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Graduate Apprenticeships

Framework document for

Civil Engineering

at SCQF level 10

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Document control

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Terms and abbreviations

Term	Meaning
SDS	Skills Development Scotland
CIV	Civil Engineering
GA	Graduate Apprenticeship
SCQF	Scottish Credit and Qualifications Framework
TEG	Technical Expert Group
QA	Quality Assurance
HE	Higher Education
BSc	Bachelor of Science
BEng	Bachelor of Engineering
CEng	Chartered Engineer
IEng	Incorporate Engineer
ICE	Institute of Civil Engineers
IStructE	Institution of Structural Engineers
CIHT	Chartered Institution of Highways and Transportation
IHE	Institute of Highways Engineers
ICT	Information and Communication Technology
BIM	Building Information Modelling
SQA	Scottish Qualifications Authority
CIOB	Chartered Institute of Building
CITB	Construction Industry Training Board
JBM	Joint Board of Moderators

Contents

1. Graduate Apprenticeships in Scotland

1.1 Purpose of the Graduate Apprenticeship framework document

The purpose of this document is to provide employers and learning providers with information required to deliver a Graduate Apprenticeship in **CIVIL ENGINEERING**. The framework sets out the skills and learning outcomes identified through employer consultation that are required to support the development of this programme.

This framework document should be read in conjunction with the following publications:

1. Work-based Learning Principles
2. Product Specification at **SCQF level 10**
3. Quality Assurance Guidance

This documentation is available on the Skills Development Scotland (SDS) corporate website:

www.skillsdevelopmentscotland.co.uk

1.2 What are Graduate Apprenticeships?

Graduate Apprenticeships (GAs):

- are accredited work-based learning programmes that lead to degrees or degree-level, professionally recognised qualifications
- are part of the apprenticeship family, supporting the transition into employment by providing work-based learning pathways from Foundation and Modern Apprenticeships to Higher and Graduate Apprenticeships, at SCQF Levels 8 –11
- have been developed as part of the Scottish Government's approach to developing Scotland's young workforce and Skills Development Scotland's work-based learning strategy

1.3 Why do we need Graduate Apprenticeships in Scotland?

International experience demonstrates how degree-level apprenticeships can drive economic growth. We believe this approach can benefit the Scottish economy.

The range of approaches taken in countries including Switzerland and Germany to develop employer-led, work-based learning pathways to learning and employment provide the basis for how Scotland can use work-based learning to improve the operation of the labour market and to deliver economic growth[1]. Skills Development Scotland is now leveraging the development of Graduate Apprenticeships to support this change.

[1] **PWC (2015) Young Workforce' Index: How well are OECD economies developing the economic potential of their young people?**

1.4 Who develops Graduate Apprenticeships?

Graduate Apprenticeships are developed by Skills Development Scotland through consultation with employers, universities, professional bodies and qualification authorities in the form of Technical Expert Groups (TEGs). The TEGs act as advisory groups on behalf of the sector and are based on the current and future skills needs of industry. They advise on the topics and related outcomes that should be included in a framework.

More information about who was involved in the development of this framework can be found in **Appendix C**.

1.5 Who are Graduate Apprenticeships for?

Graduate Apprenticeships provide a new way into degree-level study for individuals who are either currently in employment or are entering into employment. GAs are available to employees aged 16 or over.

1.6 Who delivers Graduate Apprenticeships?

Graduate Apprenticeships are delivered by universities in partnership with employers and college learning providers. An up-to-date list of learning providers and the frameworks they offer can be found on **www.apprenticeships.scot**.

2. Delivery

As Graduate Apprenticeships are work-based degrees, the place of employment is the place of learning. The learning and skills development must be fully integrated into both the **delivery and assessment** of the degrees when part of a Graduate Apprenticeship. This integration can only be satisfactorily achieved by proper planning and design prior to delivery and not by add-on components or ad-hoc modifications.

The authenticity of the programme is shown in the way employers are involved in the design and delivery of the degrees and the way in which work-based learning is positioned as integral to both the learning and the assessment needed for successful completion of the programmes.

GA are designed as full-time programmes. They are not part-time or sandwich courses. Attendance at the place of learning will be agreed between the provider and the employer sending individuals on the programmes. Examples of how this might work are:

- by day release or
- by block release of three or four week duration, three times per year
- through distance learning with an initial “boot camp or induction”

Fundamentally, most of an individual’s time should be spent in the workplace on directed study.

