
UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2007/2008

April 2008

**REG 366 – Rekabentuk Jalan dan Lebuhraya
(Design of Roads and Highways)**

Masa: 3 jam
(Duration: 3 hours)

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

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

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

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

Jawab **LIMA** soalan sahaja.

*Answer **FIVE** questions only.*

1. (a) Terangkan jenis-jenis jalan dan siapakah yang bertanggungjawab terhadap perancangan, pembinaan dan penyenggaraan jalan dan lebuh raya di Malaysia.

Describe the various category of road and who is in charge of road and highway planning, construction and maintenance in Malaysia

(10 markah/marks)

- (b) Jelaskan mengapa "Right of Way" untuk jalanraya kadangkala terpaksa dilebarkan melebihi kebiasaan keperluan rizab jalan

Explain why Right of Way (ROW) for roadway needs to be expanded (or widen) beyond the normal road reserves

(10 markah/marks)

2. (a) Terangkan bagaimana had jarak penglihatan boleh berlaku pada penjarangan datar dan penjarangan tegak. Gunakan lakaran untuk menjelaskan lagi keterangan tersebut.

Describe sight distance restrictions on vertical and horizontal curves. Use sketches to illustrate your explanation.

(10 markah/marks)

- (b) Jelaskan jenis-jenis maklumat dan data yang diperlukan oleh kontraktor pembinaan jalan untuk membina satu lengkung mudah jalanraya

Describe the information or design data required by road contractor to construct a simple horizontal curve.

(10 markah/marks)

3. (a) Senaraikan komponen kerja perparitan dalam sebuah projek lebuhraya dan terangkan peranan setiap jenis komponen tersebut.

List drainage works component usually associated with road and highway construction and explain what their roles are.

(10 markah/marks)

- (b) Jelaskan perbezaan antara Ujian Mampatan Proctor dan Ujian "Sand Replacement".

Describe the difference between Proctor Compaction Test and Sand Replacement Test.

(10 markah/marks)

4. (a) Nilai CBR purata untuk lapisan subgred 1m adalah 8%. Sekiranya nilai ESA adalah 1×10^6 , tentukan jumlah ketebalan struktur turapan untuk jalan tersebut.

An average CBR value of 8% was found for the top 1 meter sub-grade of a proposed roadway. If the Equivalent Standard Axle (ESA) was calculated as 1×10^6 , determine the total thickness of pavement structure required. Use the given Thickness Design Nomograph.

(5 markah/marks)

- (b) Apakah jenis bahan yang selalu digunakan sebagai lapisan tapak dan sub-tapak jalan?

What kind of materials are usually used as road base and sub-base?

(5 markah/marks)

5. (a) **Rajah 5** (Road 15) merupakan sebahagian dari lukisan pembinaan sebuah jalanraya. Dapatkan maklumat berikut untuk tujuan pembinaan jalan tersebut:
- (i) Rantaian pada permulaan jajaran tegak
 - (ii) Rantaian pada penghujung jajaran tegak
 - (iii) Rantaian pada IP
 - (iv) Paras rekabentuk pada CH 90
 - (v) Apakah paras ketinggian pada titik IP?

Figure 5 (Road 15) is part of construction drawings for a roadway. Please identify the following data for construction:

- (i) Chainage at the beginning of the vertical curve
- (ii) Chainage at the end of the vertical curve
- (iii) Chainage at IP (Intersection Point)
- (iv) Design level at CH 90
- (v) What is the elevation at IP?

(10 markah/marks)

- (b) Tentukan perbezaan paras antara IP dan paras rekabentuk jalan pada CH 90. Gunakan formula berkaitan untuk membuktikan ofset ini.

Determine the offset between IP and the proposed design level at CH 90. Use relevant formula to prove the value.

(10 markah/marks)

6. (a) Bincangkan jenis-jenis kerosakan turapan dan kaedah-kaedah pembaikannya.

