
UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2008/2009

April/May 2009

REG 366 - Design of Roads and Highways
[Rekabentuk Jalan dan Lebuhraya]

Duration: 3 hours
[Masa: 3 jam]

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

Sila pastikan bahawa kertas peperiksaan ini mengandungi SEBELAS 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 **FIVE** questions only.

*Jawab **LIMA** soalan sahaja.*

Students are allowed to carry one piece of A4 size paper with relevant formulas for their reference during examination.

Pelajar dibenarkan membawa masuk sehelai kertas saiz A4 mengandungi formula berkaitan untuk tujuan rujukan semasa peperiksaan.

- 2 -

1. (a) Describe the various category of road and the common reserves required for ROW (Right of Way)

Terangkan jenis-jenis jalan dan kebiasaan luas simpanan jalan yang diperlukan berdasarkan kategori jalan tersebut.

(10 marks/markah)

- (b) Explain the need of slope reserve in land development planning and construction.

Jelaskan keperluan simpanan cerun disediakan diperingkat perancangan dan pembinaan sesuatu projek pembangunan.

(10 marks/markah)

2. (a) Describe how advancement in technology could affect road design and construction practices.

Terangkan bagaimanakah kemajuan dalam teknologi akan mempengaruhi rekabentuk dan pembinaan jalan raya.

(10 marks/markah)

- (b) What is stopping sight distance? Explain the components of a stopping sight distance.

Apakah itu jarak penglihatan berhenti? Terangkan komponen-komponen jarak tersebut.

(10 marks/markah)

3. (a) The centerline of a proposed road runs on a direction of NORTH 25 degree 10 minute EAST ($N 25^{\circ} 10' 00'' E$) to a point A and then changes direction to SOUTH 66 degree 25 minutes EAST ($S 66^{\circ} 25' 00'' E$). A curve with a radius of 50 meter is to be design to accommodate the change in direction. Calculate the deflection angle, tangent length and curve length.

Garisan tengah jalan yang direkabentuk menuju ke arah NORTH 25 degree 10 minute EAST ($N 25^{\circ} 10' 00'' E$) ke titik A and kemudian bertukar arah ke SOUTH 66 degree 25 minutes EAST ($S 66^{\circ} 25' 00'' E$). Suatu lengkung berjari 50 meter perlu direkabentuk bagi peralihan ini. Tentukan sudut, jarak tangent dan panjang lengkung

(10 marks/markah)

- (b) Assuming the road begins at 200 meter before point A and ends 200 meter after point A, sketch and locate 20 meter stations, the stations at TC and CT, and the station at the end of the road.

Katakan jalan tersebut bermula 200 meter sebelum titik A dan tamat 200 meter selepas titik A, lukis dan tanda kedudukan stesen atau CH berjarak 20m sela. Tandakan juga nilai stesen di TC dan CT seterusnya stesen di penghujung jalan.

(10 marks/markah)

4. Given road construction drawings as shown in **Figure 4.1**, calculate the amount of cut and fill required between CHAINAGE 00 and 100.

*Diberi lukisan pembinaan sebuah jalan seperti dalam **Rajah 4.1**. Tentukan jumlah isipadu pemotongan dan tambakan antara CHAINAGE 00 dan 100.*

(20 marks/markah)

