UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2009/2010

SUBJECT NAME	:	STRUCTURAL CONCRETE DESIGN II
SUBJECT CODE	:	BFC 3172
COURSE	:	3 BFF
EXAMINATION DATE	:	APRIL 2010
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTIONS IN PART A AND **TWO (2)** QUESTIONS IN PART B. DESIGN SHOULD BE BASED ON BS8110.

THIS PAPER CONSIST OF THIRTEEN (13) PAGES

PART A (ANSWER ALL QUESTIONS)

Q1 (a) Give clear definition for:

(i) Passive reinforcement.
(ii) Active reinforcement.

(4 marks)

(b) What is the difference between pre-tensioned concrete and post-tensioned concrete.

(3 marks)

(c) List **Four (4)** types of prestressed loss.

(4 marks)

(d) Concrete structures can be classified into four classes. In which class prestressed concrete structure can be classified? Briefly explain those classifications.

(6 marks)

(e) A prestressed rectangular simply supported beam 500 mm x 750 mm of 7.3 m span is loaded by a uniformly distributed load of 45 kN/m including the self weight. The prestressing tendon is located as shown in Figure **Q1** and produces an effective prestress of 1620 kN. If the beam was designed as class 1 structure, check whether all limiting stresses are satisfied. Given:

Loss of prestressing force	=	20%
Concrete grade at service, f_{cu}	=	35 N/mm^2
Concrete grade at transfer, f_{ci}	=	25 N/mm^2

(13 marks)

PART B (ANSWER TWO QUESTIONS ONLY)

Q2 (a) Figure **Q2** shows the plan view and cross sections of a longitudinal spanning staircase. Given the following data:

Rise	=	175 mm
Going	=	250 mm
Waist	=	150 mm
Characteristic strength of concrete	=	30 N/mm^2
Characteristic strength of steel	=	460 N/mm^2
Concrete cover	=	20 mm
Diameter of main reinforcement	=	12 mm
Finishing and services	=	1.0 kN/m^2
Live load	=	4.0 kN/m^2

For STR 1:

(i) Calculate the design load and then carry out the analysis.

(7 marks)

(ii) Design all the reinforcements.

(6 marks)

(iii) Check the shear, deflection and cracking.

(10 marks)

(iv) Sketch the detailing.

(4 marks)

(b) Calculate the design load for STR 2

(4 marks)

(c) Propose an alternative structural system to convert STR 2 to become the transverse spanning staircase.

(4 marks)

Q3 (a) With the aid of simple sketches, briefly explain:

(i) Single curvature column

(3 marks)

(ii) Double curvature column

(3 marks)

(b) There are three types of height in column design namely actual height (l), clear height (l_o) and effective height (l_e). Describe these three height aided with simple sketches.

(9 marks)

(c) Figure **Q3(a)** and **(b)** show a partial plan and side view of an 3 storey braced office. The design data are as follow:

Column size	=	350 x 400
Main beam size	=	350 x 500
Secondary beam size	=	300 x 350
Column cover	=	30 mm
Concrete Grade	=	35
Reinforcement Steel Grade	=	460
Link Grade	=	250
Main bar diameter (maximum)	=	25 mm

(i) Determined slenderness of column A/1 at level 3 by using BS8110 Part 2.

(7 marks)

(ii) Based on result obtained in Q3(c)(i) and Figure **Q3(c)**, design column A/1 at level 3.

(10 marks)

(d) What is the best cross section for a column located at center of a building? Justify your selection.

(3 marks)

Q4 (a) List **Three (3)** examples of bracing member.

(3 marks)

(b) Moment due to wind load can be resisted by bracing structure for braced frame. What is the element used to resist moment due to wind load for building without bracing member.

(2 marks)

(c) The building as shown in Figure **Q4** is an unbraced building and subjected to wind load pressure 0.85 kN/m^2.

(i) Calculate the wind load subjected to each level at grid A in kN.

(12 marks)

(ii) Draw moment diagram due to wind load only for beams and columns in grid A starting from beam on level VI and above.

(15 marks)

(d) What is the impact of the presence of bracing member in a building in terms of structural size?

(3 marks)

Q5 (a) By using aid of sketch, state **Four (4)** types of foundation that commonly used in building construction and explain the condition of each foundation which suitable to use.

