JBM Guidance on providing evidence for programmes of Further Learning to an appropriate level for IEng.

Introduction

Incorporated Engineers will have the know-how necessary to apply technology to engineering problems and processes and to maintain and manage current and technology, sometimes within a multidisciplinary engineering environment. They can be expected to be undertaking engineering design, development, manufacture, construction and operation. Incorporated Engineers will be variously engaged in technical and commercial management and should possess effective interpersonal skills. (UK SPEC)

In this context Further Learning comprises the additional educational achievement necessary to bridge the gap between an approved HND/Foundation Degree or equivalent and an accredited BSc degree for an Incorporated Engineer. Where appropriate, elements of Further Learning can be integrated with IPD but must be recorded and assessed separately.

This document is guidance, not requirements. The opportunities available for learning will vary with the nature of each participant's work as a professional engineer and therefore the further learning plan should be tailored to the individual and their work/company context. Work opportunities provide a springboard for the required further learning, but additional private study will almost certainly be needed to enable participants to fully meet all the requirements.

The expectation of the JBM is that the Learning Outcomes (LO) can be addressed as outlined below but it is emphasised that this is only indicative guidance and that it is the responsibility of each participant to prepare a learning plan of how they propose to achieve the desired educational base and, more importantly, evidence which demonstrates they have done so, to the satisfaction of the assessors. Some examples of activities and evidence are given as guidance of how an LO can be completed, but it is emphasised that the wording of the LO itself is the high level requirement, not the activities or examples as described. Other activities and evidence may be used to demonstrate the required learning.

All 29 LOs have to be achieved; although evidence from a single activity can be used for more than one LO (e.g. 'separate' evidence is not required for each LO). The participant's portfolio should contain a brief reflective statement for each LO that describes the activities undertaken and provides evidence as to the LO has been achieved. It is appreciated that engineers usually work in teams, with supervision/oversight, so the evidence should make clear what their input was to each example, and how that related to the wider team.

Summary

Engineering is **underpinned by Science and Mathematics**, and other associated disciplines, as defined by the relevant professional engineering institution(s). Graduates will need:

(i) Knowledge and understanding of the scientific principles underpinning relevant current technologies, and their evolution (SM1).

(ii) Knowledge and understanding of the mathematics and an awareness of statistical methods necessary to support the application of key engineering principles (SM2).

Engineering Analysis involves the application of engineering concepts and tools to the solution of engineering problems. Graduates will need

(iii) Ability to monitor, interpret and apply the results of analysis and modelling in order to bring about continuous improvement (EA1)

(iv) Ability to apply quantitative methods in order to understand the performance of systems and components (EA2)

(v) Ability to use the results of engineering analysis to solve engineering problems and to recommend appropriate action (EA3).

(vi) Ability to apply an integrated or a systems approach to engineering problems through know-how of the relevant technologies and their application (EA4).

Design at this level is the creation and development of an economically viable product, process or system to meet a defined need. It involves technical and intellectual challenges and can be used to integrate all engineering understanding, knowledge and skills to the solution of real problems. Graduates will need the knowledge, understanding and skills to:

(vii) Be aware of business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics (D1).

(viii) Define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards (D2)

(ix) Work with information that may be incomplete or uncertain and be aware that this may affect the design (D3)

(x) Apply problem-solving skills, technical knowledge and understanding to create or adapt design solutions that are fit for purpose including operation, maintenance, reliability etc. (D4)

(xi) Manage the design process, including cost drivers, and evaluate outcomes (D5)

(xii) Communicate their work to technical and non-technical audiences (D6).

Economic, legal, social, ethical and environmental context, engineering activity can have impacts on the environment, on commerce, on society and on individuals. Graduates therefore need the skills to manage their activities and to be aware of the various legal and ethical constraints under which they are expected to operate, including:

(xiii) Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct (EA1)

(xiv) Knowledge and understanding of the commercial, economic and social context of engineering processes (EA2)

(xv) Knowledge of management techniques that may be used to achieve engineering objectives (EA3)

(xvi) Understanding of the requirement for engineering activities to promote sustainable development (EA4)

(xvii) Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues (EA5)

(xviii) Awareness of risk issues, including health & safety, environmental and commercial risk (EA6).

