

SULIT



BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI DISEMBER 2015

DCC3103 : GEOTECHNICAL ENGINEERING

TARIKH : 5 APRIL 2016

MASA : 2.30 PM – 4.30 PM (2 JAM)

Kertas ini mengandungi **DUA BELAS (12)** halaman bercetak.

Bahagian A: Struktur (2 soalan)

Bahagian B: Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula, Carta Keplastikan, Taylor Stabilization Chart, Terzaghi's Bearing Capacity Factors & Kertas graf

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A : 50 MARKS
BAHAGIAN A : 50 MARKAH

INSTRUCTION:

This section consists of **TWO (2)** structured questions. Answer **ALL** questions.

ARAHAN :

Bahagian ini mengandungi DUA (2) soalan berstruktur. Jawab SEMUA soalan.

QUESTION 1

SOALAN 1

- CLO1
C1 (a) State the processes involved in the rock cycle.
Nyatakan proses yang terlibat dalam kitaran batuan. [6 marks]
[6 markah]
- CLO1
C2 (b) Explain:
Terangkan:
- (i) Organic soil
Tanah organik
 - (ii) Residual soil
Tanah Baki
 - (iii) Transported soil
Tanah terangkut
- [9 mark]
[9 markah]
- CLO2
C3 (c) A series of unconfined unconsolidated is carried out on a soil sample and the results are shown as in **Table 1c** below:
Beberapa siri ujian tidak terkurung tidak tersalir telah dilakukan ke atas sampel tanah dan keputusannya seperti Jadual 1c berikut:

Table 1c / Jadual 1c

Cell Pressure (kN/m ²) <i>Tekanan Sel (kN/m²)</i>	Stress at failure (kN/m ²) <i>Tegasan ketika gagal (kN/m²)</i>
200	281
400	319
600	382

Calculate the shear strength parameters of the soil.

Kirakan parameter kekuatan tanah tersebut.

[10 marks]

[10 markah]

QUESTION 2

SOALAN 2

CLO1
C2

(a) Explain the types of foundation below;

Terangkan jenis-jenis asas di bawah;

(i) Shallow foundation

Asas cetek

(ii) Deep foundation

Asas dalam

[8 marks]

[8 markah]

CLO2
C3

(b) A square footing (2m x 2m) is placed at depth of 1.5 m in sand with shear strength parameters $c' = 0$ and $\phi' = 30^\circ$. The unit weight of the sand is 16 kN/m^3 . Using the Terzaghi's bearing capacity equation for a factor of safety 2.5, calculate the, *Satu asas empat segi sama (2m x 2m) di tempatkan di dalam pasir pada kedalaman 1.5m mempunyai parameter kekuatan ricih $c' = 0$ and $\phi' = 30^\circ$. Berat unit tanah pasir adalah 16 kN/m^3 . Menggunakan persamaan keupayaan galas Terzaghi dan faktor keselamatan 2.5, kirakan*

(i) Allowable bearing capacity

Keupayaan galas dibenarkan

(ii) Allowable load

Beban dibenarkan

[9 marks]

[9 markah]

CLO2
C4

- (c) A square footing is shown in **Figure 2c**. The footing will carry a gross mass of 400 kN. Using a factor of safety of 3, determine the size of the footing (B).
Satu asas empat segi sama ditunjukkan seperti di dalam Rajah 2c. Asas tersebut akan membawa beban kasar 400 kN. Dengan menggunakan faktor keselamatan 3, tentukan saiz asas tersebut (B).

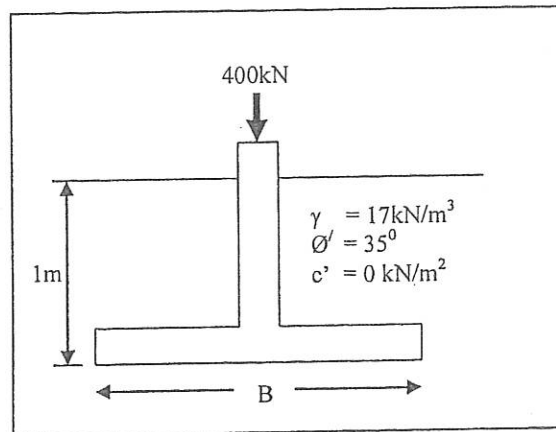


Figure 2c / Rajah 2c

[8 marks]

[8 markah]

SECTION B : 50 MARKS
BAHAGIAN B : 50 MARKAH

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **TWO (2)** questions only.

