UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Kedua
Sidang 1985/86

REE 425 - Rekabentuk Jalan dan Lebuhraya

Tarikh: 7 April 1986 Masa: 9.00 pagi - 12.00 tgh.
(3 jam)

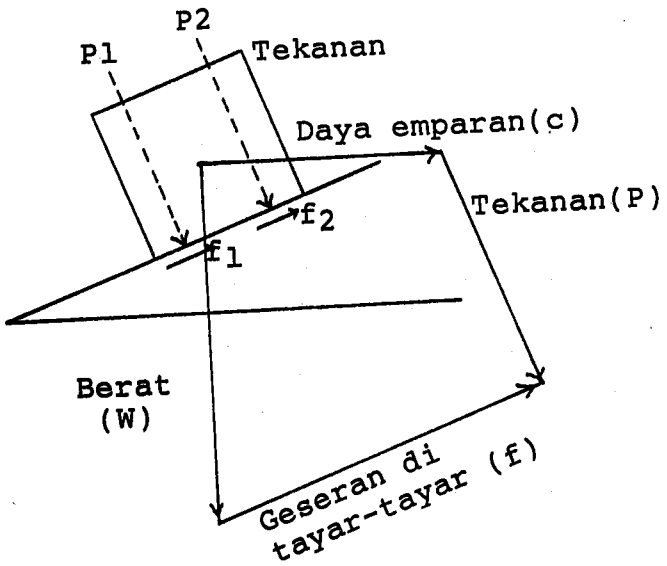
Sila pastikan bahawa kertas peperiksaan ini mengandungi EMPAT muka surat dan EMPATBELAS muka surat Lampiran yang tercetak sebelum anda memulakan peperiksaan ini.

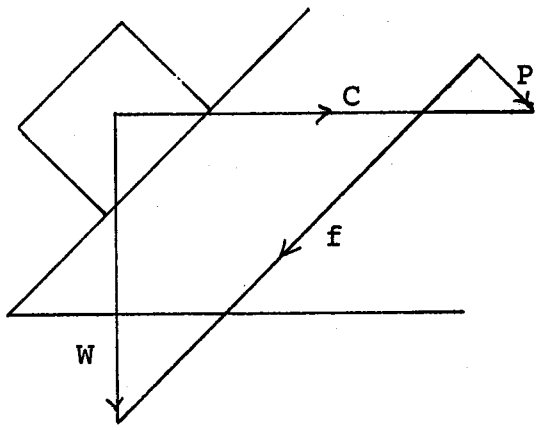
Jawab LIMA soalan.

1. (a) Nyatakan halaju rekabentuk bagi tiap-tiap enam jenis jalan sub-bandaran.

(b) Bagaimanakah daya-daya pada sebuah kereta yang sedang melalui satu lengkok diimbangi?

Terangkan gambarajah-gambarajah daya berikut:-





(c) Bezakan di antara cerun lintang dengan sendengan.

(20 markah)

2. Rekabentuk semula simpang bercabang empat di atas satu segiempat 150m x 150m seperti yang diberikan di atas kertas soalan. Gunakan skil 1 : 1000. Bebanan trafik (di dalam unit kereta penumpang sejam) adalah seperti berikut:-

Cabang Utara	=	200 ukp/j
Cabang Timur	=	100 ukp/j
Cabang Selatan	=	800 ukp/j
Cabang Barat	=	900 ukp/j

Simpangan ini sepatutnya direkabentuk menurut pengelasan fungsi jalan sub-bandaran. Lebar kesemua lorong-lorong trafik ialah 3.50 meter dan mempunyai tanda-tanda penyaluran. Nyatakan juga kedudukan kesemua jejari serta papan tanda-papan tanda atau lampu isyarat jika didapati perlu.

Tiada lengkok peralihan diperlukan ditahap rekabentuk ini.

(20 markah)

Perhatian: Jawab di dalam Lampiran 1.