In designing the degrees to meet the work-based learning requirements of the GA, learning providers must ensure that they also meet the principles and criteria noted here:

Box 1. Principles and criteria

This GA is an **SCQF level 10** work-based degree. All proposed university degree programmes for this GA framework must:

- be **480 credits**
- be based on a partnership between employers and the learning provider
- evidence how the programmes exemplify the work-based learning requirements
- have clear goals and aspirations in support of equality and diversity with appropriate monitoring and other processes in place
- demonstrate how they will ensure that apprentices, upon graduation, will consistently achieve the necessary industry skills, knowledge and competence defined in **Appendix A**
- develop learning through reflection and review of work processes and experience
- meet the requirements to apply for professional body recognition

NB Delivery models based on sandwich years or industrial placement block release are not considered as work-based learning as part of this framework.

The successful delivery of Graduate Apprenticeships depends upon an effective partnership between the apprentice, the employer and the learning provider. This will involve additions to their normal responsibilities for employees, learning providers, and apprentices.

Delivery of the content of the GA will be agreed by the participating learning providers, which may involve delivery of specialist or employer-specific content. Employers should also be closely involved with all aspects of the programme, including the course specification, delivery, and assessment of practical activities.

The learning provider has responsibility for the quality assurance and enhancement of all elements of the programmes but they must adhere to the SDS specified documents referenced in **Section 1** and any additional guidance documentation provided as part of their competitive grant award. Practical activities must make use of the work environment and course content must take account of the technologies used in the apprentice's employment.

Apprentices must have individual learning and training plans. The learning provider and existing employer HR systems should be co-ordinated during the development of the individual learning and training plan to ensure that the required employer contextualisation is effective. Even within a specific employer, there may be apprentices who use differing technologies.

3. Roles and responsibilities

3.1 Role of the employer

Apprentices are employees and subject to the standard terms and conditions applying to all employees.

Employers participating in the Graduate Apprenticeship programme must:

- consider whether a candidate has a reasonable chance of achieving the chosen programme during the selection process – this includes not only the course content but the acquisition of wider graduate attributes
- provide agreed information to support the candidate's application to the degree course
- provide apprentices with suitable opportunities to gain the type of experience in the workplace that will support their learning and skills acquisition
- provide each apprentice with a nominated mentor who must be readily accessible to the apprentice and to the learning provider
- liaise with the learning provider on the content and practical activities in the apprentice's individual learning and training plan
- provide information that will support the individual apprentice and their assessment

3.2 Role of the learning provider

Apprentices are both employed by the employer, as well as enrolled with the learning provider. As such they should have access to the same facilities as any other student.

GA course design and delivery must adhere to the principles detailed in preceding sections and in addition the learning provider must:

- adopt a flexible approach to considering the suitability of candidates by taking account of the portfolio of previous learning and experience an individual brings to the programme – this will include any relevant Foundation or Modern Apprenticeship undertaken – and support best practice in assessing individuals and in gathering evidence from employers where this is required
- liaise with the employer on the content and practical activities in the apprentice's individual learning plan

In addition, the learning provider should liaise with existing employer Training and Development and Quality Assurance (QA) systems to minimise double assessment. Development and meaningful implementation of individual learning plans is an essential component of the GA and assessments should take account of existing evidence wherever possible.

New evidence that directly relates to the workplace may be authenticated by employers or the individual's mentor.

There are a range of different delivery mechanisms, but the integration of knowledge within contextualised learning opportunities must be the overriding factor.

3.3 Possible delivery might include

Content delivery and assessment responsibilities:

	Employer	***Learning Provider***	***Other***
Delivery of knowledge and understanding content	✓ Employer specific topics	✓ Generic and non-employer specific	✓ Private providers
Assessment of practical application	✓	✓	✓ Apprentice
Development of personal and business skills	✓ Specification, delivery, progress monitoring, assessment and mentoring	✓ Specification, delivery, progress monitoring and assessment	✓ May be a third party used for delivery, monitoring and assessment

4. Entry

4.1 Eligibility

- Graduate Apprenticeships are available to new and existing employees of participating employers.
- Candidates must be at least 16 years of age. However, the suitability of an individual for entry onto a GA will be decided by the employer and their learning provider partner.
- Candidates must be resident in Scotland throughout the Graduate Apprenticeship. In addition to this, their employer's working premises must also be located in Scotland. When applying to become a Graduate Apprentice the individual will be required to satisfy the employer that they have the right to live and work in UK.
- Entry requirements are likely to vary across learning providers. For courses where there is a mandatory requirement for a specific subject, learning providers should consider ways they can provide support to individuals who don't hold a traditional qualification but have nevertheless shown aptitude and competence at the necessary level.

4.2 Recognition of prior learning

Candidates will undergo a selection process for a Graduate Apprenticeship, based on employer HR processes. The admissions departments need to take account of this and liaise with employers to provide advice and guidance on the prior learning and experience that will be accepted for entry onto the course.

