CIHT Specialisms – CEng

The criteria against which applicants are assessed are set out 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 details of eight different specialisms.

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.

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

Competence A and B are different for each of the eight specialisms, but Competence C, D and Commitment E are common to all disciplines.

You can use this guidance when reviewing and tracking your experience and when compiling 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.
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.
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.
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.
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

A: Use a combination of general and specialist engineering knowledge and understanding to optimise the application of advanced and complex systems.
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 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.
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.
Able to extend and develop established methods to new situations and opportunities.
Good knowledge of engineering solutions to road or rail transport problems.
Competent with appropriate statistical methods to plan and interpret data collection/analysis.
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.
Able to deepen knowledge base through appropriate research and investigation.
Able to promote innovation and creativity in technical areas.

B: Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.
Able to identify and describe, in quantifiable and qualitative terms, complex problems and opportunities and significant factors that have a bearing on them.
Able to use imagination, flair and experience to develop possible measures that will influence problems and opportunities.
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
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.
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.
Able to assess, critically and constructively, measures suggested by others, through mechanisms such as safety or user audits
Able to use up to date research to generate and evaluate solutions.
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.
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.
Design and implement methods of assessing the performance of measures against objectives and targets.

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.
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.
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 STRUCTURUAL ENGINEERING

A: Use a combination of general and specialist engineering knowledge and understanding to optimise the application of advanced and complex systems.
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.
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.
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

B: Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.
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.
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

B: Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.
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.
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.
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

CENG COMPETENCES C, D AND COMMITMENT E (APPLICABLE TO ALL SPECIALISMS)

COMPETENCE C: DEMONSTRATE TECHNICAL AND COMMERCIAL LEADERSHIP
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 valuate 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

COMPETENCE D: DEMONSTRATE EFFECTIVE COMMUNICATION AND INTERPERSONAL SKILLS
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

COMMITMENT E: DEMONSTRATE A PERSONAL COMMITMENT TO PROFESSIONAL STANDARDS, RECOGNISING OBLIGATIONS TO SOCIETY, THE PROFESSION AND THE ENVIRONMENT
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.