ARAHAN:

Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **DUA (2)** soalan sahaja.

QUESTION 1

SOALAN 1

CLO2
C3

- (a) The combined weight of a mould and the specimen of a compacted soil is 3500 g. The mould's volume is 845 cm³. The mold's weight is 2013 g and the specimen's water content is 10%. Given G_s is 2.67. Calculate:
Berat bekas dan sampel tanah yang telah dipadatkan mengandungi 3500g. Isipadu bekas adalah sebanyak 845 cm³. Manakala berat bekas tersebut ialah 2013 g dan kandungan air adalah pada 10%. G_s diberi 2.67. Kirakan:

- (i) Wet unit weight of the specimen (kN/m³) [5 marks]
Berat unit basah sampel tanah (kN/m³) [5 marks]
- (ii) Dry unit weight of the specimen (kN/m³) [5 marks]
Berat unit kering tanah (kN/m³) [5 marks]
- (iii) Void ratio [3 marks]
Nisbah lompong [3 marks]

CLO2
C4

- (b) Following are the results obtained from the standard compaction test.
Berikut adalah keputusan yang diperolehi daripada ujian pepadatan.

Bulk density (kg/m ³)	2138	2186	2213	2228	2212	2192
Moisture content (%)	8.5	9.4	10.2	11.3	12.5	13.6

Draw the curve of dry density against moisture content, determine the maximum dry density and optimum moisture content of the soil.

Plotkan lengkung pemadatan melawan kandungan lembapan, tentukan ketumpatan kering maksimum dan kandungan air optimum bagi pemadatan tersebut.

[12 marks]

[12 markah]

QUESTION 2

SOALAN 2

CLO 2
C3

a) A 5m layer of clay is overlaid by a 3m layer of sand. The groundwater level is located at 1.5m below surface. Above the surface, the weight of sand is 19.4 kN/m^3 , and the saturated unit weight for sand and clay are each valued at 21.4 kN/m^3 and 18.6 kN/m^3 .

Satu lapisan tanah liat yang tebalnya 5m ditindih oleh lapisan pasir setebal 3m. Aras air bumi berada pada paras 1.5m di bawah permukaan bumi. Di atas aras air bumi, berat unit pasir adalah 19.4 kN/m^3 , manakala berat unit pasir tepu dan tanah liat masing-masing adalah 21.4 kN/m^3 dan 18.6 kN/m^3 .

- i. Calculate the normal stress, pore water pressure and effective stress at 8m depth below earth's surface.

Kira tegasan normal, tekanan air liang dan tegasan berkesan pada kedalaman 8m di bawah permukaan bumi.

- ii. Sketch the stress distribution diagram for normal stress, pore water pressure and effective stress.

Lukiskan gambarajah taburan tegasan untuk tegasan normal, tekanan air liang dan tegasan berkesan.

[13 marks]

[13 markah]

CLO 2
C4

b) A smooth backed vertical wall is 6 m high and retains a soil with a bulk unit weight of 20 kN/m^3 and $\phi = 20^\circ$ (Refer Figure 2b). The top of the soil is level with the top of the wall and is horizontal. If the soil surface carries a load of 50 kN/m^2 ,

Sebuah tembok setinggi 6 m dengan belakang yang licin menahan tanah yang mempunyai berat unit 20 kN/m^3 dan $\phi = 20^\circ$ (Rujuk Rajah 2b). Bahagian atas tanah yang mengufuk searas dengan bahagian atas tembok. Jika permukaan tanah menanggung beban sebanyak 50 kN/m^2 ,

- i. Draw the soil stress distribution diagram

Lukiskan gambarajah taburan tegasan tanah.

[2 marks]

[2 markah]

- ii. Determine the total thrust on the wall metre of wall and its point of application.

Tentukan tujah seluruh yang bertindak keatas tembok dan juga titik pengenaannya

[10 marks]

[10 markah]