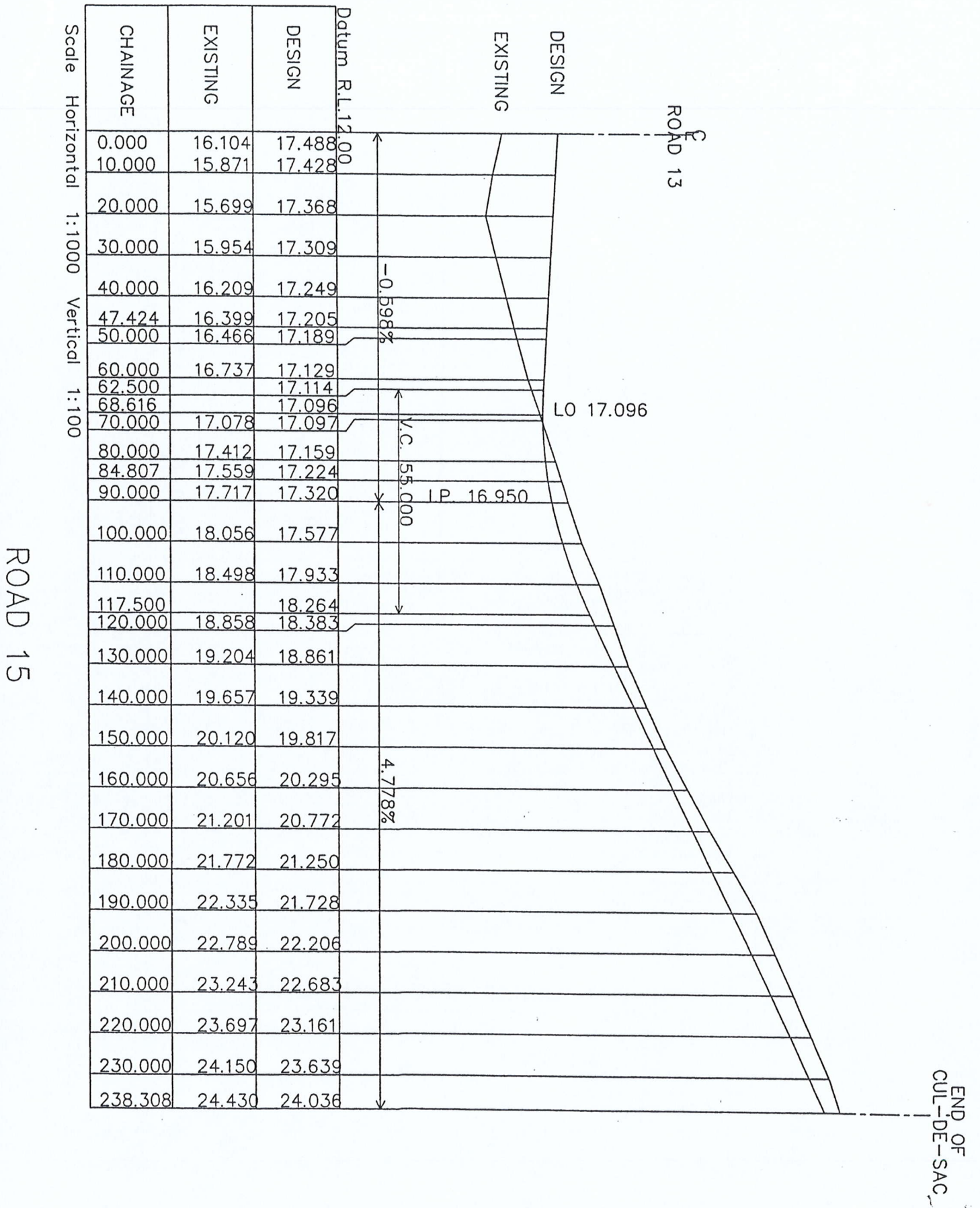
Discuss the various types of pavement cracks or deterioration and the remedial options.

(5 markah/marks)

- (b) Terangkan bentuk organisasai pentadbiran tapak yang lazim dalam projek pembinaan jalanraya yang besar. Jelaskan peranan pemilik, perunding, kontraktor, dan pihak berkuasa dalam pelaksanaan projek seperti ini. Gunakan contoh dan carta untuk menjelaskan lagi bentuk organisasi yang tipikal.

