



Gap Analysis Exercise – CEng

The criteria against which candidates are assessed are set down by the **Engineering Council** in Competence and Commitment Statements.

Competence	A	Knowledge and understanding
	B	Design, development and solving engineering problems
	C	Responsibility, management and leadership
	D	Communication and interpersonal skills
Commitment	E	Professional commitment

Health and safety, risk assessment as well as environment and sustainability are embedded within the headings above.

To help highways and transportation professionals relate what they do at work to the generic standards in [UK-SPEC \(4th edition\)](#), we have produced a gap analysis exercise for eight different specialisms. This exercise should assist your understanding of what is required to succeed at the Professional Review stage.

You will be asked to choose which of the eight specialisms are applicable to you when making your application (*you may choose more than one*). To determine this, you should measure your engineering competence against the specialisms' criteria and see which one(s) are relevant to your career. You should be able to cover all the areas listed for your chosen specialism as these will be the areas assessed at the Professional Review stage.

At least one of your reviewers will be an expert in your declared specialism/s so it is important that you choose carefully.

- 1) Transport planning
- 2) Materials and geotechnics
- 3) Traffic management, safety and systems engineering
- 4) Infrastructure planning, design, construction and/or maintenance
- 5) Transport related structural engineering
- 6) Academic research, teaching, or training
- 7) Research and development in highways and transportation
- 8) Intelligent transport systems

The requirements for Competences A and B are different for each of the eight specialisms, but the requirements for Competences C, D and the one commitment E, are common to all disciplines.

You can use this guidance when completing your UK-SPEC Evidence Forms as part of your Portfolio of Evidence.

CHARTERED ENGINEER COMPETENCE STATEMENTS CONTEXTUALISED FOR HIGHWAYS & TRANSPORTATION SPECIALISMS

1 TRANSPORT PLANNING

A: Use a combination of general and specialist engineering knowledge and understanding to optimise the application of advanced and complex systems.	Sufficient experience (Y/N)
Understand trends and the current position with Government policies for the environment, planning and transport; and be able to interpret their significance within a more local application.	
Be familiar with Regional Planning Guidance, the development planning system and Local Transport Plans.	
Be aware of the sources and trends in national environment and transport statistics and be able to interpret their significance.	
Understand the statutory procedures and practices within which transport planning activities operate and plan and modify such activities to be consistent with the regulatory and best practice framework.	
Have a comprehensive understanding of survey techniques and analysis, data synthesis, validation, predictive tools, calibration, appraisal methods, telematics, audit procedures.	
Be able to extend and develop established methods to new situations and opportunities.	
Identify and use appropriate statistical methods to plan and interpret data collection/analysis.	
Understand the capabilities, shortcomings and development of techniques to identify and interpret the future operational, economic and environmental impacts of a range of multi-modal transport projects.	
Be able to deepen one's knowledge base through appropriate research and investigation	
Be able to promote innovation and creativity in technical areas.	
B: Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.	Sufficient experience (Y/N)
Identify and describe, in both quantifiable and qualitative terms, complex problems and opportunities, and the significant factors that have a bearing on them.	
Use imagination, flair, and experience to develop solutions to problems and take advantage of opportunities	
Promote measures that are practical, affordable, and deliverable, and identify the constraints that influence the application of such measures using relevant design guidance, advice, and best practice	
Select, develop and apply the appropriate techniques to assess the future operational, economic, environmental, social and other impacts of suggested measures.	
Make and explain reasoned recommendations about the assessment and selection of measures, and a tactical plan for their implementation including an analysis of the risks involved.	
Assess critically and constructively measures suggested by others, through mechanisms such as safety or user audits.	
Use up to date research to generate and evaluate solutions.	
Demonstrate responsibility for delivery of transport planning projects, from project feasibility studies & outline concepts, through initial design studies, public consultation and inquiry, detailed design and implementation stages.	
Design and execute methods to elicit reliable opinions from interested and involved parties.	
Design and implement methods of assessing the performance of measures against objectives and targets.	

