. This will include working with information that may be uncertain or incomplete.

Outcome	Example Evidence	Example Reflective Statement
M2 Problem Analysis Formulate and analyse complex problems to reach substantiated conclusions. This will involve evaluating available data using principles of mathematics, statistics, natural science and engineering p , and using engineering judgment to work with information that may be uncertain or incomplete, discussing the limitations of the techniques employed.	Shortly after starting to widen my experience beyond hydraulic modelling, I was given the opportunity to contribute to the production of a surface water management plan for a critical drainage area at ●●● where I had previously carried out modelling work. I was able to identify areas where infiltration basins could be installed. This introduced me to the study of geological maps for the identification of areas where such basins should be feasible but I quickly learnt that these maps did not always give full information on superficial deposits.	
M3 Analytical tools and techniques Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed.	At ●●● I engaged consultants to carry out modelling of a drainage network. As the eventual outfall was into a tidal river, I sought guidance on tidal patterns and surge events and was able to challenge the consultant's assumption that the modelled rainfall events would always correspond with bank-full conditions in the river.	I have learnt that, although mathematical modelling is a valuable tool, it is vital to ensure that realistic assessments are made of boundary conditions.

M4 Technical literature Select and critically evaluate technical literature and other sources of information to solve complex problems.	Whilst I was still a hydraulic modeller, I sought to widen my knowledge of sustainable drainage systems. I studied the CIRIA SuDS manual and became aware of the source-pathway-receptor philosophy and the SuDS treatment train. I arranged to visit a site where SuDS were being introduced.	I have subsequently studied other CIRIA documents including those on designing for exceedance in urban drainage and retrofitting of SuDS. These have generally been a good source of practical advice. However there have been circumstances where the situation I have been dealing with goes beyond the coverage of the documents.

Design and Innovation

Design is the creation and development of an economically viable product, process or system to meet a defined need. It involves significant technical and intellectual challenges.

Outcome	Example Evidence	Example Reflective Statement
M5 Design Design solutions for complex problems that evidence some originality and meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards.	In re-designing a channel at ●●● I had to consider, not only the theoretical aspects of hydraulic design, but also the need to provide continuity of a satisfactory environment for aquatic life during periods of low flow. I therefore sought advice from other specialists, including our ecologist and from such discussions built up a fuller appreciation of the wider constraints on engineering design. At ●●● I was required to carry out flood risk assessment for a proposed industrial development. I was aware that the then PPS25 required that the development would not increase the flood risk elsewhere. I studied CIRIA report C635 on *Design for Exceedance*. This not only provided me with design approaches for the specific site, but also gave me an insight into wider issues such as stakeholder engagement and the evolution of design standards for piped solutions. For the ●●● scheme I had to carry out economic analysis in order to select the optimum solution and to justify it to the Environment Agency for grant in aid. I therefore became aware of the principles of discounting benefits and costs occurring over a period of time.	I have become aware that hydraulic engineering design is not merely a straight forward application of principles obtained from textbooks. Each scheme is different. Assumptions have to be made and justified. The needs of a diverse range of stakeholders, for example clients, regulators, funders and the public, have to be balanced. I realise that my knowledge of economic analysis remains limited.

M6 Integrated/systems approach Apply an integrated or systems approach to the solution of complex problems.	I was able to integrate my knowledge in the ●●● scheme in which I was involved from initial discussions with the client, tender preparation, survey, data collection, preparation of options, recommendation of the solution to be adopted , advising on the selection of contractors and subsequent monitoring of the implemented solution.	I learnt that clients may often have a solution before they knew what the problem really was! I needed to convince the client that rather than telling the public that they were to lose a facility to allow the proposal to go ahead, it would be better to work with the community so that they understood that they would gain benefits from the proposal. I learnt the need for compromise: for example the initial preference for an infiltration basin being ruled out by the presence of low permeability soils. I prepared the business case justifying the scheme on technical, social and economic grounds. As well as the development of proposals I was able to advise on a suitable form of contract and the selection of a suitably experienced contractor. When unexpected services were encountered during construction, I worked with the contractor to minimise the disruption to the programme.