Describe the common site administration setup of a large scale road or highway projects. Explain the role of the client, consultant, contractors and authorities. Use example and charts to illustrate typical setups.

(15 markah/marks)



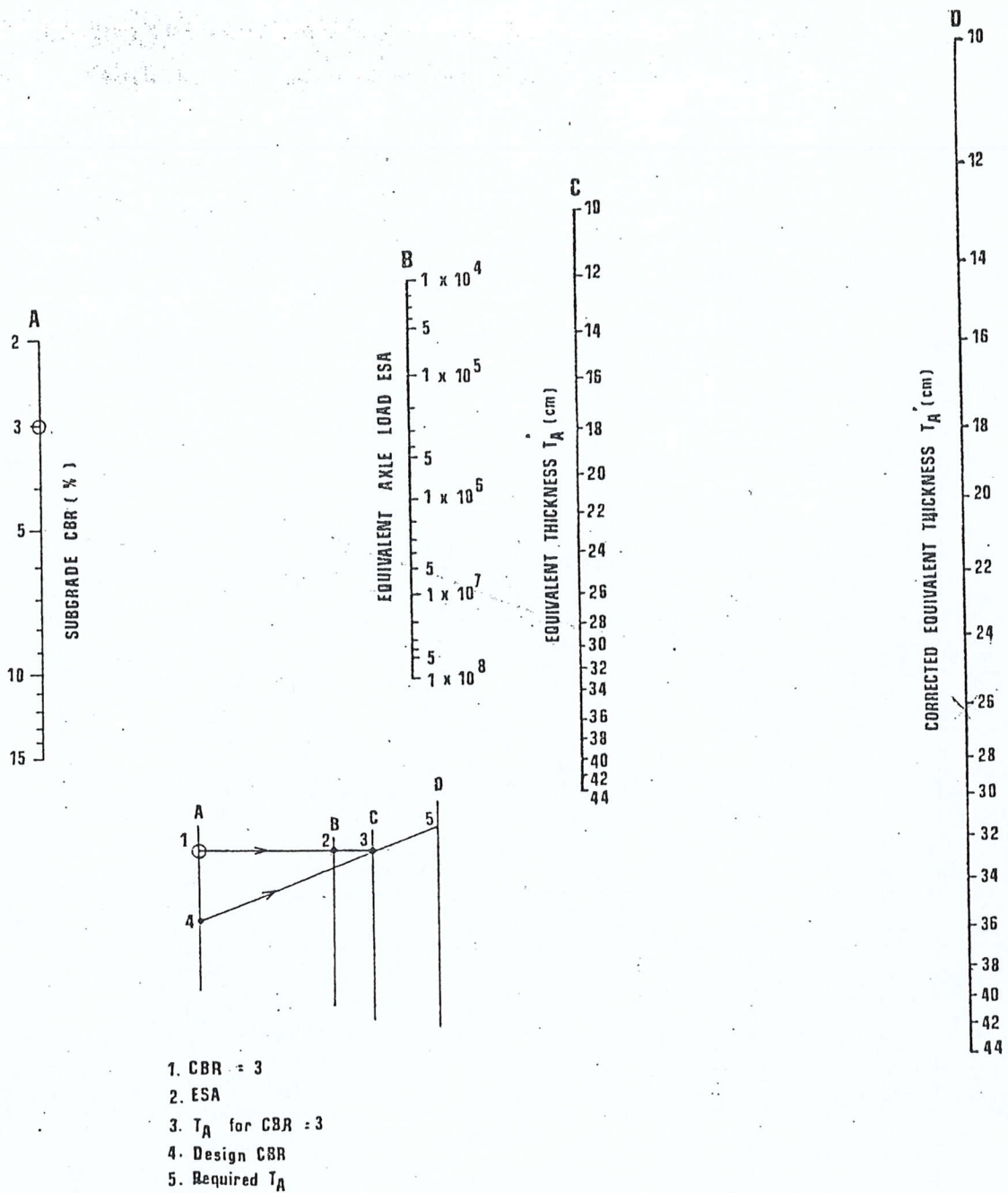
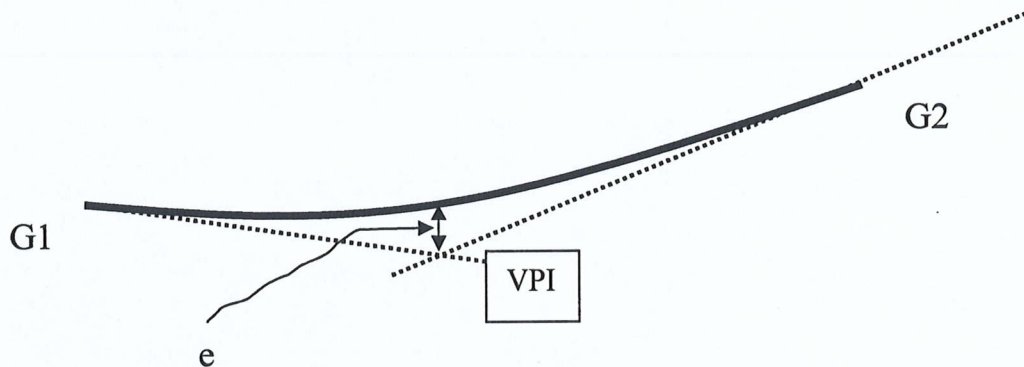