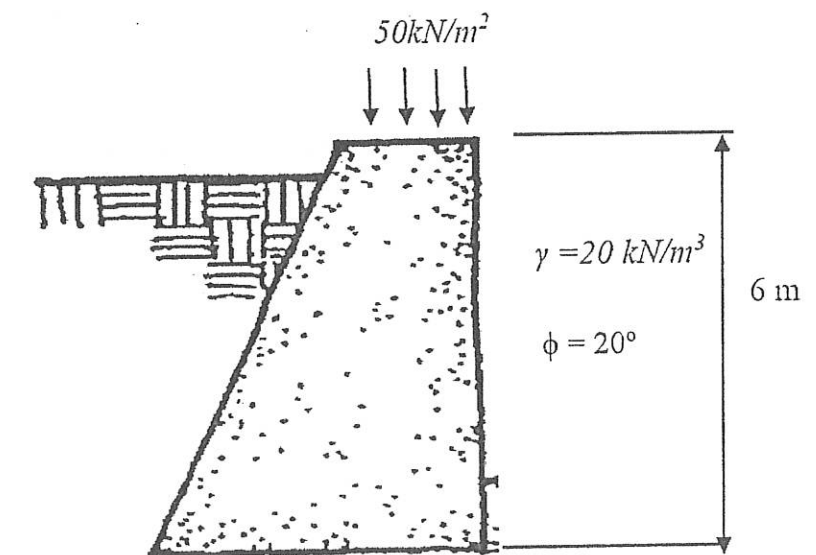


Figure 2b / Rajah 2b

QUESTION 3
SOALAN 3

Figure 3 below shows a 10m height slope. The slope comprises of a clay layer with the shear strength, C_u of 50kN/m^2 , and the average unit weight is 19.0kN/m^3 .

Rajah 3 di bawah menunjukkan satu cerun yang mempunyai ketinggian 10 m. Cerun ini terdiri daripada lapisan tanah liat dengan kekuatan ricih, C_u iaitu 50 kN/m^2 dan purata berat unit adalah 19.0 kN/m^3 .

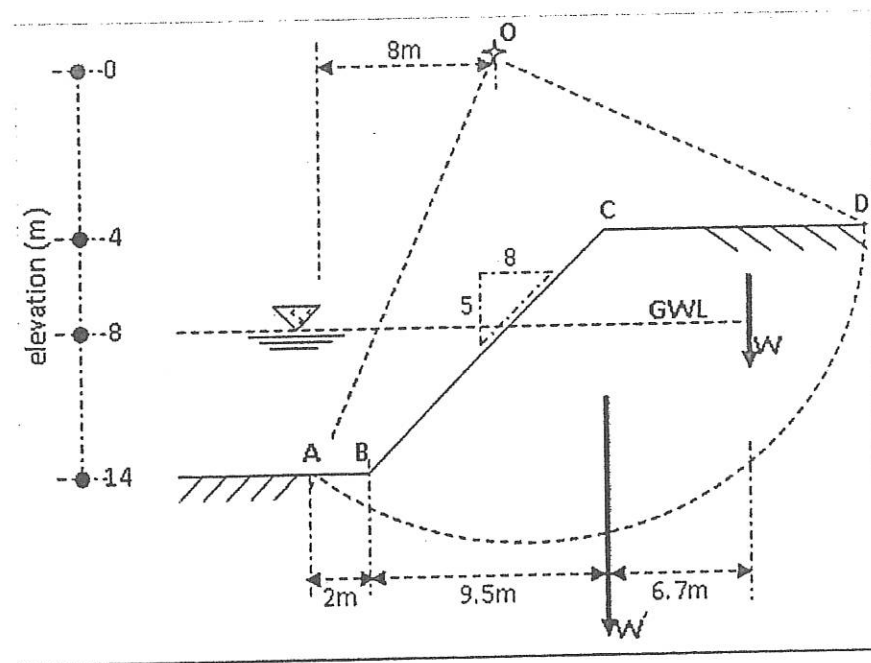


Figure 3 / Rajah 3

- (i) The lower 6m of the slope is submerged under water.
Sedalam 6m daripada kaki cerun ditenggelam oleh air

[10 marks]

[10 markah]

- (ii) If there is no external water pressure on the slope face.
Jika tidak ada tekanan air luaran pada muka cerun.

[5 marks]

[5 markah]

In both cases, assume a tension crack at the crest of the slope, and the crack is filled with water.

Pada kedua-dua kes diatas, anggap retak ketegangan di puncak cerun, dan retak dengan dipenuhi air.

- CLO2 (a) Sketch the area above and below water level in a graph paper.

C3

Lakarkan luas di atas dan di bawah paras air bumi di dalam kertas graf.

[10 marks]

[10 markah]

- CLO2 (b) Determine the safety factor against slip failure if it occurs along the profile shown in **Figure 3** with the following conditions:

C4

*Tentukan faktor keselamatan terhadap kegagalan slip jika berlaku di sepanjang profil yang ditunjukkan dalam **Rajah 3** berdasarkan pada kes berikut:*

QUESTION 4

SOALAN 4

CLO2
C3

- (a) (i) Interpret the flow net.

