A Practical Guide to Assessment for Learning

The specification for

TLM Level 3 Qualifications in Designing, Engineering and Constructing a Sustainable Built Environment (RQF)

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High Quality Qualifications for the
2017-2019 School League Tables

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TLM Technology and Quality Assurance

This is version 1.1 of the specification for TLM/COYO Level 3 qualifications in Building Information Modelling developed in partnership with Mott MacDonald.

The assessment model for the qualifications presented in this publication was designed by TLM in consultation with industry partners.

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1. Introduction

1.1 We believe these new and innovative qualifications provide the most inclusive and cost-effective qualifications available for a new built environment curriculum at Level 3, preserving the necessary rigour for stretching the highest attaining candidates. In addition, there is a clear intention to reduce the bureaucratic overhead on teachers while preserving the benefits of coursework for motivating learners and dealing validly with recognition of practical competences in what are essentially practical, technical and vocational skills and activities related to SOC 17-1022, 17-2051 and 17-3011 and associated contexts. We have demonstrated that we can provide Level 1 and Level 2 qualifications that are accessible to all learners while still differentiating the top performing students. This enables a clear progression route for the weakest mainstream learners through to Level 3 attainment.

1.2 BIM qualifications offer teachers and learners the opportunity to develop a range of skills and knowledge fundamental to successful engagement in the professional aspects of the Construction and Built Environment sector of industry. The qualifications enable coverage of a wide range of general knowledge, understanding and competences related to the technical competences identified by employers in the industry. Progression routes from Level 1 through Level 2 to Level 3 will provide any young person with the technical knowledge understanding and skills to progress to a professional career in the construction sector.

1.3 This specification is for a Level 3 Award, Certificate and Diploma building on Level 1 and 2 certificate specifications that are available in a separate document. The qualifications are targeted on secondary schools and further education colleges. They have the following key benefits.

- devised in consultation with leading industry consultants, professional bodies and universities.
- clear and flexible unit based structure referenced to the European Qualifications Framework (EQF).
- straightforward assessment of competence in real rather than contrived contexts.

- grading through controlled exams introduced progressively from KS4.
- provides a focus for continuing professional development for teachers through moderation/verification feedback.
- moderation/verification of coursework on demand.
- three examination opportunities per year.
- use of open source cloud based technologies to reduce costs and add value for schools.
- reduced bureaucracy for teachers and flexibility for them to target specific interests.

1.4 These qualifications lend themselves to formative assessment practices allied to summative differentiation by outcome that can optimise and motivate attainment for individuals rather than assume all will reach a certain level or grade at a particular time. We do this by providing a coursework component that is competence based, reflecting the best and most up to date research in assessment in the workplace, complemented by an academic synoptic examination for the Certificate and Diploma.

1.5 All candidates must complete the coursework before being eligible to take the exam. This provides an incentive to complete the coursework and makes it less likely that those sitting an exam fail through inadequate preparation. It is essential to involve employers in the construction industry in the coursework assessment and suitable contacts can be provided where needed.

1.6 The Level 3 exam grades candidates across a range from Pass to A* with grades A*, A, B, C, D, E, available as pass grades. If coursework is completed to the Level 3 standard, in keeping with the Level 3 general descriptor, the candidate can go on to take the Level 3 exam which will then differentiate grades A*-E.

1.7 In this way we can provide valid competence based assessment and rigorous testing of knowledge and understanding at a lower cost than both traditional vocational and academic methods applied separately. There is research evidence that this approach should enhance motivation that will result in higher attainment by supporting both performance-approach goals that focus on displaying competence and performance-avoidance goals

that focus on avoiding a display of incompetence. (Conclusions from Effects of Classroom Assessment Practices on Students' Achievement Goals, Hussain Alkharusi Sultan Qaboos University, Oman.)

2. Summary of the qualifications specifications

2.1 The Level 3 Diploma and Certificate for BIM are both graded across 6 levels from A*-E with A* the highest grade equating to 80%+ of the available marks and grade C equating to a minimum of 50%. Candidates that complete the coursework to the appropriate standard at Level 3 will carry forward 30 marks. Those that achieve 20 more from the exam will be awarded a grade E corresponding to 50% in total. 55% for a grade D, 60% for grade C, 70% for grade B, 75% for grade A and 80% or more for A*. 100% of the content is assessed in both the coursework and in the examination. The weighting is 70% for the exam and 30% for the coursework in terms of marks. All units are mandatory.

Content

2.2 The qualification content has been designed for use in schools by building it on L1 and 2 foundations and testing it against similar assessments carried out in current Level 3 qualifications. It is also designed to enable learners to meet the needs of employers, through consultation with leading built environment and engineering consultancies, the RICS and progressive universities and professional bodies representing a wide section of the industry. Guidance for coursework is aligned with the CBI employment criteria. Guidance takes into account the lack of experience of many teachers in this area ensuring that the most academically able can be stretched and routed to appropriate academic progression in Higher Education. Strong industry support provides great potential for staff development, keeping teachers up to date in what is still a rapidly changing sector. Unlike purely academic qualifications, regular reference is made to practical skills and standards and the use of real equipment and technology rather than simulations or generic terms only. There is an emphasis on increasing understanding of the importance of collaborative working systems in keeping with recent Cabinet Office policy and the Government Industrial Strategy 2025.

Assessment

2.3 The qualifications at Level 3 have two assessment components.

1. Coursework assessed in terms of competence in practical areas where knowledge and understanding can be applied in real and motivating contexts, it covers all aspects.

2. An externally set and externally marked examination to assess knowledge and understanding that underpins user competence. This also covers all aspects.

2.4 The qualifications are unit based. The Award consists of one unit, the Certificate consists of three units and the Diploma requires 5 units. Each unit has a credit value in the Regulated Qualifications Framework (RQF) and is expected to be supported with 60 Guided Learning Hours. 50 credits is needed for the Diploma equating to 300 Guided Learning Hours, 30 credits for the Certificate equating to 180 GLH and 12 Credits for the Award equating to 60 GLH. 50 credits is 1 third of the core credit required for the Modern Baccalaureate at Advanced Level.

2.5 The synoptic examinations of knowledge and understanding that are used for grading the Certificate and Diploma are based on a syllabus related to all the available units. The design does not allow candidates to compensate for weak coursework by doing well in the exam only or vice versa. Candidates must complete the coursework to a satisfactory standard at the level to be eligible to take the examination. A weak examination performance will limit the attainment level graded. It is likely that candidates with a satisfactory coursework performance will at least pass but that is not inevitable and they must take the exam to pass either the Certificate of the Diploma. The exam then also provides an additional very low cost dimension to external moderation/verification feedback for the coursework. Centres with a high proportion of candidates judged to be satisfactory on coursework yet failing to gain sufficient marks in the examination flag up a need for further investigation and will help prioritise CPD.

Summary of the rationale

2.6 The assessment model is specifically designed to motivate learning that will support the highest grade(s) attainable by each candidate but also broader aspects of learning that can not be assessed in a traditional exam. Learners must demonstrate basic practical competence through their coursework before being eligible to take an examination. There is considerable flexibility to enable contexts of individual interest to be explored in depth. Those that have completed the coursework in areas of personal interest and to a high standard are far less likely to fail to achieve at least the minimum standards set in the examination. This ensures basic practical competence in realistic and motivating scenarios as well as at least some general knowledge and understanding in the more academic sense to underpin skills transfer.

Aggregation of marks

2.7 Coursework contributes 30 marks in the Certificate and the Diploma. In the Award there is no grading it is simply a pass based on demonstrating competence against the unit criteria. Each examination is worth 70 marks. To pass the Certificate or the Diploma with grade E candidates need to achieve 20 marks in the examination on top of the 30 acquired from the coursework, grade D when they achieve 25 marks, grade C for 30 marks, grade B 40 marks, grade A, 45 marks and grade A* for 50 marks. This equates to 50% through to 80% of the marks in the qualification as a whole. Candidates will be provided with their marks as well as their grades. Candidates can take the examination when their assessors judge that they are ready and when they have completed the coursework to a Level 3 standard across the required units.

2.8 The examination questions get progressively more difficult and those achieving the highest marks will be those most likely to be suited to academic degree level study at university.

2.9 Any candidate that completes the coursework to a satisfactory standard at Level 3 but fails to gain sufficient marks in the examination can retake the examination once.

2.10 In the interests of inclusion, there will only be additional fees for additional examinations taken since the coursework cost will already have been paid. An optional subscription model that covers the family of BIM qualifications means that schools can enter as many candidates as they believe can meet the criteria and there are no hidden costs such as late entry fees, double entries or replacement certificate fees. This maximises the opportunities for learners to get their achievements recognised without the school worrying about financial penalties and providing the savings associated with economies of scale.

3. Qualifications Content

3.1 The qualifications are made up from units in the Regulated Qualifications Framework (RQF). The RQF is referenced to the European Qualifications Framework (EQF), the largest system for referencing nationally accredited qualifications in the world. Unit credit is designed to be compatible with the European international credit transfer system ECVET. The units were designed by TLM in collaboration with teachers currently working in the classroom, industry consultants, professional bodies and universities. In order to provide learners with the skills needed by all sector employers, extensive consultation with business leaders has taken place. This specification is a distillation of this extensive market research specifically geared to supporting learning in schools. There is an emphasis on developing the transferable knowledge, skills and competences that will support lifelong learning providing the grounding needed for future construction industry professionals. There are references to science and mathematics especially in terms of control of variables, energy efficiency and sustainability, structural engineering and measurement. Specialist vocabulary with words such as sustainability, life cycle, energy efficiency, prefabrication, budget and BIM, will help support technical English at a level beyond that of most adults.

Key subject aims

3.2 The overarching aim is to enable learners to broaden their understanding of technical and professional procedures so they are better equipped decision makers in a technological age. Those seeking careers in a digital built environment will have an appropriate grounding in collaboration and BIM techniques to enable them to make rational decisions about their progression routes into employment in this sector.

Subordinate aims include:

- developing the knowledge and skills needed for employment.
- gaining practical experience needed to underpin lifelong learning.
- increasing the knowledge needed to transfer skills and understanding between contexts.

- reinforcement of learning in the core subjects of English, mathematics and science.
- developing practical skills in creativity and problem solving in technological contexts of personal interest.
- developing an understanding of their place in the community and society.
- developing safe, secure and responsible attitudes to working with other people.
- developing the skills for working collaboratively with IT.
- developing knowledge in the field of critical evaluation and feedback.

Knowledge and understanding

3.3 The following knowledge and understanding will be required to underpin the desired learning outcomes for each qualification. At each level the understanding needed is in keeping with the RQF general description of the qualification level.