FIG-2 THICKNESS DESIGN NOMOGRAPH

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:

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

Lx = design elevation on curve

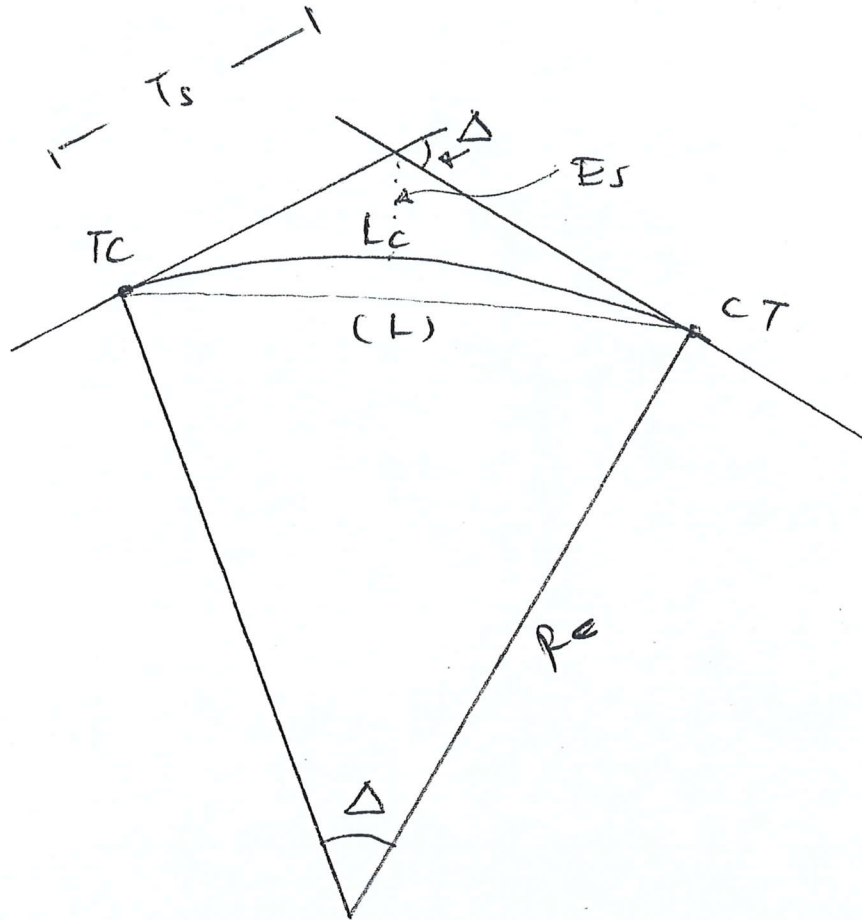
Lp = elevation on tangent line

L = length/distance in meter

e = middle point offset

x = distance from VPC

HORIZONTAL ALIGNMENT - SIMPLE CURVE.