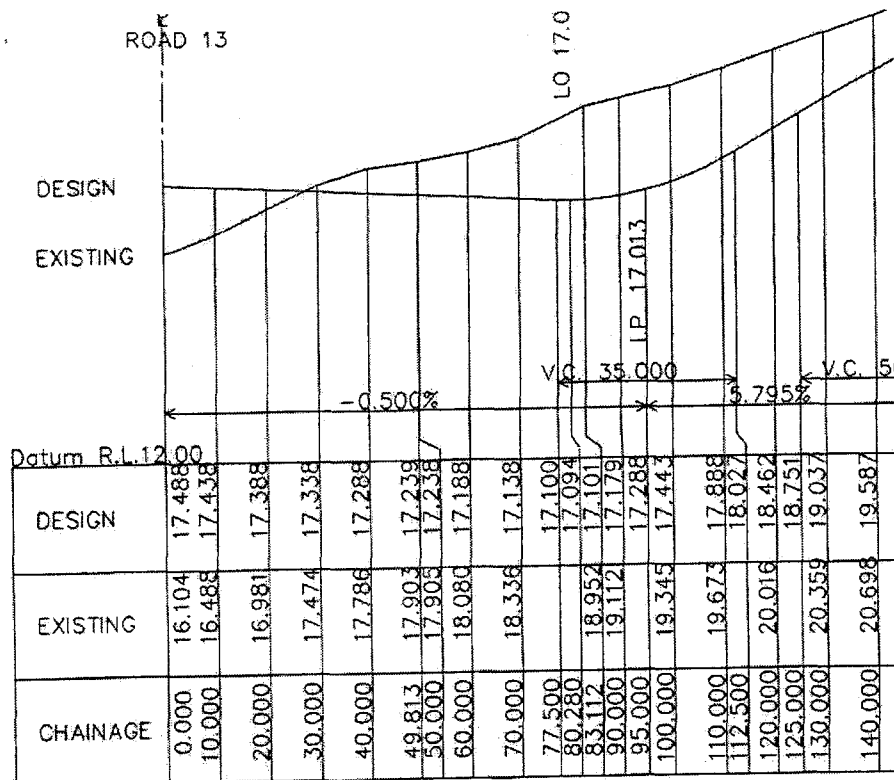


Figure 4.1(Rajah 4.1)

5. There are various tests and monitoring carried out prior to, during and after road constructions.

Terdapat berbagai ujian dan pemantauan dilakukan sebelum, semasa dan selepas pembinaan jalan.

- (a) Describe **two (2)** types of test or investigation usually carried out during design stage.

*Terangkan **dua (2)** jenis ujian atau penyiasatan yang lazimnya dilakukan untuk tujuan peringkat rekabentuk.*

- (b) Describe **two (2)** types of test or monitoring during constructions.

*Terangkan **dua (2)** jenis ujian atau pemantauan yang lazimnya dijalankan semasa kerja pembinaan.*

- (c) What is CBR test and what is it for?

Apakah itu ujian CBR dan untuk apakah ianya dijalankan.

(20 marks/markah)

6. (a) Explain when and why site or soil improvement is required in the construction of road and highways.

Jelaskan bila dan mengapa pembaikan tapak atau tanah diperlukan dalam kerja-kerja berkaitan pembinaan jalan dan lebuh raya.

- (b) List **four (4)** soil or site improvement methods and discuss how the methods improve or strengthen soil conditions.

*Senaraikan **empat (4)** kaedah pembaikan tanah atau tapak dan bincangkan bagaimana kaedah-kaedah ini dapat meningkatkan kekuatan dan keadaan tanah.*

- (c) Describe the role of geosynthetics particularly in road constructions.

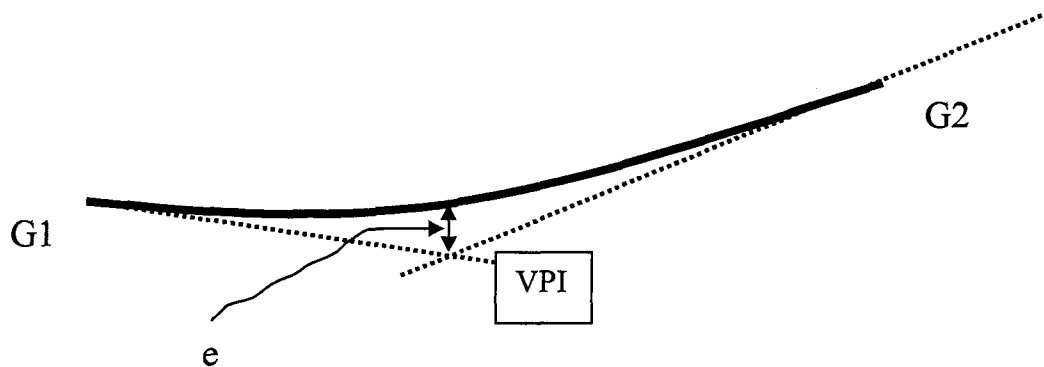
Jelaskan peranan geosintetik terutamanya dalam kerja-kerja pembinaan jalan dan lebuh raya.

