



Civil Engineering Degree Apprenticeship

Mapping of Knowledge, Skills & Behaviours against
ICE Attributes



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Introduction

This guide provides an explanation of the relationship between the KSB outlined in the Apprenticeship Standard for the Civil Engineering Non-integrated Degree Apprenticeship and the ICE Attributes and any differences.

As a Civil Engineering Degree Apprentice, you will need to demonstrate throughout your apprenticeship programme how your practical experience is providing you with evidence to show that you have gained the appropriate Knowledge, Skills and Behaviours (KSB) outlined in the Apprenticeship Standard and the associated assessment criteria.

The Apprenticeship Standard has a unique set of KSB that must be achieved and ICE has ensured that these professional standards are comparable with our professional development requirements.

The Apprenticeship Standards reference the terms Knowledge, Skills and Behaviours that an apprentice must gain and be able to demonstrate achievement of, to allow an application for an End Point Assessment (EPA) which is to be made at the end of the apprenticeship programme.

ICE documentation uses different terms. Evidence of an apprentice's Initial Professional Development (IPD), the practical experience gained in parallel to an apprentice's academic studies, should be recorded against the seven Attributes.

Apprentices wishing to become a Member of the Institution of Civil Engineers, and register as an Incorporated Engineer, can use this guide to assist in recording the work-based aspects of their apprenticeship against the seven Attributes. Training Providers can use this guide to help them understand how the apprentice's work can be mapped against the KSB outlined in the apprenticeship standard and associated assessment criteria.

Each apprenticeship standard and assessment plan is unique and can be found on the Institute for Apprenticeships and Technical Education's [website](#).

Full details of the End Point Assessment can be found in the [Civil Engineering Degree EPA guidance](#) which also includes the application form.

Our Membership Support Team (MST) can give you advice and guidance on all aspects of the End Point Assessment, please email membershipsupport@ice.org.uk or call +44 (0)121 227 5948 for help.



Knowledge

Core Knowledge to be assessed		ICE Attributes
K1	<p>The principles and techniques used to evaluate the impact of civil engineering infrastructure on society and the environment taking account business, client and end user needs in its construction, management and use. This includes the importance of the tools used to measure welfare, health, safety, and sustainability.</p> <p>Examples include: knowledge and understanding of environmental impact assessment, building information modelling taking into account the context of sustainability, CEEQUAL (a sustainability assessment tool used for the assessment of all types of civil engineering, infrastructure, coastal protection works, coastal landslides, sewerage and drainage systems, and public realm projects and contracts) the environmental impact of materials, integrated transport systems, water quality and supply as well as urban drainage systems for a sustainable built environment.</p>	1c
K2	<p>The mathematical, scientific and engineering principles, methods and modelling that underpin the design and construction of civil engineering infrastructure. This will include understanding structural and ground responses, properties of materials and their predicted behaviour as part of integrated systems.</p> <p>Examples include: knowledge of the design and construction of buildings, transportation systems, water and wastewater networks, foundations and temporary works, coastal protection, understanding slope stability, retaining walls, ground water movement, elastic/plastic and failure behaviour of materials such as concrete, steel, asphalt and timber, behaviour of structural elements such as beams, land surveying and formulating applicable mathematical solutions through suitable software.</p>	1a, 1b
K3	<p>The use and validation of digital solutions to model, evaluate, design, test, build and manage civil engineering infrastructure refining as required and applied to integrated solutions.</p> <p>Examples include: knowledge of software packages including building information modelling, structural engineering design and analysis, computational fluid dynamics and finite element modelling software.</p>	1b, 1c
K4	<p>A range of research techniques used to develop innovative solutions to civil engineering problems and the use of current and emerging technologies and products.</p> <p>Examples include: knowledge of site investigation techniques, flood risk management, materials testing, physical and numerical modelling, transport analysis, road traffic flow, growth, traffic management and safety.</p>	1b, 1c