2 MATERIALS AND GEOTECHNICS

A: Use a combination of general and specialist engineering knowledge and understanding to optimise the application of advanced and complex systems.	Sufficient experience (Y/N)
Understand trends and the current position relating to Government/International policies for the environment and infrastructure and be able to interpret their significance within a more local application.	
Be familiar with relevant codes of practice and specifications applicable to the nature of the work and environment in which it is performed.	
Be aware of the sources and trends in local, national and international utilisation of material resources, their exploitation and sustainability and be able to interpret the significance of these factors in relation to construction and maintenance of the infrastructure.	
Understand the statutory procedures and practices within which the foregoing activities are undertaken. Be able to plan and modify such activities to be consistent with the regulatory and best practice framework.	
Have a comprehensive understanding of data collection and interpretation, use of predictive analyses and the limitations thereof. Be able to extend and develop established methods to new situations and opportunities.	
Be competent in using appropriate statistical methods to plan and interpret data collection/analysis.	
Be able to deepen one's knowledge base through appropriate research / investigation and monitoring of existing processes.	
Be able to promote innovation and creativity in technical areas.	
B: Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.	Sufficient experience (Y/N)
Identify and describe, in both quantifiable and qualitative terms, complex problems and opportunities, and the significant factors that have a bearing on them.	
Use imagination, flair and experience to develop possible measures that will influence problems and opportunities.	
Promote measures that are practical, affordable and deliverable, and identify the constraints that influence the application of such measures using relevant design guidance, advice, and best practice	
Ability to predict the likely consequences resulting from the use and potential misuse of materials.	
Make and explain reasoned recommendations about the procedures to be adopted in construction and maintenance operations including an analysis of the risks involved.	
Assess critically and constructively measures suggested by others, through mechanisms such as safety or user audits.	
Use up to date research to generate and evaluate solutions.	
Demonstrate innovation in the use of such research and its transfer into practical application.	
Assist with the resolution of conflict in the workplace.	

3 TRAFFIC MANAGEMENT, SAFETY AND SYSTEMS ENGINEERING

<p>A: Use a combination of general and specialist engineering knowledge and understanding to optimise the application of advanced and complex systems.</p>	<p>Sufficient experience (Y/N)</p>
<p>Understand trends and the current position with Government policies for the environment, planning and transport; and be able to interpret their significance within a more local application.</p>	
<p>Be familiar with Regional Planning Guidance, the development planning system and Local Transport Plans.</p>	
<p>Be aware of the sources and trends in national environment and transport statistics and be able to interpret their significance.</p>	
<p>Understand statutory procedures and practices governing traffic management and system engineering activities and be able to plan and modify such activities to be consistent with regulatory and best practice framework.</p>	
<p>Understand survey techniques and analysis, data synthesis, validation, predictive tools, calibration, traffic engineering, appraisal methods, traffic control systems, intelligent transport systems, design tools and techniques, audit procedures, scheme costing and contract documents.</p>	
<p>Able to extend and develop established methods to new situations and opportunities.</p>	
<p>Good knowledge of engineering solutions to road or rail transport problems.</p>	
<p>Competent with appropriate statistical methods to plan and interpret data collection/analysis.</p>	
<p>Understand the capabilities, shortcomings, and development of appraisal techniques to identify and interpret the future operational, economic and environmental impacts of a range of multi-modal transport projects.</p>	
<p>Able to deepen knowledge base through appropriate research and investigation.</p>	
<p>Able to promote innovation and creativity in technical areas.</p>	
<p>B: Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.</p>	<p>Sufficient experience (Y/N)</p>
<p>Able to identify and describe, in quantifiable and qualitative terms, complex problems and opportunities and significant factors that have a bearing on them.</p>	
<p>Able to use imagination, flair and experience to develop possible measures that will influence problems and opportunities.</p>	
<p>Able to promote measures that are practical, affordable and deliverable, and identify the constraints that influence the application of such measures using relevant design guidance, advice, and best practice</p>	
<p>Able to select, develop and apply the appropriate techniques to assess future operational, economic, environmental, social and other impacts of suggested measures and design appropriate engineering solutions to road and/or rail transport problems.</p>	
<p>Able to make and explain reasoned recommendations about the assessment, selection and design of measures, and a tactical plan for their implementation including an analysis of the risks involved.</p>	
<p>Able to assess, critically and constructively, measures suggested by others, through mechanisms such as safety or user audits</p>	
<p>Able to use up to date research to generate and evaluate solutions.</p>	
<p>Able to demonstrate some responsibility for the delivery of traffic management/system engineering projects, from project feasibility studies and outline concepts, through initial design studies, public consultation and inquiry, detailed design and implementation stages.</p>	
<p>Able to design and execute methods to elicit reliable opinions from interested and involved parties and consult with the public on transport problems and proposed solutions.</p>	
<p>Design and implement methods of assessing the performance of measures against objectives and targets.</p>	