A more flexible approach to entry requirements should be adopted by learning providers, and be done in consultation with employers. This should involve consideration of candidates on a case by case basis, who have completed relevant Foundation, Modern or Technical Apprenticeships as well as industry / vendor certifications.

Universities and other providers are asked to consider ways they can optimise the apprentice's prior learning within the programme to ensure there is no unnecessary repetition of content.

5. Demand

The Construction sector includes planning for construction projects (architecture, urban planning etc.), the manufacture of products needed for construction projects (cement, heating systems etc.), and the sub-sectors necessary to build developments (electrical installations, joinery etc.). The sector covers the construction of a wide range of projects from domestic buildings to roads and railways.

Employment[2]

In 2017, **employment in the sector was 233,600** accounting for eight per cent of all employment in Scotland. This makes it the **third largest employing sector.** Since the recession in 2008 employment in the sector has declined by ten per cent, which is faster than the one per cent decline for all industries. However, more recently (since 2015) employment has grown by two per cent, compared to no growth across all industries. This suggests a **large sector which declined during the recession but has experienced recent recovery and growth.**

Regionally, the highest levels of employment were in Lanarkshire (36,000), Glasgow (33,000) and Aberdeen City and Shire (33,000). Furthermore, the highest employment concentration was in West Lothian (almost double the national average). In this region the absolute level of employment was lower but the Construction sector was an important source of jobs.

The employment growth in the sector is forecast to continue and accelerate. By 2020, employment in the sector will have grown by 6,400, an increase of three per cent. This is compared to static employment across all industries. The sector's growth is expected to increase over the longer term; **by 2027 employment in the sector will have increased by 11 per cent making it the fastest growing sector**. By comparison, the employment growth across all industries will be three per cent.

[2] **Oxford Economics Regional and Sector Forecast Data (2000-2027)**

Growth will create jobs in the sector and the need to replace workers will also generate demand. Based on employment in 2017, **28 per cent the workforce will need to be replaced by 2027.** The Construction Industry Training Board has highlighted the need to find over 12,000 new workers to meet the replacement demand by 2022. **The sector's net requirement for workers up to 2027 will be 91,100**. This is seven per cent of the net requirement for workers across all industries.

Over half of the total net requirement for workers in the Construction sector will be distributed across four regions. These are: Glasgow (16 per cent); Lanarkshire (15 per cent); Edinburgh, East and Midlothian (13 per cent); and Aberdeen City and Shire (12 per cent).

Given that ten per cent of the construction workforce in Scotland is non-UK nationals; the implications of Brexit are likely to have an impact on the industry's supply of labour. [3]

Occupations[4]

In 2017, half of the people working in the Construction sector were in mid level occupations. The proportion of the workforce in high and low level occupations was lower, 33 per cent and 17 per cent respectively. In 2027 there will be a small change in the occupational structure of the workforce with one per cent more of the workforce being in mid level occupations and one per cent fewer in low level occupations.

CITB forecast increasing demand for Civil Engineers; the industry is forecast to require 350 additional civil engineers per year for the next five years with the total number of civil engineer in Scotland reaching 7,500 by 2021.This demand stems from planned large infrastructure projects, continued skills shortages, and an increasingly ageing workforce.[5]

Demand for GAs in Civil Engineering is further evidenced by the nine per cent reduction of university student studying civil engineering in the five years to 2014, and a 32 per cent reduction in the number of further education students over the same timeframe.[6]

Construction Skills Investment Plan

The Construction Skills Investment Plan (developed in 2012) acknowledges the apprenticeship family as a means of addressing skills needs. The SIP details modern apprenticeships to be well established in the sector for technical traders however notes interest in expanding the modern apprenticeship approach into higher level skills.

[3] CITB White Paper – Migration and Construction
[4] Oxford Economics Regional and Sectoral Forecast (2000-27)
[5] Construction Skills Network Forecast (2017-21)
[6] ICE Submission of Evidence to he Education and Skills Committee of the Scottish Parliament (2016)

6. The framework

6.1 Overview

The **Civil Engineering (CIV)** Graduate Apprenticeship is based on industry-defined needs and has been developed in collaboration with employers and the education sector to allow knowledge, understanding, skills and competence to be developed with the necessary attributes industry expects from graduates.

Within the **Civil Engineering (CIV)** Graduate Apprenticeship, the degree content must be delivered per the principles and outcomes detailed in this framework.

The specific Graduate Apprenticeship included in this framework is:

- **Civil Engineering**

The output of this framework will be a Graduate Apprenticeship at **SCQF Level 10** entitled:

Graduate Apprenticeship in BSc or BEng (Hons) Civil Engineering

6.2 Purpose

The purpose of this programme is to produce graduates with the required skills, knowledge and attributes to fulfil the role of Civil Engineer in whichever context or discipline they chose to pursue. Graduates will have a thorough understanding of key concepts and theories and the underpinning mathematical and scientific knowledge required to be a successful Civil Engineer. They will also possess the key skills of project management and the important attributes and behaviours to make them responsible and reflective problem-solvers, critical-thinkers and managers.