(8 marks)

(b) A square pad footing is design to carries axial dead and imposed load of 1050 kN and 520 kN respectively from a column. The column dimension is 400 mm x 400 mm. If allowable soil bearing capacity is 200 kN/m^2 and grade of concrete used are 35,

(i) determine the minimum depth of pad footing by assuming the concrete cover 50 mm and the diameter of starting bar is 25 mm and bent 300 mm.

(4 marks)

(ii) determine the suitable size of pad footing.

(3 marks)

(c) Figure **Q5** shows a plan view and cross section of a pile cap with 9 number of pile groups. The pile cap is subjected to characteristic dead load of 2800 kN and characteristic imposed load of 2100 kN. Given the following data:

Characteristic strength of concrete, f_{cu}	=	40 N/mm^2
Characteristic strength of steel, f_y	=	460 N/mm^2
Concrete cover, c	=	50 mm
Bar diameter	=	25 mm

(i) Design the main reinforcement of the pile cap.

(8 marks)

(ii) Check the shear resistance of the pile cap.

(6 marks)

(iii) Sketch the detailing of the pile cap.

(3 marks)

(d) During driven of pile, one of the pile group is deviated against it original position. As a design engineer, suggest the solution.

(3 marks)

BAHAGIAN A (JAWAB SEMUA SOALAN)

S1 (a) Berikan definisi yang jelas untuk:

(i) Tetulang pasif.
(ii) Tetulang aktif.

(4 markah)

(b) Apakah perbezaan di antara konkrit pra-tegasan dengan konkrit pasca-tegasan.

(3 markah)

(c) Senarai **Empat (4)** jenis kehilangan tegasan.

(4 markah)

(d) Struktur konkrit boleh dikelaskan kepada empat pengkelasan. Di kelas manakah konkrit prategasan dikelaskan? Terangkan secara ringkas pengkelasan tersebut.

(6 markah)

(e) Satu rasuk prategasan sokong mudah segiempat tepat berukuran 500 mm x 750 mm mempunyai panjang rentang 7.3 m dan dikenakan beban teragih seragam sebanyak 45 kN/m termasuk berat sendiri rasuk. Tendon prategasan diletakkan seperti yang ditunjukkan dalam Rajah **Q1** dan menghasilkan prategasan efektif sebanyak 1620 kN. Jika rasuk dikelaskan sebagai kelas 1, semak samada semua had tegasan dipenuhi. Diberi:

Kehilangan daya tegasan	= 20%
Gred konkrit (khidmat), f_{cu}	= 35 N/mm^2
Gred konkrit (awal), f_{ci}	= 25 N/mm^2

(13 markah)

BAHAGIAN B (JAWAB DUA SOALAN SAHAJA)

S2 (a) Rajah **Q2** menunjukkan pandangan pelan dan keratan rentas untuk sebuah tangga rentang memanjang. Diberikan data berikut:

Penaik	=	175 mm
Pemijak	=	250 mm
Cekak	=	150 mm
Kekuatan ciri konkrit	=	30 N/mm^2
Kekuatan ciri tetulang	=	460 N/mm^2
Penutup konkrit	=	20 mm
Diameter tetulang utama	=	12 mm
Kemasan dan servis	=	1.0 kN/m^2
Beban hidup	=	4.0 kN/m^2

Untuk STR 1:

(i) Kirakan beban rekabentuk dan kemudian lakukan analisis.
(7 markah)

(ii) Rekabentuk semua tetulang.
(6 markah)

(iii) Semak ricih, pesongan dan keretakan.
(10 markah)

(iv) Lakarkan lukisan perincian.
(4 markah)

(b) Kirakan beban rekabentuk untuk STR 2.
(4 markah)

(c) Cadangkan satu sistem struktur alternatif untuk menukarkan STR 2 kepada tangga rentang melintang.
(4 markah)

S3 (a) Berbantukan rajah yang mudah, jelaskan dengan ringkas:

(i) Tiang satu kelengkungan.
(3 markah)

(ii) Tiang dua kelengkungan.
(3 markah)

(b) Terdapat tiga jenis ketinggian dalam rekabentuk tiang iaitu tinggi sebenar (l), tinggi bersih (l_o) dan tinggi efektif (l_e). Terangkan ketiga-tiga jenis ketinggian tersebut berbantukan lakaran yang mudah.
(9 markah)

(c) Rajah **Q3(a)** dan **(b)** menunjukkan sebahagian daripada pelan dan pandangan sisi sebuah pejabat 3 tingkat yang dirembat. Data-data rekabentuk adalah seperti berikut:

Saiz tiang	=	350 x 400
Saiz rasuk utama	=	350 x 500
Saiz rasuk kedua	=	300 x 350
Penutup tiang	=	30 mm
Gred konkrit	=	35
Gred tetulang utama	=	460
Gred tetulang pengikat	=	250
Diameter bar utama (maksimum)	=	25 mm

(i) Tentukan kelangsingan tiang A/1 pada aras 3 berdasarkan BS8110: Part 2.

