

## 1 PROFESSIONAL STANDARDS AND ENGINEERING RESPONSIBILITY (Minimum standard K)

This objective is intended to demonstrate knowledge of professional conduct, a commitment to continuous professional development and engagement with the Institution and wider industry.

### The candidate **must** demonstrate that they have knowledge of:

- the structure and purpose of the Institution of Structural Engineers, together with an awareness of the Institution's Code of Conduct
- an involvement in Institution affairs appropriate to their individual circumstances and location
- the limits of their technical competency in recognising complexity in problems and solution methods
- the importance of sharing knowledge and data across the industry
- the importance of CPD, the Institution requirements for CPD and a record of appropriate training
- their need to plan for an ongoing commitment to CPD
- being supportive of the needs and concerns of others, especially where this relates to diversity and inclusion
- the ethical issues that could arise in their role and how they should carry out their responsibilities in an ethical manner

### The candidates **may** also wish to demonstrate a further understanding of:

- how social inclusion, diversity, equality and the UN Sustainable Development Goals (UN SDGs) all relate to being a professional engineer
- the need for ongoing change and evolution of the role and responsibility of the engineer
- the benefits of ongoing involvement in Institution affairs appropriate to their individual circumstances and location
- the relationship between the IStructE and the Engineering Council
- the institutions of other related disciplines in the candidate's home country and around the world (e.g. ASCE, CIBSE, HKIE, IEAust, ICE, IEE, IEI, IES, RIBA, RICS, SAICE, SEI)

### Examples of evidence to demonstrate compliance with this objective:

Attendance at technical meetings and seminars, whether in person or remotely (via live broadcast or recorded video). The candidates may list their involvement with a brief overview of all activities and a brief commentary selected events.

A completed CPD record showing a variety of learning along with a plan for the learning to be undertaken over the following year.

By giving an example of where the candidate has applied:

- ethical principles as described in the Engineering Council's Statement of Ethical Principles *and/or*
- ethical principles as defined by the Institution's Code of Conduct or their employer.

Candidates are strongly encouraged to support, and encourage others to support, Institution activities in universities, colleges and schools by giving careers talks, lecturing, providing case studies, assisting in the marking/critiquing of project work, etc.

Other examples:

- Regular contact with members of the Regional Group committee
- Knowledge of the Institution's Council and committee structure and the work of those committees
- Regular use of the Institution's website
- Regular review of the Structural Engineer journal
- Knowledge of the Institution's services including CPD courses and the library
- Knowledge of the international dimension of the Institution

## **2 COMMUNICATION (Minimum standard B)**

This objective is intended to demonstrate candidates have an ability to communicate effectively in a variety of situations and demonstrate appropriate interpersonal skills.

**The candidate must demonstrate an ability to:**

- produce appropriate drawings, sketches, or models (physical or digital) to communicate ideas
- produce formal reports
- produce both formal and informal communications appropriately
- communicate verbally and demonstrate effective inter-personal skills
- prepare and deliver presentations
- produce documents suitable for a variety of appropriate audiences
- create, maintain and enhance productive working relationships, and resolve conflicts.
- evaluate and provide positive critical feedback on the work of others
- exchanging information and providing advice to technical and non-technical colleagues

**Examples of evidence to demonstrate compliance with this objective:**

The ability to communicate verbally will be assessed during the interview. The overall standard of the candidate's portfolio will be included in the assessment of this objective. Sketches and diagrams included in Objective 3 may also be considered as support to this objective provided they are referenced in the summary report form.

Possible examples that may be included are:

- In-house/client presentations
- Design stage reports, feasibility studies, reports to support planning applications etc.
- Drawings, sketches, diagrams or visualisations illustrating design concepts or details, structural behaviour, or construction methodology
- Communications or reports describing engineering solutions or principles to a non-technical reader
- Communications (emails) illustrating the candidate's collaboration with other parties, or situations where the candidate has contributed to working relationships or conflict resolution
- Presentations to schools, colleges, universities, etc.
- Team building exercises
- Participation in Institution competitions e.g. Young Structural Engineers' International Design Competition or other competitions supported by other institutions

### 3 CONCEPT CREATION AND DESIGN (Minimum standard B)

This objective is intended to demonstrate a candidate's skills around producing structural solutions in response to a brief. This would account for key aspects of a structural engineer's skillset such as designing for safety, carbon, durability, reuse, aesthetics and cost.