The Engineer and Society

Engineering activity can have a significant societal impact and Engineers must operate in a responsible and ethical manner, recognise the importance of diversity, and help ensure that the benefits of innovation and progress are shared equitably and do not compromise the natural environment or deplete natural resources to the detriment of future generations.

Outcome	Example Evidence	Example Reflective Statement
M7 Sustainability Evaluate the environmental and societal impact of solutions to complex problems (to include the entire life-cycle of a product or process) and minimise adverse impacts.	I represented one of our clients at a community engagement event for a proposed scheme of surface water management. This was an uncomfortable experience. It turned out that this event, held after the client had applied for planning permission, was the first the affected community had heard of the proposals.	After the community engagement event, I found that the client's surface water management strategy required that they develop a community engagement plan at an early stage. I further found that the Environment Agency distinguish between "decide-inform-defend" and "engage-deliberate-decide" approaches. It was clear that our client was reaping the dis-benefits of adopting the former approach in spite of its stated strategy. I have since discovered that CIRIA has produced excellent advice on good practice on community engagement and have since sought to demonstrate to our clients the advantages of proper planning for early community engagement.

M8 Ethics Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct.		
M9 Risk Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular project or activity.	I have become familiar with the constraints and business opportunities offered by environmental legislation such as the Water Framework Directive. As a team leader I am aware of issues of safety management. I have researched our responsibilities under the CDM regulations.	I see the need to be aware of political developments that may affect the way we work: anticipating requirements rather than reacting to them.
M10 Security Adopt a holistic and proportionate approach to the mitigation of security risks. (The Engineering Council defines security as 'the state of relative freedom from threat or harm caused by deliberate, unwanted, hostile or malicious acts. It operates on a number of levels ranging from national security issues to countering crime' – see the guidance note at: https://www.engc.org.uk/standards-guidance/guidance/guidance-on-security/)		
M11 Equality, diversity and inclusion Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion.		

Engineering Practice

The practical application of engineering concepts and tools, engineering and project management, teamwork and communication skills. Engineers also require a sound grasp of the commercial context of their work, specifically the ways an organisation creates, delivers and captures value in economic, social, cultural or other contexts.

Outcome	Example Evidence	Example Reflective Statement
M12 Practical and workshop skills Use practical laboratory and workshop skills to investigate complex problems		
M13 Materials, equipment, technologies and processes Select and apply appropriate materials. Equipment, engineering technologies and processes, recognising their limitations.		
M14 Quality management Discuss the role of quality management systems and continuous improvement in the context of complex problems.		
M15 Engineering and project management Apply knowledge of engineering management principles, commercial context, project and change management, and relevant legal matters including intellectual property rights.		

M16 Teamwork Function effectively as an individual, and as a member or leader of a team. Evaluate effectiveness of own and team performance.		I believe that my generic skills are as expected for a team leader in my position, but will continue to seek opportunities for further development.
M17 Communication Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used.	I am preparing an article on the challenges and lessons of the ●●● scheme for the *Journal of Flood Risk Management*.	Communication involves listening as well as telling: I have become aware that it is sometimes necessary to look beyond mathematical models. Residents' knowledge of actual events can be a useful guide in questioning the "ideal" assumptions of hydraulic modelling.
M18 Lifelong learning Plan and record self-learning and development as the foundation for lifelong learning/CPD.	My work as a hydraulic modeller built on my initial HND in computer science. I participate in an annual appraisal process with my manager which includes a personal development plan. I have sought opportunities to expand my knowledge into wider aspects of hydraulic engineering. I reflect on my CPD activities. I also appraise members of my team and encourage them also to reflect on their CPD activities.	

Action Plan

Enter here details of how you intend to fill any gaps you have identified in your learning. You should include target dates for completion.

I have identified above the need for me to increase my understanding of economics applied to flood management projects. I intend to enrol for the next available delivery of CIWEM's Environmental Economics course.

[The Action Plan will need to be expanded depending on any further gaps that are identified when all the QAA Learning Outcomes have been considered]