(7 markah)

(ii) Berdasarkan keputusan yang diperolehi pada S3(c)(i) dan Rajah **Q3(c)**, rekebentuk tiang A/1 aras 3.

(10 markah)

(d) Apakah keratan rentas yang terbaik bagi sebuah tiang yang terletak di tengah-tengah sebuah bangunan? Berikan justifikasi terhadap pilihan anda.

(3 markah)

S4 (a) Senaraikan tiga contoh anggota perembat.

(3 markah)

(b) Momen akibat daripada beban angin akan ditanggung oleh anggota perembat bagi bangunan yang dirembat. Apakah elemen yang akan menanggung momen daripada beban angin bagi bangunan yang tidak mempunyai anggota perembat?

(2 markah)

(c) Sebuah bangunan seperti yang ditunjukkan di dalam Rajah **Q4** adalah bangunan yang tidak dirembat Bangunan berkenaan terdedah kepada tekanan angin sebanyak 0.85 kN/m^2.

(i) Kirakan beban angin bagi setiap aras pada grid A dalam unit kN.

(12 markah)

(ii) Lukiskan gambarajah momen akibat daripada beban angin sahaja untuk rasuk dan tiang pada grid A bermula dari aras VI ke atas.

(15 markah)

(d) Apakah impak kehadiran anggota perembat di dalam sesebuah bangunan terhadap saiz anggota struktur?

(3 markah)

S5 (a) Dengan bantuan lakaran, nyatakan **Empat (4)** jenis penapak yang biasa digunakan di dalam pembinaan bangunan dan terangkan keadaan yang bersesuaian bagi penggunaan setiap penapak tersebut.

(8 markah)

(b) Sebuah penapak tunggal segiempat sama direkabentuk untuk menanggung beban paksi mati dan kenaan daripada tiang masing-masing 1050 kN dan 520 kN. Dimensi tiang adalah 400 mm x 400 mm. Sekiranya keupayaan galas tanah yang dibenarkan adalah 200 kN/m^2 dan gred konkrit yang digunakan adalah 35,

(i) tentukan ukur dalam minimum penapak tunggal tersebut dengan menanggap penutup konkrit 50 mm dan diameter bar pemula 25 mm serta dibengkokkan sebanyak 300 mm.

(4 markah)

(ii) tentukan saiz penapak yang bersesuaian.

(3 markah)

(c) Rajah **Q5** menunjukkan pandangan pelan dan keratan tukup cerucuk yang terdiri daripada 9 batang cerucuk. Tukup cerucuk dikenakan beban mati ciri sebesar 2800 kN dan beban kenaan ciri sebesar 2100 kN. Diberi data-data berikut:

Kekuatan ciri konkrit, f_{cu}	=	40 N/mm^2
Kekuatan ciri tetulang keluli, f_y	=	460 N/mm^2
Penutup konkrit, c	=	50 mm
Diameter bar	=	25 mm

(i) Rekabentuk tetulang utama tukup cerucuk.

(8 markah)

(ii) Semak rintangan ricih tukup cerucuk.

(6 markah)

(iii) Lakarkan perincian tukup cerucuk.

(3 markah)

(d) Semasa kerja melantak cerucuk, di dapati salah satu cerucuk terpesong daripada kedudukan asal. Sebagai jurutera rekabentuk, cadangkan penyelesaian.