Jelaskan dengan terperinci jaringan aliran.

[5 marks]

[5 markah]

- (ii) Sketch the flow net of concrete dam and explain clearly about the equipotential (
- N_e
-) and flow lines (
- N_f
-).

Lakarkan jaringan aliran bagi empangan konkrit dan terangkan dengan jelas mengenai garis sama upaya (N_e) dan garis aliran (N_f).

[10 marks]

[10 markah]

CLO2
C4

- (b) Figure 4b below shows one dig of sheet piling on sandy soil. If the coefficient of permeability (
- k
-) is
- 7.2×10^{-3}
- mm/sec.

Rajah 4b menunjukkan satu korekan cerucuk keping pada lapisan tanah pasir. Jika diberi pekali kebolehtelapan (k) tanah adalah 7.2×10^{-3} mm/s.

- (i) Draw a flow net and get the value of equipotential (N_e) and flow lines (N_f).
Lukiskan jaringan aliran dan dapatkan nilai garis sama upaya (N_e) dan garis aliran (N_f).
- (ii) Determine the quantity of seepage, Q in m^3 /hour/m length.
Tentukan kadar alir resipan, Q dalam unit m^3 /jam/m panjang.
- (iii) Evaluate the pore water pressure at point P.
Anggarkan tekanan air liang pada titik P.