4 INFRASTRUCTURE PLANNING, DESIGN, CONSTRUCTION AND/OR MAINTENANCE

A: Use a combination of general and specialist engineering knowledge and understanding to optimise the application of advanced and complex systems.	Sufficient experience (Y/N)
Be aware of, and able to implement the forward planning process for transport infrastructure projects in economic, social and environmental terms	
Understand the current design and construction standards for new transport infrastructure projects and the maintenance of existing transport infrastructure.	
Be aware of and be able to undertake and/or commission the assessment techniques available to establish the condition of existing transport infrastructure and be able to interpret the results obtained.	
Be aware of emerging techniques and options for the design, construction and maintenance of transport infrastructure projects.	
Be able to extend and develop established methods to new situations and opportunities.	
Be competent with data collection and interpretation.	
Be able to extend one's knowledge base through appropriate research and investigation.	
Be able to promote innovation and creativity in technical areas.	
B: Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.	Sufficient experience (Y/N)
Be familiar with the processes required to progress a new transport infrastructure scheme through the forward planning, legal order, design, contract and construction stages.	
Select and apply appropriate current standards, techniques and statutory requirements to the process.	
Demonstrate innovation in progressing solutions to non-standard situations.	
Explain the rationale behind decisions taken	
Undertake a risk assessment of options being evaluated.	
Demonstrate responsibility for the delivery of new transport infrastructure projects through part of the process from forward planning, legal order, design, contract and construction stages.	
Demonstrate responsibility for the assessment of the condition of elements of existing transport infrastructure and the evaluation and commissioning of appropriate maintenance solutions.	
Demonstrate the effective use of project management techniques.	
Demonstrate experience of good practice in cyclic, routine and emergency highway or rail maintenance.	