- Demonstrate knowledge and understanding associated with the built environment terms:
- sustainability, planning, procurement, brownfield, building information modelling, zero carbon, energy efficiency, structural analysis, thermal mass, indoor climate, insulation, stress, strain, load, torsion, HVAC, renewable energy, precedent, biodiversity, resource efficiency, bill of quantities, facilities management, 2D, 3D, engineering, infrastructure, innovation, damp proof course, clash detection, organogram, carbon footprint, client, procurement process, project team, facilities management, model, walk-through, visualisation, contractors, clash detection, coordinate system, BIM, simulation, aesthetics, functionality, prefabrication, 3D,4D, 5D, 6D, health and safety, schedule, mass, quantity take-offs, estimate, productivity, projection, 'Real Time', value engineering, life cycle, life cycle management, specification, operation and maintenance (O&M), data capture, BREEAM, Code for Sustainable Homes, TPO, Tree Preservation Order, easement, legislation, 'National Planning Policy Framework', 'Localism Act', 'Neighbourhood Planning', major development,

environmental impact, transport study, design and access statement, Section 106 agreement, legally binding, Local Development Framework (LDF), circulation, accessibility, Site of Special Scientific Interest (SSSI), concept, rationale, solar radiation, solar gain, sun path, material considerations, acoustics, precedent, undesirable precedent, parametric, foundation, structural walls, beam, column, slab, thermodynamics, heat transfer, thermal mass, electricity, combustion and psychometry. moments, inertia, load, shear, tension, forces, loads, elasticity, stress, strain, bending, 'as built' model', 'post occupancy behaviour', MMC

- Demonstrate mathematical knowledge associated with quantitative methods, simple statistics, and simple geometric structures, algebraic and trigonometric relationships, vectors, exponential and logarithmic functions
- Demonstrate scientific knowledge and understanding associated with energy and materials
- SI units kg, m, m^2, m^3, s, m/s, m/s^2, newton, pascal, ^oC, K, joules, watts, hectare, amp, volt, ohm, cd, , Bq, Hz, lux,
- Non-SI units in common use. e.g. Acre, kWhr, in, ft, yd, mile, pint, gallon, ftcd, dB.
- insulation and the effects of conduction, convection and radiation, balancing forces and moments and their application in simple and straightforward cases, moments of inertia, load, shear, tension, forces, loads, elasticity, stress and strain, material properties related to construction.
- Deal with unfamiliar contexts drawing on learning and information provided.

3.4 Opportunities are provided to support real skills, the great majority of which will be assessed directly in coursework in valid contexts. Through a range of sections. For the Certificate and Diploma, students will carry out a major project based on a real and significant construction project. A range of appropriate tasks follow the journey of the building including;

1. Understanding sustainability and sustainable design.
2. Aesthetic considerations.
3. Working with clients and promoting community cohesion.

4. Building Information Modelling skills.
5. Architectural skills in schematic and design development.
6. Building services engineering.
7. Energy efficiency and post occupancy behaviour.
8. Land surveying and site engineering.
9. Landscape design.
10. Planning constraints.
11. Facilities management.
12. Sustainable procurement and resource efficiency.
13. Applied construction mathematics.

Unit contents

3.5 The content of units is in Annexe C below with some examples of interpreting the criteria. These are available in more detail on the TLM community learning site and will be linked to progressively more supporting resources and guidance as these become available.

3.6 All centres have an assigned Account Manager who will be very pleased to help at any time. Our aim is to give professional assessors, most of whom are qualified teachers, the confidence to make judgements with a minimum of bureaucracy so that they can focus their time on maintaining their professional knowledge and skills and support learning through effective teaching rather than “chasing paper”.

3.7 There is often a confusion between bureaucracy and rigour, since unnecessarily complex bureaucracy can actually detract from rigour by obscuring the importance of the outcomes in unnecessary process. We also encourage coursework to be carried out in valid and real contexts rather than as contrived simulations. Competence is best assessed in context. All assessors must sign an agreement to uphold standards and feedback from moderation/verification will support consistency.

3.8 Websites - TLM provides support through a cloud based system for evidence management linked to grading and certification. Providing assessment grades and the management of certification through the Awards Site is mandatory and all assessors are provided with training in its use. It is simply a matter of recording learner competence against the unit

criteria as the evidence is collected and claiming credit on behalf of the learner when a unit has been fully assessed. All assessors must sign an agreement to uphold standards before they can use this site.

3.9 The use of the community learning site is optional at no additional cost. It provides facilities for learners to submit their evidence online, linking it to the assessment criteria across single or multiple units. The assessor can accept or reject this evidence and comment on it providing a full audit trail for evidence. Moderator/verifiers can get immediate access to this evidence and so it is potentially a lot more efficient than alternative methods. No paper, no emails with file attachments are necessary. There are facilities for progress tracking that can be based on criteria and/or units and reports that can be shared securely online with parents. The system can be linked as an extension to any standards compliant VLE/e-portfolio system for centres that are already committed to a specific VLE product. Training can be provided and free support is available from your Account Manager. The aim is to eliminate all paper based bureaucracy, all screenshots and referencing that draws time away from teaching. As far as possible we want assessment of real tasks in real contexts that are truly representative of a real working environment. This is a fundamental goal for the competence based assessment at the heart of the Qualifications and Credit Framework and European Vocational Education and Training policy (ECVET). It is the way in which most employers will judge the effectiveness of individuals in their tasks at work.

3.10 **Telephone** and e-mail support is available to all Centres. There is a general convention of firstname.secondname@theingots.org for e-mail addresses. It is usually best to e-mail your account manager in the first instance. Google hangouts can be arranged for video conferencing support.

4. Assessment

Assessment summary

Coursework

4.1 Evidence has to be provided against the unit assessment criteria from practical tasks related to the learners' everyday work. This is likely to be from specialist lessons supported by a subject specialist but links with A levels and other equivalent subjects, for example from maths, science, computing art and design and other relevant subjects are to be encouraged. The way evidence is gathered is up to the assessor, the only requirement is that it clearly supports the judgements against the assessment criteria and the relevant learning outcomes and reflects the learners personal competence in keeping with the guidance in the handbook. If on moderation the account manager finds gaps in evidence related to a particular candidate they will request more evidence before approving the award of the unit certificate. Assessors must then adjust their work to ensure all their learners are providing the appropriate level and breadth of evidence. We encourage early submission of at least some evidence so that assessors are confident from the feedback that what they are providing is sufficient (and indeed not over-kill). In this way we can maintain standards while supporting improved efficiency.

4.2 Synoptic assessment has become a popular term. In essence all the coursework assessment is synoptic in that the evidence provided is against collectively synoptic assessment criteria underpinning the learning outcomes for the unit in context. Evidence of competence to a minimum value of 50 credits across the units is mandatory for the Diploma, 30 credits for the Certificate and 12 credits for the Award. This equates to a minimum of 300 guided learning hours, 180 GLHs and 60 GLHs respectively.

4.3 Dividing into a unit structure is for convenience and compatibility with international conventions for referencing national qualifications frameworks and to enable credit transfer e.g. as in the European system ECVET. It is **NOT** intended to determine the method of delivery. Teachers are free to cover units concurrently deciding where the elements are logically related or sequentially e.g. by following a route through Award, Certificate to Diploma. If so the Diploma has to be considered in its own right so learning

from the Award will require revision if it was achieved significantly earlier. We encourage the use of the flexibility provided to target particular interests of learners, to motivate them in persevering in difficult areas and to raise the level of expectation in cognitive development.

4.4 The central project within the curriculum is to shadow a substantial and recent real building project, following industry standard commercial practices, and suggesting improvements that could be made to the real project. This includes the use of Building Information Modelling techniques using industry standard software and provides young learners with a range of progressive skills which are in high demand in a wide range of technical careers in the built environment.

4.5 There is an obvious progression from Level 2 to Level 3 where learners will be expected to tackle academically more challenging questions requiring analysis and quantitative skills. The outcomes for individuals in terms of the broad level descriptors allied to the assessment criteria, verified by the teacher/assessor and externally moderated by TLM will determine the final outcome.

Progression and inclusion

4.6 There are some fundamental misunderstandings of unit based assessment with regards to progression and inclusion. The paragraphs below will explain how criticisms related to these issues can be rejected. It is mainly an issue of having higher levels of professional expectation and better CPD strategies rather than simply “dumbing down” to less professional approaches.

4.7 BIM is a unique project based learning programme which introduces a range of high level employability and built environment industry specific skills offering students with an interest in construction careers a recognised progression route from KS3 through to university, apprenticeships or employment. There is support for numeracy skills through applied mathematics and literacy through practical communication, providing essential aspects of general education as well as the specifically vocational technical knowledge understanding and skills. This ensures that those that

take these qualification but later decide against a construction career, are well-placed to go on to specialise in other fields.

4.8 BIM offers links to career progression in the built environment industries - in architecture, engineering and construction management, and introduces the growing career opportunities focusing on sustainable development. The provision at Level 3 is underpinned by qualifications at Level 1 and Level 2 providing a bridge to undergraduate study as well as apprenticeships and direct employment.

4.9 It is very unlikely that any learner embarking on a TLM qualification based on these methods will not achieve at least some kind of recognition for their work at a level appropriate to their current attainment level with a progression route from where they end up to higher levels. Clearly some will take longer than others. This inclusion is achieved without sacrificing rigour for the highest attainers since the questions in the examination targeting the A/A* grades can be as difficult as necessary without risking weaker candidates dropping out of a grade altogether. Indeed able students can start Level 3 work in KS4 differentiated by outcome where appropriate using the Level 3 Award and build from it to the Certificate and Diploma. Currently there is a good argument that candidates achieving A* and A grades across all their subjects are not being adequately stretched and the natural progression from Level 2 to Level 3 can be used to tackle this directly.

4.10 For the highest attainers that gain some Level 3 credit early, additional time to tackle more ambitious real world projects, with opportunities to making early links with universities who are only too pleased to help support the most able candidates becomes more manageable.

4.11 Coursework at Level 3 should reflect useful and meaningful activities with practical activities that add to the wider understanding of construction issues in the wider community. Examples might be to provide a new insight into an existing building design brief or tackling an environmental design issue in their own school. We want to encourage work that reflects contemporary society using industry standard tools and technologies that enable level 3 learners individuals to contribute to their potential. Projects

lend themselves to cross-curricular work supporting raising attainment in other subjects, numeracy, literacy, science and information skills but also aesthetic subjects such as art and design. It is far better to learn through creating original and useful work than to do simulations or theoretical exercises. This is a fundamental part of TLM's coursework philosophy and founded in research evidence.

Criticisms of coursework answered

Criticism 1: Coursework is too susceptible to plagiarism and other forms of dishonesty.

4.12 A Google search will have a high chance of finding any extended text that has been copied from an online source. If we are genuinely concerned about "copying from the internet" simply inform teachers of how to combat the issue using freely available tools. Require teachers to accept professional responsibility for the authenticity of their learners' evidence. If teachers really want to cheat why would they not simply tell students the answers to an exam question? If learners want to cheat why not simply forge a convincing looking certificate? There is no tradition of easy certificate authentication so there is a high probability that forgery will be successful. Using a complementary examination means that we can check back to see if individual teachers are "passing" student coursework for a disproportionately high number that then fail the examination. That provides an evidence source to cross-reference the quality assurance in order to better target staff development. Work smarter not harder!

Criticism 2: Unit based assessment means that knowledge is in compartments.

4.13 Unit structures are for administrative convenience **NOT** teaching plans. There is nothing to stop elements of several units being supported through one or more projects concurrently. Most academic syllabuses are divided up into sections. That is no different in practice to labelling the sections units. There is no requirement to assess units at a particular time. If most evidence is provided at the end of the course across all units why is that any different in the principles related to timing from a controlled

synoptic terminal examination? If on the other hand a unit is naturally covering work at the beginning or end of a project why not assess it at the appropriate time? Rationality is usually better than ideology in these contexts. If teachers do not teach unit based courses effectively, train the teachers, don't make blanket rules that might well be inappropriate in particular circumstances.

Criticism 3: Unit based assessment does not support progression.

4.14 On the contrary, the scope of unit based qualifications organised in a levelled framework provides a better support for progression when the unit content and structure is designed for that purpose. Where qualifications are opportunistically designed to simply target one level in a terminal examination that is only representative of a subset of the learning, there is a good argument that progression is badly supported but that is true of any qualification whether unit based or not.