Engineering Practice. This is the practical application of engineering skills, combining theory and experience, and use of other relevant knowledge and skills. This can include:

(xix) Knowledge of contexts in which engineering knowledge can be applied (e.g. operations and management, application and development of technology, etc. (EP1)

(xx) Understanding of and ability to use relevant materials, equipment, tools, processes, or products (EP2).

(xxi) Knowledge and understanding of workshop and laboratory practice (EP3)

(xxii) Ability to use and apply information from technical literature (EP4)

(xxiii) Ability to use appropriate codes of practice and industry standards (EP5)

(xxiv) Awareness of quality issues and their application to continuous improvement (EP6)

(xxv) Awareness of team roles and the ability to work as a member of an engineering team (EP7).

Additional general skills. Graduates must have developed transferable skills, additional to those set out in the other learning outcomes, that will be of value in a wide range of situations, including the ability to:

(xxvi) Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities (G1)

(xxvii) Plan self-learning and improve performance, as the foundation for lifelong learning/CPD (G2)

(xxviii) Plan and carry out a personal programme of work (G3)

(xxix) Exercise personal responsibility, which may be as a team member (G4)

Bachelors' Level

Some examples of general approaches that can help a participant demonstrate Bachelors' level learning on the topic of a learning outcome are:

- Using one (or perhaps two) specific examples that they have been active in – examples are much more effective evidence than general claims/statements
- Showing an ability to apply the methods and techniques that they have learned to review, consolidate, extend and apply their knowledge and understanding and to initiate and carry out projects
- Being able to demonstrate that they can critically evaluate arguments, assumptions and data (that may be incomplete), to make judgements, and to frame questions to achieve a solution to a problem
- Providing evidence of exercising initiative and personal responsibility
- Demonstrating assessment of a range of risks for a project and appraisal of the relative merits of mitigation options, with an ability to convey this concisely
- Evidence of being able to communicate information, ideas, problems and solutions
- Highlighting reflection on formal learning from courses, seminars and the like, and how this has been applied in the workplace

NB These are not the only approaches!

Guidance on Bachelors' level characteristics that assessors look for in the portfolio that a participant prepares for demonstrating their further learning to Bachelors' level is available from a number of sources, for example:

- The Accreditation of Higher Education Programmes (AHEP), 3rd edition published by the Engineering Council:
- Quality Assurance Agency for Higher Education
- SEEC level descriptors:

Guidance on Bachelors' level marking/assessment/grade criteria is also available, for example:

- Leeds university
- Warwick University
- Kingston University

(links at February 2016)

Preamble to the examples of activities and evidence for each learning outcome (LO)