...3/-

3. (a) Sambungkan jalan pengumpul di dalam Lampiran 2 pada stesyen 0 + 000 ke jalan raya di utara. Tunjukkan garis tengah (gunakan dakwat), garis kompas dan garis tangen (gunakan pensil untuk kedua-duanya). Selang di antara semua garis kontur ialah 2 meter. Cerun maksima ialah 8% dan jejari minima ialah 70 meter. Kedudukan klotoid hendaklah ditunjukkan dengan anak panah.

(b) Tunjukkan penyebarisan tegak (garisan tangen sahaja) di antara stesyen-stesyen 0 + 000 dan 0 + 200 di atas kertas graf.

(20 markah)

4. (a) Buat nota-nota ringkas mengenai silangan-silangan berikut:-

(i) diaman
(ii) semanggi
(iii) trampet

Nyatakan di dalam keadaan manakah silangan bertingkat secara umum dan silangan-silangan di atas sesuai di adakan.

(b) Bezakan prestasi bulatan dengan lampu isyarat.

(20 markah)

...4/-

5. (a) Terangkan faktor-faktor yang diambilkira di dalam rekabentuk hamparan.

(b) Rekabentuk sebuah hamparan fleksibel menggunakan carta-carta dan jadual-jadual dari Road Note 29. Perincian untuk rekabentuk adalah seperti berikut:-

- hayat rekabentuk = 30 tahun
- jumlah kenderaan komersial di dalam kedua-dua arah setiap hari = 2000
- kadar pertumbuhan trafik = 4%
- jenis tanah-bawah-jalan ialah tanah liat silt yang mempunyai had cecair 50% dan had plastik 20%.
- aras mata-air melebihi 1.0 meter di bawah permukaan jalan.

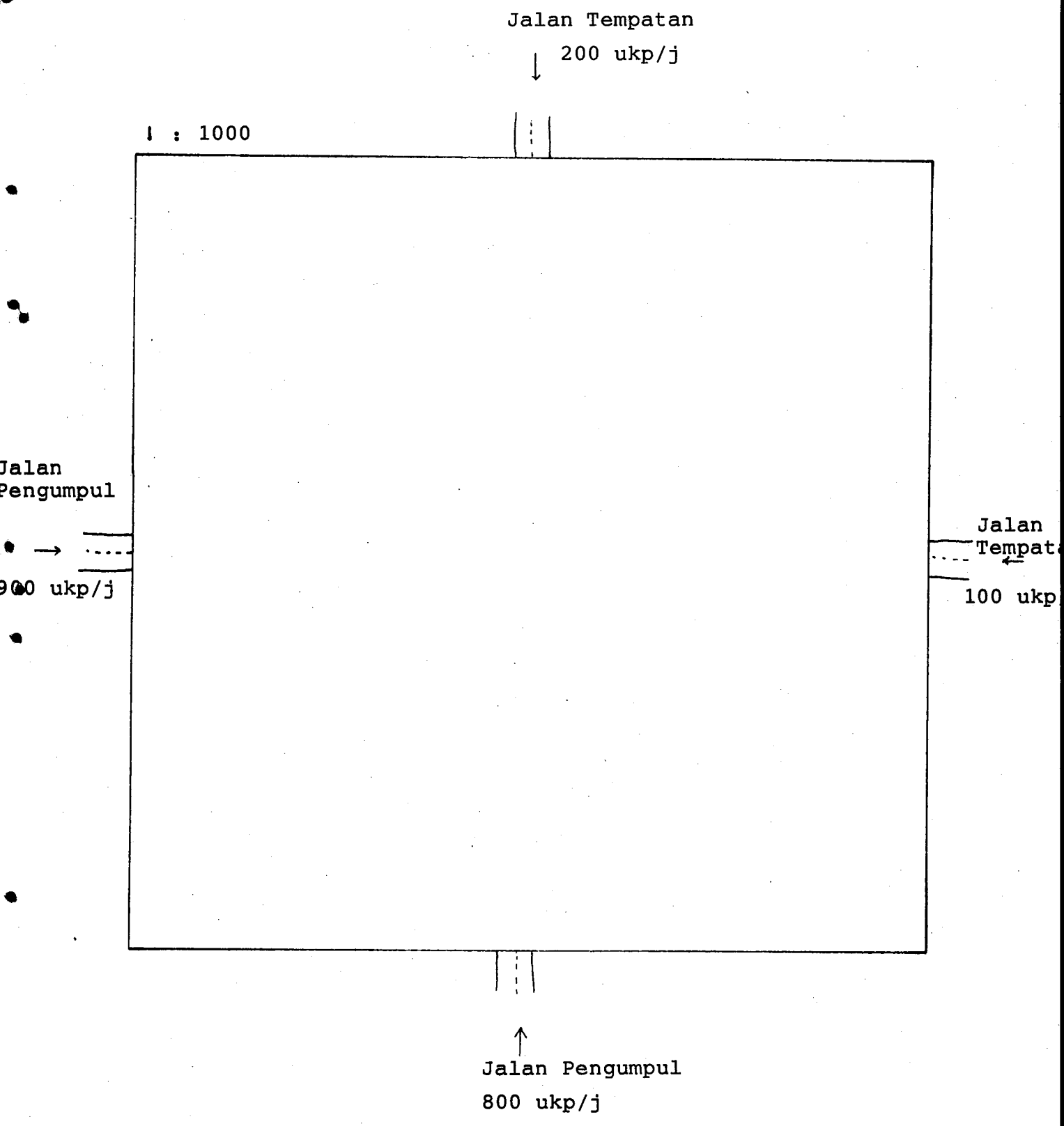
(20 markah)