5 TRANSPORT RELATED STRUCTURAL ENGINEERING

A: Use a combination of general and specialist engineering knowledge and understanding to optimise the application of advanced and complex systems.	Sufficient experience (Y/N)
Understand trends and the current position with relevant Government/International policies for the environment and infrastructure and be able to interpret their significance within a more local application.	
Be familiar with relevant codes of practice and specifications applicable to the nature of the work and environment in which it is performed with particular reference to Structural Safety e.g. SCOSS reports and advice.	
Be aware of the opportunities and problems associated with the creation and maintenance of sustainable structures.	
Understand the statutory procedures and practices within which the foregoing activities are undertaken. Be able to plan and modify such activities to be consistent with the regulatory and best practice framework.	
Have a comprehensive understanding of data collection and interpretation, use of predictive analyses and the limitations thereof. Be able to extend and develop established methods to new situations and opportunities	
Be competent with analysis techniques to predict behaviour of structures under expected and exceptional loading configurations	
Be able to deepen one's knowledge base through appropriate research / investigation and monitoring of existing processes.	
Be able to promote innovation and creativity in technical areas.	
B: Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.	Sufficient experience (Y/N)
Identify and describe, in both quantifiable and qualitative terms, complex problems and opportunities, and the significant factors that have a bearing on them.	
Use imagination, flair and experience to develop possible measures that will influence problems and opportunities.	
Promote measures that are practical, affordable and deliverable, and identify the constraints that influence the application of such measures using relevant design guidance, advice, and best practice	
Be able to predict the likely consequences resulting from change in environment or utilisation of structures	
Be able to make and explain reasoned recommendations about the procedures to be adopted in construction and maintenance operations including an analysis of the risks involved.	
Have ability to assess critically and constructively measures suggested by others, through mechanisms such as safety or user audits.	
Use up to date research to generate and evaluate solutions.	
Demonstrate innovation in the use of such research and its transfer into practical application	

6 ACADEMIC RESEARCH, TEACHING OR TRAINING

A: Use a combination of general and specialist engineering knowledge and understanding to optimise the application of advanced and complex systems.	Sufficient experience (Y/N)
Be able to evaluate and review the current development of policy and practice in relation to the fundamental principles of transport and related theory	
Be able to develop and implement a programme of study to meet teaching and learning objectives in the field covered by the programme, having regard to the health and safety of students and teachers	
Underpin teaching and training, whether in engineering or multidisciplinary programmes, with engineering principles and mathematical and statistical competence	
Understand and apply appropriate academic standards and principles of equity and justice in the selection, tutoring, assessment and qualification of students and trainees	
Conceive, lead and contribute to systematic investigation at the frontiers of knowledge and communicate the resulting findings effectively	
Supervise project work giving students and trainees the experience of original investigation	
Understand the importance of moving towards sustainability and be able to take account of its implications for the application of technology	
Be able to extend and develop established methods to new situations and opportunities	
Be able to deepen one's knowledge base through appropriate research and investigation and by monitoring existing situations and processes	
Be able to promote innovation and creativity in technical areas	

B: Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.	Sufficient experience (Y/N)
Identify and describe, in both quantifiable and qualitative terms, complex problems and opportunities, and the significant factors that have a bearing on them	
Use imagination, flair and experience to develop possible measures that will influence problems and take advantage of opportunities	
Promote measures that are practical, affordable and deliverable, and identify the constraints that influence the application of such measures using relevant design guidance, advice and best practice	
Select, develop and apply the appropriate techniques to assess the future operational, economic, environmental, social and other impacts of suggested measures and to design appropriate engineering implementations	
Use media of oral, audio and visual presentation, print and guided activity to provide students and trainees with effective learning experience	
Implement procedures of assessment through coursework, project work and written and oral examination	
Develop contacts with employers of students and trainees and understand their requirements	
Be aware of sources of, and where necessary seek funding for, teaching and training initiatives, for student support and for research	
Carry out original investigations leading to achievement of stated objectives and reporting of findings to sponsors and clients and by publication	
Use up to date research to generate and evaluate solutions and update content of teaching and training	
Demonstrate innovation in the use of such research and its transfer into practical application	

7 RESEARCH AND DEVELOPMENT IN HIGHWAYS AND TRANSPORTATION

A: Use a combination of general and specialist engineering knowledge and understanding to optimise the application of advanced and complex systems.	Sufficient experience (Y/N)
Be able to ascertain and summarise the current state of knowledge on any relevant topic and identify the need and scope for further investigation	
Be able to conceive practicable and effective ways of addressing questions that have been identified for investigation	
Lead and contribute to systematic investigation at the frontiers of knowledge	
Communicate the resulting findings effectively to employer, client or sponsor and by publication	
Recognise limitations in one's own skills and knowledge, and when effective investigation depends on additional skill or knowledge either acquire this or seek help from those who possess it	
Understand the importance of moving towards sustainability and be able to take account of its implications for the application of technology	
Be able to extend and develop established methods to new situations and opportunities	
Be able to deepen one's knowledge base through appropriate research and investigation and by monitoring existing situations and processes	
Be able to promote innovation and creativity in technical areas	