The **Civil Engineering** degree GA is designed to produce graduates with:

- the ability to work in a safe and sustainable way, according to environmental requirements;
- the ability to select appropriate techniques, procedures and technology and use relevant theoretical knowledge and understanding of key concepts and materials;
- scientific and mathematical knowledge and understanding;
- skills in the use of appropriate technologies and digital platforms used in civil engineering;
- skills in the collection and critical analysis of data, combined with appropriate critical-thinking and problem-solving ability;
- skills to design and evaluate civil engineering solutions and to communicate them in an appropriate way;
- the ability to plan and manage projects, including managing and monitoring risk, operating and evaluating performance and managing and allocating tasks and resources;

- the ability to contribute to continuous improvement and organisational performance;
- the ability to comply with professional standards and work in an ethical manner;
- an understanding of the importance of, and the ability to, maintain awareness of sustainability and environmental legislation, innovation and best practice;
- the ability to critically reflect on own performance and identify areas for improvement to broaden and expand theoretical understanding and knowledge of current and emerging professional engineering practice and techniques;
- the ability to communicate with others at all levels, including when presenting and managing discussions;
- skills in leading others and taking appropriate responsibility for their work, as well as working effectively as a member of a team.

A key part of the **Civil Engineering** GA is that each of the five key content areas is combined to deliver a holistic learning experience. These are:

1. Civil engineering practice
2. Civil engineering design, analysis, specification and maintenance
3. Project management
4. Professional practice
5. Interpersonal skills

Details of the high level learning and skills outcomes for these content areas are provided in **Appendix A**.

6.3 Occupational outcomes

The **Civil Engineering** GA is aimed at employment in the **Civil Engineering sector**. Specific roles will depend on the nature of the organisation, including, but not limited to:

- Civil Engineer (and associated job roles)

Completion of the Civil Engineering GA may also lead for example to employment in the following occupational areas:

- Project management
- Asset management
- Engineering

6.4 Learning outcomes

Please refer to **Appendix A** for a full list of learning outcomes for the **Civil Engineering** GA.

6.5 Professional recognition

The primary focus of the **Civil Engineering** GA is on developing the knowledge, understanding and skills outcomes sought by employers. This GA framework can provide a route to Chartered Engineer status, and is intended to fulfil the requirements to achieve Incorporate Engineer (IEng) status. It is therefore intended to provide full accreditation of IEng status and partial accreditation of Chartered Engineer (CEng) status. The framework is not prescriptive about the awards to be made available by learning providers, however these should be national qualifications at **SCQF level 10** with **480 credits**.

NB

The framework should only be delivered by providers capable of bestowing the correct awards at the appropriate SCQF level (or working in a partnership to be able to do so). To ensure recognition by the following professional bodies all HE qualifications should be accredited by the Joint Board of Moderators (JBM):

- Institution of Civil Engineers (ICE);
- Institution of Structural Engineers (IStructE);
- Chartered Institution of Highways & Transportation (CIHT);
- Institute of Highways Engineers (IHE).

6.6 Related Scottish apprenticeship frameworks

The following Scottish Apprenticeship frameworks and qualifications are relevant pathways that may contribute toward progression into the **Civil Engineering** GA. The apprenticeships are eligible for funding contributions from Skills Development Scotland, and provide employers with a range of alternative pathways at different levels of entry:

In school:

- Foundation Apprenticeship in Engineering (SCQF level 6)

FA in Engineering SCQF L6

- Foundation Apprenticeship in Civil Engineering (SCQF level 6)

FA in Civil Engineering SCQF L6

Post-school:

- Modern Apprenticeship in Industrial Applications (SCQF level 5)

MA Industrial Applications SCQF L5

- Modern Apprenticeship in Construction Civil Engineering (SCQF level 5)

MA Construction Civil Engineering SCQF L5

- Modern Apprenticeship in Construction Civil Engineering (SCQF level 6)

MA Construction and Civil Engineering SCQF L6

- Modern Apprenticeship in Engineering (SCQF level 6)

MA Engineering SCQF L6

- Technical Apprenticeship in Engineering (SCQF level 8/9)

TA Engineering SCQF L8/9

- Technical Apprenticeship in Construction at (SCQF Level 9)

TA Construction SCQF L9

- Higher Apprenticeship in Civil Engineering at (SCQF level 8)

HA Civil Engineering SCQF Level 8

Appendix A. Learning and skills outcomes

FRAMEWORK: Civil Engineering (SCQF level 10)

This section details the high-level learning and skills outcomes for the GA in **Civil Engineering** that must be covered within the degree.