Criticism 4: Competence based assessment has to be lowered to the level of the least difficult assessment criterion.

4.15 In well designed assessment units the assessment criteria are contextualised to the general level specified in the overall level descriptors. This means all assessment criteria should be interpreted in terms of that overall level descriptor. It is impossible to measure anything with absolute precision and it is scientifically bogus to claim we can, even if it is politically sensitive to admit that there will be some uncertainty in assessment outcomes when applied to individuals. This is true of both coursework based and exam based methods. The important thing is to get a reasonably consistent set of outcomes within the expected degrees of uncertainty. The competence based component of these qualifications is intended to provide a baseline consistent with the level and to motivate beyond basic competence by providing the flexibility to pursue contextual interests. Grading is achieved by a terminal examination. This means we can match the assessment method to the aspect of attainment such that we cover all aspects of learning but we also provided reliable differentiation that can accurately inform progression routes for individuals.

Criticism 5: Exams have always been the tried and trusted way of assessing attainment. There is no need for anything else.

4.16 Written examinations have been widely used for academic assessments in schools and universities. However, that is largely due to their academic heritage where theory is often more important than practice. Even so coursework is well-established where there are practical elements e.g. in science and medicine. Few jobs assess prospective candidates exclusively using written exams. In most practical areas from brain surgery to teaching, no-one would trust a written examination on its own to prove competence. That is not to say such examinations are not of value. The key is to use coursework **and** examinations intelligently together in order to provide something that is better than either treated in isolation.

The Examination

4.17 Examinations at Level 3 are primarily for grading. The details of the way grades relate to marks are provided above in section 2. The examinations also provide a cross reference in order to increase confidence in the validity of the coursework component.

Weightings

4.18 There are two classes of objectives. AO1, AO2, AO3 are generic assessment objectives:

AO1 - Recall, select and communicate knowledge and understanding.
AO2 - Apply knowledge and understanding through analysis, reasoned judgements and drawing conclusions.
AO3 - Practical and technical skills related to applying skills knowledge and understanding in context.

4.19 Additionally, the qualification units each specify subject specific learning outcomes. The qualification design draws on both classes of objective to ensure balanced representation and that the assessment is a valid representation of what has been learnt.

4.20 The assessment objectives provided by the unit learning outcomes are evenly weighted in the coursework element since all must be achieved in order to pass.

4.21 The synoptic examinations are directly related to the unit learning outcomes and assessment criteria using the content definitions in section 3. This is designed to be broadly representative of the aspects of the learning outcomes testable in a synoptic terminal controlled examination related to the learning outcomes. The examination provides a means of testing associated knowledge and understanding, powers of analysis and reasoning and of grading the qualification whereas the course work ensures that there is basic competence in their practical implementation in real and relevant contexts.

4.22 At Level 3 the examination weighting of AO1 is 20% and AO2 80%.

4.23 The overall weighting of the objectives varies depending on the grade because for higher grades AO2 will contribute a greater proportion of the marks. This is a deliberate strategy because AO2 is the most important learning when it comes to academic learning in HE. The assessment will therefore better inform progression pathways while still having the characteristic of inclusion.

Grade E approximately weighted AO1 - 40%, AO2 - 40%, AO3 20%.
Grade A* approximately weighted AO1 - 20%, AO2 - 70%, AO3 10%

4.24 This then provides evidence that the Grade A* candidate is likely to be more suited to future academic study whereas the Grade E candidate is likely to find it difficult to cope with courses highly dependent on academic testing.

Learner entry and costs

4.25 TLM's subscription model enables schools to enter learners at times convenient to them. There are no late entry fees and no additional fees

should a learner fail to produce evidence at a particular level but can meet the criteria at a lower level. This can reduce costs to the school by more than 50%. Examination entry will depend on whether or not learners meet the coursework criteria. This again saves money because the school is not paying for examination administration for learners that are unlikely to be successful or for whom there is little or no benefit in taking an exam. There are no fees for replacement certificates or verification of certificates because all certificates can be directly authenticated against a secure database. For details of current subscription costs please contact us or refer to the web site. All of these design features are intended to reduce direct costs but just as importantly the indirect administrative overhead that diverts teachers from teaching.

Online examination

4.26 The examinations can be delivered in a traditional paper based format or online. There is a surcharge for paper based examining reflecting the extra cost involved. The online versions have a secure web user interface and require no software installation. They can run through any standards compliant web browser on any type of computer. The user is restricted to an area in the centre of the screen during the examination and has no access to the internet, or any other storage device without moving the mouse pointer out of the secure area and this will set off a warning. Persistence will result in disqualification from the examination. Since the Level 3 online exam contains open-ended questions it has to be physically marked and so the results will not be immediately available but we will aim to have these ready within 2 weeks of taking the exam. For those taking the examinations in the traditional paper based format it is likely to take 4 weeks to finalise results.

Examination Schedules

4.27 Examinations are available on demand subject to three main constraints. The coursework must have been moderated and the candidate judged to be competent against the criteria. The exam fees for the candidates must have been paid in full and you must give 6 weeks notice before the scheduled examination date. Currently exams are taken on-line and you need to set up the group(s) on the markbook site to then

automatically register accounts on the learning site. You need to do this even if you are administering the exam on paper. There are more details in the "How to" section linked to help on the INGOT site front page.

Internal standardisation of coursework

4.28 The Principal Assessor has the ultimate responsibility for consistency in assessment standards within a centre and has signed an agreement to that effect. All assessors have signed a contract agreeing to uphold standards and should therefore co-operate with the Principal Assessor and Account Manager at TLM to ensure that standards across the centre are consistent. It is advisable to send work samples to TLM early to check that evidence is at the right standard so that there is time to make any adjustments necessary to the course and learner expectations. TLM will generally check a higher quantity of work from new assessors and feedback to ensure that they are confident to make appropriate judgements over time. This reduces risk and improves efficiency in the longer term.

Authentication

4.29 All assessors must take reasonable steps to ensure that any coursework evidence submitted by candidates is a true reflection of the candidates' competence. This is in keeping with the assessor undertaking to uphold and maintain standards in the contract with TLM.

4.30 Certificates can be authenticated directly online using the certificate number or by scanning the QR code on the certificate. There is no charge and it makes it more likely that certificates will be checked and that in turn improves security. Certificate forgeries are a significant problem when authentication is not simple and straightforward because convincing forgeries are easy to achieve with recent technologies and will get easier as time goes on.

4.31

5. Other considerations

Access arrangements and special requirements

5.1 All TLM's qualifications are intended to be accessible, as widely as possible. There is an extensive policy documented on the web site at https://theingots.org/community/node/5494 RQF G6

Centres should contact TLM if they have any questions related to accessibility issues.

Language

5.2 The language for provision of this qualification is English only. This will only change if we have a significant demand in another language that is sufficient to cover the additional costs involved and some cultural alterations will be needed. TLM will actively support any work in this line that can be shown to cover costs.

Malpractice

5.3 TLM has comprehensive policies and procedures for dealing with malpractice. These are documented with links on the web site at https://theingots.org/community/node/5492 RQF A8 Assessors should be familiar with these policies and make them clear to candidates. Assessors should inform their account manager if they suspect any instance of malpractice that could have a material effect on the outcome of any assessments, either for themselves or colleagues. This is part of the upholding of standards that is part of the contract with TLM.

Equality of opportunity

5.4 TLM promotes equality of opportunity through policies and procedures. These are again documented in detail on the web site at https://theingots.org/community/node/5493 RQF D2

Resources, support and training

5.5 A clear goal of these qualifications is to enable learners to support their own learning and to reduce dependency in order to become "lifelong

learners". The IT revolution makes this progressively easier. As far as possible we encourage the use of technology and up to date methods especially those based on empirical evidence.

5.6 TLM encourages the use of free and open source applications to reduce costs and to further inclusion. All of the key proprietary software applications needed to support any of the assessed units are available freely from Autodesk®, one of the world's leading industrial design software specialists, including architectural 3D modelling and visualisation software. This national scheme also allows free access to students and teachers in the home. However, students are at liberty to use any modelling software they wish, and there are many free alternatives which can be accessed from the internet.

5.7 Integrated aspects of the BIM programme ensure that teachers and learners receive a fully supported, expertly enhanced, stimulating and challenging learning experience. It is anticipated that teachers will soon grow in confidence, develop their own networks of industry based support and be able to develop new projects of their own – ones that may be unique to their local context or that offer specific targeted challenges.

5.8 The curriculum introduces new areas of learning that include close engagement with the world of work and academia. Teachers and learners alike will find it rewarding, challenging and exciting – a combination that guarantees successful outcomes and a learning environment that is happy, productive and fun.

5.9 BIM qualifications are designed to support learning that enables access to Further Education, Higher Education and employment for a wider range of young people.

6. Grade Descriptions

A **grade A** candidate will exhibit most the following characteristics.

6.1 Candidates demonstrate a high level of independence in using their knowledge and understanding to support activities beneficial to themselves and others in everyday contexts. They recall, select and communicate a thorough knowledge and understanding of the general competences needed to support lifelong learning and personal well-being in keeping with the Level 3 general level descriptor in the RQF.

6.2 They apply knowledge, understanding and skills to a variety of situations including those that are unfamiliar and require some analysis and synthesis of new ideas, selecting and using knowledge and information efficiently to solve problems and produce effective support for their own learning as well as the needs of others. They relate these to comparable activities in the world of work. They manipulate and process data efficiently and effectively based on objective criteria. They interpret information and transfer knowledge and understanding from familiar to unfamiliar contexts and produce new insights in practical circumstances. They work creatively exploring and developing new ideas. They adopt systematic approaches to safety, promoting secure and responsible practices.

6.3 They use scientific and mathematical methods to analyse problems such as control of variables, setting up and solving equations. They set hypotheses in relevant contexts and critically analyse and evaluate the knowledge they gain. They use sound knowledge to review their own work and that of others including that of industry professionals making appropriate, supportive and constructive criticisms and recommendations for improvements. They communicate effectively, demonstrating a clear sense of purpose and audience.

A **grade E** candidate will exhibit most of the following characteristics

6.4 Candidates demonstrate the ability to select and use relevant knowledge, ideas, skills and procedures to complete defined tasks and address realistic but straightforward construction problems. They take

responsibility for completing tasks and procedures initiating and completing tasks and procedures as well as exercising autonomy and judgement within limited parameters.

6.5 They use factual, procedural and theoretical understanding to support their work and use appropriate investigation to inform actions. They address problems that, while well defined, may be complex and non-routine. They appreciate different perspectives on subjective issues.

6.6 They work safely and securely, identifying key risks, taking reasonable actions to avoid them. They can work in teams, where relevant taking responsibility for supervising or guiding others, collaborating in reviewing their work evaluating the way they and others use their construction knowledge and skills and taking positive actions to improve. They use standard English and IT to support clear and efficient communication, demonstrating consideration of purpose and audience and use straightforward mathematical techniques in quantitative work.

Annexe A - example examination Level 3

The following principles will apply to the design and structure of each exam.

Questions will vary in the general area of the required learning outcomes specified in the units and cover the assessment criteria in the approximate proportions presented in this document. Questions will reflect a balance of the content listed and explained in the guidance in keeping with Level 3 as defined by the RQF global level descriptors and the grade descriptions above. The exam for the certificate will be the same structure as that for the Diploma but with questions restricted to the first three units.

Each multiple choice question is worth 0.5 of a mark. Choose the alternative that best fits the question or statement in the question.