B: Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.	Sufficient experience (Y/N)
Identify and describe, in both quantifiable and qualitative terms, complex problems and opportunities, and the significant factors that have a bearing on them	
Use imagination, flair and experience to develop possible measures that will influence problems and take advantage of opportunities	
Promote measures that are practical, affordable and deliverable, and identify the constraints that influence the application of such measures using relevant design guidance, advice and best practice	
Select, develop and apply the appropriate techniques to assess the future operational, economic, environmental, social and other impacts of suggested measures and to design appropriate engineering implementations	
Specify, plan and execute lines of investigation that will confirm or refute stated hypotheses and/or measure or estimate unknown quantities to a required accuracy	
Carry out programmes of measurement or other data collection and the appropriate mathematical and statistical analysis of the resulting data	
Apply sound judgment in interpreting the results of investigations by oneself and others	
Use up to date research to generate and evaluate solutions	
Demonstrate innovation in the use of such research and its transfer into practical application	

8 INTELLIGENT TRANSPORT SYSTEMS

A: Use a combination of general and specialist engineering knowledge and understanding to optimise the application of advanced and complex systems.	Sufficient experience (Y/N)
Understand trends and current position with Government policies for the environment, planning and transport and be able to interpret their significance within a more local application	
Be familiar with National, Regional and Local Transport Plans	
Understand the purpose of the key UK ITS organisations and the relationships between them	
Understand system architectures in all forms and how they are used as system design tools	
Be able to establish 'User Needs', interpret them as system requirements and evaluate the extent to which a proposed systems meets the stated requirements	
Be able to identify the appropriate communications and communication architecture for a system or function, including identifying where there are potential issues that need to be resolved or managed	
Be able to identify systems, sub-systems, methods or techniques and technology that will meet system requirements and ensure that the complete system will function as designed for all relevant modes of transport	
Understand the capabilities and shortcomings of the ITS systems and services and undertake measures to maintain benefits under abnormal conditions	
Be able to identify emerging techniques and technologies and understand the conditions under which they are applicable	
Be able to deepen one's knowledge base through appropriate research and investigation	
Be able to promote innovation and creativity in technical areas	
Understand the principles of cost-benefit assessment, including determining the business case and economic viability of a proposal	
B: Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.	Sufficient experience (Y/N)
Identify and address, in both quantitative and qualitative terms, complex problems and opportunities and the significant factors that have a bearing on them	
Use the main building blocks of ITS including sensors and actuators, computing and memory, positioning technology, communications technology and human interfaces to provide effective solutions	
Use innovation to develop methods and measures to influence problems and opportunities, with particular reference to the human element	
Select the appropriate systems and functions to deliver the required services which will enable the delivery of policies, whether social or environmental	
Make recommendations for ITS functions and explain the reasons and facilities to stakeholders	
Assess critically and constructively measures suggested by others and develop them into viable and deliverable services	
Use up to date research and development to generate and evaluate solutions and system requirements	
Demonstrate responsibility for delivery or management of ITS systems at feasibility study, outline design, system requirements, system testing and commissioning, system operation	
Demonstrate the ability to involve stakeholders and other network managers in co-operative development of operational procedures	
Develop and implement valid performance measures	
Design and perform evaluations of an installed ITS system	