$T_s = \text{jarak tangen} = R_c \tan \frac{\Delta}{2}$ - (tangent length)

$E_s = T_s \tan \frac{\Delta}{4}$ - (jarak lurus)

$L_c = \frac{\Delta \pi R_c}{180}$ - (length of curve)

$L = 2 R_c \sin \frac{\Delta}{2}$ - (length of chord)

$M = R_c \left(1 - \cos \frac{\Delta}{2}\right)$ - (middle point offset)

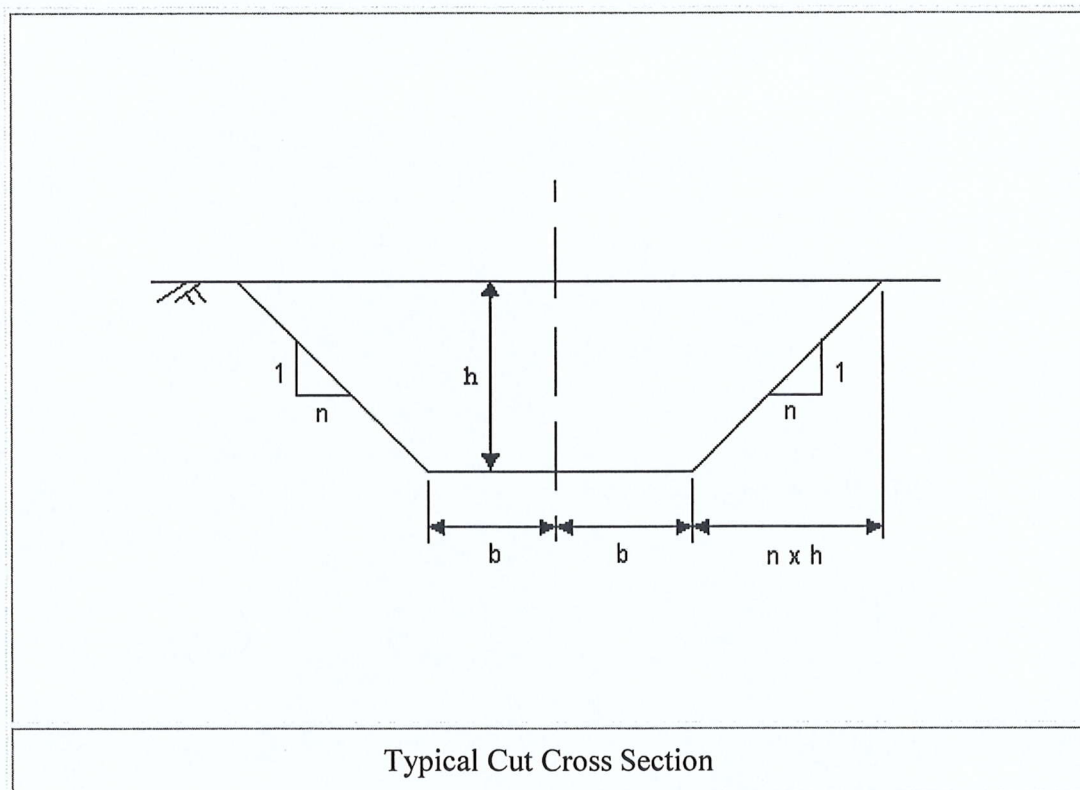
in practice R_c and Δ dirujuk kepda ^{survey} design guide. ^{or tangent length} _{data dan}

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.