Questions

1. A “Vision Statement” conveys:

    a) the concerns of a financial director
    b) the outline costs of a building project
    c) high level, aspirational ambitions for a building project
    d) the underlying principles for BIM adoption

2. A GPR survey will provide data regarding:

    a) subsurface utilities
    b) general procurement regulations
    c) the position of satellites for a topographical survey
    d) community views regarding a potential construction project

3. What planning policy is critical to achieving a balance between protecting the countryside and constructing enough new houses to meet growing demand?

a) Green Shield Policy
b) Countryside Policy
c) Green Belt Policy
d) Country Life Policy

4. Proposals for the construction of wind turbines in rural areas have lead to many controversial planning applications and decisions. Which of the following is NOT a local environmental objection to such a proposal?

a) I am concerned about the noise they will make
b) I think they will have a negative impact on the appearance of the landscape
c) I am concerned about the impact on wildlife
d) I think they will not be cost-effective

5. 6D BIM will include information regarding

a) precedent
b) lifecycle management
c) river pollution
d) directors' pension contributions

6. A structural engineer is working on a small UK construction project and needs to design a beam to span a distance of 9.2m but must ensure the structure meets the sustainability policy. Which material is likely to be least appropriate?

a) Reclaimed steel from a local demolition project
b) Pre-cast concrete fabricated overseas
c) Sustainably sourced engineered timber
d) In-situ concrete made from locally recycled aggregates

7. You are designing a façade system for a building in a hot climate where the use of air conditioning will be minimised. What is likely to be the most important design consideration of those listed below?

a) A modern and contemporary appearance
b) Maximising solar gain
c) Providing shading and allowing natural ventilation
d) Maximising views from inside

8. What does the acronym MMC stand for in the construction industry?

a) Monumental Methods of Construction
b) Maximised Manual Construction
c) Modern Methods of Construction
d) Mechanical Methods of Construction

9. Building Information Modelling can potentially help reduce the cost of a construction project by

a) providing information about competitors designs
b) asking automatic suggestions to design issues.
c) reducing the amount of construction waste on the project.
d) roving government policy guidance.

10. The most important outcome to record when an environmental analysis of a BIM model is undertaken is the

a) overall height of the building.
b) energy efficiency of the building.
c) amount of concrete needed to build the foundations.
d) overall floor area of the building.

11. The professional body for building services engineering professionals in the UK is known as

a) BSE
b) CIBSE
c) BSEC
d) BSE Limited

12. The thick red line around the edge of a land registry site plan indicates
a) flood plain limits.

b) the listed boundary of the site.
c) a proposed road.
d) a fence.

13. The branch of science concerned with energy flow in buildings is

a) aerodynamics.
b) power dynamics.
c) ergonomics.
d) thermodynamics.

14. Which of the following is not a structural element of a building?

a) column
b) truss
c) window
d) foundation

15. The Government Soft Landings policy recommends:

a) end users have comfortable seating areas at lunchtimes.
b) recreation areas make use of wet-pour concrete.
c) the early engagement of the end user.
d) government officials have access to the building at all times.

16. Energy produced by generating electricity is:

a) always clean energy and good for the environment.
b) always the most efficient way of heating a house.
c) always generated by burning coal.
d) always easy to convert to other energy forms.

17. A contractor needs to find out about how the water drains through a site. He will commission

a) an aqueous investigation.
b) a hydrology survey.
c) a hygrometry investigation.

d) a hyperbaric survey.

18. The UK WRAP programme focuses on:

a) waste reduction.
b) world renewable energy levels.
c) respect for wildlife.
d) packaging of concrete blocks.

19. How bright will a light source for an external illuminated sign appear 30m away compared with 10m away

a) 3 times as bright.
b) $^1/_9$ of the brightness.
c) ⅓ of the brightness.
d) The same brightness.

20. Health and Safety coordination on a site is generally the responsibility of

a) the local doctor
b) the client
c) the structural engineer
d) the facilities manager

21. A BREAMM Assessment has been undertaken on a new school building. It has achieved the highest rating achievable. This is

a) green star
b) perfect
c) outstanding
d) checked

22. Two neighbours share a wall suffering from subsidence. The Party Wall Act (1996) can be used by one neighbour to

a) prevent the other from making a repair.

b) make the repair if it is in their interest to do so.
c) demand 50% payment for the repair from the other.
d) make the repair without notifying their neighbour.

23. During refurbishment of a building, you find evidence of asbestos in the walls. Your duty to report this to your boss is mandated by

a) CDM regulations (2007).
b) Anti-asbestosis society rule 8.
c) Party Wall Act (1996).
d) Planning Act (2008)

24. A clash has been detected in the design. What could this mean?

a) The engineer and architect have had a disagreement.
b) Site traffic is too busy before 9 am.
c) The noise level on site has been reported by a member of the community.
d) An air conditioning duct is running through a structural beam.

25. Which of the following produces a lateral force?

a) Wind
b) End Users
c) Heavy Furniture
d) A steel beam

26. The point when a material will not return to its original shape once a stress is removed is known as its

a) breaking limit
b) stress limit
c) elastic limit
d) material limit

27. Which of the following is an effective carbon reduction measure?

a) only use products with high recycled content.
b) only use products made in the EU.
c) only use products made by people in developing countries.
d) only employ an architect who has a degree from a UK university.

28. A construction company must comply with a Section 106 agreement. Which of the following is a valid proposal?

a) To provide affordable housing in the development scheme.
b) To restrict the height of houses to 6.5 metres.
c) To use triple glazing in the fenestration schedule.
d) To employ a project manager.

29. Post Occupancy Evaluation is concerned with:

a) the people who use a building
b) the people who design a building
c) the people who live near a building
d) the fence line that acts as a boundary around a building

30. If a company aims to reduce its variable costs by 25%, which of the following will contribute to this aim?

a) bank interest of 7.8% on a loan of £50,000
b) construction managers salary of £35,000 per annum
c) company car fuel usage of £24,000 per annum
d) head office utilities costs of £6,000 per month

31. The use, operation and maintenance of a building is the responsibility of:

a) The structural engineer
b) The architect
c) The planning officer
d) The facilities manager

32. A purpose of a sensitivity analysis is:

a) To test the robustness of the results of a building model
b) To test the feelings of the local community towards a building
c) To check whether the team is collaborating
d) To test the weathering of building materials

33. Normal conversation produces a sound intensity of 60 decibels. On a construction site the noise from machinery is measured to be 80 decibels. How many times louder than conversation is the site noise?

a) 1.33
b) 13.3
c) 20
d) 100

34. The cost of wooden flooring is £4.50/m^2 today. The cost is predicted to escalate at an annual rate of 4% throughout the building's lifecycle. How much will the same flooring cost in 20 years?

a) £9.45
b) £8.10
c) £5.30
d) £9.86

35. A building requires a cold water tank with a capacity of 30 $m^{3.}$ Suitable dimensions for the tank are

a) 3m x 3m x 3m
b) 1m x 3.2m x 3.3m
c) 3m x 3.2m x 3m
d) 3.2m x 3.2m x 3.2m

36. For a tank weighing 2 tonnes, what will be the total load when filled with 30 m^3 of water of density 1000 kg/m^3

a) 28 tonnes

b) 30 tonnes
c) 32 tonnes
d) 60 tonnes

37. A steel girder weighs 1 metric tonne. Steel has a specific heat capacity of 480 J/Kg.K. A good approximation of the thermal mass of the girder is

a) 480000 J/K
b) 240000 J/K
c) 480000 JK
d) 240000 JK

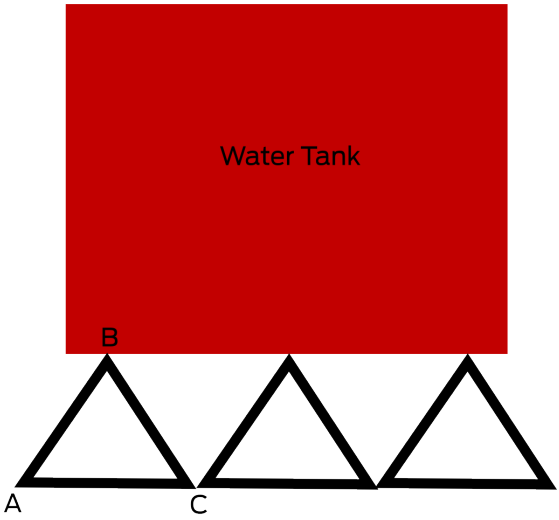
38. If a planning policy allows 50% of a site to be developed and the site is 150m x 47m and there must be a clear 2m easement around any buildings, what would be the maximum permitted building footprint?

a) 6278 m^2
b) 2847 m^2
c) 3139 m^2
d) 3525 m^2

39. The U value of a building element is a measure of its heat transfer capability. It is the reciprocal of all the thermal resistances of the materials making up the element. The thermal resistance of a material is d/k where d is the material thickness and k is its thermal conductivity. What is the U value of a material made up from 2 elements with thermal conductivities of k1 and k2, and thicknesses d1 and d2.

a) d1k1 + d2k2
b) (k1 + k2)/(d1 + d2)
c) k1k2/(d1k2 + d2k1)
d) (d1k2+d2k1)/k1k2

40. A water tank and contents weighing 18 tonnes is supported by a structure made from three equilateral triangles as shown below.



Equilateral triangle supports

Assuming the weight is evenly distributed on the triangles, the compression force in AB is

a) 6 tonnes
b) 3 tonnes
c) $2\sqrt{3}$ tonnes
d) $\frac{2}{\sqrt{3}}$ tonnes

Short questions 10 marks

41. Give an example of what we might find in a site of special scientific interest.

(2 mark)

42. Outline the key objectives of the BIM Protocol.

(2 marks)

43. Explain what is meant by the terms ‘embodied carbon’ and ‘operational carbon’.

(2 marks)

44. Describe, and provide an example of, an Easement.

(2 marks)

45. A steel girder expands 1 part in 100,000 for every degree rise in temperature. The girder has a cross sectional area of 2,500 mm^2 and a length of 5m. Its tensile modulus is 2 x 10^7 $N/m^{2.}$ If it is fixed horizontally between two vertical concrete walls at a temperature of 10^0C. What force will be generated if the temperature rises to 20^0C?

(2 marks)

Long questions 40 marks

46.

a) Describe the process of natural ventilation in a building.

(3 marks)

b) What steps can you take to optimise air flow to maximise thermal comfort?

(4 marks)

c) Describe how you will measure the performance of your ventilation system through the building’s lifecycle.

(3 marks)

d) Give one health reason why under floor ventilation is required in buildings with suspended floors.

(1 mark)

47. Your client has contracted you to design a two storey office block. His key objectives are to create an efficient, sustainable environment in which to work and to minimise life cycle costs. He owns a small multidisciplinary import/export business.

a) Prepare a Design Brief including the considerations you will take to ensure his objectives will be met?

(4 marks)

b) Your client asks you to produce a sketch scheme. Describe key factors which will influence the scheme.

(4 marks)

c) What steps could you take to ensure effective end user consultation?

(2 marks)

48. Your client wishes to construct 8 light industrial units on a brownfield site on the edge of the town by the river. The site previously accommodated a paint manufacturing factory and is now derelict.

Provide a preliminary plan for undertaking a site analysis to ascertain the acceptability of the site in relation to the client's needs.

(10 marks)

49. "BIM is not simply a technology, but a process that virtually represents a building and much of the information associated with that building."

Use your knowledge and understanding of BIM to argue for or against this statement.

(10 marks)

Coursework

30 marks are available from the portfolio of evidence covering all unit assessment criteria giving a maximum total of 100 marks.