REG 366 ROAD AND HIGHWAY
(JALAN DAN LEBUHRAYA)

DESIGN CHART/INFORMATION/AIDS

Ver2.09

VERTICAL ALIGNMENT



$$e = \frac{(g2 - g1) \times L}{800}$$

e = offset in meter

L = distance from VPC to VPT

g2 = outgoing gradient in percent

g1 = incoming gradient in percent

Using the following expression, calculate the remaining design levels:

$$L_x = L_p + (x/L)^2 4e$$

L_x = design elevation on curve

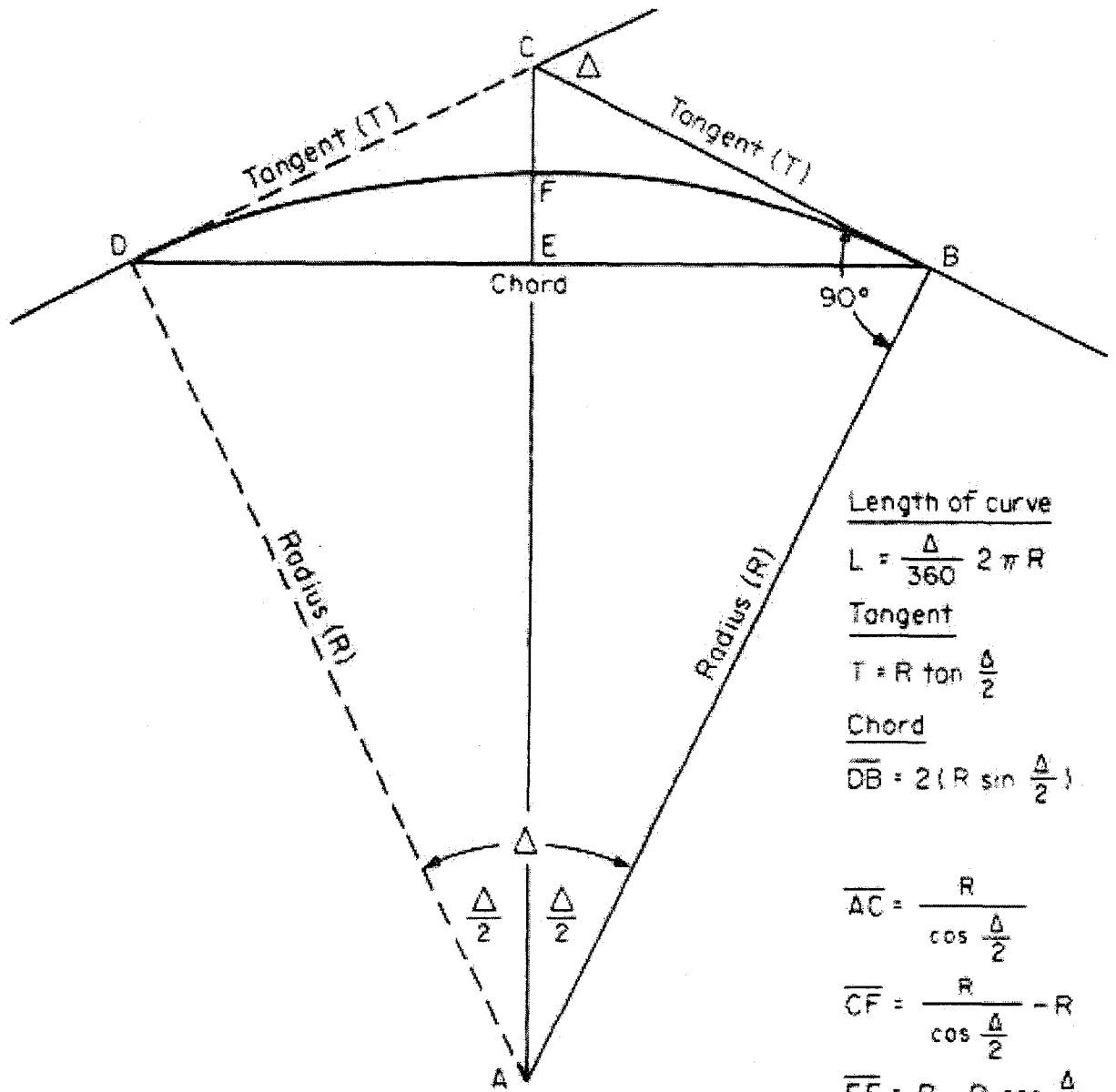
L_p = elevation on tangent line

L = length/distance in meter

e = middle point offset

x = distance from VPC

HORIZONTAL CURVE