**CHARTERED ENGINEER MANAGEMENT COMPETENCIES
(APPLICABLE TO ALL SPECIALISMS)**

C DEMONSTRATE TECHNICAL AND COMMERCIAL LEADERSHIP	Sufficient experience (Y/N)
C1 Plan the work and resources needed to enable effective implementation of a significant engineering task or project	
Systematically review the factors affecting the project implementation including safety and sustainability considerations	
Define a holistic and systematic approach to risk identification, assessment and management	
Lead on preparing and agreeing implementation plans and method statements	
Ensure that the necessary resources are secured and brief the project team	
Negotiate the necessary contractual arrangements with other stakeholders (client, subcontractor, suppliers etc)	
C2 Manage (organise, direct and control), programme or schedule, budget and resource elements of a significant engineering task or project	
Set up appropriate management systems	
Define quality standards, programme and budget within legal and statutory requirements	
Organise and lead work teams, coordinating project activities	
Ensure that variations from quality standards, programme and budget are identified, and that corrective action is taken	
Gather and value feedback, and recommend improvement	
C3 Lead teams or technical specialisms and assist others to meet changing technical and managerial needs	
Agree objectives and work plans with individuals	
Identify team and individual needs, and plan for their development	
Reinforce team commitment to professional standards	
Lead and support team and individual development	
Assess team and individual performance and provide feedback	
C4 Bring about continuous quality improvement and promote best practice.	
Promote quality throughout the organization and its customer and supplier networks	
Develop and maintain operations to meet quality standards	
Direct project evaluation and propose recommendations for improvement	
D DEMONSTRATE EFFECTIVE COMMUNICATION AND INTERPERSONAL SKILLS	Sufficient experience (Y/N)
D1 Communicate effectively with others, at all levels, in English	
Lead, chair, contribute to and record meetings and discussions	
Prepare communications, documents and reports on complex matters	
Exchange information and provide advice to technical and non-technical colleagues	
D2 Clearly present and discuss proposals, justifications and conclusions	
Prepare and deliver presentations on strategic matters	
Lead and sustain debates with audiences	
Feed the results back to improve the proposals	
Raise the awareness of risk	
D3 Demonstrate personal and social skills and awareness of diversity and inclusion issues.	
Know and manage own emotions, strengths and weaknesses	
Be aware of the needs and concerns of others, especially where related to diversity and inclusion	
Be confident and flexible in dealing with new and changing interpersonal situations	
Identify agree and lead work towards collective goals	
Create, maintain and enhance productive working relationships, and resolve conflicts	

E DEMONSTRATE A PERSONAL COMMITMENT TO PROFESSIONAL STANDARDS, RECOGNISING OBLIGATIONS TO SOCIETY, THE PROFESSION AND THE ENVIRONMENT	Sufficient experience (Y/N)
E1 Understand and comply with relevant codes of conduct	
Understand and comply with CIHT's Code of Conduct.	
Lead work within all relevant legislation and regulatory frameworks, including social and employment legislation	
E2 Understand the safety implications of their role and manage, apply and improve safe systems of work	
Identify and take responsibility for own obligations for health safety and welfare issues	
Ensure that systems satisfy health, safety and welfare requirements	
Develop and implement appropriate hazard identification and risk management systems and culture	
Manage, evaluate and improve these systems	
Apply a sound knowledge of health and safety regulations	
E3 Understand the principles of sustainable development and apply them in their work	
Operate and act responsibly, taking account of the need to progress environmental, social and economic outcomes simultaneously	
Use imagination, creativity and innovation to provide products and services which maintain and enhance the quality of the environment and community, and meet financial objectives	
Understand and secure stakeholder involvement in sustainable development	
Use resources efficiently and effectively	
E4 Carry out and record the Continuing Professional Development (CPD) necessary to maintain and enhance competence in their own area of practice	
Undertake reviews of own development needs	
Plan how to meet personal and organizational objectives	
Carry out planned (and unplanned) CPD activities	
Maintain evidence of competence development	
Evaluate CPD outcomes against any plans made	
Assist others with their own CPD	
E5 Understand the ethical issues that may arise in their role and carry out their responsibilities in an ethical manner.	