



# ICE Exam

## Examiners Report 2019

E: [iceexam@ice.org.uk](mailto:iceexam@ice.org.uk) W: [ice.org.uk](http://ice.org.uk)

# Pilot Examination to Assess Masters Level Further Learning of BEng Candidates Pursuing ICE Chartered (CEng) Professional Qualifications

## Background

The ICE is developing an examination to support its Qualifications Panel in assessing whether a candidate with a BEng qualification has gained (through further learning, CPD and academic study) a level of knowledge sufficient to sit the ICE Chartered Professional Review: that is a level of learning and critical thinking equivalent to a master level candidate.

The ICE would like to thank those candidates who volunteered to undertake a course of study and sit the pilot examination. The contribution of the Examination Panel of experienced academics and industry professionals, who voluntarily developed the syllabus, set the case-study examination and marked the papers, is also greatly appreciated.

## Pilot Examination 2019

28 UK candidates were initially identified by Membership Development Officers to participate in the pilot. Candidates held an accredited BEng degree and could demonstrate several years post graduate experience. 17 candidates progressed to sit the examination and 14 candidates passed (pass rate 82%). Each paper was marked by one academic examiner and one from industry. Differences in pass/fail marks were resolved by the ICE Examinations Panel, chaired by the Chief Examiner. Learning from this initial pilot, including valuable candidate feedback, will inform the development of the examination for both UK and international candidates.

## Rationale behind the Syllabus, Case Study and Full-Day Examination

It is important that candidates understand the purpose of the examination and the response's examiners are looking for. Whilst ICE has provided further learning modules the examination is not a test of that knowledge alone. Candidates will be expected to draw on experiential learning developed over their career, knowledge gained through CPD and academic study, and to apply that learning through critical thinking in relation to a specific scenario.

The syllabus aligns closely with the attributes required as part of the Chartered Professional Review and masters level UKSPEC learning outcome:

- Procurement, Contracts & Project Management
- Project Appraisal & Financial Management
- Sustainable Development
- Management & Leadership
- Health, Safety, Welfare & Risk Assessment

At the start of the examination candidates should read the scenario and the questions carefully and should take the time to plan how to answer the specific questions whilst covering the syllabus breadth.

The use of a Case Study format requires candidates to apply their learning in relation to an unexpected scenario, rather than a typical knowledge-based examination. The case study is intended to be a project that

may not be in the candidate's normal field of work. The intention is to assess how they would consider and approach this situation based on the experience and the learning they have carried out. Candidates need to demonstrate how their learning, together with the materials provided, has allowed them to form judgements in how to respond to the scenario set (i.e. answer the question). Writing three paragraphs of learned knowledge is unlikely to gain marks unless it applies directly to the question and scenario.

Providing candidates with a full day for the examination provides time to plan, to consider scenario implications and the opportunity to demonstrate syllabus knowledge, learning and critical thinking.

## Moderator's Report

The essay format of the examination may be different to the papers sat by candidates at BEng level. As it may be some years since they wrote essays under examination conditions, future candidates should seek training in examination writing technique. Company tender teams may be able to offer advice and support.

The first rule of examinations is to read the paper fully, ensuring that each aspect of a question is understood. Time spent reading the case study, deconstructing the questions (understand each part) and planning the essays is time well spent.

There may be a number of unknowns within the Case-Study (e.g. who the client is): candidates are encouraged to make informed assumptions and to state those assumptions within their answer. It may also be beneficial to assume a role, e.g. Project Manager or Project Director in order to articulate from a leadership perspective "this is the approach I would take."

The Pilot Examination questions were linked. Whilst each question is marked independently, together the responses tell a story. Whilst Question 4 (Q4) relates specifically to health and safety management, the siting of the camp (Q1) and the risk of conflict (Q2) both have implications for workforce/community safety and welfare. Considering H&S more roundly will lead to a higher mark in relation to Module 4 of the syllabus.

A good essay will have a beginning, a middle and an end. The opening paragraph will provide assurance that the question is understood and will lead into the overall approach. Sub-headings addressing each part of a question will help structure the response. A closing paragraph should summarise the key aspects of the approach and the benefits each will deliver.

It would be useful for candidates to familiarise themselves with the scope of the syllabus. Not all topics need to be covered but examiners do expect candidates to demonstrate a masters level understanding of the five modules outlined above. Mapping of the syllabus against the essay plan will ensure that all modules are covered. Responses will be richer if candidates draw on relevant examples based on experience. A candidate's ability to decide which elements of the syllabus are relevant to the question being asked is critical. The questions are not intended to relate one-to-one to syllabus modules. Good answers will combine knowledge from several modules to deal with each individual question fully.

The pilot examination was based on a Refugee Camp Case-Study. Most candidates demonstrated an understanding of the technical, environmental and social challenges of constructing the refugee camp. Few demonstrated any understanding of the challenges or opportunities of developing and operating a camp over a 30-year period. Development should have been considered across three phases during which parallel planning, design, procurement and construction operations could be managed. The implementation of the emergency phase (temporary shelters, security fencing, emergency power generators and tankered drinking water) could, for example, be constructed in parallel with procurement of transport links, permanent infrastructure and camp buildings. This second phase could run in parallel with stakeholder engagement,

initial skills / supply-chain development and the collaborative planning and design of a permanent township (Phase 3). Procurement and forms of contract would most likely be different in each of these phases.