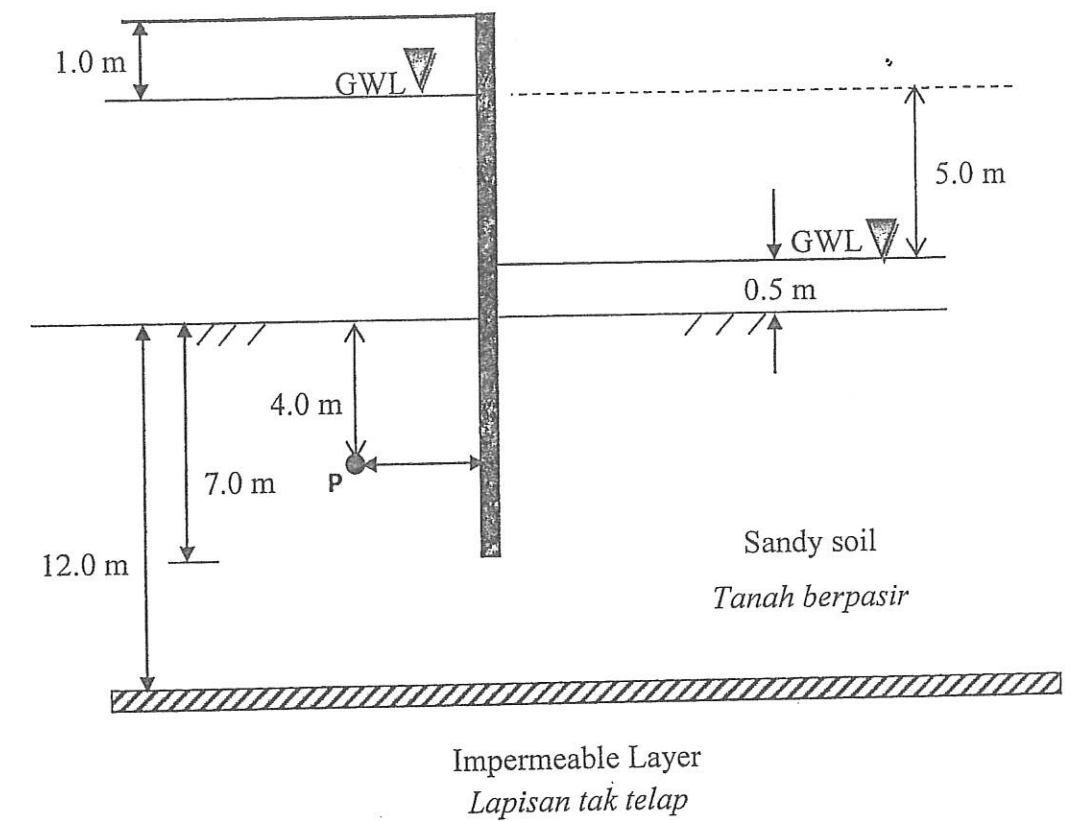


Figure 4b / Rajah 4b

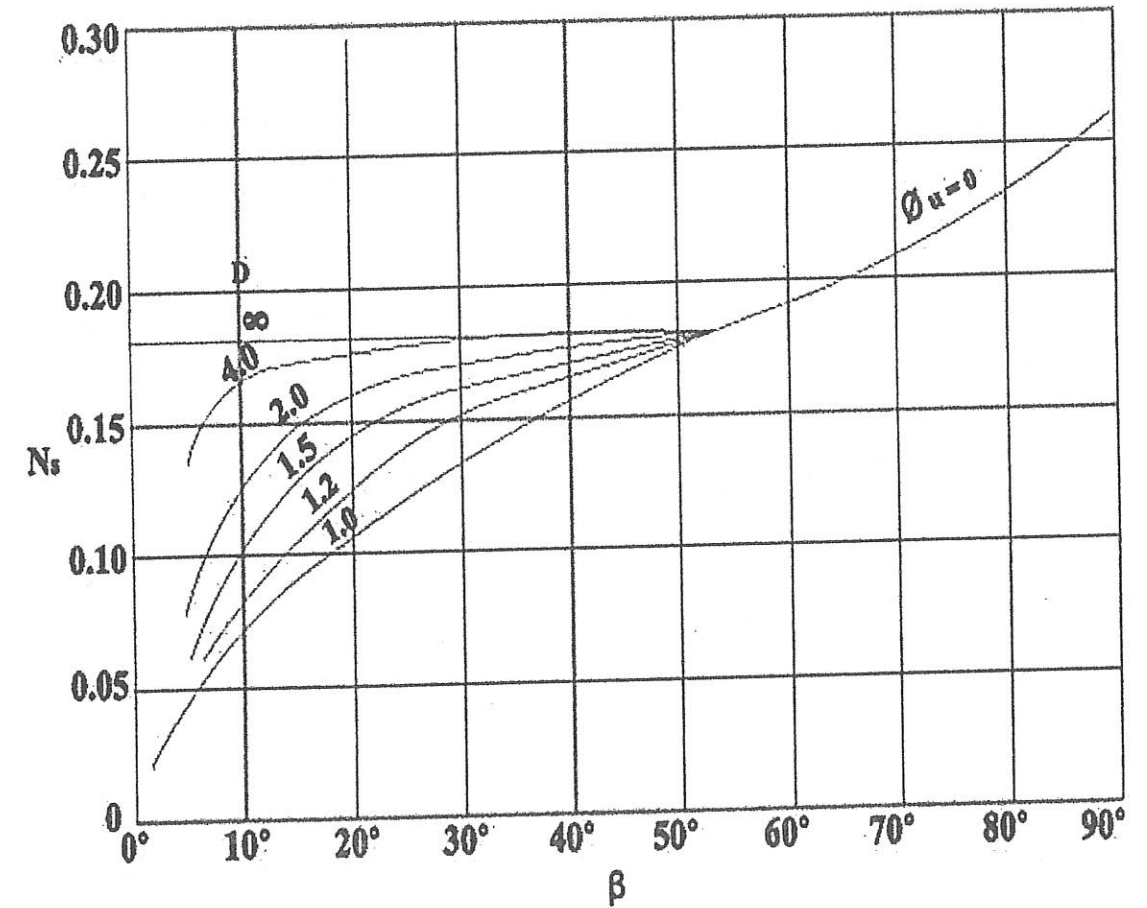
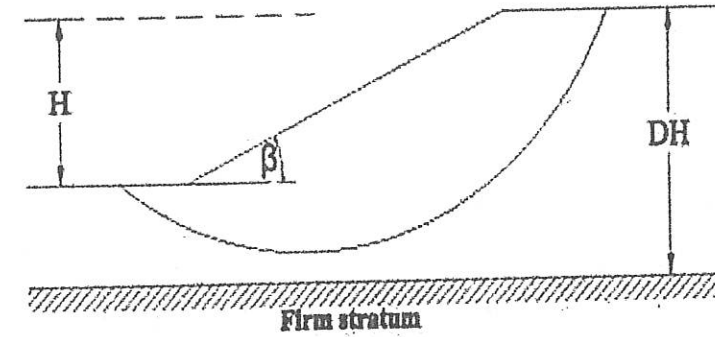
[10 marks]

[10 markah]