This presents a broad set of outcomes against which universities can position their intended provision to meet the high-level learning outcomes and flavour the programme for their intended employer audience.

Topics and high-level learning and skills outcomes:

Learning and skills outcomes for Civil Engineering
1. Civil engineering practice
1.1. Manage and apply safe systems of work
1.2. Contribute to sustainable development and apply environmental requirements when undertaking civil engineering
1.3. Select appropriate techniques, procedures and technologies to undertake engineering tasks
1.4. Use relevant theoretical knowledge and understanding of key concepts and materials used in civil engineering
1.5. Apply scientific and mathematical knowledge and understanding to civil engineering tasks
1.6. Demonstrate the competent application of digital platforms appropriate to civil engineering
1.7. Collect and critically analyse evidence/data in the application and implementation of civil engineering
2. Civil engineering design, analysis, specification and maintenance
2.1. Define and deconstruct civil engineering problems, including constraints and limitations
2.2. Use critical-thinking, problem-solving skills and technical knowledge to develop solutions
2.3. Develop appropriate design solutions and evaluate their effectiveness
2.4. Communicate engineering solutions to technical and non-technical audiences

3.	**Project management**
3.1	Plan for successful implementation of civil engineering projects
3.2	Implement risk management
3.3	Operate within contracts and evaluate performance
3.4	Manage and allocate tasks and resources to project plan and budget
3.5	Contribute to continual improvement and effective organisational performance
4.	**Professional practice**
4.1	Comply with professional standards for civil engineering
4.2	Exercise responsibilities in an ethical manner
4.3	Maintain current awareness of sustainability and environmental legislation, innovation and best practice
4.4	Apply knowledge of the commercial, economic and global context in which civil engineering is undertaken
4.5	Critically reflect on performance to identify areas for improvement
4.6	Broaden and expand sound theoretical understanding and knowledge of current and emerging professional engineering practice and techniques
5.	**Interpersonal skills**
5.1	Communicate orally, graphically and in writing in English with others at all levels
5.2	Present and discuss proposals
5.3	Demonstrate personal and social skills
5.4	Lead others and work productively as a member of a team

Appendix B. Low-level outcomes examples

The next section provides examples of low level learning and skills outcomes which employers may expect individuals to cover in a Graduate Apprenticeship **Civil Engineering** degree.

The low-level learning and skills outcomes are not intended to be used as a pro-forma curriculum.

Each learning provider will have its own approach to delivering the degree and progression between stages. The low-level skills and derived learning outcomes that are detailed in the following sections will provide guidance to ensure that each degree covers the desired learning outcomes appropriately.

Table 1 Skills and knowledge coverage in civil engineering practice

1.	Civil engineering practice
1.1.	Manage and apply safe systems of work
1.2.	Contribute to sustainable development and apply environmental requirements when undertaking civil engineering
1.3.	Select appropriate techniques, procedures and technologies to undertake engineering tasks
1.4.	Use relevant theoretical knowledge and understanding of key concepts and materials used in civil engineering
1.5.	Apply scientific and mathematical knowledge and understanding to civil engineering tasks
1.6.	Demonstrate the competent application of digital platforms appropriate to civil engineering
1.7.	Collect and critically analyse evidence/data in the application and implementation of civil engineering

1.1. Manage and apply safe systems of work

CIV1.1.a Develop knowledge of current, relevant health and safety legislation

CIV1.1.b Identify and take responsibility for obligations for health, safety and welfare issues

CIV1.1.c Develop and implement appropriate hazard identification and risk management systems

CIV1.1.d Manage systems that satisfy health, safety and welfare requirements

CIV1.1.e Contribute to the development of a health, safety and welfare culture

CIV1.1.f Manage, evaluate and improve health, safety and welfare systems

1.2. Contribute to sustainable development and apply environmental requirements when undertaking civil engineering

CIV1.2.a Describe the impact of civil engineering practice on the environment, society and individuals

CIV1.2.b Understand the need for civil engineering activities to promote sustainable development

CIV1.2.c Undertake engineering activities in a way that fosters and promotes sustainable development, using resources efficiently and effectively

CIV1.2.d Act in accordance with the principles of sustainability and mitigate unavoidable adverse impact on the environment and society in line with current, relevant legislation and best practice

CIV1.2.e Understand and encourage stakeholder involvement in sustainable development

1.3. Select appropriate techniques, procedures and technologies to undertake engineering tasks

CIV1.3.a Apply understanding of relevant techniques, procedures and technologies

CIV1.3.b Use knowledge of techniques to compare and contrast alternative options and approaches