Annexe B - Level 3 Units

Level 3
Unit 1: Defining a Sustainable Construction Project
12 credits (60 GLH) M/505/6096

1. Research and convey the project remit.	**2. Set standards for sustainability in a construction project.**	**3. Define site information required at pre-design phase.**
1.1 identify a significant construction project for in-depth study.	2.1 define commitments to positively impact on the local community and the local environment	3.1 identify the importance of site analysis and the roles of professional consultants at pre-design phase.
1.2 communicate the vision for the project.	2.2 define and explain commitments to energy and water efficiency and carbon reduction.	3.2 determine requirements for topographical information including ways to collect accurate data for the site.
1.3 set the scene for the project in the context of the existing environment.	2.3 define and explain commitments to minimise construction waste.	3.3 identify information required to produce a geotechnical report related to the specified project.
1.4 set the scene for the project in the context of end users.	2.4 define and explain commitments to ethical sourcing and responsible procurement.	3.4 identify information required to produce an ecological study related to the specified project.
1.5 write a mission statement for the project.	2.5 define and explain sustainability monitoring and reporting procedures for the lifecycle of the project.	3.5 identify information required to produce a hydrology study and relate to the specified project.

Level 3
Unit 2: Developing a Sustainable Construction Project
10 credits (60 GLH) T/505/6097

1. Prepare a design brief and take steps to appoint an effective design team.	**2. Use building information modelling techniques for concept design.**	**3. Prepare information and resources needed to support a planning application.**
1.1 describe the role and responsibility of the client in a construction project.	2.1 create preliminary concept designs based on a design brief.	3.1 explain the planning process for a specific construction project.
1.2 prepare a design brief for a specific construction project and receive critical feedback for client sign off.	2.2 assess concept designs for space requirements, circulation and accessibility.	3.2 make use of current legislation and guidance.
1.3 formalise the appointment of an integrated Project Team in contractual terms.	2.3 assess concept design to produce preliminary cost and lifecycle cost prediction.	3.3 prepare a planning feasibility study for a specific construction project.
1.4 produce an organogram outlining professionals and their roles at each phase of the project.	2.4 perform energy analysis relative to form, orientation, weather, surfaces and glazing.	3.4 describe what is meant by the term ‘undesirable precedent’ in planning decisions and provide an example of such.
1.5 devise an effective communication strategy to promote collaboration between all parties.	2.5 present information for whole project lifecycle providing validation for chosen model.	3.5 formulate justification and present evidence for the approval of a specific project.

Level 3
Unit 3: Support Design, Structural and Services aspects of a Sustainable Construction Project
8 credits (60 GLH) A/505/6098

1. Use building information modelling techniques to develop the design	**2. Use building information modelling techniques to develop structural elements of a building project**	**3. Use building information modelling techniques to develop building services elements of a building project**
1.1 define design elements and operational practicalities to provide the basis of a building information model	2.1 define and create data rich structural elements including foundations, structural walls, slabs, beams and columns	3.1 define and create appropriate systems from prior research, concept analysis and operational practicalities and constraints
1.2 create an architectural model using materials with properties relevant to a sustainable construction project.	2.2 apply science and mathematics to structural specifications.	3.2 apply science and mathematics to assess and calculate energy efficiency in a range of scenarios.
1.3 validate sustainable design ideas through production of data rich detailed 3D information	2.3 validate structural engineering methods through production of data rich detailed 3D information	3.3 validate building services proposals through production of data rich detailed 3D information
1.4 present the design model to critical design experts.	2.4 present the structural model to critical structural experts.	3.4 present the services model to critical services experts.
1.5 resolve design errors, clashes and omissions making	2.5 resolve structural errors, clashes and omissions and making	3.5 resolve service related errors, clashes and omissions making

modifications as a result of feedback.	modifications as a result of feedback.	modifications as a result of feedback

Level 3
Unit 4: Lifecycle and Financial Planning for a Sustainable Construction Project
10 credits (60 GLH) F/505/6099

1. Use building information modelling techniques to support the operational management of a building.	**2. Understand cost analysis and financial control.**	**3. Produce a budget for a complex building project.**
1.1 explain the role of BIM in the operation, management and maintenance of a sustainable building project throughout its lifecycle.	2.1 explain the role of BIM in the financial management of a building project.	3.1 compile an accurate list of capital costs.
1.2 devise an appropriate handover process from the construction team to the end user.	2.2 produce a cost model based on the project time line.	3.2 provide an annual projection for recurrent fixed costs.
1.3 set targets for whole life energy performance, water consumption, waste reduction, operation and maintenance costs	2.3 identify points of accountability for keeping the project to budget.	3.3 provide an annual projection for recurrent variable costs.
1.4 analyse the impact of post occupancy behaviour on the life cycle of a building.	2.4 explain the consequences of weaknesses in financial control.	3.4 provide a sensitivity analysis based on possible variations in costs.
1.5 describe the benefits of early engagement of the Facilities Manager and the client/end user in the design process	2.5 devise policies for sustainable procurement to establish audit trails.	3.5 present and negotiate variations to the design within budget constraints.

Level 3
Unit 5: Evaluating and Documenting a Sustainable Construction Project
10 credits (60 GLH) K/505/6100

1. Make objective comparisons between construction methods.	**2. Communicate outcomes from professional perspectives.**	**3. Make a presentation of a summary report to a critical audience.**
1.1. compare construction methods on the basis of aesthetics and appropriateness to design intent.	2.1 explain the strengths and weaknesses of the design from a facilities management perspective.	3.1 support a presentation with appropriate digital technologies.
1.2 compare construction methods on the basis of cost.	2.2 explain the strengths and weaknesses of the design from an architectural perspective.	3.2 compare the client brief to the finished project and communicate to a professional audience.
1.3 compare construction methods on the basis of sustainability.	2.3 explain the strengths and weaknesses of the design from a structural engineering perspective.	3.3 compare social, economic and environmental outcomes with planned intentions.
1.4 compare construction methods on the basis of endurance and reliability.	2.4 explain the strengths and weaknesses of the design from a building services engineering perspective.	3.4 assess and validate the project's major strengths and weaknesses with supporting evidence.
1.5 compare construction methods on the basis of reduction of operating costs.	2.5 explain the strengths and weaknesses of the design from an end user perspective.	3.5 make clear judgements about the success of the project and lessons learned for the future.

Annexe C - Assessor's guide to interpreting the criteria

General Information

RQF general description for Level 3 qualifications

- Achievement at Level 3 (EQF Level 4) reflects the ability to identify and use relevant understanding, methods and skills to complete tasks and address problems that, while well defined, have a measure of complexity. It includes taking responsibility for initiating and completing tasks and procedures as well as exercising autonomy and judgement within limited parameters. It also reflects awareness of different perspectives or approaches within an area of study or work.
- Use factual, procedural and theoretical understanding to complete tasks and address problems that, while well defined, may be complex and non-routine.
- Identify, select and use appropriate skills, methods and procedures.
- Use appropriate investigation to inform actions.
- Review how effective methods and actions have been.
- Take responsibility for initiating and completing tasks and procedures, including, where relevant, responsibility for supervising or guiding others.
- Exercise autonomy and judgement within limited parameters information and ideas.

Requirements

- Standards must be confirmed by a trained Level 3 Assessor or higher.
- Assessors must at a minimum record assessment judgements as entries in the online mark book on the INGOTs.org certification site.
- Routine evidence of work used for judging assessment outcomes in the candidates' records of their day to day work will be available from their e-portfolios and online work. Assessors should ensure that relevant web pages are available to their Account Manager on request by supply of the URL.

- When the candidate provides evidence of matching all the criteria to the specification, subject to the guidance below, the assessor can request the award using the link on the certification site. The Account Manager will request a random sample of evidence from candidates' work that verifies the assessor's judgement.
- When the Account Manager is satisfied that the evidence is sufficient to safely make an award, the candidate's success will be confirmed and the unit certificate will be printable from the web site.
- Each unit at Level 3 has recommended guided learning hours based on time required to complete by an average learner.

Assessment Method

Assessors can score each of the criteria N, L, S or H. N indicates no evidence and it is the default setting. L indicates some capability but some help still required to meet the standard. S indicates that the candidate can match the criterion to its required specification in keeping with the overall level descriptor. H indicates performance that goes beyond the expected in at least some aspects. Candidates are required to achieve at least S on all the criteria to achieve the full unit award. Once the candidate has satisfied all the criteria by demonstrating practical competence in realistic contexts they achieve the unit certificate.

Expansion of the assessment criteria

Unit 1: Defining a Sustainable Construction project 10 credits (60 GLH)

1. The candidate will research and convey the project remit.

I can:

1.1 identify a significant construction project for in-depth study

Candidates will identify sources which will provide the basis for a construction project.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will select an appropriate project either through an existing genuine architectural competition, or by identifying a building which they believe is needed in their own town.

1.2 communicate the vision for the project

Candidates will write a vision statement for their project and communicate it to relevant third parties.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates should articulate their high level, aspirational ambitions for their project; what it will achieve when it is completed in the context of the people who will use it, the environment in which it sits and the sustainable objectives it will realise.

1.3 set the scene for the project in the context of the existing environment

Candidates will provide a descriptive study of the local area where their project will be constructed.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates should discuss the existing built environment and infrastructure, describe the current social, economic and environment situation and the general aesthetics and 'feel' of the area, what it means to the people who live and work, and indeed what it means to them personally. Candidates can provide a range of evidence to support their findings by devising appropriate questionnaires for on street surveys and interviewing diverse groups of the immediate local community e.g. local businesses, shoppers, the elderly, young people and students etc. They can find information through, for example, local authority, civic society, chamber of commerce and the office of national statistics' websites.

1.4 set the scene for the project in the context of the end user

Candidates will describe the prospective end user.

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will provide a profile of the end user of their building project, detailing anticipated wishes and demands. They may choose to research end users in similar facilities both physically and operationally.

1.5 write a mission statement for the project

Candidates will produce a mission statement for their project.

Evidence: portfolios of evidence.
Additional information and guidance: Candidates will determine clear values, objectives and outcomes for their project, ideally working as a team to identify key themes, for example purpose, environmental impact, design excellence, sustainability, economic contribution. Candidates might gain inspiration by exploring the mission statements of leading architecture, engineering and construction companies.

2. The candidate will set standards for sustainability in a construction project.

I can:

2.1 define commitments to positively impact on the local community and the local environment

Candidates will produce a community and environmental statement.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will produce a statement which outlines their commitment to positively impact the local community and the local environment not only in terms of the building itself and its entire life cycle, but also through the ethos, behaviour and passion of the entire project team in caring for the community and protecting the environment in the immediate vicinity of the project. This should be based on referenced research evidence.
A series of Construction Commitments devised by the Strategic Forum for Construction provides valuable guidance
(http://www.strategicforum.org.uk/).

2.2 define and explain commitments to energy and water efficiency and carbon reduction

Candidates will produce an energy, water and carbon statement based on research.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will produce a statement which outlines their commitment to energy and water efficiency, and to reduce carbon emissions throughout the entire life cycle of the building, and also through the ethos, behaviour and passion of the entire project team. This should be based on referenced research evidence.