Length of curve

$$L = \frac{\Delta}{360} 2\pi R$$

Tangent

$$T = R \tan \frac{\Delta}{2}$$

Chord

$$\overline{DB} = 2 \left(R \sin \frac{\Delta}{2} \right)$$

$$\overline{AC} = \frac{R}{\cos \frac{\Delta}{2}}$$

$$\overline{CF} = \frac{R}{\cos \frac{\Delta}{2}} - R$$

$$\overline{EF} = R - R \cos \frac{\Delta}{2}$$

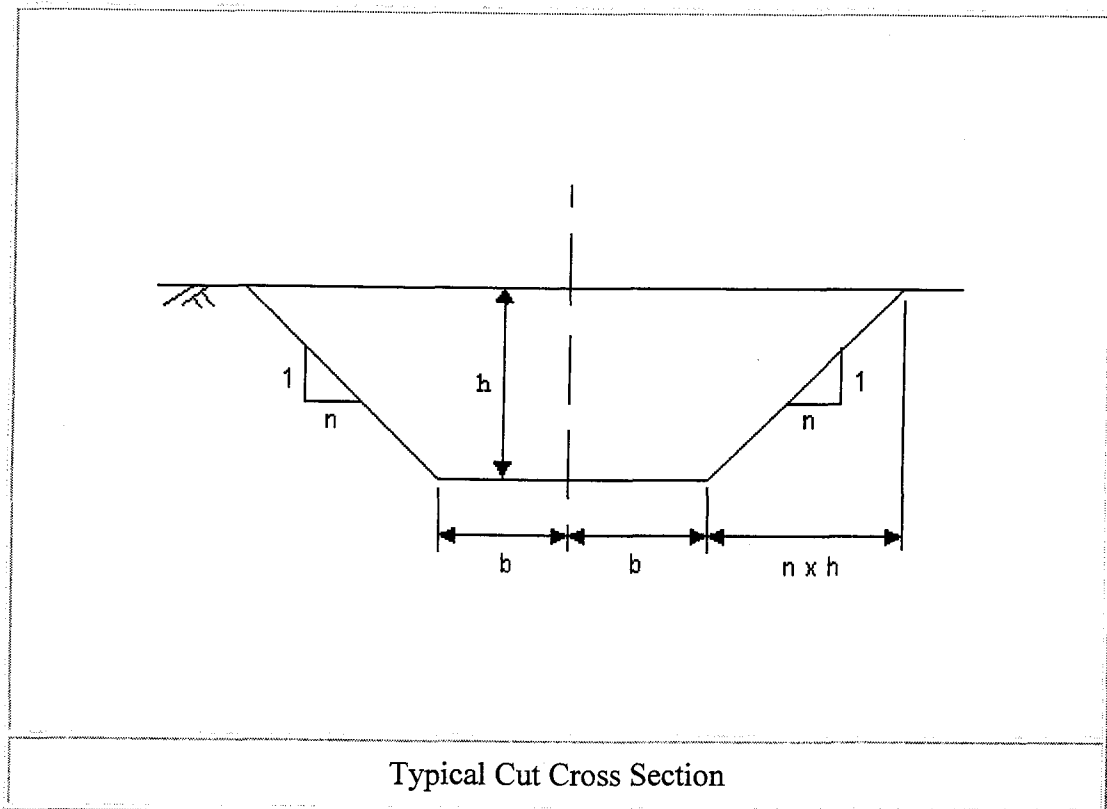
$$\overline{AE} = R \cos \frac{\Delta}{2}$$

EARTHWORK VOLUME CALCULATION (AVERAGE END AREA METHOD)

$$V = \frac{(A1 + A2) \times L}{2}$$

Calculation of Cross Sectional Area

For a cut or fill on horizontal ground.



