

L3 Lead Examiner Report 1901

January 2019

**L3 Qualification in
Construction and the Built
Environment**

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January 2019

Publications Code 20075K_1901_ER

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Grade Boundaries

What is a grade boundary?

A grade boundary is where we set the level of achievement required to obtain a certain grade for the externally assessed unit. We set grade boundaries for each grade, at Distinction, Merit and Pass.

Setting grade boundaries

When we set grade boundaries, we look at the performance of every learner who took the external assessment. When we can see the full picture of performance, our experts are then able to decide where best to place the grade boundaries – this means that they decide what the lowest possible mark is for a particular grade.

When our experts set the grade boundaries, they make sure that learners receive grades which reflect their ability. Awarding grade boundaries is conducted to ensure learners achieve the grade they deserve to achieve, irrespective of variation in the external assessment.

Variations in external assessments

Each external assessment we set asks different questions and may assess different parts of the unit content outlined in the specification. It would be unfair to learners if we set the same grade boundaries for each assessment, because then it would not take accessibility into account.

Grade boundaries for this, and all other papers, are on the website via this link:

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Unit 1: Construction Principles

Grade	Unclassified	Level 3			
		N	P	M	D
Boundary Mark	0	12	25	38	51

Introduction

This was the second series for the Unit 1 Construction Principles examination, with the examination being in the same format as June 2018, which is a traditional paper-based examination with a number of different styles of question.

The question paper followed the format identified in both sets of sample assessment materials and also the June 2018 paper. The focus of the paper being on a range of questions that assess construction materials, the application of mathematics and human comfort. The range of questions will change each examination series with the aim of covering all of the topics listed within the specification. It is important for centres to remember that, due to nature of the specification, they will need to ensure that learners are given the opportunity to become familiar with the processes of producing written explanations, the approaches to adopt when answering extended writing questions and skills needed to address questions involving calculations.

The paper had 5 questions. Each question was based on construction related scenarios, with each question having multiple parts. Learners were required to demonstrate knowledge and understanding of a range of specification topics and to apply this knowledge to the specific question scenario. The intention was to offer as broad a coverage as possible for all areas of the unit content. Questions had varying weightings attached to them, with 1 to 4 marks for the lower demand questions and up to 12 marks for questions where an extended response was required, such as questions where information needed to be interpreted and knowledge drawn from multiple areas of the specification.

Each of the questions that involved calculations was marked using both method

(M) marks and accuracy (B) and (A) marks, as shown in the mark scheme. The short written response questions were point marked against mark schemes with linked responses being required for explain questions, whilst longer questions were assessed using a levels-based mark scheme. A small number of questions were multiple choice for which learners had to select the correct answer from four alternative options.

Introduction to the Overall Performance of the Unit

Learner performance was generally consistent across the paper, although when answering the longer open questions, learners performed less well as a result of their synoptic nature. Overall, there was evidence of learners having been taught well across the range of unit content, with most learners attempting all of the questions. It was positive to see that there were examples of full marks being

awarded for the majority of the shorter response questions, whilst in general learners answered the longer questions better than they did in June 2018.

It is important that learners are given the opportunity to practice responding to shorter and/or lower demand questions as well as the applied calculation questions that relate to aspects of human comfort as exemplified in Learning Aim C. When completing calculations it is important to show working as this allows access to 'method marks' should the solution be incorrect.

Learners responded well and provided clear responses to the majority of the questions in the examination with many being able to achieve marks allocated for identification for written 'explain' questions even where the lead point was not justified or expanded upon. It is important that learners are prepared fully for the examination and have the opportunity to practice questions of the various types that were used in this paper and other examination papers that are available.

Individual Questions

Question 1

This question was in four parts and was related to a warehouse constructed from pre-fabricated steel sections. Learners performed with mixed success across the four parts of the question.

1(a)

This question was generally answered well by learners, with the majority being able to identify that workability was the property that allows concrete to be fully compacted. This was a multiple choice question and learners were able to make an appropriate choice from the four options available to them, although malleability was a common incorrect selection.

1(b)

Learners performed with less success on this part question. Many learners made reference to steel having good compressive strength, or that pre-fabrication allows for the frame to be constructed off site which reduces construction time.

