



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2011/2012**

**COURSE NAME : STRUCTURE REPAIR AND REHABILITATION**

**COURSE CODE : BFP 4043**

**PROGRAMME : 4 BFF**

**DATE OF EXAMINATION : JUNE 2012**

**DURATION : 3 HOURS**

**INSTRUCTION : ANSWER ALL QUESTION**

**THIS QUESTION PAPER CONSISTS OF SIX (6) PRINTED PAGES**

- Q1** (a) Define structural defects. (2 marks)
- (b) Subsidence is the downward movement of the ground around the building. Explain **five (5)** causes of subsidence. (10 marks)
- (c) With the aid of illustration, compare the effects of environmental and loading effects to the structure. (8 marks)
- Q2** (a) The purpose of visual inspection is to get an overview of the concrete structure. State **five (5)** items that should be addressed during the visual inspection. (5 marks)
- (b) Non-destructive test is the inspection or analysis of material, existing structure and involving the process of manufacturing without destroying the integrity of materials and structures. Explain the purpose of the following tests:
- (i) Carbonation test
  - (ii) Ultrasonic pulse velocity testing. (4 marks)
- (c) Internal fracture test and pull out test are several methods that being used in destructive test. With the aid of sketches explain the process of both methods. (8 marks)
- (d) Measurement of exposed bolt using Windsor Probe Testing for a beam is shown in Figure Q2(a). The bolt is 6.35 mm in diameter and 79.5 mm in length. Based on the graph given in Figure Q2(b), evaluate on the compressive strength of the beam. (3 marks)
- Q3** (a) Compare the application of the following temporary works. (6 marks)
- (i) Shoring
  - (ii) Scaffolding
- (b) A single cased beam has been found to have shear failure and requires additional strength improvement shear. As an engineer, suggest **one (1)** method of strengthening to be used for that beam. (4 marks)

- (c) Propose **two (2)** methods of construction repair foundation stabilization. (10 marks)

**Q4** There are several methods available in repairing crack.

- (a) Propose the process involved before epoxy injection started if the epoxy pressure injection technique is decided to rehabilitate reinforced concrete beam-column joints damaged by earthquakes. (10 marks)

- (b) During extremely high injection pressures needed, the crack must be cut out to a certain depth. Explain **two (2)** methods that must be applied before the injection. (10 marks)

**Q5** A spall in a concrete surface may be resulting of localized distress or the symptom of a more widespread distress in the concrete element. In either case, an attempt should be made to determine the causes of the distress prior to selecting a remedy.

- (a) Explain **four (4)** possible causes of spalling. (10 marks)

- (b) Proposed the surface preparation process of concrete removal before the repairing technique can be applied. (10 marks)

- S1 (a) Berikan definisi kecacatan struktur. (2 markah)
- (b) “*Subsidence*” adalah pergerakan ke bawah tanah yang menyokong bangunan. Jelaskan lima (5) punca berlakunya “*subsidence*”. (10 markah)
- (c) Dengan bantuan gambarajah, bandingkan kesan ke atas struktur yang disebabkan oleh kesan alam semulajadi dan kesan pembebanan. (8 markah)
- S2 (a) Pemeriksaan secara visual dilakukan bagi mendapatkan gambaran keseluruhan struktur konkrit. Berikan lima (5) perkara yang perlu dilihat semasa pemeriksaan visual dijalankan. (5 markah)
- (b) Ujian tanpa musnah adalah pemeriksaan atau analisis terhadap bahan, struktur asal dan melibatkan proses pembinaan tanpa memusnahkan integriti sesuatu bahan atau struktur. Sila berikan tujuan ujian-ujian berikut:
- (i) *Carbonation test*
- (ii) *Ultrasonic pulse velocity testing*. (4 markah)
- (c) “*Internal fracture test*” dan “*pull out test*” adalah antara kaedah-kaedah yang digunakan dalam ujian musnah. Beza dan lakarkan prinsip kedua-dua kaedah ini. (8 markah)
- (d) Ukuran “*bolt*” yang terdedah menggunakan “*Windsor Probe Testing*” bagi sebuah rasuk ditunjukkan pada Rajah Q2(a). Ukuran bagi “*bolt*” tersebut adalah 6.35 mm diameter dan 79.5 mm panjang. Berdasarkan graf pada Rajah Q2(b), nilaikan kekuatan mampatan rasuk tersebut. (3 markah)
- S3 (a) Kerja sementara merupakan salah satu dari kaedah pembaikan. Bandingkan aplikasi kerja sementara yang dinyatakan di bawah:
- (i) Tupang (*Shoring*)
- (ii) Perancah (*Scaffolding*) (6 markah)

