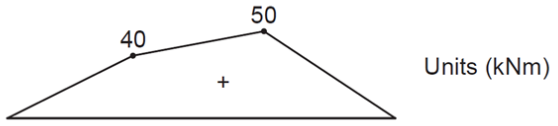
6720-556 March 2018

6720-37 Level 3 Advanced Technical Extended Diploma in Constructing the Built Environment (Civil Engineering) (1080)

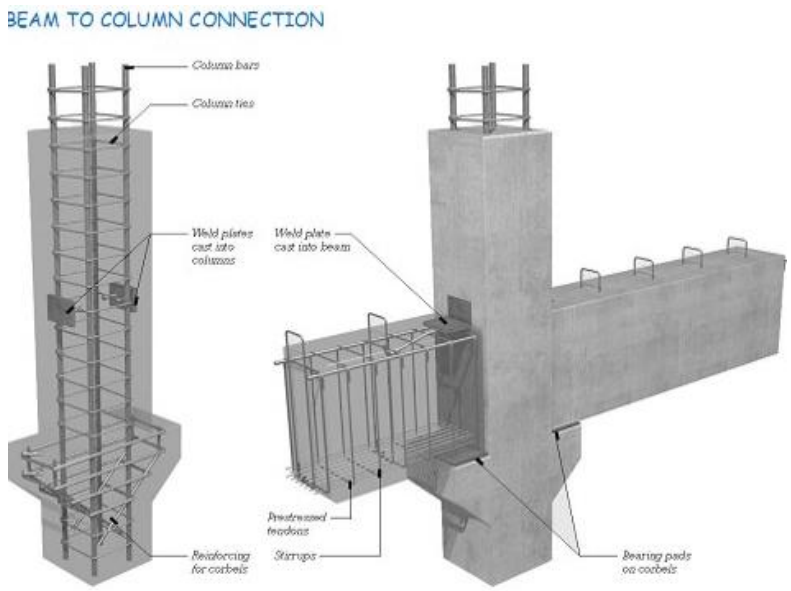
Q	Acceptable answer(s)	Guidance	Max marks
1a)	Point load.	Accept concentrated load.	**1**
1b)	Uniformly distributed load (UDL).	n/a	**1**
2a)	A = 20 x 2 = 40 kNm (1) B = 2 x 25 = 50 kNm (1)	n/a	**2**
2b)	 Correct shape (1). Labelling values (1)	n/a	**2**
3	**One** mark for each: M = Maximum bending moment (1), accept moment (1) f = permissible stress I = moment of inertia or second moment of area (1 for either), accept inertia (1) y = depth of neutral axis (1) accept depth of centroid (1)	n/a	**4**
4a)	mm3 **or** length to the power of 3 (1)	n/a	**1**
4b)	mm^4 **or** length to the power of 4 (1)	n/a	**1**
5a)	$I_{xx} = BD^3/12 - bd^3/12 = (140 \times 320^3/12)$ (1) - $(128 \times 270^3/12)$ (1) $= 3.82 \times 10^8 - 2.095 \times 10^8$ $= 1.72 \times 10^8$ (1) mm^4 (1)	n/a	**4**
5b)	M/I = f/y so M= fI/y (1) = $165 \times 1.72 \times 10^8/160$ (1) = 1.774×10^8 (1) mm = 177.4 kNm (1)	n/a	**4**
6	**One** mark for each of:	n/a	**2**

	• Associated Risk- Explosion leading to injury or death (1) • Control Measure- Locate underground services (1) • Use of local gas company plans to find the location of services • Use of CAT (cable avoidance tool) Any other suitable answers.		
7	**One** mark each for: (i) wearing course (ii) base course (iii) sub-base or roadbase (iv) sub-grade	n/a	**4**
8	An explanation of the following. Marks as shown to a maximum of **three** marks in total. The pavement is noisier to drive along as a result of the need to provide a rough riding surface (1) due to the need to provide skid resistance (1). More complex specification form (1) as joints are required for contraction and expansion (1). High repair/maintenance costs (1) as usually greater sections of the pavement, compared to a flexible pavement, needs to be cut out (1).	Accept any other appropriate answer.	**3**
9a)	Any **three** from: • Health & Safety at Work Act • CDM Regulations • Health & Safety Management Codes L21, L144 • Control of Substances Hazardous to Health (COSHH) Accept any other appropriate answer.	Accept Manual handing and working at height.	**3**
9b)	Any **two** of the following. **One** mark for an identified advantage and **one** mark for a linked response. Maximum **four** marks. • Reduced wastage on site (1) because components are made to measure (1) • Lower installation costs (1) speed of erection/use of less skilled workforce (1) • Minimises impact on the local environment (1) due to reduced construction traffic etc. (1) Accept any other appropriate answer.	Do **not** accept reduction in disturbance to the public as it is not a reason why it is used.	**4**
10	Any **two** of the following. **One** mark for an identified advantage and **one** mark for a linked response. Maximum **four** marks.	n/a	**4**