1. The key requirement is to demonstrate Bachelors' level learning on the topics of the LOs. The name of the broad areas under which LOs are listed also indicates the area in which evidence should be provided.
2. Attention is drawn to the notes on Bachelors' level learning earlier in this document.
3. The aim of the examples of activities and evidence given in the following Tables is to try and assist participants, their employers and mentors to identify activities and evidence available in the context of their own work as professional engineers that could serve as a springboard to show Bachelors' level learning in the various LOs. The activities and examples of evidence are NOT prescriptive; there are many other activities and topics of evidence that could also enable a participant to demonstrate the required Bachelors' level learning. Demonstration of that learning is the key aim for the participant. Evidence presented that is about one of the example topics listed but which doesn't show Bachelors' level learning on that LO will not be acceptable.
4. Several examples of activities and evidence are given in the following Tables, but **the evidence required for a participant would typically only need one, or perhaps two, relevant examples of evidence from that engineer's work, treated in depth to show their Bachelors' level learning**. Multiple activities may be involved in the evidence.
5. Examples of activity and evidence listed under one LO might also serve for a different LO, if suitably evaluated and presented, but a good range of topics and examples will typically be needed across the FL programme as a whole.
6. It is anticipated that most engineers undertaking a programme of further learning to Bachelors' level will need to undertake some private study/investigation/evaluation linked to but beyond their normal day-to-day work, and in addition to the time preparing/presenting the evidence itself.
7. The focus of the evidence should be on the participant's reflection and evaluation about their actions and learning. Enough project information should be included to give context and to help convey the learning well. However, care should be taken to avoid overloading the evidence with more project detail than is needed to show the learning. Reflective statements in a further learning report can provide additional supporting evidence
8. A common error in evidence is to include more factual information about a project than is needed and too little that conveys the Bachelors' level learning of the participant. It is typically more effective to focus on one or two particularly pertinent aspects of a project and treat them in depth. The whole point is to clearly demonstrate to the assessors in the evidence, ideally in the written evidence, that the required further learning has been achieved. The assessors should not have to indirectly deduce or infer the participant's learning from the evidence or from their personal knowledge of the participant.
9. Examples of evidence will often include some form of report in which conclusions are reached after critically analysing the output of a suitable engineering activity e.g. of investigation, feasibility study, design, a monitoring programme, testing, a survey or research, but other forms of evidence are acceptable. **If an interview is part of the evidence used in assessment, a written record of the interview describing that evidence should be retained, and be available for audit purposes.**
10. If using abbreviations, a glossary of them should be included in the evidence – particularly important for self-managed programmes where the assessors may be engineers with a different specialism. (A glossary of terms and abbreviations in JBM documents about further learning is available separately - FLJBM03.)

JBM Further Learning Programme (IEng)

Learning Outcome (i) - Science & mathematics (SM1)

Knowledge and understanding of scientific principles underpinning relevant current technologies and their evolution

Activity Examples	Evidence Examples
Engineering solutions are founded on physical, biological, natural and social sciences. Therefore there is a need to have an understanding of those sciences. You are continuously developing this knowledge formally and informally but there are particular aspects of these sciences that relate to civil engineering and this will depend on the branch of civil engineering you are in. Fundamentally this is about understanding and explaining things. Understanding the science underlying a situation enables better informed judgements. For example, understanding how a material will perform if temporarily over-stressed, such as its non-linear stress/strain performance or it's plasticity/brittleness, enables its limitations to be taken account of. Example activities could include: • Asset surveys • Materials (including geo materials) testing and appraisal • Selection of materials, products and processes that solve a particular problem • Numerical analyses	• Design of surveys/data acquisition explaining the issues to be measured and how they were measured, what the measurements meant, measures to help check data validity or to manage errors or anomalies. These include quantitative and qualitative surveys. • Interpretation of soil data • Design of temporary works • Analysis of highway run-off data and design of appropriate drainage

JBM Further Learning Programme (IEng)

Learning Outcome (ii) - Science & mathematics (SM2)

Knowledge and understanding of the mathematics and an awareness of statistical methods necessary to support the application of key engineering principles.

Activity Examples	Evidence Examples
This is very much an extension of formal education in which you learnt about the interaction of mathematics with engineering and scientific principles and how to apply them. Example activities could include: • Exercise using LSS surveying/setting out software • Highway drainage design for a residential housing estate using Microdrainage	• Approval of output by assessor • Continual assessment by line manager

JBM Further Learning Programme (IEng)	
Learning Outcome (iii) - Engineering analysis (EA1) **Ability to monitor, interpret and apply the results of analysis and modelling in order to bring about continuous improvement**	
Activity Examples	**Evidence Examples**
Much of engineering is about modelling reality to produce solutions to known hazards. Hence it often includes making assumptions, choosing appropriate models, assembling data and reviewing option analyses. Examples of activities include: • Assessment and interpretation of data collected throughout the lifespan of a project to revise and update project review procedures • Assessment and interpretation of project data, for example modelling non-signalised junctions using ARCADY/PICADY or traffic signalised junctions using LINSIG • Collection of data through feasibility and design stage of project used to influence and improve final designs • Preparation of FL Report on findings and recommendations, for example discussing improvement in junction efficiency following modification of design parameters	• A Further Learning Report (FLR) at the end of the programme summarising this integration • Assessment will be through an interview based on the report • Identify different design revisions and ability to explain why the designs needed improving

