
UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2008/2009

November 2008

REG 361 – Methods of Construction
(Kaedah Binaan)

Duration : 3 hours
(Masa: 3 jam)

Please check that this examination paper consists of **EIGHT** printed pages before you begin the examination.

*Sila pastikan bahawa kertas peperiksaan ini mengandungi **LAPAN** muka surat yang tercetak sebelum anda memulakan peperiksaan ini.*

Students are allowed to answer all questions either in English OR in Bahasa Malaysia only.

Pelajar dibenarkan menjawab semua soalan dalam Bahasa Inggeris ATAU Bahasa Malaysia sahaja.

Answer **Any FIVE** questions only.

*Jawab mana-mana **LIMA** soalan sahaja.*

- 2 -

1. (a) Earthwork operation involve the cutting and filling process. Discuss the stated operation. Provide any sketches to support your discussion.

Operasi kerja tanah melibatkan proses pemotongan dan penambakan. Bincangkan operasi tersebut dengan ringkas. Sertakan lakaran bagi menyokong perbincangan anda.

(5 marks/markah)

- (b) Soil compaction is an important factor in earthwork activities. What is the definition of compaction process and discuss the soils properties affected by compaction.

Pemadatan tanah merupakan proses yang penting dalam kerja tanah. Apakah yang dimaksudkan dengan proses pemadatan dan bincangkan perubahan yang berlaku pada ciri-ciri tanah akibat daripada proses tersebut.

(5 marks/markah)

- (c) Moisture content of soil gives a high influence on soil compaction process. Discuss this based on the relationship between the dry density and moisture content of soil.

Kadar kandungan lembapan memberikan pengaruh yang tinggi terhadap proses pemadatan tanah. Bincangkan berpandukan hubungan ketumpatan kering dengan kandungan lembapan tanah

(10 marks/markah)

2. (a) What does it mean by concrete workability? Explain the factor that will influence the workability of concrete.

Apakah yang dimaksudkan dengan kebolehkerjaan konkrit. Nyatakan faktor yang mempengaruhi kebolehkerjaan konkrit.

(5 marks/markah)

- (b) Discuss **Two (2)** types of fresh concrete testing and **Two (2)** types of hardened concrete testing. Explain the needs of those testing.

*Bincangkan **Dua (2)** jenis ujian yang dijalankan bagi konkrit segar dan **Two (2)** jenis ujian konkrit keras. Nyatakan keperluan ujian tersebut dijalankan.*

(5 marks/markah)

- 3 -

- (c) A concrete mix, grade 25 was proposed for the construction of ground floor level. The type of proposed cement was Ordinary Portland Cement (OPC). The aggregate was uncrushed aggregate with a maximum size of 20mm. The specific gravity of aggregate of 2.65. The standard deviation value of for characteristic strength between $30\text{N/mm}^2/50\text{N/mm}^2$ is 6. The degree of workability was high with the slump value of 65mm. The sand falls into zone 1. Prepare the design mix for the concrete.

If the moisture content and rate of soil absorption are 6% and 0.5% reflectively, while the moisture content of coarse aggregate is 2% and ignoring the rate of soil absorption, calculate the actual proportion weight for the concrete.

Satu campuran konkrit, gred 25 telah dicadangkan bagi pembinaan rasuk lantai bawah. Simen yang dicadangkan ialah simen Portland biasa (OPC). Batu baur adalah batu baur tidak hancur dengan saiz maksima 20mm. Ketumpatan bandingan 2.65. Sisihan piawai bagi kekuatan ciri $30\text{N/mm}^2/50\text{N/mm}^2$ adalah 6. Darjah keboleherjaan adalah tinggi dengan nilai turun 65mm. Pasir terdiri daripada zon 1. Sediakan rekabentuk campuran konkrit tersebut.

Jika kandungan lembapan dan kadar resapan pasir adalah 6% dan 0.5%, manakala kandungan lembapan batu baur kasar adalah 2% dan kadar resapan batu diabaikan, dapatkan berat sebenar campuran konkrit terbabit.

(10 marks/markah)

3. (a) Discuss the functions of formwork in concrete works and explain **Three (3)** factors that need to be considered in designing a formwork.

*Bincangkan peranan acuan dalam kerja-kerja konkrit dan nyatakan **Tiga (3)** faktor yang perlu dipertimbangkan dalam rekabentuk acuan*

(5 marks/markah)

- (b) Discuss **Four (4)** causes of formwork failure.

*Bincangkan **Empat (4)** punca yang menyebabkan berlakunya kegagalan pada acuan.*

(5 marks/markah)

- 4 -

- (c) What is the definition of ferrocement and describe the advantages of ferrocement as compared to other building materials.

Apakah definisi ferrosimen dan terangkan kelebihan ferrosimen berbanding dengan bahan binaan lain.