(3 markah)

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SEMESTER/SESSION : SEMESTER II 2009/2010
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COURSE : 3 BFF
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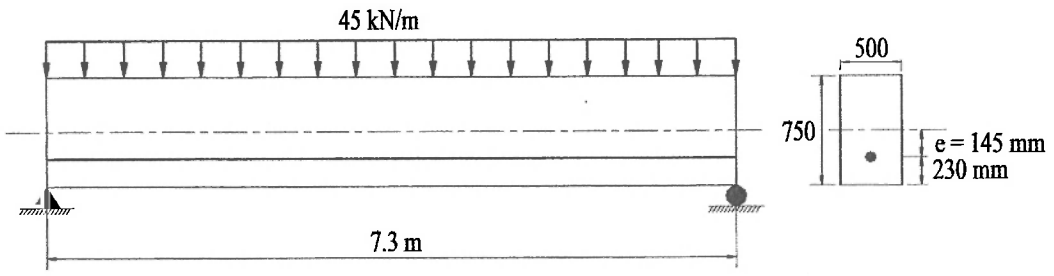
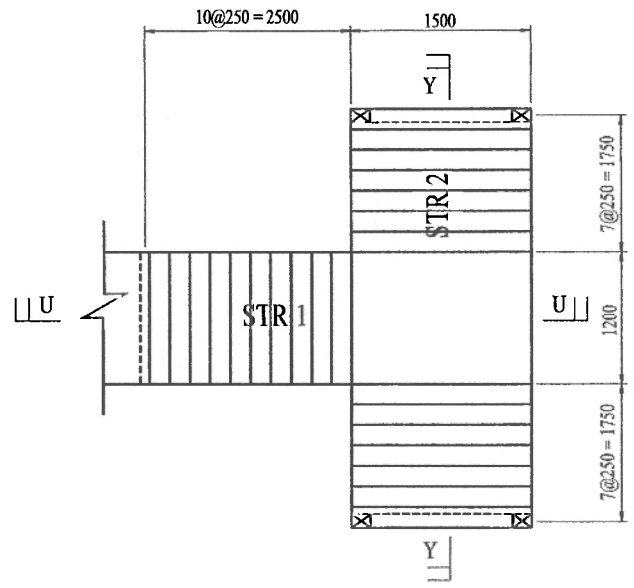
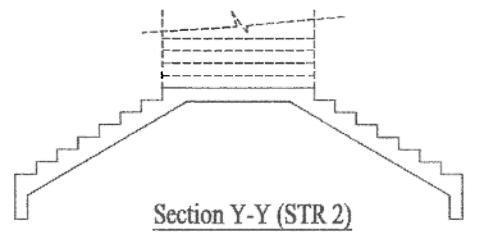
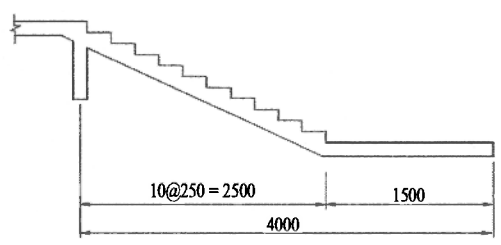


FIGURE Q1







Section U-U (STR 1)

FIGURE Q2

FINAL EXAMINATION

SEMESTER/SESSION	: SEMESTER II 2009/2010	COURSE	: 3 BFF
SUBJECT	: STRUCTURAL CONCRETE DESIGN II	SUBJECT CODE	: BFC3172

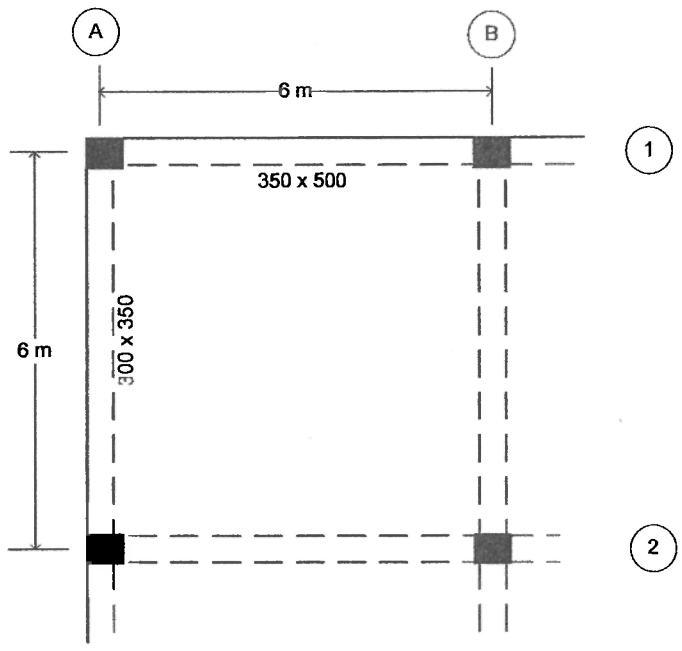


FIGURE Q3(a)