CIV1.3.c Identify and select appropriate products and services considering the design, construction and maintenance requirements and capital and whole life cost of the asset

CIV1.3.d Incorporate products and services which maintain and enhance the quality of the environment and community and meet client requirements

CIV1.3.e Incorporate appropriate technologies which meet client requirements

1.4. Use relevant theoretical knowledge and understanding of key concepts and materials used in civil engineering

CIV1.4.a Apply knowledge of onsite and offsite construction and testing practices

CIV1.4.b Prepare and interpret laboratory reports on standard tests used on civil engineering materials

CIV1.4.c Use and apply information from technical literature

CIV1.4.d Provide specification for a range of materials which meet client requirements, including affordability

1.5. Apply scientific and mathematical knowledge and understanding to civil engineering tasks

CIV1.5.a Use knowledge of scientific principles and underpinning methodologies relevant to civil engineering

CIV1.5.b Apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems

CIV1.5.c Apply and integrate knowledge and understanding of other engineering disciplines to support own engineering practice

1.6. Demonstrate the competent application of digital platforms appropriate to civil engineering

CIV1.6.a Make appropriate use of available technologies including digital methods and tools, sketching, drawing, graphical information, technical reports, information modelling and BIM to convey complex information to a range of audiences

CIV1.6.b Use a range of standard ICT applications to process and store data to produce written records of construction activities

CIV1.6.c Fully exploit and implement current digital applications, critically evaluating and validating outcomes

CIV1.6.d Share with others digital knowledge and expertise, encouraging appropriate integration of digital technologies into everyday practice

CIV1.6.e Understand how the digital platform integrates within the wider digital environment

1.7. Collect and critically analyse evidence/data in the application and implementation of civil engineering

CIV1.7.a Obtain, appraise and collate relevant evidence/data from a variety of sources including from original data/experiments and from secondary sources

CIV1.7.b Critically analyse, interpret and validate data using quantitative methods, including root cause analysis, to understand the performance of components and structures

CIV1.7.c Monitor, interpret and apply the results of analysis, modelling and testing to bring about continuous improvement

CIV1.7.d Conduct statistically sound appraisal and evaluation of data

Table 2 Skills and knowledge coverage in civil engineering, design, analysis, specification and maintenance

2. Civil engineering design, analysis, specification and maintenance
2.1. Define and deconstruct civil engineering problems, including constraints and limitations
2.2. Use critical-thinking, problem-solving skills and technical knowledge to develop solutions
2.3. Develop appropriate design solutions and evaluate their effectiveness
2.4. Communicate engineering solutions to technical and non-technical audiences

2.1. Define and deconstruct civil engineering problems, including constraints and limitations

CIV2.1.a Define the problem and identify any constraints including health, safety, environmental, sustainability, ethical, cost, security and risk issues

CIV2.1.b Describe business, client and user needs, including considerations such as the wider engineering context, public perception and aesthetics

CIV2.1.c Determine the availability of information for solving problems and identifying any missing or incomplete information

2.2. Use critical-thinking, problem-solving skills and technical knowledge to develop solutions

CIV2.2.a Apply knowledge and experience to investigate problems arising during civil engineering tasks

CIV2.2.b Apply an integrated or systems approach to engineering problems through know-how of relevant technologies and their application

CIV2.2.c Work with information that may be incomplete or uncertain and be aware that this may affect solutions and designs

CIV2.2.d Use the results of civil engineering analyses for problem-solving and to recommend appropriate action

CIV2.2.e Evaluate possible engineering solutions, taking account of health, safety, environmental, sustainability, cost, quality, reliability, appearance and fitness for purpose

2.3. Develop appropriate design solutions and evaluate their effectiveness

CIV2.3.a Specify the development requirements for civil engineering projects

CIV2.3.b Develop and evaluate design solutions taking account of value engineering and critical constraints including due concern for safety and sustainability

CIV2.3.c Perform, check and validate required calculations using appropriate technologies

CIV2.3.d Interpret and analyse performance and contribute to determining critical success factors

CIV2.3.e Contribute to reports on the evaluation of the effectiveness of designs, including risk, safety and life-cycle considerations

CIV2.3.f Contribute to recommendations for improvement and actively learn from feedback on results

2.4. Communicate engineering solutions to technical and non-technical audiences

CIV2.4.a Produce detailed designs using freehand techniques and appropriate technologies

CIV2.4.b Develop technical and commercial reports for internal and external audiences

CIV2.4.c Use effective and appropriate interpersonal skills when communicating technical matters to non-technical audiences

Table 3Skills and knowledge coverage in project management

3. Project management
3.1. Plan for successful implementation of civil engineering projects
3.2. Implement risk management
3.3. Operate within contracts and evaluate performance
3.4. Manage and allocate tasks and resources to project plan and budget
3.5. Contribute to continual improvement and effective organisational performance