SOALAN TAMAT

1. $V_t = V_s + V_v = V_s + V_w + V_a$
2. $G_s = \frac{m_s}{V_s \rho_w}$
3. $\rho_d = \frac{\rho_b}{1+w}$
4. $\rho_b = \frac{M_s(1+w)}{v}$
5. $\rho_b = \frac{G_{spw}(1+w)}{1+e}$
6. $\rho_d = \frac{G_{spw}}{1+e}$
7. $S = \frac{wG_s}{e}$
8. $\rho_{sat} = \frac{\rho_w(G_s+e)}{1+e}$
9. $\rho_d = \frac{G_s \rho_w (1-A_r)}{(1+wG_s)}$
10. $n = \frac{e}{1+e}$
17. $\sigma = \rho gh = \gamma h$
18. $\sigma = \sigma' + u$
19. $u = \gamma_w h$
1. $Q = KH \frac{Nf}{Ne}$
2. $\sigma_a = K_a (q + \gamma z) - 2C \sqrt{K_a}$
3. $K_a = \frac{1 - \sin \phi}{1 + \sin \phi}$
4. $\sigma_p = K_p (q + \gamma z) + 2C \sqrt{K_p}$
5. $K_p = \frac{1 + \sin \phi}{1 - \sin \phi}$
6. $K_a = \frac{\cos \beta - \sqrt{\cos^2 \beta - \cos^2 \phi}}{\cos \beta + \sqrt{\cos^2 \beta - \cos^2 \phi}}$
7. $P = \frac{Rv}{B} (1 \pm \frac{6e}{B})$
8. $F.K = \frac{Rv \tan \delta}{Rh}$
9. $F.K = \frac{CuR^2 \theta}{Wd}$
10. $F.K = \frac{Rv \times (B - \bar{x})}{Rh \times \bar{y}}$
11. $hc = \frac{2C}{\gamma \sqrt{K_a}}$
12. $N = \frac{\gamma z}{Cu}$
13. $F.K = \frac{\sum CL + \sum W \cos \alpha (\tan \phi)}{\sum W \sin \alpha}$
14. $F.K = \frac{\sum CL + (\sum W \cos \alpha - \sum UL) \tan \phi}{\sum W \sin \alpha}$

CARTA KESTABILAN TAYLOR



Taylor's stability coefficients $\phi_u = 0$. (Reproduced by permission of the Boston of Civil Engineers)

BEARING CAPACITY FACTORS FOR GENERAL SHEAR

BEARING CAPACITY FACTORS FOR GENERAL SHEAR

ANGLE OF FRICTION ϕ (DEGREES)	TERZAGHI		MEYERHOF		HANSEN	
	N_c	N_q	N_c	N_q	N_c	N_q
0	5.70	1.00	5.10	1.00	0.00	1.00
2	6.30	1.22	5.63	1.20	0.01	1.20
4	6.97	1.49	6.19	1.43	0.04	1.43
5	7.34	1.64	6.49	1.57	0.07	1.57
6	7.73	1.81	6.81	1.72	0.11	1.72
8	8.60	2.21	7.53	2.06	0.21	2.06
10	9.60	2.69	8.34	2.47	0.37	2.47
12	10.76	3.29	9.28	2.97	0.60	2.97
14	12.11	4.02	10.37	3.59	0.92	3.59
15	12.86	4.45	10.98	3.94	1.13	3.94
16	13.68	4.92	11.63	4.34	1.37	4.34
18	15.52	6.04	13.10	5.26	2.00	5.26
20	17.69	7.44	14.83	6.40	2.87	6.40
22	20.27	9.19	16.88	7.82	4.07	7.82
24	23.36	11.40	19.32	9.60	5.72	9.60
25	25.13	12.72	20.72	10.66	6.77	10.66
26	27.09	14.21	22.25	11.85	8.00	11.85
28	31.61	17.81	25.80	14.72	11.19	14.72
30	37.16	22.46	30.14	18.40	15.67	18.40
32	44.04	28.52	35.49	23.18	22.02	23.18
34	52.64	36.50	42.16	29.44	31.15	29.44
35	57.75	41.44	46.12	33.30	37.15	33.30
36	63.53	47.16	50.59	37.75	44.43	37.75
38	77.50	61.55	61.85	48.93	64.07	48.93
40	95.66	81.27	75.31	64.20	93.69	64.20
42	119.67	108.75	93.71	85.37	139.32	93.71
44	151.95	147.74	118.37	115.31	211.41	115.31
45	172.29	173.29	133.87	134.87	262.74	133.87
46	196.22	204.19	152.10	158.50	328.73	152.10
48	258.29	287.85	199.26	222.30	526.45	199.26
50	347.51	415.15	266.88	319.06	873.86	266.88
						319.06
						266.88
						568.57

PLASTICITY CHART - CARTA KEPLASTIKAN