**The candidate must demonstrate ability in:**

- understanding and interrogating the brief to identify possible solutions
- producing and comparing a variety of options to a single brief
- determining appropriate loading and design criteria
- designing load transfer and stability systems, both superstructure and substructure
- considering robustness and accidental actions including fire
- estimating and communicating the embodied carbon (both upfront and whole-life) in the structure as part of the decision making process, and minimising this as far as possible
- consideration of construction issues (e.g. detailing, constructability, phasing, site constraints)
- driving collaboration across the project team through an appreciation of wider objectives
- coordinating the structural design with other disciplines (e.g. civils, drainage, facades)

**The candidates may also wish to demonstrate ability in:**

- reusing or repurposing existing structures or components, wherever feasible
- considering inclusive design in structural schemes
- designing for deconstruction, adaptability and reuse at end-of-life
- proposing concepts more suited to lower-carbon materials

Examples of evidence to demonstrate compliance with this objective:

- Sketches, drawings, models (digital or images of physical), reports, presentations etc. to communicate:
  - Structural arrangement and behaviour
  - Resistance to failure modes (e.g. robustness, fire)
  - Construction and deconstruction
  - Interaction with other disciplines
- The use of carbon calculations (including use of The Structural Carbon Tool) to demonstrate and advocate for low-carbon designs
- The development or use of software to evaluate or compare solutions

#### 4 ANALYSIS AND SIZING (Minimum standard B)

This objective is intended to demonstrate an understanding of structural behaviour and the ability to assess behaviour using appropriate methods of analysis. This objective is also intended to demonstrate competency of interpreting that analysis and using it to size structural elements and details, using the minimum amount of necessary material.

**The candidate must demonstrate ability in:**

**Analysis:**

- understanding structural behaviour at all scales, from a single element to an entire frame
- using the appropriate analysis tools for each purpose (e.g. hand calcs and models to the appropriate level of detail)
- using suitable modelling assumptions for each purpose
- applying appropriate design criteria including loading, utilisation targets, serviceability and user comfort (e.g. vibration)
- understanding the limitations of the model and its outputs (approximations, simplifications, etc)
- verifying results through hand checks, simple approximation, and engineering judgement
- validation and verification of analysis or design methods
- identification of limitations in analysis and/or design methods either in terms of accuracy or capability

**Sizing and detailing:**

- sizing structures to minimise material usage within the agreed design criteria (eg. strength, stiffness, durability/maintenance, buildability, etc.)
- designing structural details such as connections and reinforcement to the appropriate level of detail at each stage of design
- determining and utilising the capacity of existing structures and components through collection and analysis of appropriate information or data where relevant
- using appropriate standards, codes of practice, specifications, Institution publications, technical agency publications, bulletins, reports, commercial and relevant publications from other professional institutions etc., and applying the requirements or recommendations of these documents within specification or design criteria

Examples of analysis evidence to demonstrate compliance with this objective:

- beam and frame interaction
- braced and unbraced frames action
- resistance to disproportionate collapse and other accidental actions (e.g. fire)
- movement (thermal, wind, seismic, settlement, creep)
- assessing soil-structure interaction
- analysing connections and interfaces where standard assumptions are inappropriate
- dynamic analysis e.g. for floor vibrations or seismic
- sensitivity analysis to determine if a structural system or element requires particular attention or is disproportionately affecting the overall structural behaviour of the model
- the Certificate in Structural Behaviour may be used to demonstrate understanding of structural behaviour, including trusses, beams, plasticity and dynamics

Examples of sizing and detailing evidence to demonstrate compliance with this objective (at levels of detail appropriate for the design stage):

- stability elements (e.g. walls, bracing, diaphragms)

- vertical load transfer elements (e.g. slabs, beams, columns)
- substructure elements (e.g. foundations, basements, retaining walls)
- transfer structures (e.g. beams, trusses, lintels)
- verification of existing and/or reused structural components
- connections between elements, including those enabling composite action
- reinforcement detailing
- interface details between materials e.g. timber to steel
- movement joints and construction joints
- superstructure to substructure connections
- details between reused structures and new extensions

## 5 MATERIALS (Minimum standard B)

This objective is intended to demonstrate an in-depth understanding of the structural materials used in the candidate's work, along with an ability to specify and coordinate the use of such materials.