JBM Further Learning Programme (IEng)	
Learning Outcome (iv) - Engineering analysis (EA2) **Ability to apply quantitative methods in order to understand the performance of systems and components**	
Activity Examples	**Evidence Examples**
This is very much an extension of formal education in which you learnt about the underlying engineering and scientific principles and how to apply them. You will review materials, products and processes such as: • Use and application of standard packages for the production of a building services maintenance manual in conjunction with other architectural, engineering and construction professionals. • Use and output from standard software packages in use • Use of surveying/setting out software, LSS • Use of CAD software in the design of projects and the manipulation of the designs to suit the target audience • Software and CAD in-house training courses	• Approval of output by assessor • Continual assessment by line manager • CAD designs with different iterations such as public consultation, as built drawing and design details • End of course exercises

JBM Further Learning Programme (IEng)

Learning Outcome (v) - Engineering analysis (EA3)

Ability to use the results of engineering analysis to solve engineering problems and to recommend appropriate action

Activity Examples	Evidence Examples
Much of engineering is about modelling reality to produce solutions to known hazards. Hence it often includes making assumptions, choosing appropriate models, assembling data, reviewing option analyses and making appropriate decisions. Examples of activities include: • Application of site investigation and soil analysis data to temporary works design. • Interpretation of soil data and design of temporary works • Preparation and implementation of method statements and risk assessments • Use of traffic surveys to determine type of highway traffic calming required • Design of the above and surveys to confirm effectiveness • In-house training courses	• Approval by site manager of output • Interpretation of data in a report or tabular format used to determine process or method required • End of course exercises

JBM Further Learning Programme (IEng)

Learning Outcome (vi) - Engineering analysis (EA4)

Ability to apply an integrated or systems approach to engineering problems through know-how of the relevant technologies and their application.

Activity Examples	Evidence Examples
The candidate must demonstrate solving a problem by implementing a process or devising a methodology. Permanent or temporary situations can be considered such as: • Use and application of a design manual • Design and application of temporary works • Creating and maintaining a programme for a project	• Approval of output by assessor/line manager • Programme with key points such as milestones and critical path highlighted

JBM Further Learning Programme (IEng)

Learning Outcome (vii) - Design (D1)

Be aware of business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics

Activity Examples	Evidence Examples
Engineering does not take place in a vacuum and in developing a solution it is necessary for the engineer to consider the impacts that a project can have in a wider context. Activities could include: • Understanding of company accounts and medium term plan • Understanding of market opportunity phase and customer feedback • Participation in public consultation undertaken as part of the formal planning process	• Reflective report based on candidate's experience • Discussion with supervising engineer

JBM Further Learning Programme (IEng)

Learning Outcome (viii) - Design (D2)

Define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards

Activity Examples	Evidence Examples
Engineering activities are generally carried out within an overarching regulatory framework with additional requirements for a specific discipline. Participants are expected to have an awareness of the overall framework with specific knowledge in their own specialism and knowledge of the holistic issues that need to be considered in the development of engineering solutions. Activities could include: • Application of best practice in the production of healthy buildings • Temporary works design • Production of method statements and short term programmes • Designing a Highway Improvement scheme such as junction re-design or new features • Design of a sustainable urban drainage scheme (SUDS) • Use of CEQUAL (water quality and hydrodynamic model)	• Identify findings in FL report • Options study of various solutions • Calculations and drawings • Approval of output by line manager/assessor

JBM Further Learning Programme (IEng)

Learning Outcome (ix) - Design (D3)

Work with information that may be incomplete or uncertain and be aware that this may affect the design

