

# Level 3 Lead Examiner Report 1906

Summer 2019

**Level 3 National in Construction  
and the Built Environment**  
***Construction Principles (Unit 2)***

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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:

<http://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html>

### Construction Principles

Grade	Unclassified	Level 3			
		N	P	M	D
Boundary Mark	0	9	19	34	50

## Introduction

This was the third series for the Unit 1 Construction Principles examination, with the examination being in the same format as both previous examinations, which is a traditional paper-based examination with a number of different styles of question. There was a significant increase in the number of learners taking the examination in June 2019 compared to both previous series.

The question paper followed the format identified in both sets of sample assessment materials and also the past examinations. 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 (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. One question was 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, performance was slightly lower than in both previous series, potentially due to the larger number of learners new to the qualification. There was evidence of learners having been taught well across the significant parts of unit content, with most learners attempting all of the questions; it was however recognised that questions related to acoustics were often less well answered. 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 both previous examinations.

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 many 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 five parts and was related to a new building for a college with a variety of different types of room. 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 embedded energy was the term used to describe the total amount of energy used to produce a construction material. This was a multiple choice question and learners were able to make an appropriate choice from the four options available to them, although potential energy was a common incorrect selection.

#### 1(b)

Learners performed with less success on this part question. Many learners seemed to be confused between echoes and reverberation time. Where learners achieved marks they tended to make reference to the time for sounds to die away, linking this to being absorbed or the amount by which the sound level reduced.

This response gained 1 mark.

(b) The lecture rooms need to meet certain acoustic performance requirements.

Describe what is meant by reverberation time.

(2)

The time taken from the moment a sound originates until the sound can no longer be heard or measured.

The learner has identified that reverberation time is the time taken for sound to no longer be heard, but has not expanded on this. To achieve the second mark the answer would need to have further expansion of this point.

### 1(c)

Learners took a wide range of approaches to answering this question, with a number considering a large cuboid with a triangular section removed, or a small cuboid with an additional triangular prism. Some learners considered the average height of the room and completed the calculation in one stage. It was positive to see learners showing their working in full, which allowed method marks to be awarded for partial solutions. 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 6 marks

The image shows handwritten work on a whiteboard. It includes a small drawing of a cuboid and a triangular prism. The calculations are as follows:

$$\begin{aligned} \text{Cuboid} &= 4 \times 8 \times 10 = 320 \text{ m}^3 \\ \text{Triangular Prism} &= \frac{4 \times 8}{2} \times 10 = 80 \text{ m}^3 \\ &= \underline{400 \text{ m}^3} \end{aligned}$$

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 marks for the volume of the cuboid and three marks for the volume of the triangular prism. The correct answer has been stated for a further mark.

### 1(d)

This was the first 'explain' question on the paper. The focus was on how a thermostat controls temperature in a room, rather than how to use a thermostat. The latter was the approach taken by a large number of learners, as such they were unable to access the marks available. To achieve marks, learners were required to recognise that a thermostat senses the temperature in a room, and then controls the heat output to maintain the desired temperature.



This response gained 2 marks

(d) The temperature of the lecture rooms will be controlled using a thermostat.

Explain **one** way a thermostat controls temperature.

(2)

a thermostat controls temperature by  
 detecting the temperature of a room and  
 switching off the heating once the room  
 has reached the required temperature

The learner has recognised that the thermostat 'detects' the temperature in a room, and links this to switching off the heating once the required temperature is reached. This is an appropriate interpretation of the mark scheme and has been rewarded with both of the available marks.

### 1(e)

This was a further 'explain' question. The focus was on noise criteria indices, and asked learners to explain two reasons why they should be considered when designing a new building. A proportion of learners answered with generic responses related to noise pollution, or sources of noise, as opposed to reasons for considering noise criteria indices. Where learners did achieve marks they often made reference to different acoustic requirements of the various spaces, or that materials could be specified based on the requirements of different types of room.

This response gained four marks.

(e) Various areas of the building will have different acoustic requirements.

Explain **two** reasons for the need to consider 'noise criteria indices' when designing the new building.