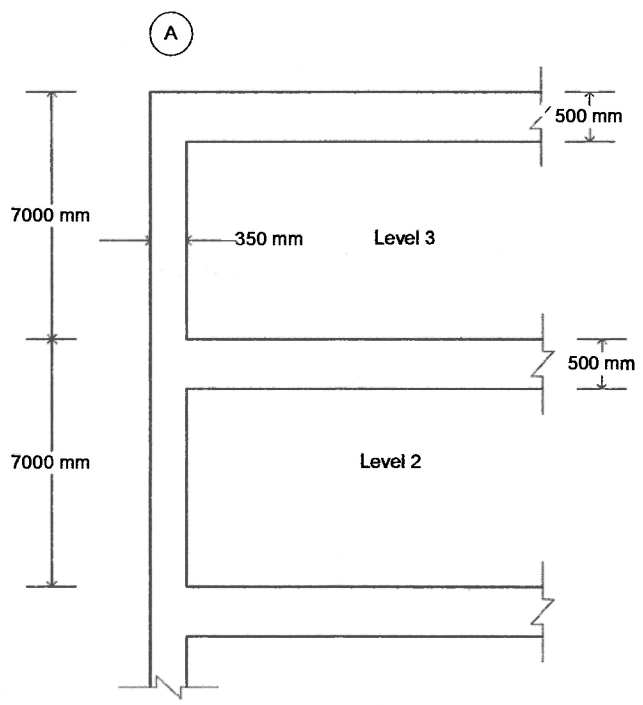


FIGURE Q3(b)

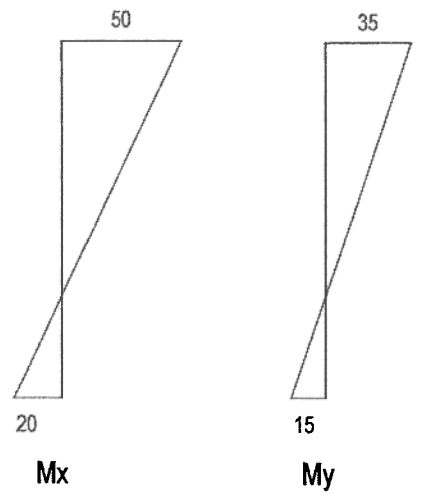


FIGURE Q3(c)