Activity Examples	Evidence Examples
Civil engineering is an innovative industry as many projects that are dealt with are done for the first time, in the particular circumstances of that location. However, it is also an industry that learns from past experience including failures and shortcomings. It involves uncertainty which is either natural or anthropogenic. Therefore much of what is done is based on site-specific observations, drawing on (but not limited by) experience of prior practice. These observations can be used to develop guidelines and standards, inform practice or allow solutions to be developed and monitored. Examples of activities include: • Reviewing survey information and carrying out a 'gap analysis' • Carrying out a review of contract drawings • Awareness of the need for factors of safety in temporary and permanent works design	• Technical queries and early warnings • Reflective report based on experience

JBM Further Learning Programme (IEng)

Learning Outcome (x) - Design (D4)

Apply problem-solving skills, technical knowledge and understanding to create or adapt design solutions that are fit for purpose including operation, maintenance, reliability etc.

Activity Examples	Evidence Examples
The candidate must demonstrate knowledge of engineering principles, implementing a process or devising a methodology in situations with familiarity. The design process does not necessarily include detailed design. Design for either permanent or temporary situations is acceptable. It is not necessary for the design to be implemented. Checks of design viability, e.g. by a small scale trial, could be used to demonstrate 'fitness for purpose'. Activities could include: • Application of resource efficient products, services and solutions particularly with respect to water, energy and waste. • Design office experience • Develop new site working methods • Contribute to site risk assessments • In-house Environmental course, recognising BREEAM requirements	• Works orders or designs showing the incorporation of resource efficient products. • Photographs of installed products, service or solution • Production of designs during secondment, assessed by design manager • Assessed by line manager • Exercises during the course

JBM Further Learning Programme (IEng)

Learning Outcome (xi) - Design (D5)

Manage the design process, including cost drivers, and evaluate outcomes

Activity Examples	Evidence Examples
Engineering design thinking involves much more than analysis/calculation. In managing this process, the participant would need to demonstrate independent judgement of the implications of any information shortcomings, notably risks and opportunities missed, in order to inform decisions about the need to take measures to improve outputs. Examples include: • Preparation of design briefs • Risk and opportunity assessment • Preparation of cost plan • Project design review and close out meetings	• Minutes of meetings • Risk assessment • Cost plan • Reflective report

JBM Further Learning Programme (IEng)

Learning Outcome (xii) - Design (D6)

Communicate their work to technical and non-technical audiences

Activity Examples	Evidence Examples
Engineering does not take place in a vacuum and in developing a solution both now and in the future, the engineer must be able to communicate ideas with a wide audience. This could be demonstrated by: • Carrying out toolbox talks or briefings • STEM activity • Preparation of materials for stakeholder consultation • Preparation of company feedback reports • Raising technical queries and early warnings • Preparation of drawings, sketches, activity plans and risk assessments	• Briefing records • Reports • Technical queries and early warnings • Risk assessments and activity plans • Reflective report summarising what candidate has learnt through work undertaken

JBM Further Learning Programme (IEng)

Learning Outcome (xiii) - Economic, legal, social, ethical and environmental context (EL1)

Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct

Activity Examples	Evidence Examples
Ethical behaviour is a cornerstone as to how professionals go about their duties. Participants must demonstrate a level of awareness of how to conduct their work in an ethical manner • Awareness of human capital and its role in the creation of wealth and the maintenance of infrastructure. • Understanding of moral responsibilities as an engineer in terms of level of responsibility of role undertaken • Awareness of financial irregularity issues, bribery, etc. • Attendance at ICE, IStructE, CIHT, IHE regional meetings • Attendance on external courses • Maintenance of suitable CPD records • Awareness of the code of conduct of the Institution you are seeking membership of	• Proof that candidate is aware of own responsibilities • A brief report to be written after each meeting • Include a section in the FLR to be assessed at interview • Regular review by assessor