(4)

- 1 One part of the building will have a different use than others so the noise criteria indices need to be looked at when designing the rooms to suit so that they are built to the specific regulations regarding noise transmission and insulation.
- 2 Another reason to look at the noise criteria indices is to ensure that the correct materials are selected when designing the building, certain materials will transmit sound more easily than others, and different insulation is better than others for noise insulation.

The learner has recognised that different rooms will have different uses and that the specific noise criteria indices for these rooms is set out in regulations. They have also recognised that the use of noise criteria indices allows appropriate materials to be specified to meet acoustic insulation requirements.

## Question 2

This question had more of a civil engineering context, with the focus being on access roads and related structures.

### 2(a)

This question was generally answered well by learners, with most learners being able to state a component of concrete. The full range of answers in the mark scheme was seen, along with some specific additives which also gained the mark available. Where learners did not achieve the mark available they tended to state a property of concrete as opposed to a component.

### 2(b)

Learners performed with varying degrees of success on this question. In a number of examples, learners did not seem to be familiar with the approaches to follow when solving problems including simultaneous equations. Many made errors in balancing the expressions, or substituting from one equation to the other. Those learners who were more confident with the method to use tended to achieve four marks.

This response gained 4 marks.

$y = 2x - 8$      $\rightarrow$      ~~$y = 2x - 8$~~      $y = 2x - 8$     ①  
 $y = x + 3$      $\rightarrow$      ~~$y = x + 3$~~      $y = x + 3$     ②  
 ~~$2x - 8 = x + 3$~~   
 $2x - 8 = x + 3$   
 $2x = x + 11$   
 $x = 11$   
 $y = 11 + 3$   
 so  
 $y = 14$   
 $x = 11$   
 $14 = 22 - 8 = \text{true.}$

Although somewhat untidy, the learner has followed an appropriate method to complete the solution. They have correctly found the value for  $x$ , and then substituted this to find the value for  $y$ . All four marks have been awarded despite the answer not being presented as coordinates. Note the learner has demonstrated good practice by checking the accuracy of their answer ( $14 = 22 - 8 = \text{true}$ ).

**2(c)**

Learners performed well on this question, with a large proportion able to identify two ways in which brickwork can fail. There was less success when providing an expansion to the initial point. In general this would be expected to be an explanation of how a particular failure mode causes the brickwork to fail, or what the cause is.

This example gained 4 marks.

(c) A retaining wall is to be constructed from brickwork.

Explain **two** ways in which brickwork can fail.

(4)

1. Freeze thawing can cause a failure in brickwork - where water gets into cracks within bricks, and freezes - up on doing so it expands. This is also known as spalling.

2. Movement of the surrounding landscape and the retained earth can destabilize the brickwork. This movement could lead to additional strain on the mortar which would consequently crack.

The learner has identified freeze-thaw and movement of the ground on which the wall has been built as causes of failure. Each has been expanded upon appropriately. Note that the second response is effectively reversed - the failure mode is cracking and ground movement is the cause. Provided learners provided a linked response, such as this, then answers which are presented in this way will gain credit.

### Question 3

This question was focussed on the refurbishment of parts of a health centre and assessed learners knowledge and understanding of a range of materials and also simply supported beams.

#### 3(a)

This question was answered with some success by learners, with most learners being able to recognise properties of aerated concrete blocks that make them suitable for internal walls. Where learners did not achieve the marks available they tended to provide answers which were generic and lacked the required focus on the internal wall aspect of the question. As such, answers that considered compressive strength or thermal resistance

were not appropriate. Many learners did however recognise that the aerated concrete blocks offered sound insulation or were sufficiently durable for the location.

This response gained 3 marks.

1 They are commonly large in sized. This would increase the surface area that can be filled therefore speeding up the construction of the wall. This would limit the amount of disruption on the health centre and its customers.

2 ~~concrete~~ They have very good fire resistance. This would help to ensure if a fire breaks out in a room - evacuation time can be optimised by ~~maintain~~ containing the fire into certain areas - improving the building's overall fire rating.