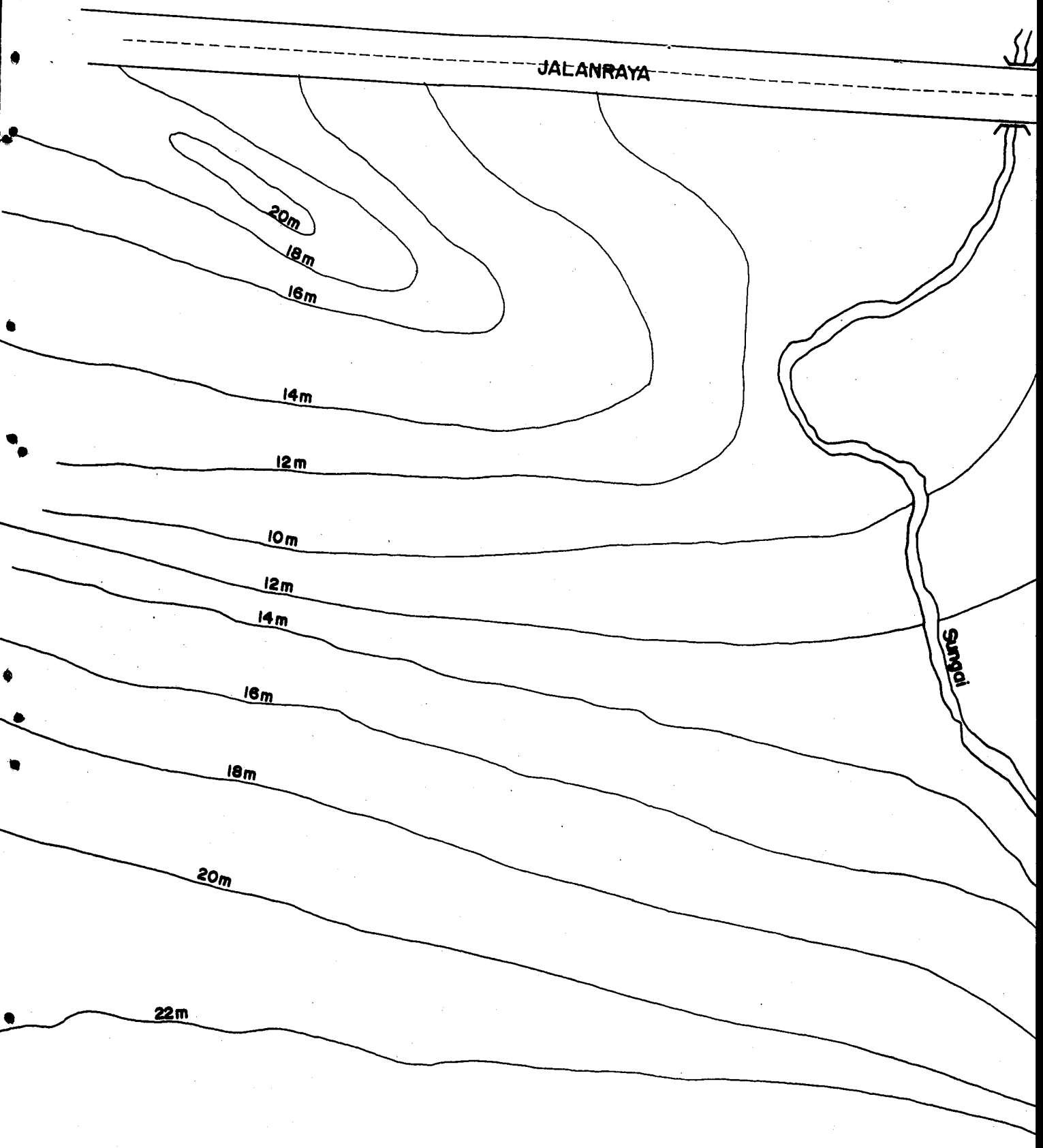
6. (a) Mengapakah tanah-bawah-jalan perlu kuat dan terangkan dengan ringkas cara-cara untuk menguatkannya.