JBM Further Learning Programme (IEng)	
Learning Outcome (xiv) - Economic, legal, social, ethical and environmental context (EL2) **Knowledge and understanding of the commercial, economic and social context of engineering processes**	
Activity Examples	**Evidence Examples**
Engineering does not take place in a vacuum and in developing a solution it is necessary for the engineer to consider the impacts that a project can have in a wider context • Risk and opportunity assessment • Preparation of cost plan • Involvement with formal planning process • Public consultation, environmental surveys and consents • Knowledge of funding streams • Company accounts and medium term plan	• Risk assessment • Cost plan • Survey reports • Reflective report demonstrating candidates learning

JBM Further Learning Programme (IEng)

Learning Outcome (xv) - Economic, legal, social, ethical and environmental context (EL3)

Knowledge of management techniques which may be used to achieve engineering objectives

Activity Examples	Evidence Examples
A thorough understanding of how business is conducted and projects are managed is required by all practising engineers. This includes a knowledge of the supporting systems and processes that are used by organisations to run their business Activities will be wide ranging and reflect not only practices encountered in the workplace but also demonstrate an understanding of their effectiveness • Application and use of environmental management systems. • Understanding of contractual procedures • Budget management • Junior managers in-house training course • Annual appraisal and competency framework	• Evidence of involvement within a contractual process • A Works estimate • Programme management • Exercises during course • Include a section in the FLR to be assessed at interview

JBM Further Learning Programme (IEng)

Learning Outcome (xvi) - Economic, legal, social, ethical and environmental context (EL4)

Understanding of the requirement for engineering activities to promote sustainable development

Activity Examples	Evidence Examples
The world is continually changing and as engineers we are party to that change as we deal with social, environmental, economic and technological issues. Examples of such change include: technological developments in our industry, climate change, resource depletion, the carbon economy, changing sea levels and security of resource supply. In addition to a broader understanding of how the world is changing, engineers need to develop an understanding of the potential technical engineering implications of such changes. As engineers we will be engaged with others in society in making soundly based, ethical decisions. Some of these will be based on scientific evidence which we have to master. For example activities could include: • Appraising the social, economic and environmental impacts of projects in local, regional and global contexts, for example assessing the adequacy of the current storm return period standard for a new housing estate or highway and factoring in climate change • Assessing the use of recycled materials in project delivery, analysis of cost/ benefit of materials • Design to incorporate carbon efficiency	• Public consultation strategy • Environmental appraisal or assessment • Application of WRAP criteria in solution development and cost benefit derived • Carbon calculation

JBM Further Learning Programme (IEng)

Learning Outcome (xvii) - Economic, legal, social, ethical and environmental context (EL5)

Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues.

Activity Examples	Evidence Examples
The candidate may draw upon knowledge gained from discussion with the wider project team to include the following: • The impact of SHE legislation and its impact in the workplace • Relevant H&S legislation relating to the individual's role Further knowledge may arise from: • Attendance at in-house H & S and environmental courses • Implementation of policies in workplace	• A report on the CDM regulations, H&S at Work Act, and/or specific codes of practice • Exercises during courses • Assessment by line manager

JBM Further Learning Programme (IEng)

Learning Outcome (xviii) - Economic, legal, social, ethical and environmental context (EL6)

Awareness of risk issues, including health & safety, environmental and commercial risk.

Activity Examples	Evidence Examples
Engineering is about risk; i.e. identifying the hazards, identifying who or what will be harmed, assessing the probability of that harm occurring and mitigation against that harm occurring. This could be demonstrated through: • Preparation of pre-construction or construction phase health and safety plan • Preparation of a local authority winter maintenance programme • Preparation of risk assessments and activity plans • Quarterly forecasts • Cost monitoring • Safety and environmental inspections • Preparation of as constructed records • Project start up and close out meetings • Company feedback reports	• Reports, risk assessments and activity plans • Quarterly forecast and cost monitoring records • Inspection forms • As built records • Meeting minutes • Reflective report based on candidates experience

JBM Further Learning Programme (IEng)

Learning Outcome (xix) - Engineering Practice (EP1)

Knowledge of contexts in which engineering knowledge can be applied (e.g., operations and management, application and development of technology, etc.)