3.1. Plan for successful implementation of civil engineering projects

CIV3.1.a Understand how to implement the phases of a project including; initiation, progress gathering and reporting by exception, project deviation and recovery, capturing and managing actions and the final handover of specified deliverables

CIV3.1.b Identify and contribute to agreement on the project scope, timescale and deliverables

CIV3.1.c Engage and liaise with key stakeholders, including the public/communities and other disciplines necessary for successful project delivery

CIV3.1.d Identify factors that may affect project implementation, carrying out a holistic and systematic risk identification and assessment

CIV3.1.e Plan project budgets, identifying assumptions, dependencies and constraints that might impact on delivery

CIV3.1.f Plan timings for project delivery, identifying and agreeing key milestones and deliverables

CIV3.1.g Prepare schedules of works for various phases of a civil engineering project

3.2. Implement risk management

CIV3.2.a Adopt a systematic and holistic approach to risk and hazard identification, assessment, mitigation and management

CIV3.2.b Define, analyse and prioritise project risks and issues, identifying their severity, ranking and dealing with residual risk

CIV3.2.c Record and communicate risk through reports, registers or logs

CIV3.2.d Plan and implement contingency plans and risk responses

CIV3.2.e Track risks and associated tasks, linking risks and dependencies to project activities

CIV3.2.f Critically analyse current practices including being encouraged to develop alternative solutions or ways of working to minimise or eliminate risks

3.3. Operate within contracts and evaluate performance

CIV3.3.a Understand the procedures to establish contracts and their advantages and disadvantages

CIV3.3.b Contribute to negotiating contractual arrangements with other parties preparing and applying contracts/work orders

CIV3.3.c Identify the roles of parties and duty holders within a contract

CIV3.3.d Identify and take appropriate action to address disputes/conflicts with other parties

CIV3.3.e Review and evaluate contract performance at appropriate levels and intervals, including at project close

3.4. Manage and allocate tasks and resources to project plan and budget

CIV3.4.a Contribute to setting up the project team, including defining the roles and responsibilities of a typical project management team and how they interact

CIV3.4.b Understand the issues of health, safety, environmental, cost, quality and time concerned with project implementation, including contractual obligations and resource constraints

CIV3.4.c Understand the importance of regular project reviews and the need to effectively manage the project review process, including planning and management

CIV3.4.d Monitor and report on progress and manage resources (plant, materials etc.)

CIV3.4.e Identify variations from quality standards, programme and budget and take corrective action

CIV3.4.f Understand the management of project funding, payments and recovery

3.5. Contribute to continuous improvement and effective organisational performance

CIV3.5.a Understand quality issues and their application to continuous improvement

CIV3.5.b Understand and contribute to the application of quality management principles

CIV3.5.c Contribute to best practice methods of continuous improvement

CIV3.5.d Carry out quality audits to monitor delivery and identify areas for improvement

CIV3.5.e Review potential for enhancing organisational performance using evidence from best practice

Table 4 Skills and knowledge coverage professional practice

4. Professional practice
4.1. Comply with professional standards for civil engineering
4.2. Exercise responsibilities in an ethical manner
4.3. Maintain current awareness of sustainability and environmental legislation, innovation and best practice
4.4. Apply knowledge of the commercial, economic and global context in which civil engineering is undertaken
4.5. Critically reflect on performance to identify areas for improvement
4.6. Broaden and expand theoretical understanding and knowledge of current and emerging professional engineering practice and techniques

4.1. Comply with professional standards for civil engineering

CIV4.1.a Engage with a relevant professional body or institution representing own discipline of civil engineering

CIV4.1.b Demonstrate a high level of professional and ethical conduct

CIV4.1.c Maintain a commitment to professional civil engineering values and codes of conduct, recognising obligations to society, the profession and the wider environment

CIV4.1.d Comply with relevant organisational codes of conduct including relevant diversity and anti-discrimination legislation

4.2. Exercise responsibilities in an ethical manner

CIV4.2.a Practice in such a way as to operate ethically in a professional manner

CIV4.2.b Accept appropriate responsibility for work carried out under own supervision

CIV4.2.c Treat all persons fairly and with respect

CIV4.2.d Act responsibly and ethically in all communications, including social media

4.3. Maintain current awareness of sustainability and environmental legislation, innovation and best practice

CIV4.3.a Contribute to a sustainable society in your role as a civil engineer by engaging with others to solve sustainability challenges and complying with environmental legislation

CIV4.3.b Actively seek and implement the latest and accurate information, and innovations, on sustainability and environmental issues