(b) Sebuah rasuk memerlukan kekuatan ricih tambahan bagi mengelakkan dari berlakunya kegagalan ricih. Sebagai seorang jurutera, cadangkan **satu (1)** kaedah pengukuhan yang boleh digunakan pada rasuk tersebut. (4 markah)

(c) Cadangkan dua (2) kaedah di dalam membaikpulih pengukuhan asas bangunan. (10 markah)

**S4** Terdapat beberapa kaedah untuk membaiki retakan.

(a) Cadangkan proses yang terlibat sebelum suntikan epoxy dimulakan sekiranya teknik epoxy suntikan bertekanan digunakan untuk membaikpulih konkrit tetulang antara sambungan rasuk-tiang. (10 markah)

(b) Semasa suntikan epoxy yang memerlukan tekanan sangat tinggi, retak perlu dipotong pada kedalaman tertentu. Tunjukkan **dua (2)** kaedah yang diperlukan sebelum menyuntik epoxy. (10 markah)

**S5** Pecahan kepingan permukaan konkrit mungkin disebabkan kerosakan pada tempat yang tertentu atau simpton kerosakan yang merebak di dalam elemen konkrit. Dalam kes tertentu, usaha perlu dilakukan untuk mengenalpasti punca kerosakan sebelum memilih kaedah untuk memperbaiki keadaan itu.

(a) Analisis **empat (4)** kemungkinan punca pecahan kepingan konkrit. (10 markah)

(b) Cadangkan proses penyediaan permukaan dalam membuang konkrit sebelum teknik membaikpulih dijalankan. (10 markah)

## FINAL EXAMINATION

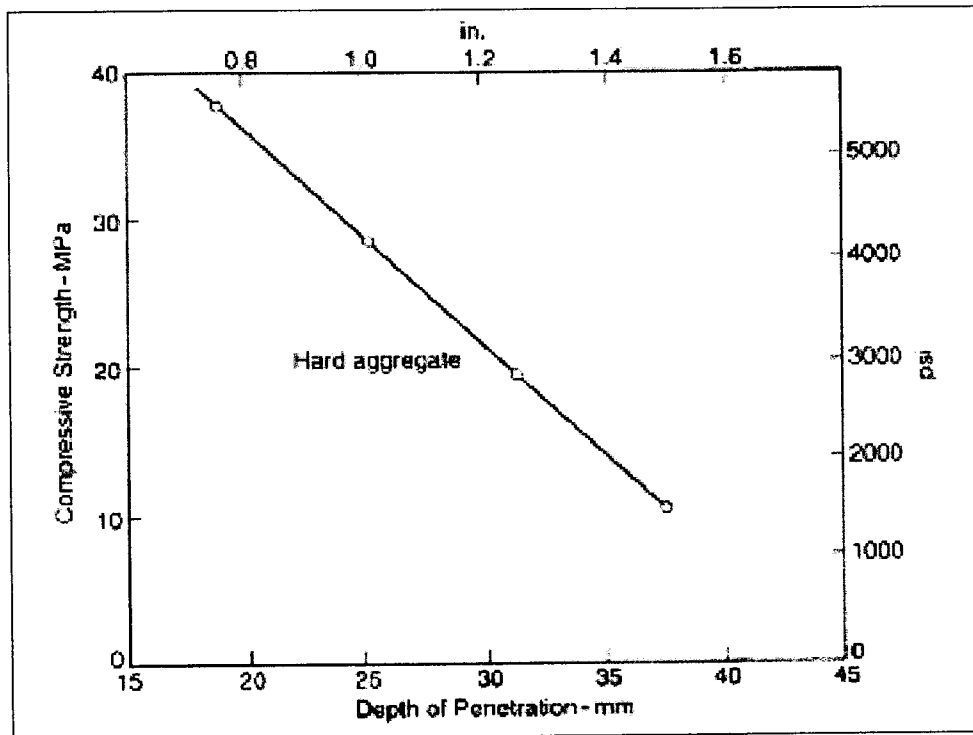
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Beam	A1	A2	A3
	B1	B2	B3
	C1	C2	C3

A1 to C3 (Location of testing on a beam)

**FIGURE Q2(a)**



**FIGURE Q2(b)**