**The candidate must demonstrate ability in specifying and designing with materials in response to an understanding of:**

- the behaviour and structural properties (including strength, stiffness, ductility, and directionality) for different materials and their common grades/subgrades, and how these impact design and detailing requirements
- the effects on carbon emissions related to production methods, material sourcing and supply chains
- durability requirements
- detailing requirements, including an appreciation of how these affect end-of-life disassembly and reuse
- movement behaviour including creep, drying, and thermal movement

Whilst candidates often choose to specialise in one or two materials (and thus will have developed an ability in determining their behaviour) they must still have some knowledge of the carbon credentials, availability, behaviour, cost, manufacture, principal engineering properties and potential applications of a wider range of construction materials.

Examples of evidence to demonstrate compliance in this objective:

- appropriate selection and use of materials in response to their characteristics
- appropriate interfaces between materials
- response to carbon emissions that has been affected by material type, sourcing, and production methods, including the interpretation or use of Environmental Product declarations (EPDs) where applicable
- production of material specifications including aspects such as protective finishes, paints, reinforcement cover etc.
- the appropriate use of materials considering manufacturing technologies, locale and culture

## 6 SUSTAINABILITY (Minimum standard E)

This objective is intended to demonstrate experience in applying structural engineering in a way that minimises (and ultimately, reverses) negative environmental impacts whilst maximising societal benefit

### The candidate must demonstrate experience in:

- communicating the environmental impact of a structural design to the design and client team
- questioning the brief to reduce negative impacts whilst achieving the client's desired outcomes
- advocating for reuse and 'build less' design approaches
- considering wider sustainability aspects within their work

### The candidates may also wish to demonstrate experience in:

- working with the wider design team to reduce the overall project carbon
- balancing the reduction of upfront embodied carbon and whole-life carbon
- use of circular economy principles
- considering regenerative design principles
- use of, or interaction with, environmental rating schemes and design standards e.g. BREEAM, LEED, Passivhaus.

Examples of evidence to demonstrate compliance with this objective:

- reports, presentations or emails used to communicate:
  - the expected carbon impact of a design, perhaps including temporal aspects (upfront, end-of-life, sequestration)
  - impact of the structure within the wider context of the impact of the whole design
  - alternative design solutions that require a change to 'the brief' but reduce negative impacts – noting that 'the brief' can be as simple as a single architectural request
  - the benefits of a proposal that reuses an existing structure
  - the use of environmental rating schemes
- designs that use circular economy principles such as designing for future adaption, deconstruction, and reuse
- consideration of wider sustainability impacts during design such as those outlined in The Climate Framework (<https://www.climateframework.com/>) and the Living Building Challenge (<https://living-future.org/lbc/>), for example:
  - global context, sustainability policy,
  - health and wellbeing, pollution and contamination,
  - human factors such as social value, labour rights, traceability,
  - waste management and recycling,
  - land use, protection of plants and habitats,
  - economic sustainability such as involvement in new markets
- the specification of in-service data collection as a way of informing future designs and evaluating the performance of existing methods

## 7 CONSTRUCTION (Minimum standard E)

This objective is intended to demonstrate a candidate's experience of the practical process to convert design work into completed structures and should demonstrate that they are able to contribute to this in a meaningful way. Practical experience of site conditions and working practices is essential to the safe design and specification of projects.

**The candidate must demonstrate that they have gained experience of:**

- construction techniques, construction plant and machinery
- designing, specifying, or reviewing temporary systems
- reviewing construction programmes and construction sequencing
- reviewing or producing fabrication or shop drawings
- erection methodologies
- identification and correction of potential errors
- how their observations of construction/fabrication has informed their approach to design/buildability

**Examples of evidence to demonstrate compliance in this objective:**

It is recognised that not all candidates will be able to spend a continuous period on site for any significant length of time. In this case ad-hoc exposure to construction or assembly sites should be recorded.