Those learners who were awarded two marks, answers tended to consider the two points above, or reference the ability to provide long clear spans.

(b) State **two** advantages of using steel for the structural frame of the warehouse.

(2)

1 ALLOW LARGE SPANS

2 QUICK TO PUT BUILDING UP

This response gained 2 marks

The learner has not stated two responses that are linked to those suggested in the mark scheme. Note that for 'state' questions short answers are acceptable, and there is no necessity to answer in a full sentence.

1(c)

Learners took a wide range of approaches to answering this question, with a number considering a large rectangular site which they then subtracted the two triangular sections, or one rectangle on to which they added the area of the triangular section of the wall. Although the number of approaches was varied, in many cases the correct area was calculated. Where learners failed to achieve higher marks they either omitted one of the sections, or they made arithmetic errors in their working.

This response gained 5 marks

$$\begin{array}{l} 12\text{m} \times 40\text{m} = 480\text{m} \\ 18 \times 3 = \frac{54}{2} = 27\text{m}^2 \\ \text{Rectangle area} = b \times h \\ \text{Triangle} = \frac{b \times h}{2} \\ 480\text{m}^2 + 33\text{m}^2 + 27\text{m}^2 = \underline{540\text{m}^2} \end{array}$$
$$\begin{array}{l} 40 - 18 = 22 \\ 22 \times 3 = \frac{66}{2} = 33\text{m}^2 \end{array}$$

In this example the learner has followed good practice to show the various stages of their working which allows access to method marks. The learner has gained two method marks for the areas of the rectangle and the triangles, a further method mark for the process of adding the areas together. Two accuracy marks are also awarded for the correct answer and the correct unit.

Where a question asks for the unit to be stated, this must be fully correct to be awarded the mark.

1(d)

This was another calculation question where learners were required to use an appropriate approach to calculate the missing dimension for the slope length for one side of the roof. A number of approaches were used by

learners including the use of trigonometry, however Pythagoras' Theorem was the most common approach used.

This response gained 3 marks



$$a^2 + b^2 = c^2$$

$$18^2 + 3^2 = c^2$$

$$324 + 9 = c^2$$

$$333 = c^2$$

$$18.24828759 = c \xrightarrow{2DP} 18.25 \text{ m}$$

The learner has again shown their working, although not fully. They have been awarded one mark for populating the formula correctly with the values given in the diagram. Two further marks are awarded for the rearranging of the formula, although this is implied, and the correct answer. Note that although the question does not ask for a specific number of decimal places, the learner has stated their final answer to an appropriate degree of precision.

Question 2

This question was in three parts and was related to a project to construct a two-storey shopping centre. Learners performed with some success across the various parts of the question.

2(a)

Most learners achieved the one mark that was available for stating one performance related benefit of using discharge lamps in the shopping centre. As a 'state' question single word answers were again acceptable. Common correct answers included those related to energy efficiency, larger areas being able to be illuminated and longer life spans compared to alternatives.

2(b)

Learners performed with varied success on this question with the full range of marks being awarded to learners. Where learners did not achieve the higher marks the causes for this tended to be because they confused float glass with either tempered glass or smart glass, both of which have featured in either the sample materials or previous examinations.

As an explain question, learners need to identify a relevant point and then expand on this to show either a justification or deeper understanding.

This response gained 3 marks

(b) Explain **two** properties of float glass that make it suitable for shop display windows.

(4)

1. The First property of float glass is that it can come in different colour meaning it can suit with the shop display. It will also be transparent.
2. The second property is that float glass can come in large sheets meaning for large window display for the shop.

In this example the first response is an interpretation of the first part of BP8 in the mark scheme. There is a further identification (transparent) however this does not gain credit as all available identification marks have been awarded. The second response does however gain two marks, with this being an interpretation of the bullet point 3 in the mark scheme.

2(c)

Learners had somewhat less success with this question. In some cases the responses were limited to stating that the consideration of both dead and live loads would be needed to prevent the building from collapsing. In many cases answers were generic, or they provided a description of what dead and live loads are, which was not asked for in the question.

This response gained 3 marks

(c) The architect has calculated the loadings on the upper floor of the building.