(b) Bezakan di antara makadam dan asfalt.

(20 markah)

-ooo00ooo-


Jalan Tempatan
200 ukp/j
1 : 1000
Jalan
Pengumpul
900 ukp/j
Jalan
Tempat
100 ukp
Jalan Pengumpul
800 ukp/j



Rmin. = 70m

Gmin. = 8%

V_d = 40 km/h

Skil. 1 : 1000

0 + 000

JALAN PENGUMPUL

Nama:.....

No. Matrik:

Table 1 **Commercial traffic flows recommended for use in the design of roads in residential and associated developments when more accurate assessments are not available**

Type of road	*Estimated traffic flow of commercial vehicles per day* **(in each direction)** *at the time of construction*
1 Cul-de-sacs and minor residential roads	10
2 Through roads and roads carrying regular bus routes involving up to 25 public service vehicles per day **in each direction**	75
3 Major through roads carrying regular bus routes involving 25–50 public service vehicles per day **in each direction**	175
4 Main shopping centre of a large development carrying goods deliveries and main through roads carrying more than 50 public service vehicles per day **in each direction**	350

Table 2 **Conversion factors to be used to obtain the equivalent number of standard axles from the number of commercial vehicles**

Type of road	*Number of axles per commercial vehicle (see paragraph 14) (a)*	*Number of standard axles per commercial axle (b)*	*Number of standard axles per commercial vehicle (a) × (b)*
Motorways and trunk roads designed to carry over 1000 commercial vehicles per day **in each direction** at the time of construction	2·7	0·4	1·08
Roads designed to carry between 250 and 1000 commercial vehicles per day **in each direction** at the time of construction	2·4	0·3	0·72
All other public roads	2·25	0·2	0·45

Table 3 **Estimated laboratory CBR values for British soils compacted at the natural moisture content**

Type of soil	*Plasticity index (per cent)*	*CBR (per cent)*	
		Depth of water-table below formation level	
		More than 600 mm	*600 mm or less*
Heavy clay	70	2	1*
	60	2	1·5*
	50	2·5	2
	40	3	2
Silty clay	30	5	3
Sandy clay	20	6	4
	10	7	5
Silt	—	2	1*
Sand (poorly graded)	non-plastic	20	10
Sand (well graded)	non-plastic	40	15
Well-graded sandy gravel	non-plastic	60	20