The first response gains one mark for reference to reduced construction time, but has not been developed sufficiently for the second mark to be awarded. The second answer links fire resistance to increasing the time available to escape. This is an appropriate expansion to allow a further mark to be awarded.

### 3(b)

Learners were less familiar with the approach to answer this question about a simply supported beam than they had been for other maths-based questions on the paper. The question included only a uniformly distributed load, although a number of learners added point loads. There were often mistakes when taking moments, or resolving the forces.

This example gained 4 marks.

$$(R_A \times 0) + (5000 \times 1.25) = R_B \times 2.5$$
$$6250 = R_B \times 2.5$$
$$\frac{6250}{2.5} = R_B$$
$$R_B = 2500$$
$$5000 - 2500 = R_A$$
$$R_A = 2.5 \text{ kN}$$

The learner has calculated the total loading due to the UDL and taken moments around the left hand support. The correct mid point of the UDL has been identified, and the learners has completed the calculation with accuracy. As is recommended, the learner has shown their working in full.

### 3(c)

Learners performed with varying levels of success on this question. The question asked for explanations of why obscured glass is suitable for internal windows in the health centre. Many learners recognised that it provided privacy and allowed light to pass, but often each of these was expanded upon with a repetition of the same point. Very few learners made two separate points and justified them.

This example achieved 2 marks.

1 The manufacturing of the glass means people from the outside of the room can't see inside properly. This will give patients much needed privacy so they don't feel exposed.

2 As the glass is still transparent it will allow plenty of natural light into the building. This will light up each room without the use of artificial light which saves money and makes for a good aesthetic.

The learner has recognised in their first answer that obscured glass provides privacy, however they have then explained why privacy is needed as opposed to why obscured glass is suitable. Similarly in the second response they have identified that the glass still allows natural light in, but again links this to a generic answer of reducing the need for artificial light instead of an answer specific to the application.

### 3(d)

A wide range of responses were provided by learners, with a significant proportion achieving marks in band three. To reach this mark band answers needed to link together each aspect of the source-path-receiver approach and how it can be used to prioritise methods of reducing noise. The higher scoring responses considered each aspect in detail, and suggested approaches to be taken at each stage. These were often supported by good technical knowledge that was applied to the situation. Some learners achieved marks at the lower end of the mark range by suggesting ways of reducing noise at the source, or providing PPE for the workers.

This is an extract from a response that achieved 7 marks.



This approach is a very effective way to reduce sound contamination. It is important to locate the sound at its source before it has dispersed too greatly. It is likely that the mechanical plant room will generate high noise levels - which may inconvenience those using the facility. In this case this would be the source. Any location in the medical centre where the noise can be heard - would be classed as the receiver - whilst the path is identified as the way in which the noise reached the receiver would also be the maintenance worker. By determining the source of the noise - appropriate reduction methods can be explored. Depending on the sound generated - several barriers to enclose such can be used. Often noise barriers - such as insulating panels can be used to enclose the source which

The learner has recognised the importance of identifying the source, the path and the receiver. They have identified that the first stage should be to determine the source and attempt to reduce noise using enclosures or barriers. The answer continued to develop approaches for both the path and the receiver before a concluding comment related to which was most effective and appropriate. When answering questions where a number of factors need to be considered, it is important that all are included in order to achieve their higher mark bands.

## Question 4

The focus of question 4 is a leisure centre which includes a number of different spaces. There were three parts to the question, including the final calculation on the examination.

### 4(a)

This question was generally answered well by learners, with many being able to select the correct formula from the information booklet and then substitute the correct values from the question.



Where learners failed to achieve full marks their either did not use the extension of the cable, but the new overall length, or they inverted the values in the formula.

#### 4(b)

Question 4b tested learners understanding of one of the types of lamps in the unit content, in this case fluorescent tubes. A number of learners appeared to misread the question and stated an advantages, whilst others implied the heat of the tubes would increase the temperature of the food in the snack bar. Where learners did achieve marks this was often due to factors related to energy efficiency, or issues related to the tubes flickering.

In this example, the learner achieved 1 mark.