Explain **two** reasons why the architect would need to consider the dead and live loads on the upper floors of the building.

(4)

- 1 The architect needs to consider the dead load and the live load because he needs to make sure the 2nd floor is supported properly as it may collapse and cause injuries to people.
- 2 another reason why is because he needs to use the right material that ~~can~~ has a high compressive strength so the 2nd floor is supported properly.

The learner has given one linked response in their first answer which can be awarded against bullet point one in the mark scheme. The second response lacks a justification, however one mark can nonetheless be awarded for recognition that dead and live loads can be used to design suitable materials which is linked to the first part of bullet point 3 in the markscheme.

3(d)

This was a further calculation question. Learners were provided with information about a square concrete column and then asked to calculate the stress in each column. The majority of learners performed well on this question, with a large proportion achieving the three marks available. Where learners did not achieve full marks this was often due to misinterpreting the information in the question, or making errors in their working.

Question 3

This question was in four parts and was related to a design and build project for a motorway service area.

3(a)

Part (a) of the question focused on materials that would be suitable for the roof of the various buildings that make up the service station. Learners were required to be specific, therefore answers such as tiles were not accepted, however clay tile or concrete tile was. Typical responses included slates, metal sheeting, clay tile and concrete tile. The majority of learners were able to access the one mark available for this question.

3(b)

Part (b) assessed learners knowledge of equipment used within construction activities. In this example learners who achieved the one mark available typically gave decibel meter or similar as their answers. Those learners who stated 'sound meter' did not gain any credit as this was cued by the question.

3(c)

Learners were tasked with explaining the use of smart glass within buildings. Learners had some knowledge and understanding of smart glass, however often there was confusion with other types of glass listed in the specification such as toughened glass or tempered glass. Where learners achieved higher marks they were able to identify one benefit of using smart glass, for example the ability to reduce solar gain, and describe how this is a benefit, such as reducing the energy requirements of the building.

This response gained 3 marks

(c) Explain **two** ways in which sound insulation can be included in the design of the buildings.

(4)

1 One way is to include double or triple glazed windows so that less sound can go through the windows

2 Another way is to include good seals on windows, doors and walls so sound is less likely to travel through

The first response can be awarded one mark as it recognises that double or triple glazing will reduce the amount of sound in the building, but does not state how it achieves this which means the second mark cannot be awarded. The second answer can however be awarded two marks. The learner has recognised that seals will prevent sound from travelling through. This is a linked response therefore two marks can be awarded.

The learner has identified two points, and has expanded on both of these. The expansion is appropriately linked to the leading point in each case and there is no repetition. The answers are linked to the scenario which is required to be awarded both marks for each response.

3(d)

This is the first of two longer open questions where learners need to draw together information provided in the scenario with their wider knowledge of construction principals. Learners are assessed through a level-based mark scheme where they need to demonstrate their application of knowledge; the mark awarded reflecting their ability to consider the factors highlighted in the question and demonstrate their knowledge and understanding of concepts related to the scenario.

Learners need to become familiar with this type of question and the method by which they are marked.

This response gained 6 marks and is an example of a band 2 response

(9)

The service station will have different types of structure for different needs ~~such~~ such as shops, ~~dining~~ dining areas and petrol filling stations, ~~de~~ depending upon which the lighting levels ~~need to~~ are needed.

The dining areas require slightly less brighter lighting and preferable because people would like to relax ~~to~~ to some extent while dining, which can be disturbed if the lighting levels are too high. Preferably natural lighting is more suitable in the dining areas as ~~they~~ natural lighting is healthier for people as ~~the~~ some ~~more~~ modern artificial lighting can cause eye damage. And ~~the~~ people ~~would~~ would most probably spend majority of their time in the ~~the~~ dining areas ~~the~~ than any other areas of ~~the~~ the service area. ~~Transparent~~ Transparent ~~glass~~ or float glass can be used. ~~Natural lighting can also be used in the shops.~~ Natural lighting can also be used to allow natural lighting in.

In the petrol filling station, the lighting levels should be high, as there are tools that needs **(Total for Question 3 = 15 marks)** to be clearly visible to prevent accidents as well as the movements of the vehicle needs to be visible. Natural lighting can be used at day times as the station ~~is~~ will be open outside, which saves energy. But at ~~the~~ night, artificial lighting.