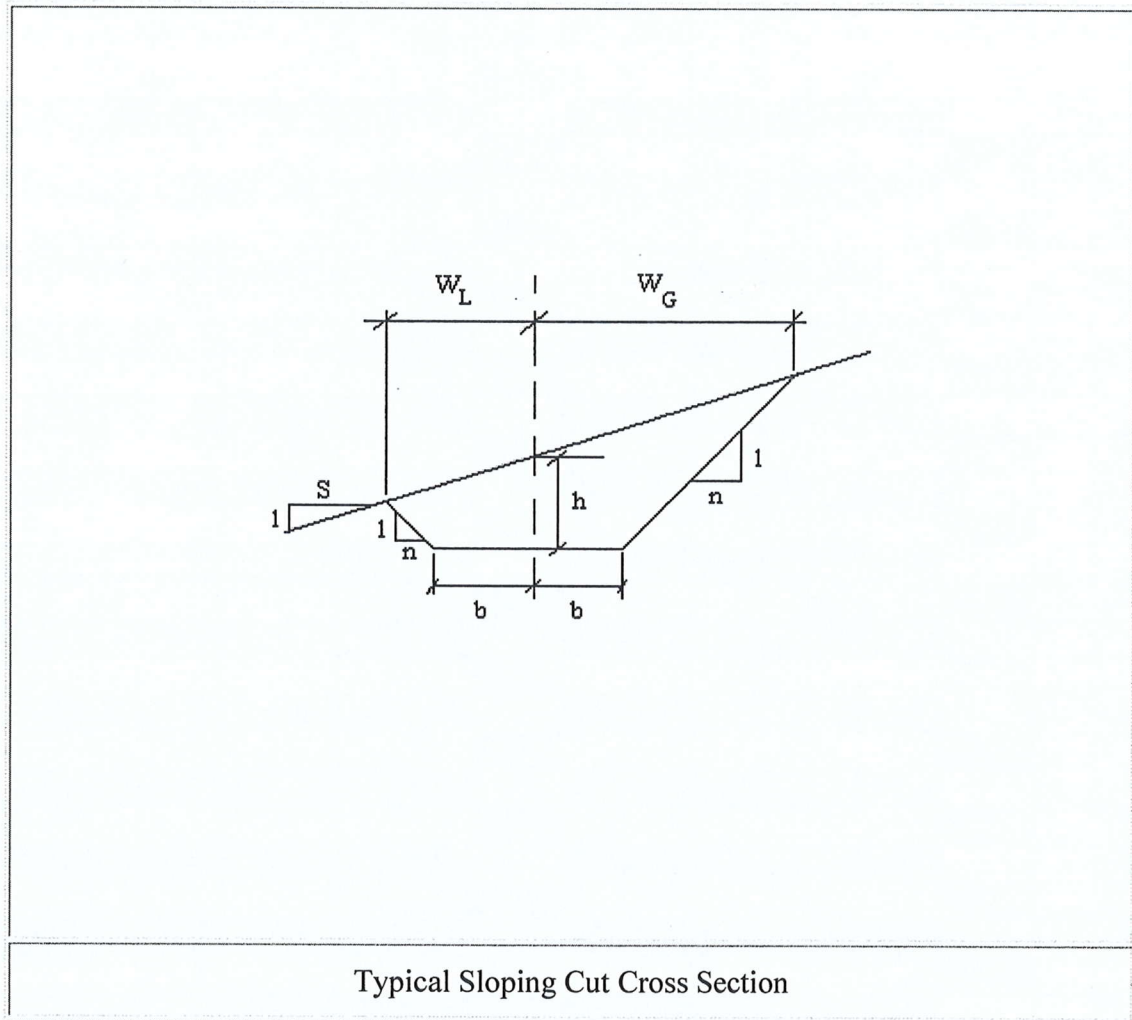


(Graphic source: www.dur.ac.uk/~des0www4/cal/roads/earthwk/)

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



Typical Sloping Cut Cross Section

(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 (10)
	Area M ² (2)	Average m ² (3)	Length M (4)	Volume m ³ (5)	Area m ² (6)	Average m ² (7)	Length M (8)	Volume m ³ (9)	
0									
25									
50									
75									
100									
125									
150									
175									
200									
225									
250									
275									
300									