A series of Construction Commitments devised by the Strategic Forum for Construction provides valuable guidance (http://www.strategicforum.org.uk/).
WRAP (Waste and Resources Action Programme) provides valuable guidance: http://www.wrap.org.uk/category/sector/construction

2.3 define and explain commitments to minimise construction waste

Candidates will produce a waste statement based on research.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will produce a statement which outlines their commitment to waste minimisation throughout the entire life cycle of the building, and also through the ethos, behaviour and passion of the entire project team. This should be based on referenced research evidence.
A series of Construction Commitments devised by the Strategic Forum for Construction provides valuable guidance (http://www.strategicforum.org.uk/)
WRAP (Waste and Resources Action Programme) provides valuable guidance: http://www.wrap.org.uk/category/sector/construction

2.4 define and explain commitments to ethical sourcing of materials and responsible procurement

Candidates will produce a procurement statement based on research and their personal ethics.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will produce a statement which outlines their commitment to ethical sourcing and responsible procurement throughout the entire life cycle of the building, and also through the ethos, behaviour and passion of the entire project team. This statement should be based on referenced research including information from the Strategic Forum for Construction.

A series of Construction Commitments devised by the Strategic Forum for Construction provides valuable guidance (http://www.strategicforum.org.uk/).
WRAP (Waste and Resources Action Programme) provides valuable guidance: http://www.wrap.org.uk/category/sector/construction.

2.5 define and explain sustainability monitoring and reporting procedures for the lifecycle of the project

Candidates will define their methods for monitoring and reporting their commitments to sustainability throughout the entire life cycle of the project.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates should explore existing industry procedures to produce a methodology. Valuable guidance can be found by registering with BREAMM, an internationally recognised measure and mark of a building's sustainable qualities, and certified buildings are immediately identifiable as having been planned, designed, constructed and operated in accordance with best practice sustainability principles. Click on the Resources tab at: http://www.breeam.org/.

3. The candidate will be able to define site information required at pre-design phase.

I can:

3.1 identify the importance of site analysis and the roles of professional consultants at pre design phase

Candidates will produce an overview of site analysis requirements and the professionals involved at pre-design stage.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will understand the importance of an adequate site investigation and describe who and what is

involved, and why it is carried out. They will outline the risks involved in gathering insufficient or inadequate data.

3.2 determine requirements for topographical information including ways to collect accurate data for the site

Candidates can explain the need for an accurate topographical survey and can suggest and validate an appropriate survey method.

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will understand the role of the topographical surveyor in providing accurate survey data. They will explore the limitations of everyday mapping information (e.g. conventional ordnance survey maps) in providing accurate geotechnical data and how technology has advanced the methods of surveying. Candidates will compare methodologies and technologies and will determine appropriate above ground survey methods for their project including laser scanning, satellite based positioning systems (GPS/GNSS), electronic distance measurement (total station), Geographical Information Systems (GIS) and ground penetrating radar (GPR) for below ground utility mapping. Candidates will define appropriate vertical/horizontal accuracy and understand the need for precision to establish boundaries, elevation for flood plain data, positioning of trees, water courses and other natural features, existing buildings and man-made features, and also the need to discover existing utilities running through and adjacent to the site. They will explore the limitations of surveying tools, for example GPS requires good satellite geometry and visibility. Tree canopies and dense, built up areas can render GPS methods ineffective. Total stations can produce unreliable data when used in highly reflective and laser Scanning: can produce poor results on low-reflectance surfaces (e.g., anything painted black), specular surfaces (e.g., shiny metal and mirrors), and transparent or translucent surfaces (e.g., windows). All methods require professional expertise and varying degrees of time to process collected data and candidates will understand the process of translating collected data to a usable, manageable format, and the data outputs produced by different methods (e.g. laser scan point clouds, GPS/EDM raw data).

3.3 identify information required to produce a geotechnical report and relate to the specified project

Candidates can identify the geotechnical data required to produce a report.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will understand the role of the geotechnical surveyor in providing accurate ground condition information regarding soil and geologic conditions on and below the surface. They will understand the process of site analysis through desk study, survey and reporting.

3.4 identify information required to produce an ecological study to related to the specified project

Candidates can identify the ecological data required to produce a report.

Evidence: portfolios of evidence.
Additional information and guidance: Candidates will understand the role of the ecology professional in providing accurate information regarding vegetation and wildlife and their habitats in the local area. They will understand the process of site analysis through desk study, survey and reporting.

3.5 identify information required to produce a hydrology study and relate to the specified project

Candidates can identify the hydrological data required to produce a report

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will understand the role of the hydrology professional in providing accurate information regarding the quality, position and flow of watercourses in the local area. They will understand the process of site analysis through desk study, survey and reporting.

Unit 2: Developing a Sustainable Construction Project. 10 credits (60 GLH)

1. prepare a design brief and take steps to appoint an effective design team.

I can:

1.1 describe the role and responsibility of the client in a construction project

Candidates will describe the role and responsibility of the client in a construction project.

Evidence: portfolios of evidence.

Additional information and guidance: The Client plays a major role in any construction project and has a wide range of responsibilities including ensuring that all appointees are competent and that suitable managers are appointed to oversee the project. He is also responsible for providing pre construction information, and ensuring that someone coordinates health and safety. Guidance can be found at http://webarchive.nationalarchives.gov.uk/20110118095356/http://www.cabe.org.uk/buildings/client-role/description.

1.2 prepare a design brief for a specific construction project and receive critical feedback for client sign off

Candidates will prepare a design brief and present to a critical audience.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will prepare an effective, jargon-free design brief which conveys a client's vision, their goals and their priorities and provides an accurate account of the project's deliverables. The brief should refer to a budget estimate and realistic timeline and should confirm the main point of contact and decision

maker(s). Operational management must be a key part of the brief. Candidates will present to an audience which will act as client in the development. The candidate must present with conviction and confidence and make appropriate adjustments on receiving critical feedback.

1.3 formalise the appointment of an integrated Project Team in contractual terms

Candidates will describe the formal appointment of an integrated Project Team.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates should describe the engagement of an efficient, multidisciplinary team focusing on their ability to work together in a collaborative design environment driven by the benefits of Building Information Modelling. In addition to standard contracts (see http://www.jctltd.co.uk/), candidates should highlight the BIM Protocol, BIM Employer's Information Requirements (EIR) and PAS1192:2 specification. Information regarding this can be found via the Government BIM Task Group website: http://www.bimtaskgroup.org/bim-protocol/.

1.4 produce an organogram outlining professionals and their roles at each phase of the project

Candidates will produce an organogram outlining professionals and their roles at each phase of the project.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will outline key members of the Project Team with specific reference to the role of the Information Manager: http://cic.org.uk/download.php?f=outline-scope-of-services-for-the-role-of-information-managment.pdf. They will draft a Project Programme outlining tasks and deliverables at each stage. The Royal Institute of British Architecture has produced a Plan of Work which offers clear guidance:

http://www.architecture.com/Files/RIBAProfessionalServices/Practice/RIBAPlanofWork2013Overview.pdf

1.5 devise an effective communication strategy to promote collaboration between all parties

Candidates will produce an effective internal and external communication strategy

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will explain what they will need to communicate and how they will use BIM to support the communication process, through collaboration, integration and improving awareness, understanding and decision-making through a 3D model. They must ensure the project is on target at each stage to meet the client's aims and objectives including quality and budget. Candidates may also consider the use of social media to assist stakeholders in keeping up to date with the project. How might a team use Twitter, Facebook and website Links and RSS feeds for people to subscribe to?

2. use building information modelling techniques for concept design.

I can:

2.1 create preliminary concept designs based on design brief

Candidates will create a concept design based on the agreed design brief.

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will produce a number of concept design options extracting key information from the design brief. They will understand the benefits of conceptual modelling as a critical stage of building design such as enabling the communication of ideas and

supporting early stage analysis for building life cycle sustainability and cost.

2.2 assess concept designs for space requirements, circulation and accessibility

Candidates will assess concept designs for space requirements, circulation and accessibility.

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will determine how their concept design maximises efficient and effective space use for those who will use it and how it facilitates the safe, convenient movement of people, both able bodied and disabled. They should define spatial requirements for a range of occupant activities and equipment and consider how the positioning of elements such as corridors, lifts, escalators, and staircases contribute to the optimisation of the flow of people through a building. They should be encouraged to explore the size of rooms and areas with specific purpose and it is useful to visit a building with a similar purpose to establish what works and what doesn't, interviewing existing end users where possible. Candidates should consider building operations and maintenance activities and the potential need for flexibility to accommodate changes in future use and technologies. They should understand the project's relationship with, and effective use, of the landscape in which it sits. Furthermore they should pay specific attention to statutory regulations concerning size, function, access etc.

2.3 assess concept design to produce preliminary cost and lifecycle cost prediction

Candidates will assess concept design to produce preliminary cost and life cycle cost prediction.

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will produce high level estimates based on number of occupants and area or volume on a standard £/m^2 and £/m^3 basis according to the type of project they have designed. Whilst this is a function that can be quickly carried out using industry software, candidates should understand the methodology behind calculation, the risks involved in estimation, and the impact of lifecycle costing on sustainability.

2.4 perform energy analysis relative to form, orientation, weather, surfaces and glazing

Candidates will perform energy analysis relative to form, orientation, weather, surfaces and glazing.
Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will produce a high level analysis of overall energy use. They will provide a solar study taking into account the shading effects of surrounding buildings where applicable and recommending ways to maximize solar gain. They will explore the effects of making changes to form and orientation to maximise energy efficiency and make comparisons. Whilst this is a function that can be quickly carried out using industry software, candidates should understand the methodology behind calculation, the risks involved in estimation, and the impact of analysis on sustainability.

2.5 present information for whole project lifecycle and provide validation for chosen model

Candidates will present a final concept model and provide whole project life cycle validation.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will present an effective, efficient concept model which is most aligned to the project design brief, life cycle objectives and vision.

3. prepare information and resources needed to support a planning application.

I can:

3.1 explain the planning process for a specific construction project

Candidates will identify the sources of information which will provide a basis for a construction project.

Evidence: portfolios of evidence.

Additional information and guidance: The 'National Planning Policy Framework' (see http://www.communities.gov.uk/publications/planningandbuilding/nppf) sets out planning policies for England and how they are expected to be applied. It provides guidance for local planning authorities and decision-takers, both in drawing up plans and making decisions about planning applications. See http://www.planningportal.gov.uk/planning/planningsystem/localplans#nppf
It is important that candidates understand the need to involve the wider community in the process and the introduction of the 'Localism Act' and the new 'Neighbourhood Planning' framework empowers communities to have their say regarding development in their neighbourhoods. A guide to the Act and the powers of communities can be found here: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/5959/1896534.pdf
If a construction project is classed as a 'major development' it is crucial that the community is involved at an early stage. There may be more evidence required, in particular an environmental impact assessment, a transport study which outlines the impact the site entry and exit will have on existing roads and traffic volumes, and a design & access statement, which outlines the suitability of the design for the particular site, and how users will access it.
Large scale developments often include a commitment from the developer to provide community services such as providing a park for local children. This is called a Section 106 agreement and is a powerful, legally binding

agreement between a local council and developer to improve the local area.

Major developments can include:

- Housing developments of more than 10 dwellings
- Housing development on a site of 0.5 hectares or more
- Any other development with a floor area of 1000 m^2
- Any other development on a site of 1 hectare or more
- Waste development or mineral working

A planning authority will facilitate community consultation by notifying neighbouring properties about an application, and in some cases they planning applications will also be advertised in the local press and a site notice.

3.2 make use of current legislation and guidance

Candidates will identify the sources of information which will provide a basis for a planning application.

