

**UNIVERSITY OF BOLTON**  
**SCHOOL OF THE BUILT ENVIRONMENT &  
ENGINEERING – RAK CAMPUS**  
**BSc(HONS) CIVIL ENGINEERING**  
**SEMESTER TWO EXAMINATION 2009/2010**  
**CONSTRUCTION MANAGEMENT**  
**MODULE NO: BLT2007**

Date: Wednesday 2 June 2010

Time: 5.00 pm – 8.00 pm

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**INSTRUCTIONS TO CANDIDATES:**

There are SIX questions.

Answer ANY FOUR questions.

All questions carry equal marks.

This examination paper carries a total of 100 marks.

Marks for parts of questions are shown in brackets.

All working must be shown.

A numerical solution to a question obtained by programming an electronic calculator will not be accepted.

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**Q1**

It is the responsibility of the originator of the communication to ensure that the message has been received, understood and acted upon.

Carefully consider the following communication scenarios that would arise as part of the development of a construction project on site:

- (i) Health & Safety Site Induction
- (ii) Administration of a Contractual Claim

- (a) Suggest the most appropriate “primary” form of communication in each case, together with any “secondary” supporting form of communication if you believe it to be necessary and identify the significant components of each scenario, i.e. outline what may be involved or utilised in the effective communication of each process.

(12 marks)

- (b) Justify your selection of communication methods by discussing the advantages and probable limitations of those methods selected.

(13 marks)

**Total 25 marks**

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**Q2**

**Fig Q2** appended, shows the logic diagram for a proposed commercial development unit to be constructed on a large scale Retail Park. The activities and their corresponding durations (extracted from method statements), are presented in **Table Q2** below.

Activity	Duration (Weeks)	Activity	Duration (Weeks)
4-6	4	3-5	18
2-3	12	7-8	0
3-4	0	5-10	4
7-9	3	2-4	10
1-2	5	4-7	13
8-10	10	9-10	5
10-11	11	6-8	8

**Table Q2**

- (a) Construct the network from the logic diagram provided, in the form of a precedence diagram adopting the format illustrated below: -

<b>EST</b>	<b>Activity</b>	<b>EFT</b>
<b>LST</b>	<b>(Duration)</b>	<b>LFT</b>

Undertake the numerical analysis of the project. Identify the critical path and state the overall project duration.

(8 marks)

**Question 2 continued over the page...**

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**Question 2 continued**

- (b) Using the information contained in the event boxes of the precedence network, prepare the Gantt Chart for the project on the graph paper provided, showing the total time available for each activity. (Horizontal axis = Duration : Scale 15 small squares = 10 weeks). (Vertical axis = Activity : Each Activity occupies 10 small squares with the Activity bar depth occupying the top 5 small squares).

All project activities require continuous craneage. The contractor owns two cranes each costing £1685 per week and the cheapest crane hire would cost £2215 per crane per week.

Determine the minimum cost of craneage to the contractor by illustrating the crane utilisation for the project on the Gantt Chart above and evaluate the total cost involved. (C1 and C2 = contractor's cranes and HC = hire crane)

(7 marks)

- (c) As the project progresses on site, activity 2-4 unavoidably takes 11 weeks to complete. Analyse the Gantt Chart and precedence diagram and comment on the logic, time and financial implications of this over-run.

(10 marks)

**Total 25 marks**

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**Q3**

It has been estimated that the construction industry could save hundreds of millions of pounds each year by utilising better waste management techniques. Reducing site wastage and exploring the potential for recycling are being more seriously investigated by the industry's contractors.