Artificial light will never be as pleasing aesthetically as natural light. Even so fluorescent tubes are not as efficient as energy saving bulbs and their large size again doesn't look great.

The learner has recognised they are not as energy efficient as alternatives, however no specific alternative has been given. This has limited the achievement to one mark.

#### 4(c)

Many learners achieved high marks on this question. The question related to heat gains within a sports hall, so responses related to physical activities within the hall or equipment generating heat were appropriate. Some learners considered methods of retaining heat or providing heat in the sports hall. Such answers did not achieve any marks; it is important that learners fully understand the focus of individual questions when giving their answers.

This response achieved 4 marks.

- 1 Heat from people playing sport, being active and sweating can cause heat gain if there are enough people.
- 2 ~~# bright light~~ ~~back of~~ If bright lights are being used they may let off some heat as waste energy. (Also we don't know how good ventilation is).

The learner has recognised two sources of heat in the sports hall, and has explained how each of these contribute to heat gains. Each response can thus be awarded 2 marks.

### 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 thatch as a roofing material that would be used for the houses in the given location. Many learners were able to identify one performance characteristic of thatch, although in many cases these lacked expansion. Where learners did not achieve marks this was often as a result of lacking understanding of the specific use of thatch as a roofing material, or were generic in nature.

This response achieved 4 marks

1 Thatch roofs are suitable because when its cold the thatch roof keeps the heat in and when its warm it keeps the hot air out.

2 Thatch roofs are suitable because their isn't a lot of rainfall where the 'x' is located, compared to the other parts of the country.

The learner has identified that thatch provides good insulation and has linked this to being able to keep the homes cool in summer. The second answer recognises the limited amount of rainfall in the location, which is linked to the waterproof properties of a thatch roof.

### 5(b)

Learners were asked to explain three ways in which the daylight factor inside the holiday homes could be improved. A number of learners made similar points such as increasing the size of window and increasing the number of windows; this type of answer was only rewarded once. A wide range of answers were provided by learners including the provision of skylights, removing obstructions, and allowing internal reflections. Each of these was often explained to some extent to achieve the second mark available for each point.

This example was awarded 4 marks.

- 1 Arrange the buildings to ~~be~~ <sup>have</sup> south facing gardens. This means it will benefit from long hours of daylight - with the sun rising in the east and setting in the west.
- 2 Use large windows particularly in south facing walls to benefit from daylight - and ensure such outside light levels are repeated internally of the building. Roof-sky lighters within the Thatch could be used to funnel light internally.
- 3 Avoid building the homes too close together - as this could affect light levels leading into a property - this too could be affected by tall landscaping externally.

No marks were awarded for the first response as the orientation of the building does not affect the daylight factor inside the homes. The other two responses have however been explained in an appropriate level of detail to be awarded two marks each. It is important that when answering questions where several responses are needed, learners do not repeat the same points.

### 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.

This is an extract from a response that gained 9 marks from band 3

- > the timber cladding is a strong durable material which protects the house from the elements as it is water-proof, frost-proof and will be able to handle the windload, this is good characteristics as the location suffers a lot with rain-fall and wind. ~~It can~~ also it can also be coated for aesthetic purposes to attract buyers. however it can be effected by UV light as the colour/grain will fade, something to consider as there is a lot of sun in the ~~top~~ location.
- > particle board is a good sustainable material as it is made from old, unused wood. it provides good insulation properties as it acts as a barrier preventing heat from being lost. particle board is durable so will be able to carry out it's function for a long time. It is a light weight, completely smooth man-made surface so can be made to size and shape, making it a good material to use. It is not negatively effected by moisture which is essential as there is a lot of rainfall in this location. It is a relatively cheap material so is cost effective in designs like figure 5 where it is used in abundance. it is easy to use and work-with meaning it is not labour intense and is quick to do.

In this response the majority of points made are relevant and there is a clear link to the situation in the question. Although not shown in the extract, each of the materials used for the construction have been covered. Whilst there is no formal conclusion the learner has produced reasons why the materials are suitable. The learner has provided some evaluative elements throughout their work and there are some conclusions throughout the body of the work.

## 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 questions.
- 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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