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will align significant legislation to their specific project. Guidance can be found via the government planning website www.planningportal.gov.uk/ and a number of key points are noted below. Candidates should be aware of a number of Acts and codes of practice from Level 2 including Tree Preservation Orders (TPOs) and the Wildlife and Countryside Act 1981. The Disabled Persons Act 1981 and Disability Discrimination Act 1995 ensures that the needs of disabled persons are provided for in any development schemes. The Equality Act 2010 ensures that local planning policies need to take into account the particular needs of women, young people and children, older people, ethnic minorities, children and disabled people. The Party Wall Act 1996 prevents and resolves disputes in relation to party walls (walls of adjoining dwellings e.g. semi detached houses and terraces), boundary walls and excavations near neighbouring buildings. Right to Light - a

private, legally enforceable easement or right to a minimum level of natural illumination through a 'defined aperture', usually a window opening.
Planning applications must also be decided in accordance with the Local Development Framework (LDF), and information regarding this can be found at
http://www.planningportal.gov.uk/planning/planningsystem/localplans
Candidates should consider location specific policy - is the site situated in a green belt, or conservation area? It may be close to listed buildings (or indeed is the proposed project a refurbishment of a listed building?) or be situated in a Site of Special Scientific Interest (SSSI) which gives legal protection to local wildlife and specific geological formations. There are also a number of local Waste Management policies which should be adhered to.
Building Regulations approval sets out design standards that focus on issues of health, safety, energy efficiency and disability access. It may also be necessary to notify the Health and Safety Executive (HSE) and may have other duties as well under the Construction Design and Management Regulations 2007 (CDM 2007). Candidates will use BIM to model Health and Safety requirements. BREEAM and the Code for Sustainable Homes sets the standard for best practice in sustainable building design, construction and operation. The measures used represent a broad range of categories and criteria and include aspects related to energy and water use, the internal environment (health and well-being), pollution, transport, materials, waste, ecology and management processes. Much of this criteria is covered in BIM at Level 1 and 2. More information about BREAMM can be found at http://www.breeam.org/about.jsp?id=66.

3.3 prepare a planning feasibility study for a specific construction project

Candidates will prepare a planning feasibility study for a specific construction project.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will create a feasibility study outlining how their proposal will conform and respond to particular areas of policy and legislation.

3.4 describe what is meant by the term 'undesirable precedent' in planning decisions and provide an example of such

Candidates will identify and describe the impact of 'undesirable precedent'.

Evidence: portfolios of evidence.
Additional information and guidance: Candidates will explain the term 'undesirable precedent' in the context of building design and impact on planning law/codes of practice. A large number of case studies can be found on the internet and candidates should provide an appropriate example aligned to their own project.

3.5 formulate justification and present evidence for the approval of a specific project

Candidates will formulate justification and present evidence for the approval of a specific project.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will include significant facts and provide appropriate evidence (e.g. site plans and design drawings (elevations, floor plans, sections). Planning authorities will focus on material considerations when deciding a planning which include:

- Overlooking/loss of privacy
- Loss of light or overshadowing
- Parking
- Highway safety
- Traffic
- Noise
- Effect on listed building and conservation area
- Layout and density of building
- Design, appearance and materials
- Government policy

- Disabled persons' access
- Proposals in the Development Plan
- Previous planning decisions (including appeal decisions)
- Nature conservation

Further information is available on the UK website http://www.planningportal.gov.uk/.

Unit 3: Support Design, Structural and Services aspects of a Sustainable Construction Project. 10 credits (60 GLH)

1. use building information modelling techniques to develop the design.

I can:

1.1 define design elements and operational practicalities to provide key information for the basis of a building information model

Candidates will produce key information to produce a building information model.

Evidence: portfolios of evidence.

Additional information and guidance: Using information gathering during the completion of previous units, candidates should create a report of key features concerning the architectural and operational principles of the project. They should be able to relate this to scientific and mathematical competence in relevant areas.

1.2 create an architectural model using materials with specific properties relevant to a sustainable construction project

Candidates will produce a building information model using appropriate materials and objects.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Using information gathering during the completion of previous units, candidates should create a model based on the use of appropriate sustainable materials and objects. Autodesk Revit Architecture offers object libraries and families where candidates can select a range of doors, walls, windows etc. All objects are created in a parametric environment allowing candidates to insert and edit dimensional and geometric constraints (i.e. change the length of a wall and move//rotate it into the required position. A range of objects can also be sourced and downloaded free of charge from the internet e.g. www.nationalbimlibrary.com, www.bimstore.co.uk, www.revitstore.com. Construction suppliers are increasingly providing BIM objects, and these can also be sourced from the internet.

1.3 validate sustainable design ideas through production of data rich detailed 3D information

Candidates can validate design ideas using building information modelling technology.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will use a range of building performance analysis tools to assess and validate their design ideas. They should ensure that they have introduced a level of detail that facilitates accurate assessment.

1.4 present the model to critical experts

Candidates will present the model to critical experts in the context of architecture.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Candidates should present appropriate information and visualisations to enable a critical audience to assess the model. Professionals should be invited to critique the model and candidates should be assisted in preparing to answer questions.

1.5 resolve design errors, clashes and omissions making modifications as a result of feedback

Candidates will make improvements to their model following professional feedback.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Candidates should act upon professional constructive feedback and demonstrate design, organisation and performance improvements as a result. They should ensure that building systems do not clash and understand the potential outcome of late identification (i.e. at construction/post construction phase). They should be proficient with quantitative measures and understand appropriate precision and use of units and standard form where appropriate.

2. use building information modelling techniques to develop structural elements of a building project.

I can:

2.1 define and create data rich structural elements including foundations, structural walls, slabs, beams and columns

Candidates will produce a building information model using appropriate structural elements.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Using information gathering during the completion of previous units, candidates should create a report of key features concerning structural performance of the project. They should create a model based on the use of appropriate structural elements and objects. Autodesk Revit Architecture offers object libraries and families where candidates can select a range of foundations, structural walls, beams, columns etc. All objects are created in a parametric environment

allowing candidates to insert and edit dimensional and geometric constraints (i.e. change the length of a beam and move//rotate it into the required position. A range of objects can also be sourced and downloaded free of charge from the internet e.g. www.nationalbimlibrary.com, www.bimstore.co.uk, www.revitstore.com. Construction suppliers are increasingly providing BIM objects, and these can also be sourced from the internet.

2.2 apply science and mathematics to structural specifications

Candidates will understand and apply mathematical techniques to process data for a variety of structural design and engineering related problems.

Evidence: portfolios of evidence and internal testing.

Additional information and guidance: Candidates will calculate structural elements of their project. Classwork should involve theory, worked examples and practice to produce evidence as methodical worked calculations, graphical solutions and other scientific and mathematical exercises. Every attempt should be made to provide industry based scenarios relevant to learners' vocational aims, and the introduction of professionals to support learners in the classroom is hugely beneficial and should be considered. Candidates will understand algebraic and trigonometric relationships, simple addition and resolution of vectors, exponential and logarithmic functions, and will understand fundamental scientific principles within structural engineering including moments of inertia, load, shear, tension, forces, loads, elasticity, stress and strain and thermal expansion.

2.3 validate structural engineering methods through production of data rich detailed 3D information

Candidates can validate structural design ideas using building information modelling technology.

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will use a range of building performance analysis tools to assess and validate their design ideas. They should ensure that they have introduced a level of detail that facilitates accurate and meaningful assessment in realistic real world scenarios. They should be able to explain the physical properties of their construction using evidence from the data in the model.

2.4 present the structural model to critical structural experts

Candidates will present the model to critical experts in the context of structural engineering.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Candidates should present appropriate information and visualisations to enable a critical audience to assess their model. Professionals should be invited to critique the model and candidates should be assisted in preparing to answer questions.

2.5 resolve structural errors, clashes and omissions and making modifications as a result of feedback

Candidates will make improvements to their model following professional feedback.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Candidates should act upon professional constructive feedback and demonstrate design, organisation and performance improvements as a result. They should ensure that building systems do not clash and understand the potential outcome of late identification (i.e. at construction/post construction phase).

3. use building information modelling techniques to develop building services elements of a building project.

I can:

3.1 define and create appropriate systems from prior research, concept analysis and operational practicalities and constraints

Candidates will produce a building information model using appropriate building services systems.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Using information gathering during the completion of previous units, candidates should create a report of key features concerning energy efficiency and life cycle operation and maintenance. They should create a model based on the use of appropriate building services elements and objects. Autodesk Revit Architecture offers object libraries and families where candidates can select a range of building services components e.g. pipes and ducts. All objects are created in a parametric environment allowing candidates to insert and edit dimensional and geometric constraints (i.e. change the length of a beam and move//rotate it into the required position. A range of objects can also be sourced and downloaded free of charge from the internet e.g. www.nationalbimlibrary.com, www.bimstore.co.uk, www.revitstore.com. Construction suppliers are increasingly providing BIM objects, and these can also be sourced from the internet.

3.2 apply science and mathematics to assess and calculate energy efficiency in a range of scenarios

Candidates will understand and apply mathematical techniques to process data for a variety of building services engineering related problems.

Evidence: portfolios of evidence, internal testing.
Additional information and guidance: Candidates will calculate the efficiency of a system using project data and classwork should involve theory, worked examples and practice to produce evidence as methodical worked calculations, graphical solutions and other scientific and mathematical exercises. Every attempt should be made to provide industry

based scenarios relevant to learners' vocational aims, and the introduction of professionals to support learners in the classroom is hugely beneficial and should be considered. Candidates will understand algebraic and trigonometric relationships, vectors, exponential and logarithmic functions, and will understand fundamental scientific principles within building services engineering including thermodynamics, heat transfer, thermodynamics, electricity, combustion and psychrometry, acoustics and light levels.

3.3 validate building services proposals through production of data rich detailed 3D information

Candidates can validate building services design ideas using building information modelling technology.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Candidates will use a range of building performance analysis tools to assess and validate their design ideas. They should ensure that they have introduced a level of detail that facilitates accurate assessment.

3.4 present the services model to critical services experts

Candidates will present the model to critical experts in the context of building services engineering.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Candidates should present appropriate information and visualisations to enable a critical audience to assess the model. Professionals should be invited to critique the model and candidates should be assisted in preparing to answer questions.

3.5 resolve service related errors, clashes and omissions making modifications as a result of feedback

Candidates will make improvements to their model following professional feedback.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Candidates should act upon professional constructive feedback and demonstrate design, organisation and performance improvements as a result. They should ensure that building systems do not clash and understand the potential outcome of late identification (i.e. at construction/post construction phase).

Unit 4: Lifecycle and Financial planning for a Sustainable Construction Project. 10 credits (60 GLH)

1. use building information modelling techniques to support the operational management of a building.

I can:

1.1 explain the role of BIM in the operation, management and maintenance of a sustainable building project throughout its lifecycle

Candidates will explain the role of BIM in the context of whole life facilities management.

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will describe the benefits of developing and maintaining lifecycle data to support the effective, efficient operation, management and maintenance of a building. Data defines the precise location and condition of systems, equipment and objects found in a building (for example lighting, air conditioning, electrical and plumbing systems, fire protection, IT, furniture), and relationships between one component and another. They should understand how information is created and updated throughout the design and construction phase, and how it can be monitored and constantly refreshed throughout the building's lifetime to provide an up to date, real time 'as built' model.

This model can be used to reduce energy usage, monitor life cycle costs, reduce the amount of time required for modification/repair/replacement/ renewal of objects/systems and critically provide a clear picture of how effectively an end user is using the building. Candidates should be able to provide examples of efficiencies and suggest how ongoing data evaluation can impact the future of building design.