K5	<p>The design and quality standards, codes of practice, legal and regulatory frameworks, such as those of asset owners and regulatory bodies, that govern the life cycle of civil engineering infrastructure.</p> <p>Examples include: British Standards, Construction (Design and Management) policies, building regulations, Eurocodes, Network Rail, and nuclear industry standards.</p>	1c, 1d
K6	<p>The principles and techniques of effective project management including resources, cost management and risk assessment.</p> <p>Examples include: knowledge of project and contract management in terms of cost, quality, performance and continuous improvement; procedures and processes involved in procuring projects, producing tenders and estimates and factors that affect profitability; management structures and relationships involved in project delivery; commercial and financial risks; project management systems and procedures for forecasting, planning, allocating and controlling human, material and financial resources; continuous quality improvement strategy.</p>	2a, 2b, 3a
K7	<p>How to manage teams and develop staff to meet changing technical and managerial needs.</p> <p>Examples include: knowing how to build teams, effective team working, time management, reviewing and appraising performance in relation to delivery of civil and infrastructure engineering projects and related wider operations. Using change-management techniques to address client changes and impacts on civil engineering design and delivery.</p>	2c, 2d
K8	<p>How to communicate effectively and provide guidance to others through design models, calculations, reports, drawings, specifications, presentations, digital media, and discussions with those both inside and outside the industry.</p>	6a
K9	<p>The professional and ethical codes of conduct and associated responsibilities as set out by the relevant professional engineering institution.</p>	7a, 7b

Skills

Core skills to be assessed		ICE Attributes
S1	<p>Evaluate the impact of civil engineering infrastructure on society and the environment taking account of business, client and end user needs in its construction, management and use.</p> <p>Examples include: the ability to use the CEEQUAL toolkit, carry out environmental impact assessments, designing and constructing the built infrastructure to ensure that it is safe, usable, appropriate and cost effective.</p>	1d, 5b
S2	<p>Proactively consider welfare, health, safety, and sustainability in the life cycle of civil engineering infrastructure using tools such as CEEQUAL and environmental impact assessments</p>	4a, 4b, 4c, 5a, 5b5

S3	<p>Apply mathematical, scientific and engineering principles, methods and modelling to the design and construction of civil engineering infrastructure.</p> <p>Examples include: the design, construction and maintenance of buildings, transportation systems, water and wastewater networks, foundations and temporary works, understanding slope stability, retaining walls, ground water movement, coastal works, elastic/plastic and failure behaviour of materials such as concrete, steel, asphalt and timber, behaviour of structural elements such as beams, land surveying.</p>	1a. 1b
S4	<p>Use and validate digital solutions to model, evaluate, design, test, build and manage civil engineering infrastructure defining engineering and other constraints, identifying risks and how these may be resolved through design.</p> <p>Examples include: ability to use building information modelling, structural engineering design and analysis, computational fluid dynamics and geospatial information systems software.</p>	1c, 1d
S5	<p>Develop innovative, safe, technical solutions to civil engineering problems through the use of research techniques, market intelligence and best practice.</p> <p>Examples include: ability to use of range of research methods to collect and analyses data to draw well-founded practical conclusions for implementation, applicable research strategy and methodology, literature searches.</p>	1c, 1d
S6	<p>Interpret and apply design and quality standards including codes of practice, legal and regulatory frameworks, in the development of civil engineering solutions, the determination of construction methods and the technical aspects of site activities.</p> <p>Examples include: planning, designing, construction and maintenance of buildings and infrastructure in compliance with current codes, standards and legislation, industry regulations, the use of Risk Assessment Method Statements</p>	1d. 2e
S7	<p>Manage and apply safe systems of work including taking responsibility for own obligations for health, safety, and welfare issues, assessing and controlling risk, working with health, safety and welfare legislation and best practice.</p> <p>Examples include: recognise the health and safety aspects of civil and infrastructural projects as well as assess associated risks and identify appropriate safety measures in site work and for undertaking construction works. Apply the principles of civil engineering and construction business risk management.</p>	4a, 4b, 4c, 4d
S8	<p>Manage the planning, budgeting and organisation of tasks, people and resources through the use of appropriate management systems, working to agreed quality standards, project programme and budget, within legal contractual and statutory requirements.</p>	3a. 3b

S9	Manage teams and develop staff to meet changing technical and managerial needs.	2c, 2d
S10	Communicate effectively and provide guidance to others through design models, calculations, reports, drawings, specifications, presentations, digital media, and discussions with those both inside and outside the industry.	6a, 6b
S11	Carry out and record the continuing professional development necessary to maintain and enhance knowledge and competence as a civil engineer.	7c