Activity Examples	Evidence Examples
Civil engineering is an innovative industry as many projects that are dealt with are done for the first time in the particular circumstances of that location. However, it is also an industry that learns from past experience including failures and shortcomings. It involves uncertainty which is either natural or anthropogenic. Therefore much of what is done is based on site-specific observations, drawing on (but not limited by) experience of prior practice. These observations can be used to develop guidelines and standards, inform practice or allow solutions to be developed and monitored. Examples of activities include: • Appraisal and selection of appropriate technologies and methodologies. • Undertaking/ managing construction/ maintenance works, using base engineering knowledge and adapting it to suit the local conditions and constraints, use of technology to improve the solution • Project Planning and Programming course • Production and implementation of short terms programmes in line with method statements	• Examples of site works and amendments made during the course of the contract to deal with circumstances specific to that site • Exercises during the course • Assessment of output by line manager

JBM Further Learning Programme (IEng)

Learning Outcome (xx) - Engineering Practice (EP2)

Understanding of and ability to use relevant materials, equipment, tools, processes, or products

Activity Examples	Evidence Examples
This is a skill that is developed over time because of the experience gained through the practice of civil engineering and the knowledge gained through independent study. It enables you to provide solutions to engineering problems which can be beneficial to your clients, your organisation and wider society either financially, environmentally, technically or socially. Examples activities include: • Interpretation of specification of materials required for construction • Preparation of programme • Cost planning • Preparation of activity plans • Concrete or asphalt technology course • Courses and demonstrations on plant and equipment, processes and products.	• Reports produced on site assessed by site manage • Programme with key points such as milestones and critical path highlighted • Cost plan • Activity plan • Exercises during courses

JBM Further Learning Programme (IEng)

Learning Outcome (xxi) - Engineering Practice (EP3)

Knowledge and understanding of workshop and laboratory practice

Activity Examples	Evidence Examples
The candidate must demonstrate a knowledge of workshop and laboratory practice to be able to use this information in the realisation of solutions to engineering problems. Activities could include: • Study of concrete site practice • Working in a laboratory or site based laboratory. Collection and analysis of samples from construction works, for example bituminous materials • In-house quality management courses • On-site roles as testing and/or quality engineer	• Site sample data, records, reports compiled form data collected • Specifications prepared for works packages/ contract documents. • Exercises during courses • Reports produced on site assessed by site manager

JBM Further Learning Programme (IEng)

Learning Outcome (xxii) - Engineering Practice (EP4)

Ability to use and apply information from technical literature

Activity Examples	Evidence Examples
The candidate must demonstrate solving a problem by using and applying appropriate information from technical literature. Activities could include: • On-going application of appropriate technologies. • Ability to interpret data from documents such as British Standards or the Design Manual for Roads and Bridges (DRMB) and apply to work-based problems • Self-analysis and study of technical literature to formulate new solutions to work based problems. • Study into appropriate and innovative technologies and the ability to apply that knowledge • Input into methodology planning and programming	• Extracts from British Standards pertaining to examples used on site • Contribution to road or bridge design • Preparation of method statements • Report on appropriate and innovative technologies and how they might be applied in situations pertinent to the experience of the participant • Assessment by line manager/assessor

JBM Further Learning Programme (IEng)

Learning Outcome (xxiii) - Engineering Practice (EP5)

Ability to use appropriate codes of practice and industry standards

Activity Examples	Evidence Examples
The candidate must demonstrate solving a problem through the use of relevant codes of practice or industry standards. Permanent or temporary situations can be considered and may include: • Application of appropriate best practice. • Use of Design Manual for Roads & Bridges in highway construction and realignment • Attendance on in-house Quality Management course • Implementation of Project Management Plan • Managing Quality processes and testing procedures	• Exercises during the course • Design output in the form of calculations and drawings • Preparation of method statements • Assessment by line manager