* See para. 27

Table 4 **Recommended bituminous surfacings for newly constructed flexible pavements** (see Note 1)

Traffic (cumulative number of standard axles)			
Over 11 millions (1)	*2·5–11 millions* (2)	*0·5–2·5 millions* (3)	*Less than 0·5 million* (4)
Wearing course (crushed rock or slag coarse aggregate only) **Minimum thickness 40 mm** Rolled asphalt to BS 594 (pitch-bitumen binder may be used) (Clause 907)		**Wearing course** **Minimum thickness 20 mm** Rolled asphalt to BS 594 (pitch-bitumen binder may be used) (Clause 907) Dense tar surfacing to BTIA Specification (Clause 909) Cold asphalt to BS 1690 (Clause 910) (see note 4) Medium-textured tarmacadam to BS 802 (Clause 913) (to be surface-dressed immediately or as soon as possible—see Note 4) Dense bitumen macadam to BS 1621 (Clause 908) (see Note 4) Open-textured bitumen macadam to BS 1621 (Clause 912) (see Note 4)	**Two-course** (a) **Wearing course—** **Minimum thickness 20 mm** Cold asphalt to BS 1690 (Clause 910) (see Note 4) Coated macadam to BS 802 BS 1621, BS 1241 or BS 2040 (Clause 913, 912 or 908) (see Notes 2 and 4) (b) **Basecourse** Coated macadam to BS 802, BS 1621, BS 1241 or BS 2040 (Clause 906 or 905) (see Note 2) **Single course** Rolled asphalt to BS 594 (pitch-bitumen binder may be used) Dense tar surfacing to BTIA Specification (Clause 909) Medium-textured tarmacadam to BS 802 (Clause 913) (to be surface-dressed immediately or as soon as possible—see Note 4) Dense bitumen macadam to BS 1621 (Clause 908) (see Note 4) 60 mm of single-coarse tarmacadam to BS 802 (Clause 906) or BS 1241 (to be surface-dressed immediately or as soon as possible—see Note 4) 60 mm of single-course bitumen macadam to BS 1621 (Clause 905) or BS 2040 (see Note 4)
Basecourse **Minimum thickness 60 mm** Rolled asphalt to BS 594 (Clause 902) (see Note 2) Dense bitumen macadam or dense tarmacadam (crushed rock or slag only) (Clause 903 or 904)	**Basecourse** Rolled asphalt to BS 594 (Clause 902) (see Note 2) Dense bitumen macadam or dense tarmacadam (Clause 903 or 904) (see Note 3)	**Basecourse** Rolled asphalt to BS 594 (Clause 902) (see Note 2) Dense bitumen macadam or dense tarmacadam (Clause 903 or 904) Single-course tarmacadam to BS 802 (Clause 906) or BS 1241 (see Notes 2 and 5) Single-course bitumen macadam to BS 1621 (Clause 905) or BS 2040 (see Notes 2 and 5)	

Notes:

1 The thicknesses of all layers of bituminous surfacings should be consistent with the appropriate British Standard Specification

2 When gravel, other than limestone, is used, 2 per cent of Portland cement should be added to the mix and the percentage of fine aggregate reduced accordingly

3 Gravel tarmacadam is not recommended as a basecourse for roads designed to carry more than 2·5 million standard axles

4 When the wearing course is neither rolled asphalt nor dense tar surfacing and where it is not intended to apply a surface-dressing immediately to the wearing course, it is essential to seal the construction against the ingress of water by applying a surface dressing either to the roadbase or to the basecourse

5 Under a wearing course of rolled asphalt or dense tar surfacing the basecourse should consist of rolled asphalt to BS 594 (Clause 902) or of dense coated macadam (Clause 903 or 904)

Figure 1 **Relation between cumulative number of commercial vehicles carried by each slow lane and design life – growth rate 3 per cent**