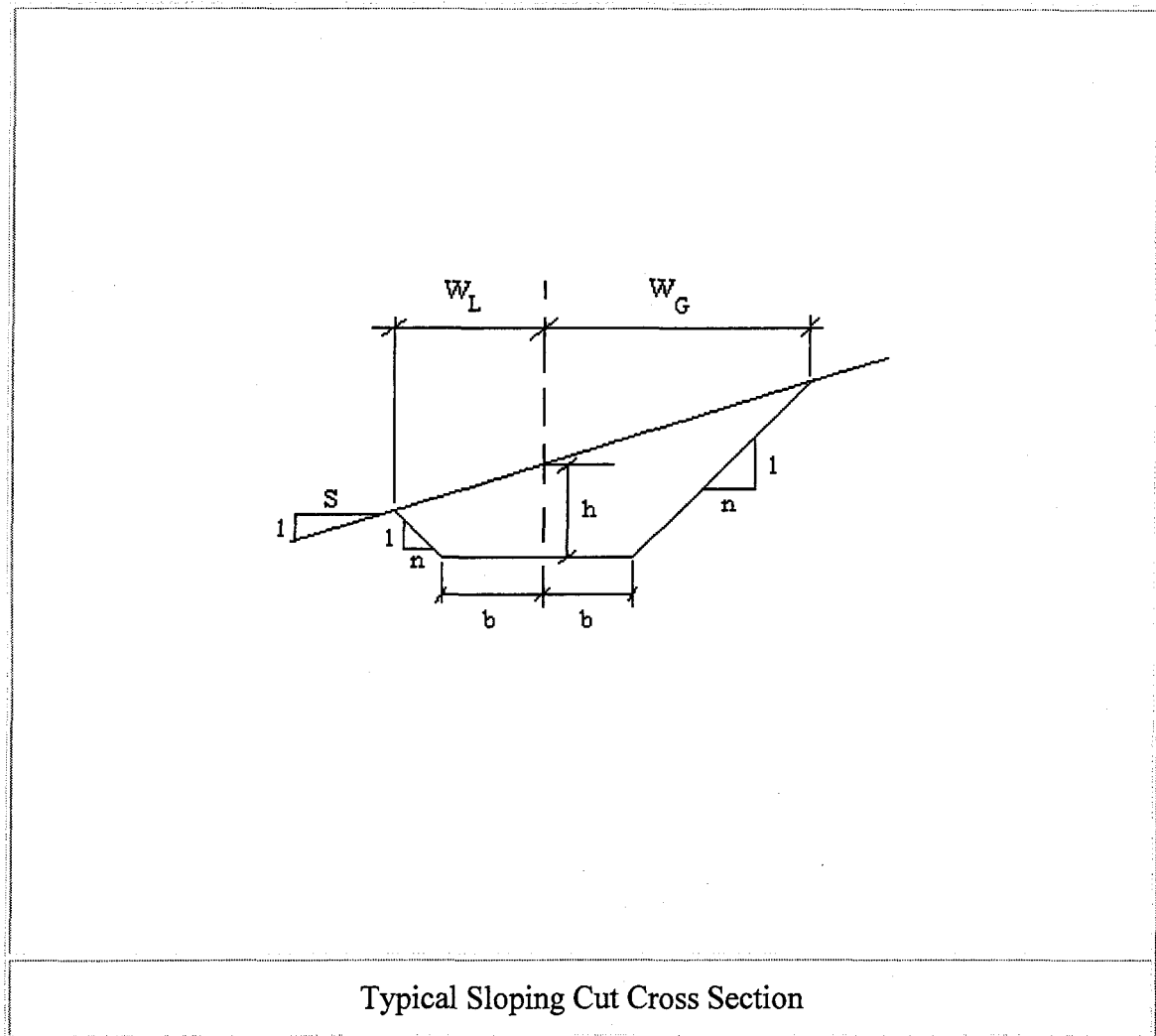
(Graphic source: www.dur.ac.uk/~des0www4/cal/roads/earthwk/)

Assuming a cut such as the one above, the cross sectional area is given by:

$$\text{Area} = h \cdot 2b + 2nh^2/2 = h(2b + nh)$$

EARTHWORKS

For a cut or fill on sloping ground

(Graphic source: www.dur.ac.uk/~des0www4/cal/roads/earthwk/)

Assuming a cut such as the one above, the cross sectional area is found firstly by calculating W_L and W_G :

$$W_L = S(b+nh)/(S+n)$$

$$W_G = S(b+nh)/(S-n)$$

$$\text{Thus Area} = \frac{1}{2}(h + b/n)(W_L + W_G) - b^2/n$$

EARTHWORK CALCULATION FORM

CH	Cut				Fill				Cumulative Volume,m3
	Area M ²	Average m ²	Length M	Volume m ³	Area m ²	Average m ²	Length M	Volume m ³	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
0									
Next CH									
Next CH									

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