CIV4.3.c Maintain and implement understanding of, and best practices in, the efficient use of resources

4.4. Apply knowledge of the commercial, economic and global context in which civil engineering is undertaken

CIV4.4.a Understand the role of civil engineering in the global context

CIV4.4.b Understand the role of technology in facilitating global supply chains

CIV4.4.c Understand the way in which different factors, such as political, economic, social, technological, legal and environmental affect commercial markets and business

CIV4.4.d Evaluate the organisational strategies, structures and management techniques for achieving business objectives

4.5. Critically reflect on performance to identify areas for improvement

CIV4.5.a Critically review own development needs and maintain an understanding of the limits of personal knowledge and skills

CIV4.5.b Plan how to meet personal and organisational objectives

CIV4.5.c Maintain evidence of competence development

CIV4.5.d Evaluate continuing professional development outcomes against personal development plans

4.6. Broaden and expand theoretical understanding and knowledge of current and emerging professional engineering practice and techniques

CIV4.6.a Improve understanding of contexts in which civil engineering knowledge can be applied

CIV4.6.b Actively seek out opportunities to extend own technical capability and knowledge

CIV4.6.c Expand own theoretical and technical knowledge base through new applications and techniques

CIV4.6.d Actively pursue and engage in formal and informal learning to meet development goals and expand skills and knowledge

CIV4.6.e Broaden own knowledge of engineering codes, standards and specifications

CIV4.6.f Keep up to date with national and international civil engineering issues

Table 5 Skills and knowledge coverage in interpersonal skills

5. Interpersonal skills
5.1. Communicate orally, graphically and in writing in English with others at all levels
5.2. Present and discuss proposals
5.3. Demonstrate personal and social skills
5.4. Lead others and work productively as a member of a team

5.1. Communicate orally, graphically and in writing in English with others at all levels

CIV5.1.a Contribute to, chair and record meetings and discussions

CIV5.1.b Prepare communications, documents and reports on technical matters

CIV5.1.c Maintain accurate and legible records of meetings, discussions and correspondence

CIV5.1.d Exchange information and provide advice to technical and non-technical colleagues

CIV5.1.e Engage and interact with professional networks and other disciplines

CIV5.1.f Inform and communicate with the public and local communities at appropriate points during civil engineering projects

5.2. Present and discuss proposals

CIV5.2.a Present and deliver appropriate presentations

CIV5.2.b Manage discussions with audiences

CIV5.2.c Use feedback from discussions to improve proposals

5.3. Demonstrate personal and social skills

CIV5.3.a Seek and respond to feedback from others appropriately

CIV5.3.b Be aware of and take account of the needs and concerns of others, especially where related to diversity, equality and inclusion

CIV5.3.c Be confident and flexible in dealing with new and changing interpersonal situations

CIV5.3.d Identify, agree and work towards collective goals

CIV5.3.e Create, maintain and enhance productive working relationships and resolve conflicts

5.4. Lead others and work productively as a member of a team

CIV5.4.a. Understand the role of the team and the individual roles and responsibilities of team members

CIV5.4.b. Plan and implement own work goals, objectives, priorities and responsibilities with others

CIV5.4.c. Take responsibility for leading appropriate members of the team

CIV5.4.d. Coordinate the activities of others to meet planned resourcing and budget plans

CIV5.4.e. Assess team and individual performance and provide feedback

CIV5.4.f. Gather evidence from colleagues of the management, assessment and feedback you have provided

Appendix C. Framework development summary

A GA framework sets out the required knowledge, skills and learning outcomes identified through employer and key partner consultation to support the delivery of a Graduate Apprenticeship programme. This is achieved through employer and key partner input to Technical Expert Groups (TEGs).

TEGs are short life working groups designed to act as an advisory group on behalf of the sector and contributes to the development and course design of a GA. TEGs are integral to the process of developing GAs that provide quality, consistency and relevance to industry.

Each TEG is made up of employers, professional or industry bodies, learning providers and subject/technical experts from the related industry.

The following organisations were consulted in the development of this framework:

Civil Engineering (SCQF level 10)

Employers	Learning providers	Qualification and industry bodies
Improvement Service	Edinburgh Napier University	Chartered Institute of Building (CIOB)
McLaughlin and Harvey	Glasgow Caledonian University	Construction Industry Training Board (CITB)
Morgan Sindall	Inverness College	Institution of Civil Engineers (ICE)
Morrison Construction	University of Aberdeen	Scottish Qualifications Authority (SQA)
Robertson	University of the Highlands and Islands	
Scottish Water		
Stewart Milne Group		
The Forestry Commission		
Scottish Government		

Skills Development Scotland

This framework is also available on the Skills Development Scotland corporate website:
www.skillsdevelopmentscotland.co.uk