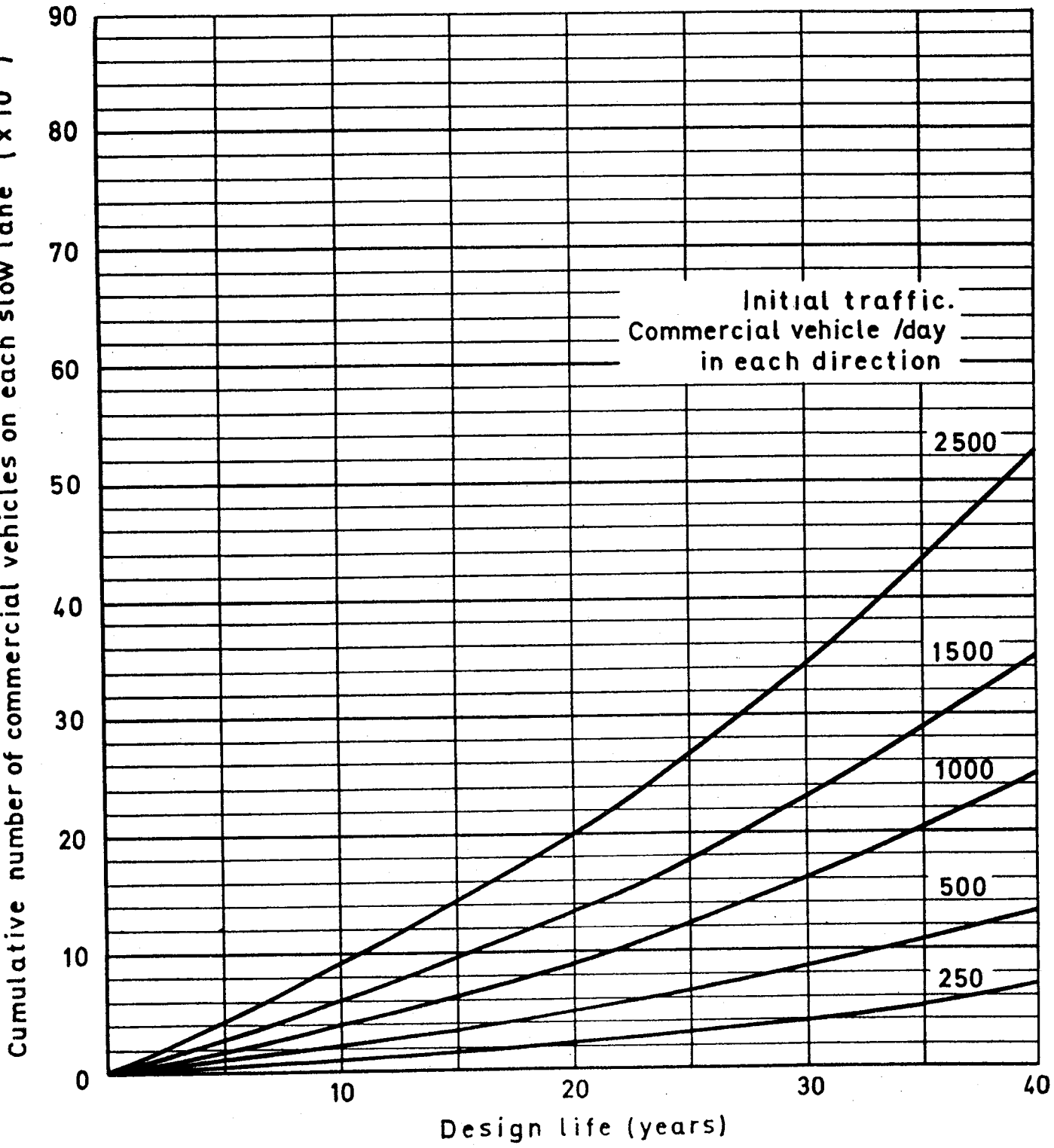


Figure 2 **Relation between cumulative number of commercial vehicles carried by each slow lane and design life – growth rate 4 per cent**