It was noted that few candidates referred to International Standards such as ISO9001, ISO14001, ISO45001 (OHSAS18001). Many candidates will use these quality, environmental and H&S management standards in their day to day work. Their use would be relevant to effective project management in this case. Candidates may also be experienced in collaborative working and yet few drew on this experience in their responses.

Whilst most candidates did demonstrate some level of critical thinking in formulating answers this was too often overly superficial. For example, Q3 asked the candidates to describe how the UN Sustainability Goals (UNSDG) could influence the design of the camp. The weaker responses would describe how 'Goal 4: Quality Education' would influence the design through the inclusion of a school. Stronger responses considered this goal in a deeper way and also described opportunities for life learning, adult education, apprenticeships, etc. The benefits of these to communities' longer term and how good education could feed into all phases of the project (e.g. designing the camp such that the construction phase could be used to train camp residents in construction skills).



### Question 1

The question broke into two parts: a) The factors to be considered in siting the camp; and b) how these might be prioritised.

Theories such as Maslow's hierarchy of needs may have helped candidates in identifying resident needs and priorities. In critically appraising the factors a structured risk assessment approach would help. Candidates may have been unfamiliar with the geography of Southern Turkey, but their experience of project appraisal should have led them to a structured approach. The PESTLE acronym would have led to consideration of Political, Economic, Social, Technological, Legal and Environmental risk factors. Weaker answers identified some geographic issues but missed significant factors. As mentioned above, the safety and welfare of the construction workforce should have been a consideration in the decision making, alongside that of the camp residents. A further dimension requires consideration of the camp over time (see paragraph 7 of moderator's report above)

The second part of the question requires a systematic and objective approach to project appraisal with a scoring mechanism and cost benefit analysis. A number of appropriate project appraisal techniques will have been studied in Module 3 but few candidates referenced appropriate techniques. A process for reporting and recommending the most appropriate site to the client provides a useful conclusion to a good response.

### Question 2

This question asks a) what the contributing factors to conflict may be and b) how these might be accommodated in your design.

Candidates were all unfamiliar with the dynamics of refugee camps. Good responses used a systematic approach (similar to the PESTLE approach outlined above) to guide critical thinking and considered changing risks over time. Engagement with a range of stakeholders (as described in the question introduction) is critical to understanding and mitigating risk. Weaker responses made subjective assumptions that missed key risks, failed to consider changing circumstances over time and failed to mention stakeholder engagement.

The design element provided an opportunity for candidates to demonstrate knowledge across significant elements of the syllabus. Weaker responses might have been expected of a lay person. Stronger responses referred to systematic risk-based design and differentiated between initial requirements for the emergency camp and the development of a longer-term township.

### Question 3

This question asks a) which of the UN Sustainable Development Goals (UNSDG) apply and b) how these might influence your design.

The UNSDGs were listed within the case study. A GCSE geography student could write a couple of sentences on how these goals may each apply to a refugee camp in Southern Turkey. More is expected of a masters level civil engineering graduate.

Weaker responses gave little reasoning for which UNSDGs apply and gave a single sentence response in relation to design. Stronger responses gave some background to the UNSDGs and systematically assessed the most relevant goals. Critical thinking led to design factors developing over-time, e.g. temporary generators and potable water tankers being used for the emergency phase; design of sustainable infrastructure for the permanent camp being designed/managed through processes such as ISO14001,

BREEAM, CEEQUAL and the building of the permanent township to incorporate water harvesting, solar panels on rooftops etc.

#### Question 4

This question relates to a site accident. Whilst the question is fundamentally in two-parts, Part a) has two elements. Thus, there are 3 questions: A1) what elements of the project might be investigated, A2) what documentation should investigators be provided with; and B) what tasks should be performed before work recommences.

A number of candidates failed to read the question fully and so missed the part of the question relating to project documentation. Few responses recognised that the injured party was a refugee rather than a site worker and many failed to describe how or why this might be investigated further.

Some candidates pasted into their response a number of paragraphs relating to CDM regulations without setting the regulations in context. ISO45001 is an international standard for Health and Safety Management that is more or less equivalent to OHSAS18001. Strong responses referred to qualitative and quantitative risk and safety assessment techniques. Risk assessments, health and safety plans, the risk register, H&S audits etc should have been amongst the documentation referenced. Weaker responses made little mention of systematic techniques and processes that most practicing engineers should be familiar with.

Some weaker responses answered part B of the question in only superficial terms or not at all.

#### Question 5

This question asks a) what the potential impact and risks are associated with a widespread supply chain and b) how the contractor might manage these.

Whilst the prelude to the question mentioned that some timber required for shelters may have to come from as far away as Ukraine, the first part of the question referred only to risks associated with a widespread supply chain. Some candidates spent time questioning the wisdom of importing timber from Ukraine and missed the opportunity to discuss supply chain risks.

None of the candidates referenced ISO9001 as an international quality management system and neither were procurement processes requiring compliance with international quality standards discussed. Strong responses demonstrated critical thinking around risks and impacts whilst weaker responses provided a shallow discussion and failed to identify many political, economic, contractual and environmental risks.

#### Question 6

This question asks a) discuss Project Management options available to resolve a significant programme delay and b) how you might manage/mitigate this shortfall.

Some candidates rightly questioned the scale of the shortfall but wasted words and time in criticising the scenario. Examiners are looking for how you apply your knowledge to the scenario not for a critique of the question.

Strong responses referred to systematic project planning/scheduling techniques and to performance management. LEAN thinking was explored, and BIM was mentioned for its potential to optimise design and delivery, and to reduce process waste.