The learner demonstrates a good understanding of how lighting levels may need to differ within the building. In this response they have demonstrated accurate knowledge and understanding of the relevant requirements for lighting levels related to the different activities in different areas of the buildings for example high levels in the shops where goods are displayed and low levels in the dining area where customers relax.

The learner demonstrates their use of logical reasoning when considering the use of the different areas, the relevant movement of people and traffic and relates them to health and safety. This is indicative of a response at the top end of mark band two.

Question 4

This question was in five parts with a scenario based around an athletics track and its related infrastructure.

4(a)

To answer 4(a) learners needed to interpret graphical information provided for the results of tensile tests on three different materials. Most learners were able to interpret the results with success and correctly identified steel as being the material with the highest modulus of elasticity.

4(b)

The focus of part (b) was on ways in which exposure can cause degradation of construction materials. The question was not specific to certain types of material, therefore answers related to a range of different types of material were acceptable. Many learners made reference to freeze-thaw cycles and the effects on concrete or corrosion and metals.

This response gained 4 marks

- (4)
- 1 Exposure to high heat and sunlight can cause the degradation of construction materials as UV rays from the sun can break the molecular bonds of materials through radiation and therefore lead to degradation.
 - 2 If the materials are subjected to cold and ice this can lead to freeze thaw as the voids and gaps in the materials will expand and cause cracking and lead to degradation.

The learner has been awarded 4 marks for their answer. They have given two linked responses as required for an 'explain two' question. The first response relates to the first bullet point in the mark scheme and recognises the effects of UV and sunlight on materials. The second response shows a good understanding of freeze-thaw effects on concrete and is also awarded 2 marks.

4(c)

Learners performed with some success for this question. Many were familiar with the properties of high density concrete blocks and were therefore able to link a property or quality of the blocks to the application in the changing rooms. Many learners made reference to the compressive strength of the blocks, or their ability to provide privacy for occupants of the changing rooms.

This response gained 4 marks

(c) The changing rooms will have high density concrete block walls.

Explain **two** reasons why high density concrete blocks are suitable for use in the changing rooms.

(4)

1 They are suitable as they have a high compressive strength meaning they would be able to support the loads of the building and any live or dead loads the building might have.
2 Another reason is because they are moisture and vapour resistant this is essential for changing rooms as there ~~are~~ is most likely going to be showers in them.

The learner has identified two appropriate reasons why high density concrete blocks are suitable for use in the given situation. Both reasons are different, which is required when two explanations are needed. Each has also been justified with answers that link the qualities of the blocks to their use in changing rooms. It is important to make sure that justifications relate to the scenarios in the question, as has been done by the learner here.

4(d)

A significant number of learners were able to explain one advantage of underfloor heating for the changing rooms. In most cases this was related the increased amount of space available due to the lack of pipework and radiators. Other responses made reference to the fact that heat rises through convection and this then allows the whole of the room to be heated.

This response gained 2 marks

(d) Explain **one** advantage of using underfloor heating for the changing rooms.

(2)

because heat rises the whole room
will be heated

Although brief, the learner has recognised that the effects of convection will be that the whole of the room is heated. This shows an appropriate level of understanding, and is linked to the application of the underfloor heating in the changing rooms.

Question 5

The final question on the paper is based around a scenario where a range of information is provided to learners. This includes information about construction details of a building and climatic information for the location where a building is located.

5(a)

The first part of the question relates to performance characteristics of damp proof membranes that would be used for the houses in the given location. Many learners were able to identify one performance characteristic, although in many cases these lacked expansion. Where learners did not achieve marks this was often as a result of lacking understanding of the use of damp proof membranes and how they are used in dwellings.

This response gained 4 marks

- (a) The construction company plans to install polythene damp proof membranes (DPM) in each of the homes.

Explain **two** performance characteristics of polythene DPMs.

- (4)
- 1 Polythene DPM prevents damp from getting through into the internal elements of the building. The polythene membrane doesn't allow damp liquids through due to the hard coating.
 - 2 The Polythene DPM is also malleable meaning it can be shaped to all the different areas and crevices of the building.