(10 marks/markah)

4. (a) Stability of foundation structures depend very much on the bearing capacity of the soil supporting them. What do you understand with the bearing capacity of the soil and discuss how each of this foundation support the weight of the building.

(i) Pad foundation

(ii) Pile foundation

Kestabilan struktur asas bergantung sepenuhnya pada kemampuan galas tanah yang menyokong asas tersebut. Apakah yang dimaksudkan dengan kemampuan galas tanah dan terangkan bagaimanakah asas berikut menyokong beban bangunan.

(i) Asas pad

(ii) Asas cerucuk

(6 marks/markah)

- (b) A two storey bungalow house is to be constructed on stable ground near the hillside. One of the pad foundation structure, 2.8 m x 2.8 m is designed to support a column load of 800 kN. If the depth of foundation, Z is 2 m below ground level, determine the safe bearing capacity of the soil and the actual pressure on the foundation. Given that the Terzaghi equation of soil bearing capacity is:-

$$q_{ult} = S_c C N_c + \gamma Z N_q + 0.5 \gamma B N_\gamma S_\gamma$$

and parameters are obtained from site investigation as follows:-

Density of soil, $\gamma = 17 \text{ kN/m}^3$

Soil strength, $\phi = 20^\circ$ and $C = 0 \text{ kN/m}^2$

Shape factors, $S_c = 1.3$; $S_\gamma = 0.8$

Bearing capacity factors, $N_c = 17.7$; $N_\gamma = 5$; $N_q = 7.4$

...5/-

- 5 -

Sebuah rumah banglo 2 tingkat akan dibina di atas tanah berdekatan bukit. Sebuah asas pad berukuran 2.8 m x 2.8 m direka bentuk untuk menyokong beban tiang sebesar 800 kN. Jika dalam asas tersebut, Z terletak 2 m dibawah aras tanah, tentukan keupayaan galas selamat bagi tanah dan tekanan sebenar keatas struktur asas tersebut. Diberi persamaan Terzaghi untuk keupayaan galas tanah sebagai:-

$$q_{\text{muk}} = S_c C N_c + \gamma Z N_q + 0.5 \gamma B N_\gamma S_\gamma$$

dan parameter dari hasil kajian tapak ialah seperti berikut:-

Ketumpatan tanah, $\gamma = 17 \text{ kN/m}^3$

Kekuatan tanah, $\phi = 20^\circ$ and $C = 0 \text{ kN/m}^2$

Faktor bentuk, $S_c = 1.3$; $S_\gamma = 0.8$

Faktor keupayaan galas, $N_c = 17.7$; $N_\gamma = 5$; $N_q = 7.4$

(14 marks/markah)

5. (a) There are several type of bridge construction. Give **ONE** of the system and describe the work procedure of the system that you choose.

*Terdapat beberapa jenis sistem pembinaan jambatan, berikan **SATU** jenis system pembinaan tersebut dan terangkan prosedur pembinaannya.*

(10 marks/markah)

- (b) Explain with sketches on the of shoring/underpinning systems and what is the procedure used before commencing the work.

Jelaskan dengan lakaran gambarajah tentang sistem-sistem menjermang dan apakah prosedur yang perlu dilakukan sebelum melakukan kerja menjermang.

(10 marks/markah)

6. (a) Describe the high rise building construction methods in this country.

Bincangkan beberapa sistem pembinaan bangunan tinggi di Negara ini.

(10 marks/markah)

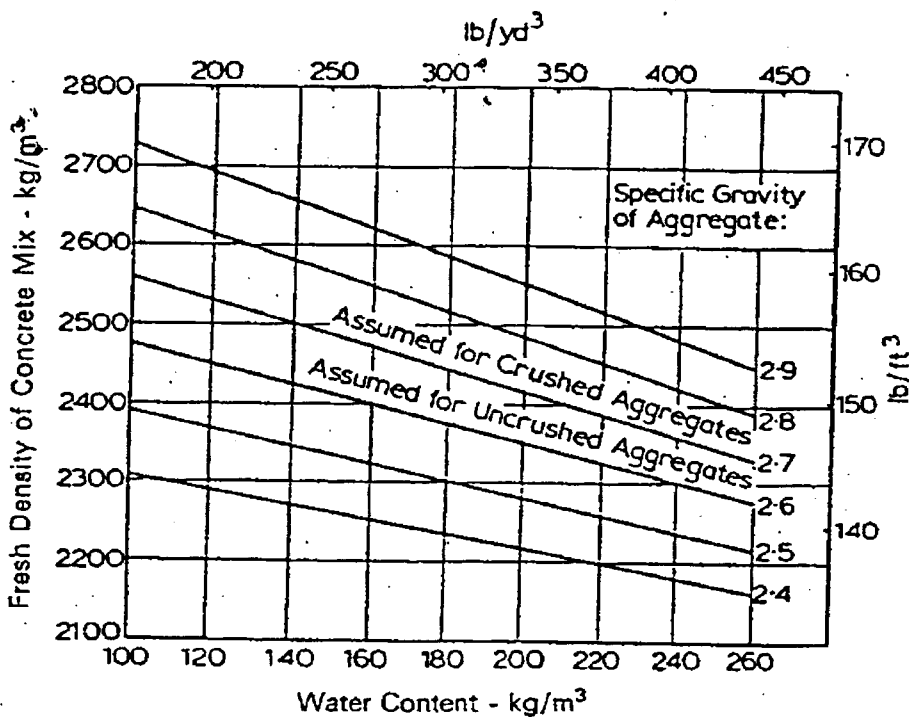
- (b) What is the prefabricated system? Describe the advantages and the problems in using this system.