- (a) Provide any six common causes of materials waste on construction sites.  
(6 marks)
- (b) Outline how designers may contribute to the reduction of materials waste on site in general.  
(5 marks)
- (c) Site Waste Management Plans (SWMPs) have become legally binding on projects above a certain value from April 2008 and they provide a structure for waste delivery and disposal at all stages during a construction project. Explain the preferred waste hierarchy prior to disposal of site waste and discuss how contractors may benefit from preparing and using a SWMP.  
(14 marks)

**Total 25 marks**

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**Q4**

Site organisation is a management function concerned with ensuring that the resources are ready in order that construction work may proceed according to the project programme. It embodies thought which should be applied to the layout of the contractor's temporary facilities in addition to assembling and utilising the various resources.

- (a) The layout of temporary facilities is usually dependant on the nature of the contract. Identify three types of "nature" and provide an appropriate example of each type.

(3 marks)

- (b) The construction site scenario plan **Fig Q4** (attached), shows a 15-storey tower block to be erected on a level site close to a major city, together with sixteen precast concrete garages divided either side of a vehicular hard-standing.

The tower block structure is reinforced concrete frame construction clad externally in brickwork. Floors and roof are also reinforced concrete and the development will be finished with a "green" roof.

Using the information provided in **Table Q4** together with the site plan, develop an appropriate contractor's site layout. Annotate the plan with brief rationale justifying the particular location of the temporary facilities.

(16 marks)

- (c) Discuss the significant factors to be considered when deciding on the location of the Contractor's and Engineer's accommodation.

(6 marks)

**Total 25 marks**

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**Q5**

- (a) Explain briefly why, in the planning of certain construction projects, it is more appropriate to prepare the programme in “line of balance” format rather than as a network. (3 marks)
- (b) The construction of a large supermarket complex includes a rectangular grid of structural columns (twenty in length & seven in width), supported on identical reinforced concrete pad foundations.

The foundation sub-contractor has confirmed his working week as 40 hours; divided equally over Monday to Friday inclusive and based on a completion rate of 8 pad foundations per week.

The information tabulated in **Table Q5** below has been provided from the sub-contractor’s method statement.

<b>Operation</b>	<b>Manhours per operation (for each foundation)</b>	<b>Optimum gang size per operation (for each foundation)</b>
A - Excavation	65	5
B - Erect formwork	86	4
C - Fix reinforcement	76	3
D - Place concrete	30	3
E - Strip/clean forms	19	2

**Table Q5**

**Question 5 continued over the page...**

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**Question 5 continued**

A buffer time of 2 days is to be employed and it is assumed that all operations are sequential.

- (I) Complete the line of balance calculation sheet provided as **Table Q5A**, for activities A to E inclusive.

(10 marks)

- (II) Produce a fully annotated Line of Balance Schedule on the graph paper provided (use landscape orientation), and state the minimum duration for completion of the foundations subcontract.

(6 marks)

Foundation on the vertical scale	1 small square = 2 pad foundations
Duration on the horizontal scale	1 small square = 1 day

- (c) Examine the activities in the Line of Balance Schedule and discuss actions which could be taken to reduce the overall project duration.

(6 marks)

**Total 25 marks**

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**Q6** The Construction (Design & Management Regulations [2007] – CDM<sub>2007</sub> – came into force on the 1<sup>st</sup> April 2007, replacing both the Construction (Design & Management) Regulations 1994 (CDM94) and the Construction (Health, Safety & Welfare) Regulations 1996 (CHSW).

(a) State the key aim and objectives of CDM<sub>2007</sub>. (5 marks)

(b) Regulation 20 of CDM<sub>2007</sub> covers the duties of the CDM Coordinator (on Notifiable Projects) – Briefly discuss these main duties.

(12 marks)

(c) A designer is engaged to develop the design of the effluent drainage system for a small industrial scheme. The initial design shows the new drainage system discharging into the existing effluent drainage system from a nearby industrial complex. This existing drain is at some depth (approximately 4m according to old drawings) whereas the new drainage system has been designed to be at the more usual depth of 1.2m.

A new manhole is proposed in the road verge, to collect a number of new drainage pipes runs, one of which will then cross the road to make the connection at a new backdrop manhole (see **Fig Q6** for general details), positioned over the existing drain in the roadway.