FINAL EXAMINATION

SEMESTER/SESSION : SEMESTER II 2009/2010
SUBJECT : STRUCTURAL CONCRETE DESIGN II
COURSE : 3 BFF
SUBJECT CODE : BFC3172

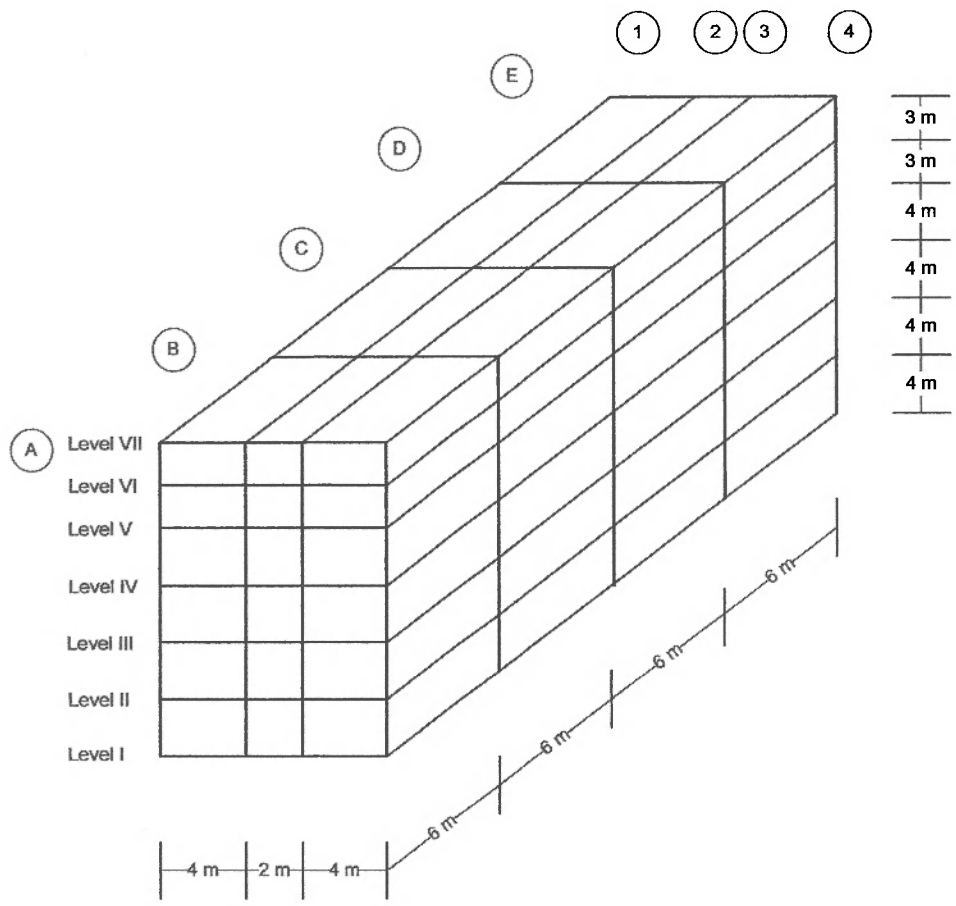


FIGURE Q4

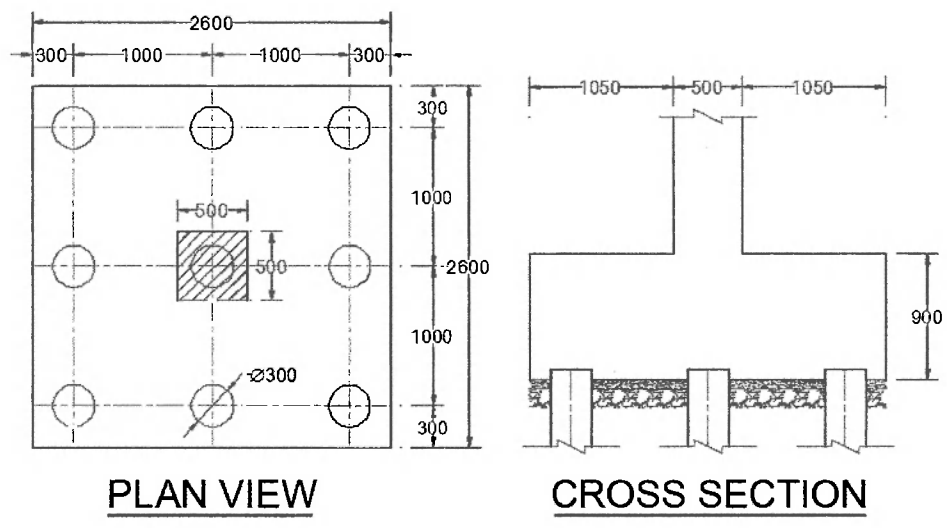


FIGURE Q5

Appendix (Cross Sectional Area of Reinforcement)

Table 1: Cross Sectional Area (mm^2) according to Size and Numbers of Bar

Bar Size (mm)	Number of bar								Perimeter (mm)
	1	2	3	4	5	6	7	8	
6	28.3	56.6	84.9	113	141	170	198	226	18.9
8	50.3	101	151	201	251	302	352	402	25.1
10	78.6	157	236	314	393	471	550	629	31.4
12	113	226	339	453	566	679	792	905	37.7
16	201	402	603	805	1006	1207	1408	1609	50.3
20	314	629	943	1257	1571	1886	2200	2514	62.9
25	491	982	1473	1964	2455	2946	3438	3929	78.6
32	805	1609	2414	3218	4023	4827	5632	6437	100.6
40	1257	2514	3771	5029	6286	7543	8800	10057	125.7

Table 2: Cross Sectional Area (mm^2) for every meter width at distance between bar

Bar Size (mm)	Distance between Bar (mm)								
	50	75	100	125	150	175	200	250	300
6	566	377	283	226	189	162	141	113	94
8	1006	670	503	402	335	287	251	201	168
10	1571	1048	786	629	524	449	393	314	262
12	2263	1509	1131	905	754	647	566	453	377
16	4023	2682	2011	1609	1341	1149	1006	805	670
20	6286	4190	3143	2514	2095	1796	1571	1257	1048
25	9821	6548	4911	3929	3274	2806	2455	1964	1637
32	16091	10728	8046	6437	5364	4598	4023	3218	2682
40	25143	16762	12571	10057	8381	7184	6286	5029	4190