Apakah yang dimaksudkan dengan sistem pasang siap? Huraikan kebaikan dan masalah yang dihadapi oleh sistem pasang siap.

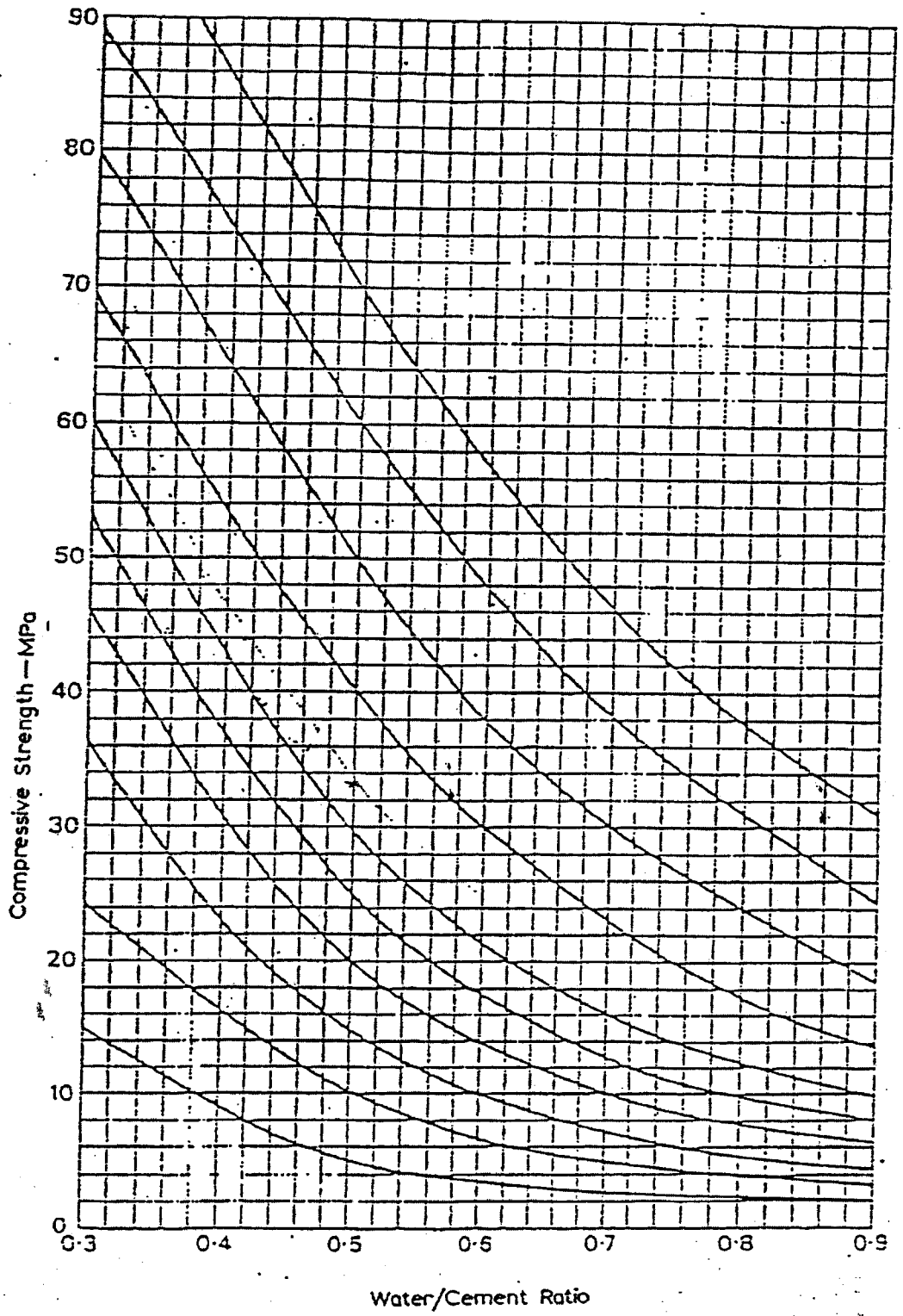
(10 marks/markah)