Experience may be demonstrated by providing records of some, or all, of:

- work placement on site
- site meetings
- site visits
- inspections
- surveys
- testing procedures
- supervision of works
- checking of as installed features
- dealing with site queries

Evidence which may be provided:

- site visit and site meeting notes
- inspection records
- survey notes
- construction sequence diagrams or outline method statements produced to support design work
- demolition drawings
- temporary works proposals/designs or comments on temporary work drawings
- movement and monitoring specifications

## **8 HEALTH, SAFETY AND RISK MANAGEMENT (Minimum standard E)**

This objective is intended to demonstrate a candidate's experience in meeting health and safety requirements and legislation.

**The candidate must demonstrate experience of:**

- using appropriate health and safety standards
- engagement with CROSS (Collaborative Reporting for Safer Structures)  
<https://www.cross-safety.org/uk>
- reviewing and applying learning from CROSS publications
- producing risk and hazard assessments
- designing out risk
- safety on construction sites

**Examples of evidence to demonstrate compliance with this objective:**

Candidates may provide examples of evidence such as:

- risk assessments and communication of residual hazards in connection with their projects
- how risk has been considered or mitigated in their design work
- where learning from CROSS publications have been used in their work
- sharing safety information with CROSS for others to learn from
- where health and safety legislation has impacted on their design work
- risk management undertaken by the candidate
- assessment of site conditions, including soil conditions, during planning and design

## 9 MANAGEMENT (Minimum standard E)

This objective is intended to demonstrate a candidate's experience of management skills for programming and control.

**The candidate must demonstrate experience of:**

- management of individuals, teams and data/information
- leadership
- programming and project control
- interdisciplinary/inter team liaison and interface management
- working within a quality management system
- contributing to and working within a quality plan

**In addition, candidates may choose to demonstrate experience of:**

- working within Environmental Management Systems
- exchange of digital information and use of a common data environment (CDE) or similar

### Examples of evidence to demonstrate compliance with this objective:

Examples of project control documents and reports generated and/or used by the candidate, such as:

- programmes
- budgets
- resource planners
- information schedules
- team briefings and feedback
- quality plans
- meeting notes and minutes

Further examples include:

- examples outlining how the candidate has applied Quality Management Systems (i.e. ISO9001 etc)
- examples outlining how the candidate has applied Total Quality Management

Management experience may be gained through:

- attendance at project meetings (design and contract)
- the development of project management skills including the definition and organisation of the project and its constituent phases
- the management of people and the interface with stakeholders within the project
- the development of time management and delegation skills
- attending quality audits
- carrying out internal quality audits

## **10 COMMERCIAL AND LEGAL (Minimum standard K)**

This objective is intended to demonstrate a candidate's knowledge of commercial, financial, contractual and legal matters relevant to the country and industry in which they work.

### **The candidate must demonstrate knowledge of:**

- commercial pressures within the construction industry including the effects of national and international current affairs on costs the methods of calculating construction costs including estimating and monitoring the cost of design work
- sensitivity of cost variations in construction techniques
- relevant forms of contract used in projects for which they are involved, for both design and construction
- the procurement routes relevant to the work in which they are involved and appropriate procurement issues including dispute resolution
- statutory legislation, negligence/liability laws, health and safety legislation
- decarbonisation and sustainability legislation
- contract law

### **The candidates may also wish to demonstrate knowledge of:**

- insurance matters
- adjudication process
- arbitration process
- the role of the expert witness

### **Examples of evidence to demonstrate compliance with this objective:**

Candidates may provide evidence such as:

- records of value engineering exercise to which they have contributed
- information relating to whole life costing exercises in connection with their designs
- fee assessments and quotations prepared by them or to which they have provided input
- bills of quantities prepared by the candidate or comments made by the candidate on such documents
- monitoring the control of project costs within their office
- examples of correspondence where the candidate has quoted or used clauses from contract documents in their work
- examples of involvement in dispute resolution
- examples of their involvement with different project procurement routes
- activities and learning points from attendance at courses

It is expected that candidates will demonstrate knowledge of a selection of contracts and procurement routes relevant to the geography and industry in which they work.