JBM Further Learning Programme (IEng)	
Learning Outcome (xxiv) - Engineering Practice (EP6) **Awareness of quality issues and their application to continuous improvement**	
Activity Examples	**Evidence Examples**
Ensuring the quality delivery of designs, construction and maintenance activities is an essential part of an engineer's duties Participants will be involved in a wide range of activities which may include • Implementation of quality and testing procedures • Compliance with Specification and Project Management Plan	• Continual assessment by line manager • Review and assessment by assessor

JBM Further Learning Programme (IEng)	
Learning Outcome (xxv) - Engineering Practice (EP7) **Awareness of team roles and the ability to work as a member of an engineering team**	
Activity Examples	**Evidence Examples**
Civil engineers are part of the built environment team. Teamwork is an essential skill that involves not only working with people from different backgrounds and disciplines but collectively producing a solution that is creative and innovative. Civil engineers also have a duty of care given their knowledge. Examples include: • Awareness of the integration of design, construction and operational activities. • Participating in the management structure on site • Formal appointments of responsibility	• Annual appraisals • Continual assessment by line manager

JBM Further Learning Programme (IEng)

Learning Outcome (xxvi) - Additional general skills (G1)

Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities

Activity Examples	Evidence Examples
The candidate must recognise the skills developed in solving engineering problems and the methods of communicating with others in order to do so. Use of IT systems should be recognised and the means of storing and retrieving data as part of solution development. This could be demonstrated by: • Design review meetings • Raising technical queries and early warnings • Document control systems • BIM • Preparing technical reports, drawings and site sketches	• Minutes of meetings • Technical queries and early warnings • Output from document control system • BIM output • Reports, drawings and sketches • Reflective report demonstrating the candidates learning

JBM Further Learning Programme (IEng)

Learning Outcome (xxvii) - Additional general skills (G2)

Plan self-learning and improve performance, as the foundation for lifelong learning/CPD

Activity Examples	Evidence Examples
This is wide ranging learning outcome that by its nature requires the participant to reflect on their learning needs in order to undertake more complex tasks, use advanced analysis techniques or manage larger teams or projects and as a consequence plan learning and development to bridge any gaps or deficiencies in knowledge. • Development action plan • Knowledge of career pathways within own organisation • Attendance at professional body events e.g. ICE, IStructE, CIHT, IHE • Self-study • Awareness of Code of Conduct • Mentoring	• Development action plan and personal development records • Reports prepared following attendance at professional body events • Discussion with Supervising Engineer • Reflective report demonstrating learning

JBM Further Learning Programme (IEng)

Learning Outcome (xxviii) - Additional general skills (G3)

Plan and carry out a personal programme of work

Activity Examples	Evidence Examples
As a professional engineer it is necessary to maintain a personal development record and if working for a professional qualification through the further learning route, a further learning plan. Evidence could include: • Development action plan • Further learning plan • Ability to carry out 'gap analysis' • Ability to identify resourcing requirements • Preparation of reflective reports	• Development action plan and personal development records • Discussion with Supervising Engineer • Reflective report demonstrating learning

JBM Further Learning Programme (IEng)

Learning Outcome (xxix) - Additional general skills (G4)

Exercise personal responsibility, which may be as a team member.

Activity Examples	Evidence Examples
Civil engineers are part of the built environment team. Teamwork is an essential skill that involves not only working with people from different backgrounds and disciplines but collectively producing a solution that is creative and innovative. Civil engineers also have a duty of care given their knowledge. Examples include: • Chairing meetings • Leading in the production of controlling documents for the works • Carrying out safety and environmental inspections • Delivering team briefings • Leadership or team member activities in the community, e.g. sports events, scouts or girl guides	• Minutes of meetings • Activity plans, risk assessments, cost forecasts, GANTT charts, quality plans • Completed briefing and inspection records • Reflective report demonstrating learning