Approximate Free Water Contents Required to Give Various Levels of Workability According to the 1988 British Method^{14.11} (Crown copyright)

Aggregate		Water content, kg/m ³ (lb/yd ³) for:				
Max size mm (in.)	Type	Slump, mm (in.)	0-10 (0- $\frac{1}{2}$)	10-30 ($\frac{1}{2}$ -1)	30-60 (1-2 $\frac{1}{2}$)	60-180 (2 $\frac{1}{2}$ -7)
		Vebe time, s	>12	6-12	3-6	0-3
10 ($\frac{3}{8}$)	Uncrushed		150 (255)	180 (305)	205 (345)	225 (380)
	Crushed		180 (305)	205 (345)	230 (390)	250 (420)
20 ($\frac{3}{4}$)	Uncrushed		135 (230)	160 (270)	180 (305)	195 (330)
	Crushed		170 (285)	190 (320)	210 (355)	225 (380)
40 (1 $\frac{1}{2}$)	Uncrushed		115 (195)	140 (235)	160 (270)	175 (295)
	Crushed		155 (260)	175 (295)	190 (320)	205 (345)



Estimated wet density for fully compacted concrete^{14.11} (specific gravity is given for saturated and surface-dry aggregate) (Crown copyright)

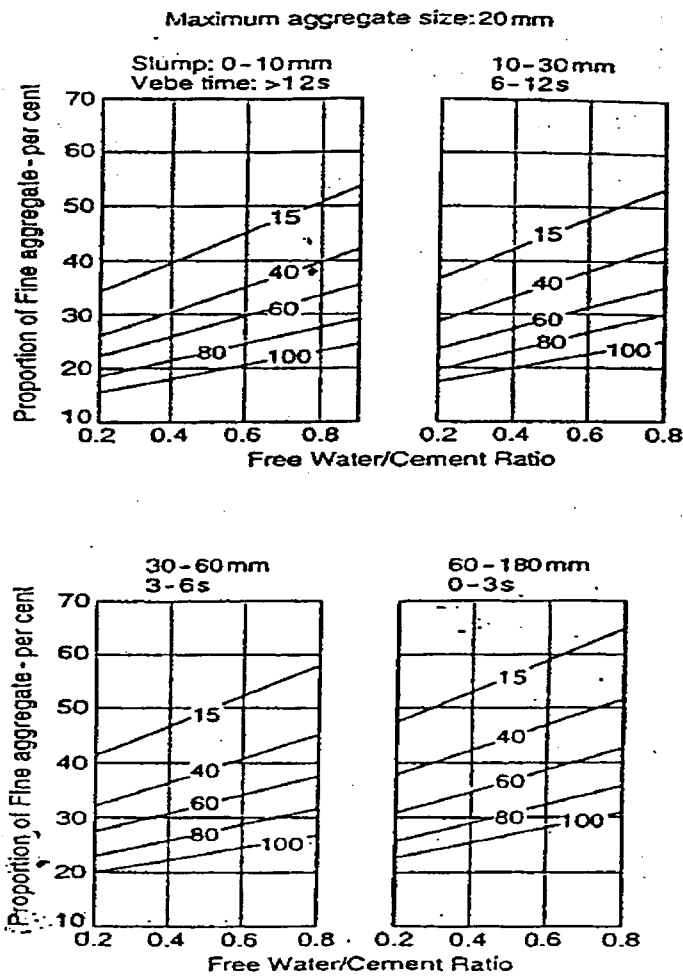


Relation between compressive strength and free water/cement ratio for use in the British mix selection method^{14.11} (see Table 14.9) (Crown copyright)

Approximate Compressive Strengths of Concretes Made with a Free Water/Cement Ratio of 0.5 According to the 1988 British Method^{14,11}

Type of cement	Type of coarse aggregate	Compressive strength* (MPa (psi)) at the age of (days):			
		3	7	28	91
Ordinary Portland (Type I)	Uncrushed	22 (3200)	30 (4400)	42 (6100)	49 (7100)
	Sulfate-resisting Portland (Type V)	27 (3900)	36 (5200)	49 (7100)	56 (8100)
Rapid-hardening Portland (Type III)	Uncrushed	29 (4200)	37 (5400)	48 (7000)	54 (7800)
	Crushed	34 (4900)	43 (6200)	55 (8000)	61 (8900)

* Measured on cubes.
Crown copyright.



Recommended proportion of fine aggregate (expressed as percentage of total aggregate) as a function of free water/cement ratio for various workabilities and maximum sizes^{14,11} (numbers refer to percentage of fine aggregate passing 600 μm sieve) (Building Research Establishment; Crown copyright)