The existing industrial complex will be fully operational during this work.

Identify four fundamental hazards that may be produced as a consequence of these proposals together with an associated risk that each hazard may give rise to.

(8 marks)

**Total 25 marks**

**END OF QUESTIONS**

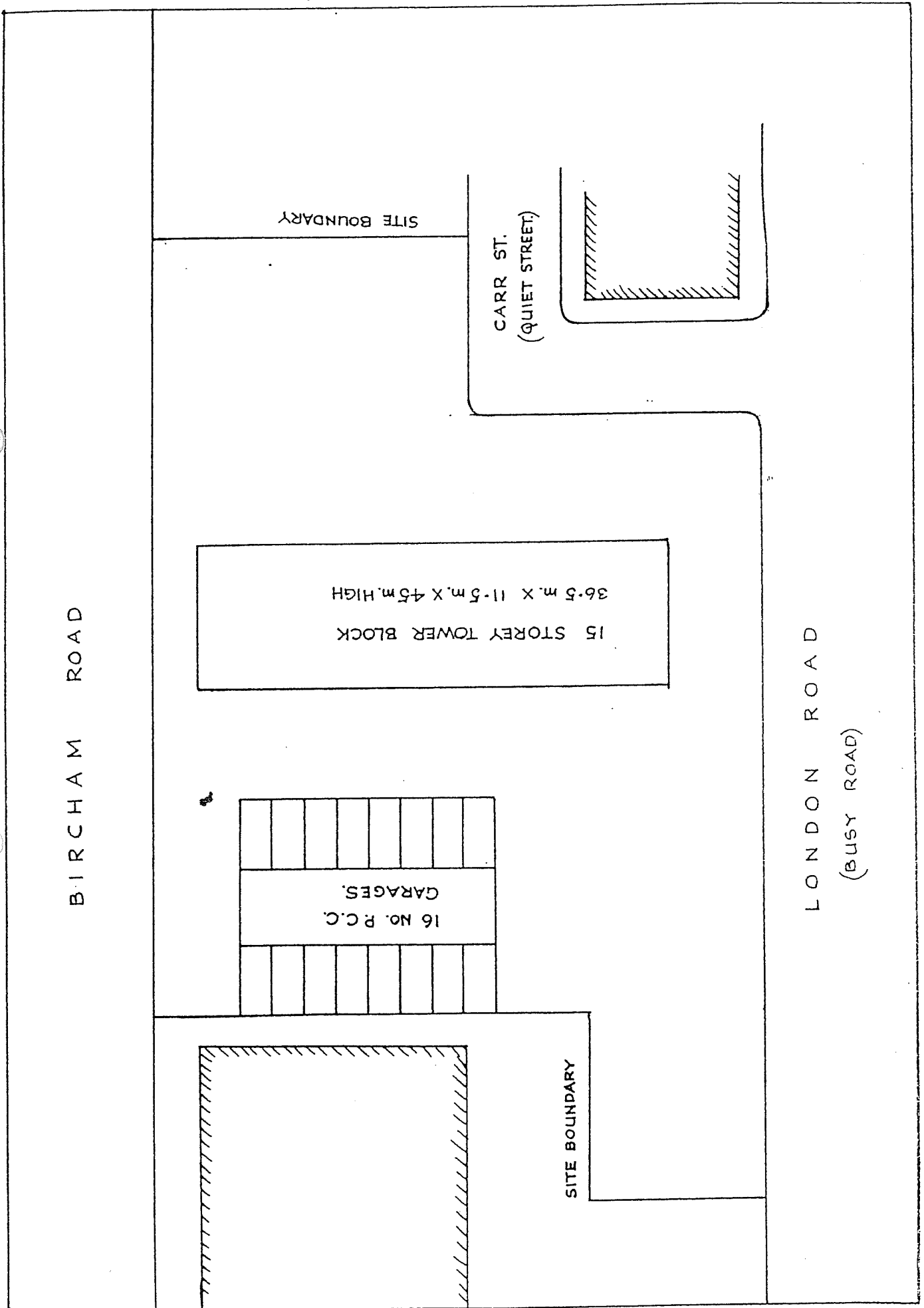
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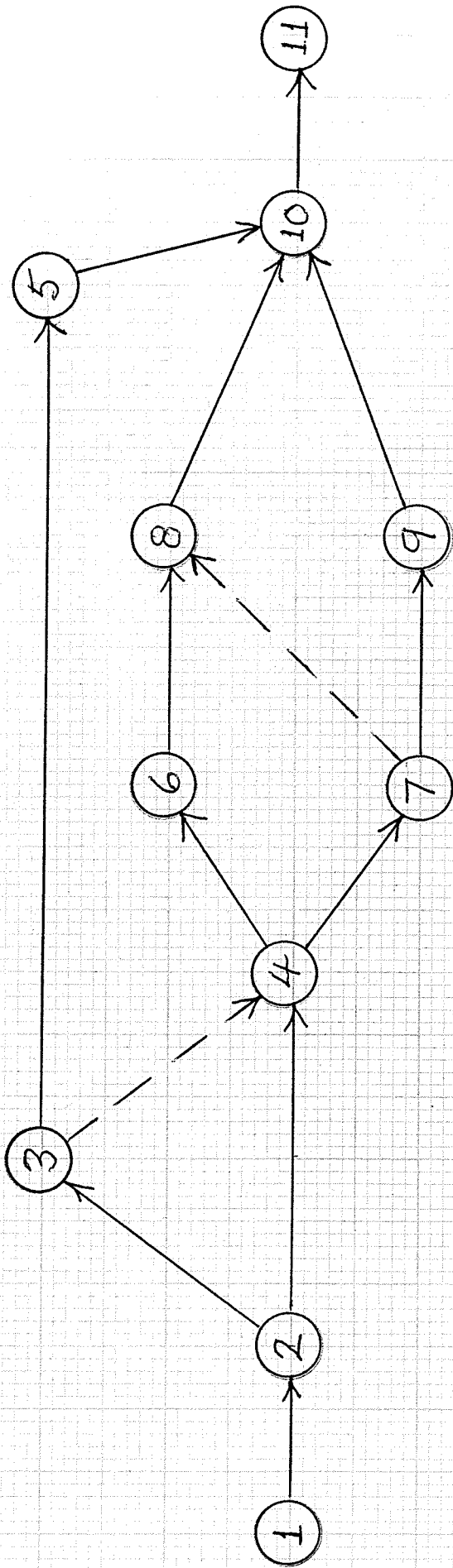
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**Table Q4**

<b>Temporary Site Facility</b>	<b>Plan Dimensions (mm)</b>
Site Offices (Contractor)	25 X 8
Site Offices (Engineer)	18 X 8
Car Park (Contractor / Engineer Staff / Visitors)	25 X 20
Site Canteen	24 X 12
Toilets & Drying Rooms	13 X 11
Clerk of Works Office	9 X 7
Fenced General Storage Compound (incorporating Site Stores / Checker / Security – 24 X 12mm)	36 X 34
Steel Bending / Fabrication Area	38 X 18
Precasting / Formwork Assembly Area	38 X 18
Steel Store / Cutting Area	36 X 10
Bricks & Mortar Storage	26 X 16
Materials Hoist	12 X 8
Tower Crane (65mm radius)	Base Area 8 X 8
Main source of concrete is Ready Mixed Concrete, but also require:-	
Cement/Aggregate / Sand Store + Mixer (for Concrete)	30 X 30
Ideally segregate staff, visitors and delivery routes.	

(FIG 04)





[ FIG 82 ]

[FIG 86]

### TYPICAL VERTICAL BACKDROP DETAIL

Note: steeper gradients are preferred to the use of backdrops