	• economical (1) when bearing capacity of soil make strip unsuitable (1) • less excavation required (1) resulting in less disposal of off-site surplus material (1) • minimal impact on the ground (1) reduces the risk of sites of archaeological interest being disturbed/encountering further poor ground conditions (1) Accept any other appropriate answer.		
11a)	Any **two** at **one** mark each, from the following: • Plans, elevations • Sections • Block plans • Site plans • Location plans • Assembly drawings. The following answers are also acceptable: • Free hand sketches/drawings (1) • Manual paper-based drawings (1) • CAD drawings (1) • Orthographic (1) • Isometric (1) • Axonometric (1)	n/a	**2**
11b)	Any **two** at **one** mark each, from the following: • Segmental • Lancet • Three centered • Semi-circular • Four centered • Drop • Gothic. • Jack or flat arch (1 mark for either) • Any other recognised arch.	n/a	**2**
12a)	French curves, flexi-curve.	n/a	**1**
12b)	Set squares (accept any angle).	n/a	**1**
12c)	Tee square, parallel motion.	n/a	**1**
12d)	Compass.	n/a	**1**
13a)	A coherent evaluation that considers the activities and not a simple list.	If the candidate provides a comprehensive list of activities	**6**

	The answer will consider some or all the following activities, up to a max of **six** marks. **Stage C** • BIM pre-start meeting. • Initial model sharing with Design Team for strategic analysis and options appraisal. • BIM data used for environmental performance and area analysis. • Identify key model elements (e.g. prefabricated component) and create concept level parametric objects for all major elements. • Enable design team access to BIM data. • Agree extent of performance specified work. • Data drop 2. **Stages D & E** • Data sharing and integration for design co-ordination and detailed analysis including data links between models. • Integration/development of generic/bespoke design components. • BIM data used for environmental performance and area analysis. • Data sharing for design co-ordination, technical analysis and addition of specification data. Export data for Planning Application. • 4D and/or 5D assessment. • Data drop 3.	with limited evaluation – a max of **two** marks only. If the candidate provides a comprehensive list of activities with reasonable detail – a max of **four** marks. If the candidate provides a comprehensive list of activities with in-depth evaluation – a max of **six** marks.	
13b)	The answer will consider some or all of the following activities, up to a max of **two** marks. **Stages J & K** • Agree timing and scope of 'Soft Landings'. • Co-ordinate and release of 'End of Construction' BIM record model data. • Use of 4D/5D BIM data for contract administration purposes. • Data drop 5**.**	For minimal evaluation with little detail **one** mark only.	**2**
14a)	Standard deviation is the measure of dispersion (1) around a mean (1).	n/a	**2**
14b)	SD^2 = variance (1).	n/a	**1**
14c)	Several items of data given the same value (1) to reduce the number of calculations required (1).	n/a	**2**

15a)	Differentiation.		**1**
15b)	$= [3x^3/3 + 4x]$ (1) $=[x^3 + 4x]$ $=3^3 + 4x3$ (1) $= 27 + 12$ (1) $= 39$ (1) units^2	n/a	**4**
16	**Four** marks awarded as below: $1 + 6(-0.03) + \frac{6x5}{2x1}(-0.03)^2 + \frac{6x5x4}{3x2x1}(-0.03)^3$ 1 (1) - 0.18 (1) + 0.0135 (1) -0.00054 = 0.833 (1)	n/a	**4**
17	The strength of concrete on site 1 is greater than that on site 2 and meets the specification requirements. The interquartile range of the concrete poured on site 2 is lower than site 1 indicating that the values of strength of the cubes are more consistent and less varied about the central value.	n/a	**2**
18a)	Marks as shown to a max of **three** marks. It is the length of a column which is subject to buckling (1). It is factor dependent on the relationship between the length of a column and how it is laterally restrained at its ends (1). The effective length can be less or greater than its actual length (1). The safe compressive stress of a column depends not only on the actual length and cross-sectional dimensions but also on the manner in which the ends of the column are restrained or fixed (1).	n/a	**3**
18b)	One sketch detail produced to an appropriate scale of foundation to column connection, beam section to column connection, beam to floor connection etc. **One** mark for basic sketch, **two** marks for scaled and labelled sketch, **three** marks for fully labelled and accurate sketch. Examples of fully labelled and accurate drawings of a beam to column connection (freehand sketches are also accepted) as shown below.	n/a	**3**

			
18c)	**Band 1 (1-4 marks)** The learner identifies a limited number of structural considerations to specify how concrete cast in situ will affect the design of the structure and there is little in the way of description. The learner's response lacks detail and is not clearly linked to the scenario. **Band 2 (5-8 marks)** The learner identifies a wide range of structural considerations of how concrete cast in situ will affect the design of the structure used and supports this with brief descriptions. The learner's response is detailed but incomplete, makes some allowance for and has clear links to the scenario in most cases. **Band 3 (9-12 marks)** The learner identifies a comprehensive range of the structural considerations to specify how concrete cast in situ will affect the design of the structure and supports this with in-depth descriptions. Their response is detailed and complete, and has clear and accurate links to the scenario.	**Indicative content:** Recognition and use of the theory of bending to design components, use of permissible stress design tables to size sections; understand the importance of terms in the design of axially-loaded columns: effective length, moment of inertia, cross-sectional area, radius of gyration and slenderness ratio, consider column sectional shape. Materials used; reinforcement needed in tension and shear; starter bars from foundation; use of formwork. ***For no awardable content, award 0 marks*** Accept the answer if linked to formwork and compressive strength of concrete.	**12**