In this example the learner has identified two appropriate characteristics of damp proof membranes as used in homes. The reference to preventing damp from entering has been justified appropriately, whilst consideration of the flexibility of the material to allow it to be shaped according to needs is also justified with examples. Both answers are linked to the scenario and draw together the characteristics of the material and the application.

5(b)

This question focussed on the application of arithmetic skills to determine thermal resistance values for materials, and then the U-value of the wall. Within Learning Aim C of the specification there are a number of topics where learners are expected to be able to apply scientific concepts to solve construction related problems. This is one such example, with learners being asked to complete the table and then calculate the final U-value of the wall.

This response gained 6 marks

Layer	Thickness (m)	Conductivity (W/mK)	Thermal resistance (m ² K/W)
Surface resistance			0.12
Plasterboard	0.025	0.14	0.18
Mineral wool	0.100	0.04	2.5
Insulation board	0.020	0.03	0.67
Cavity			0.18
Facing brick	0.113	0.84	0.13
Surface resistance			0.06
Total thermal resistance			3.84

Figure 6

(ii) Using the information from Figure 6, calculate the U-value of the wall.

(2)

$$\frac{0.14}{0.025} = 5.6$$

$$\frac{0.04}{0.100} = 0.4$$

$$\frac{0.03}{0.020} = 1.5$$

$$\frac{0.84}{0.113} = 7.43$$

$\frac{1}{3.84} = 0.26$

$$5.6 + 0.4 + 1.5 + 7.43$$

$$= 14.93$$

$$\frac{1}{14.93} = 0.067$$

The learner has achieved the full 4 marks available for part (i) as they have fully completed the table with the correct thermal resistance values and also added these to arrive at the correct total. It is important when completing tables such as this that the figures entered are accurate and do not show inaccurate rounding. The learner has also calculated the final U-value correctly, and has shown their working. This allows 2 marks to be awarded for part (ii)

5(c)

This is the final question on the paper. The question needs learners to draw together aspects of information about the construction of the building and the local climate to provide an evaluation of the materials and processes used and their suitability for the location.

To achieve higher marks learners need to make suitable links between the information they have been provided with to justify the material used with respect to their properties and working characteristics. To achieve higher marks each material and building element that has been included in the information booklet must be considered, with an answer that draws on the related underpinning knowledge from the unit content.

Looking at the figures from 3, 4 and 5 I have identified that the winter average mean temperature is 5 to 6°C and the annual average wind speed is 20-25 knots, the average maximum temperature is 13.1°C and the minimum is 7.6 the days of frost are 1 or 2 days and the sunshine hours are 137 hours annually average. The average days of rainfall throughout the year is 70 days therefore I can conclude that looking at the location is its average however there is a high amount of rainfall. Evaluating the use of these combined materials first facing bricks are a material that has high aesthetic appeal and are water resistant, therefore they are a good material to use. They also have high compressive strength and high toughness. The insulation board and cavity as well as the mineral wool insulation provide good thermal barriers however I believe this is a waste of resources and money due to the amount of sunshine hours being higher than average. Steel studs will provide good foundation and structure as they have high compressive / bending strength.

This is an extract from a response that gained 6 marks from band 2

In this extract the learner has demonstrated a good understanding of the construction principles involved. They have included arguments for and against the construction method and the materials used, these being described with some accuracy. There is however more emphasis on one side than other forms of construction which results in an answer that is rather unbalanced. All of the

points made are however relevant to the situation in the question, and has been assessed as being in mark band 2.

Summary

Based on their performance on this paper, learners should:

- Attempt all questions on the paper as marks are often awarded for partial solutions.
- Show working in full for calculation as this allows access to method marks. If arithmetic errors are made then marks can still be awarded
- Avoid excessive, or inaccurate, rounding when completing calculation.
- Provide linked responses for 'explain' questions. An initial lead point should always be expanded upon with either an expansion or a justification.
- Develop answers for the longer open response questions, making use of the information provided in the scenario and the information booklet
- Question papers are designed with sufficient space to provide answers that will achieve maximum marks; there is no need to add additional pages to the answer booklet.

Centres are reminded that learners must not submit the information booklet with their answer booklets.

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