1.2 devise an appropriate handover process from the construction team to the end user

Candidates will devise an appropriate handover process from the construction team to the end user.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will further develop knowledge gained in Level 1 and 2 qualifications regarding effective end user behaviour and should devise an effective strategy for end user handover to promote the optimum operational performance of a building. The strategy should include an end user training programme designed to educate users and operators in how they should use the building to support life cycle efficiencies and positive social, economic and environmental outcomes. Candidates should also devise a strategy to monitor, evaluate and report outcomes. The UK Government's 'Soft Landings' concept provides further guidance on effective handover: see http://www.bimtaskgroup.org/gsl/.

1.3 set targets for whole life energy performance, water consumption, waste reduction, operation and maintenance costs

Candidates will set targets for building lifecycle efficiency.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will produce and validate a clear set of targets for their building focusing on energy use, water consumption, waste reduction and operation and maintenance costs. Candidates should consider local, national and global policies and

protocols, and research existing local case studies to determine how targets are set, measured and reported, and their effectiveness over time.

1.4 analyse the impact of post occupancy behaviour on the lifecycle of a building

Candidates will understand the impact of post occupancy evaluation on building life cycle.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates should discuss quantitative and qualitative end user/operator data and how this information can provide a measurement of the success (or failure) of a building project. Candidates should discuss the analysis of data to inform the design process and real life building performance prediction.

1.5 describe the benefits of early engagement of the Facilities Manager and the client/end user in the design process

Candidates can describe the benefits of early engagement of the Facilities Manager and the client/end user in the design process.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will discuss the role of the Facilities Manager and the client/end user in early stage building design in contributing key knowledge and experience in the use, operation and maintenance of a building.

2. understand cost analysis and financial control.

I can:

2.1 explain the role of BIM in the financial management of a building project

Candidates will understand the role of BIM in the financial management of a building project.

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will understand the role and effectiveness of BIM in producing accurate building project cost information including cost plans, bills of quantities and estimates. They should discuss accuracy, time and cost savings, financial transparency, and also the ability to update cost information automatically when making modifications to the building model.

2.2 produce a cost model based on the project time line

Candidates will produce a cost model based on the project time line

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will generate a detailed cost plan from their building model in line with original budget and time line objectives.

2.3 identify points of accountability for keeping the project to budget

Candidates will identify points of accountability for keeping the project to budget.

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will identify key project stages and associated cost centres and the roles responsible for their impact on the budget and final project cost.

2.4 explain the consequences of weaknesses in financial control

Candidates will explain the consequences of weaknesses in financial control

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will understand the impact of poor financial management and reporting and should discuss the bank account and reconciliation, assets and liabilities, cashflow, invoicing, supply chain management, resolution of errors, resource prediction and allocation.

2.5 devise policies for sustainable procurement to establish audit trails

Candidates will devise policies for sustainable procurement to establish audit trails.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will establish procedures for sustainable procurement which provides a clear audit trail and promotes responsible sourcing based on whole life costing principles. They should consider social, economic and environmental impact and compliance with environmental legislation and regulation.

3. produce a budget for a complex building project.

I can:

3.1 compile an accurate list of capital costs

Candidates will compile an accurate list of capital costs.

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will provide a definition of capital costs for a construction project and compile a list referenced to their building project. Capital costs include expenses related to the initial establishment of a building and include land purchase, planning and feasibility studies, architectural and engineering design, construction (including materials, equipment and labour), construction management, insurance, tax, inspections and testing, equipment and furnishings not including in the building (e.g. site office furniture and IT).

3.2 provide an annual projection for recurrent fixed costs

Candidates will provide an annual projection for recurrent fixed costs.

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will provide a definition of fixed costs for a construction project and provide an annual projection for recurrent fixed costs referenced to their building project. Recurrent fixed costs are regular, anticipated costs and are independent of the output or activity level. They include permanent office utilities, permanent staff wages, bank interest, leasing costs.

3.3 provide an annual projection for recurrent variable costs

Candidates will provide an accurate annual projection for variable costs.

Evidence: portfolios of evidence, internal testing.

Additional information and guidance: Candidates will provide a definition of variable costs for a construction project and provide an annual projection for recurrent variable costs referenced to their building project. Recurrent variable costs are irregular, often unanticipated costs that change during the project's life cycle. They include temporary site labour, subcontractors, materials and equipment and fuel.

3.4 provide a sensitivity analysis based on possible variations in costs

Candidates will provide a sensitivity analysis based on possible variations in costs.

Evidence: portfolios of evidence.

Additional information and guidance: With an emphasis on sustainability and energy efficiency, candidates will carry out a sensitivity analysis, testing the cost effective potential of a building project throughout its life cycle by modifying a number of design objects within the model.

3.5 present and negotiate variations to the design within budget constraints

Candidates will present and negotiate variations to the design within budget constraints.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will present and validate design recommendations to a professional audience. They will use the outcomes of the dialogue to make variations that optimise their designs within the constraints of the budget.

Unit 5: Evaluating and Documenting a Sustainable Construction Project 10 credits (60 GLH)

1. make objective comparisons between construction methods.

I can:

1.1 compare construction methods on the basis of aesthetics and appropriateness to design intent

Candidates will produce a construction method evaluation on the basis of aesthetics and appropriateness to design intent.

Evidence: portfolios of evidence.

Additional information and guidance: Candidates will consider a range of construction techniques and make comparisons based on aesthetics. The end user and/or client will have a personal view on what is aesthetically pleasing (i.e. is a delightful/beautiful building) and perhaps here the candidate could collaborate with peers or seek the comments of a professional visitor. Design intent was established in the formulation of a design brief in Unit 1, and again, candidates should conform to the brief when evaluating construction methods. Candidates should present evaluations in a written report. They will come to specific conclusions and present these as judgements that are supported by the evidence.

1.2 compare construction methods on the basis of cost

Candidates will produce a construction method evaluation on the basis of cost.

Evidence: portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report in their portfolios that presents the evidence and comparisons in a clearly understandable format. They will come to specific conclusions and and present these as judgements that are supported by the evidence.

1.3 compare construction methods on the basis of sustainability

Candidates will compare construction methods on the basis of sustainability.

Evidence: portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report in their portfolios that presents the evidence and comparisons in a

clearly understandable format. They will come to specific conclusions and and present these as judgements that are supported by the evidence.

1.4 compare construction methods on the basis of endurance and reliability

Candidates will compare construction methods on the basis of endurance and reliability.

Evidence: portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report in their portfolios that presents the evidence and comparisons in a clearly understandable format. They will come to specific conclusions and and present these as judgements that are supported by the evidence.

1.5 compare construction methods on the basis of reduction of operating costs

Candidates will compare construction methods on the basis of reduction of operating costs.

Evidence: portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report in their portfolios that presents the evidence and comparisons in a clearly understandable format. They will come to specific conclusions and and present these as judgements that are supported by the evidence.

2. communicate outcomes from professional perspectives.

I can:

2.1 explain the strengths and weaknesses of the design from a facilities management perspective

Candidates will produce an evaluation of the building in the role of a facilities manager.

Evidence: portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report. Guidance and evaluation may be sought through collaboration with peers and/or from a visiting professional.

2.2 explain the strengths and weaknesses of the design from an architectural perspective

Candidates will produce an evaluation of the building in the role of an architect.

Evidence: portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report. Guidance and evaluation may be sought through collaboration with peers and/or from a visiting professional.

2.3 explain the strengths and weaknesses of the design from a structural engineering perspective

Candidates will produce an evaluation of the building in the role of a structural engineer.

Evidence: portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report. Guidance and evaluation may be sought through collaboration with peers and/or from a visiting professional.

2.4 explain the strengths and weaknesses of the design from a building services engineering perspective

Candidates will produce an evaluation of the building in the role of a building services engineer.

Evidence: portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report. Guidance and evaluation may be sought through collaboration with peers and/or from a visiting professional.

2.5 explain the strengths and weaknesses of the design from an end user perspective

Candidates will produce an evaluation of the building in the role of an end user.

Evidence: portfolios of evidence.

Additional information and guidance: Based on research undertaken throughout the course, candidates should present evaluations in a written report. Guidance and evaluation may be sought through collaboration with peers and/or from a visiting professional. Candidates are particularly encouraged to present their design to a group of end users who operate in a similar existing facility.

3. make a presentation of a summary report to a critical audience.

I can:

3.1 support a presentation with appropriate digital technologies

Candidates will present their project using appropriate digital technology.

Evidence: portfolios of evidence, assessor observations.

Additional information and guidance: Candidates will present a project summary to a group of professionals. They should provide an assessment (and make recommendations where appropriate) of the selected technology they have adopted in terms of functionality, ease of use, reliability, flexibility, accuracy, responsiveness, availability of appropriate tools, how realistic, visualisation capability, speed, collaboration opportunity, interoperability, import/export functionality, compatibility with existing hardware.

3.2 compare the client brief to the finished project and communicate to a professional audience

Candidates will present a client brief v. final design appraisal.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Candidates will present a project summary to a group of professionals. They should focus on key elements of the design brief and provide an honest evaluation of their ability to adhere to the brief.

3.3 compare social, economic and environmental outcomes with planned intentions

Candidates will compare sustainable outcomes to planned intentions.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Candidates will present a project summary to a group of professionals. They should focus on key elements of their commitments to sustainability outlined in Unit 1 and provide an honest evaluation of their ability to confirm to these commitments.

3.4 assess and validate the project's major strengths and weaknesses with supporting evidence

Candidates will present an evaluation of strengths and weaknesses.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Candidates will present a project summary to a group of professionals. They should focus on key strengths and weaknesses and provide an honest evaluation. Strengths could focus in a number of areas, for example a candidate might comment on a particular sustainable feature, or an ability to demonstrate innovate design solutions for a particular purpose. Conversely a candidate may feel his/her technical ability restricted creativity or they lacked confidence to present their project in an articulate, informed manner.

3.5 make clear judgements about the success of the project and lessons learned for the future

Candidates will present an evaluation of the project.

Evidence: portfolios of evidence and assessor observations.

Additional information and guidance: Candidates will present a project summary to a group of professionals. They should focus on providing an honest evaluation of their experience, their aptitude for certain skills and the lessons they have learned, or still need to learn, for the next project they undertake. They should comment on their aspirations for the future, and how they see their place in the industry.

Annexe D – Summary of the units and their assessment.

Unit 1 - 12 credits - 60 GLH
Unit 1: Defining a Sustainable Construction Project
Unit 2 - 10 credits - 60 GLH
Unit 2: Developing a Sustainable Construction Project
Unit 3 - 8 credits - 60 GLH
Unit 3:Support Design, Structural and Services aspects of a Sustainable Construction Project
Unit 4 - 10 credits - 60 GLH
Unit 4: Lifecycle and Financial Planning for a Sustainable Construction Project
Unit 5 - 10 credits - 60 GLH
Unit 5: Evaluating and documenting a Sustainable Construction Project

300 GLH in total for the full Diploma, 180 GLH for the Certificate and 60 GLH for the Award. Units can be assessed concurrently or consecutively enabling the school to decide how to organise teaching.

There is a unit certificate available for each unit and all units must be assessed as satisfactory through coursework at Level 3 before an exam entry is permitted.

Annexe E - Useful links and supporting information

The INGOT community learning site www.theINGOTs.org has a wealth of supporting information and practical tools for managing evidence, progress tracking and reporting. These are all free for participating schools. Contact TLM for further details or training if required. We will update and add to supporting materials as time goes on.

The INGOT web site supports multiple languages and it is not very difficult to provide new translations. If you want to teach in the context of a modern foreign language it is possible and we will provide support where we can.

Annexe F - Coursework assessment flowchart