Behaviours

Core behaviours to be assessed		ICE Attributes
B1	Be aware of the needs and concerns of others, especially in relation to diversity and equality.	6c, 6d
B2	Demonstrate reliability, integrity, and respect for confidentiality.	7b
B3	Demonstrate confidence and flexibility in dealing with new and changing interpersonal situations	6c, 6d
B4	Be conscious of the need to create, maintain and enhance productive working relationships.	2c, 6c
B5	Demonstrate a strong commitment to health, safety and welfare.	4c
B6	Demonstrate a personal commitment to professional and ethical standards, recognising your obligations to society, the profession and the environment.	7a, 7b
B7	Demonstrate self-awareness of knowledge and skills and only undertake work that you are competent to do.	1e, 7d
B8	Reflect on their personal development needs and place a strong emphasis on addressing them.	7c



ICE Attributes for Incorporated Engineers

Attribute	Sub attributes	Knowledge	Skill	Behaviour
1 Understanding and Practical Application of Engineering	<ul style="list-style-type: none"> a) Maintain and extend knowledge of engineering theory and practice, and how technology assists its application b) Solve engineering problems using a sound theoretical approach, based on evidence, and contribute to continuous improvement c) Identify, review, and select techniques, procedures and methods to undertake engineering tasks d) Contribute to the design and development of engineering solutions, implement those solutions, and evaluate their effectiveness in the context of the whole project life cycle e) Exercise sound independent engineering judgement 	1, 2, 3, 4, 5	1, 3,4,5, 6	1
2 Management and Leadership	<ul style="list-style-type: none"> a) Plan the work and resources needed to enable effective implementation of engineering tasks and projects b) Manage the planning and organisation of tasks and resources c) Manage teams or technical specialisms d) Assist others to meet changing technical and managerial needs e) Manage quality processes and contribute to quality improvements 	6, 7	6, 9	4
3 Commercial Ability	<ul style="list-style-type: none"> a) Manage, prepare and control costs/budgets of engineering tasks or projects b) Use sound knowledge of statutory and commercial frameworks within their own area of responsibility and have an appreciation of other commercial arrangements 	6	8	
4 Health, Safety and Welfare	<ul style="list-style-type: none"> a) Demonstrate a sound knowledge of legislation, hazards and safe systems of work b) Manage risks c) Manage health, safety and welfare within their own area of responsibility d) Contribute to improvements in health, safety and welfare 		2, 7	5
5 Sustainable Development	<ul style="list-style-type: none"> a) Understand the principles of sustainable development and apply them in work b) Manage engineering activities that contribute to sustainable development and the United Nations Sustainable Development Goals (UNSDGs) 		1, 2	

6 Interpersonal Skills and Communication	<ul style="list-style-type: none"> a) Communicate well with others at all levels including effective use of English¹ orally and in writing² b) Discuss ideas and plans competently and with confidence c) Demonstrate effective personal and social skills d) Demonstrate awareness of diversity and inclusion 	8	10	1, 3, 4
7 Professional Commitment	<ul style="list-style-type: none"> a) Understand and comply with the ICE Code of Conduct b) Understand the ethical issues that may arise in their role and exercise responsibilities in an ethical manner c) Plan, carry out and record Continuing Professional Development necessary to maintain and enhance competence in their own area of practice d) Identify the limits of their personal knowledge and skills e) Engage with ICE activities 	9	11	2, 6, 7, 8

¹ All assessments and reviews for Engineering Council registration will be conducted in English, subject to the provisions of the Welsh Language Act 1993.

² This will be demonstrated by your submitted report and completion of a written communications test as part of the Professional Review



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Institution of Civil Engineers is a Registered
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Our vision

Civil engineers at the heart of society, delivering sustainable development through knowledge, skills and professional expertise.

Core purpose

- To develop and qualify professionals engaged in civil engineering
- To exchange knowledge and best practice for the creation of a sustainable and built environment
- To promote our contribution to society worldwide

Diversity statement

As a membership organisation and an employer, we value diversity and inclusion - a foundation for great engineering achievement