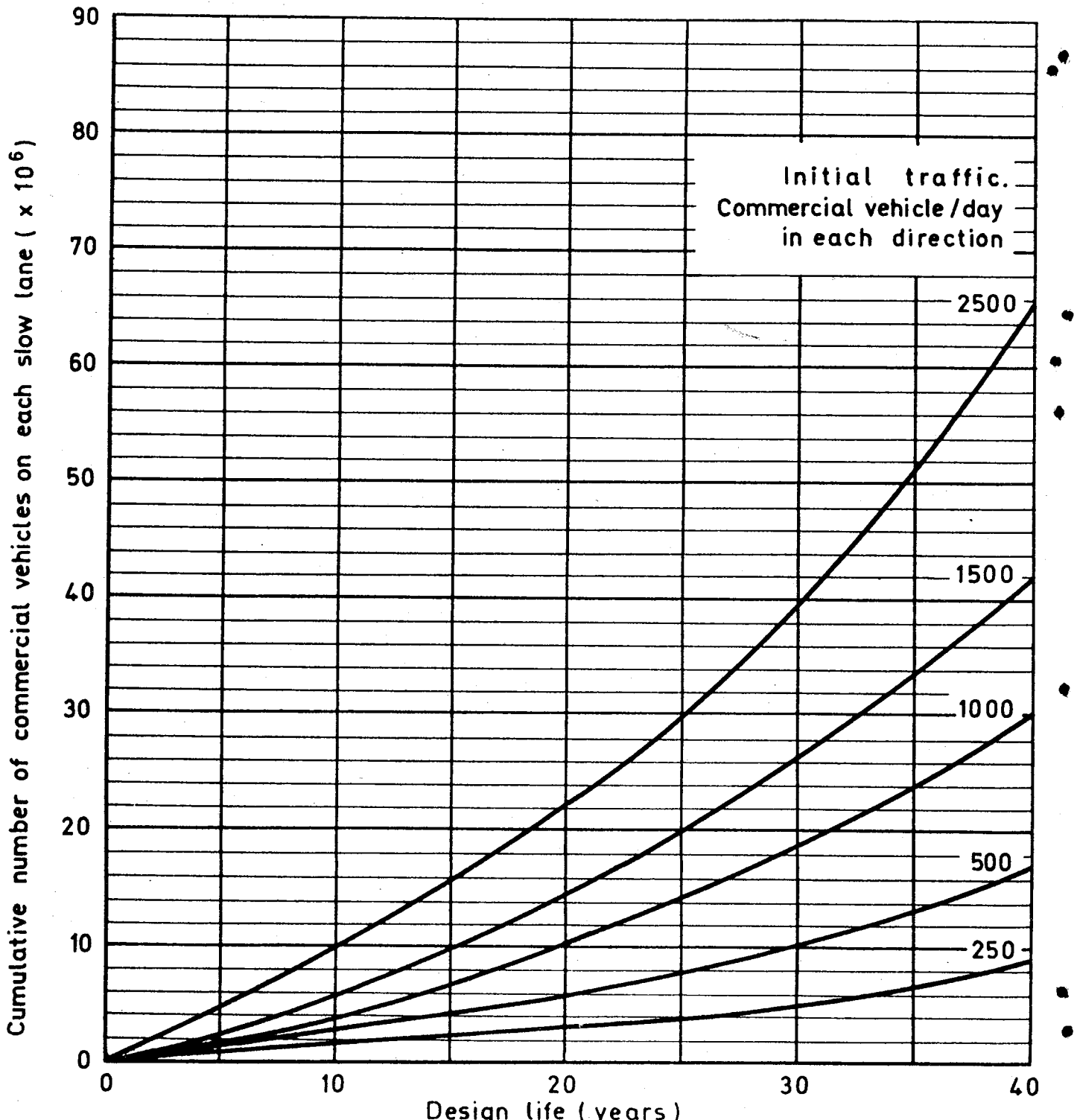


Figure 3 **Relation between cumulative number of commercial vehicles carried by each slow lane and design life – growth rate 5 per cent**

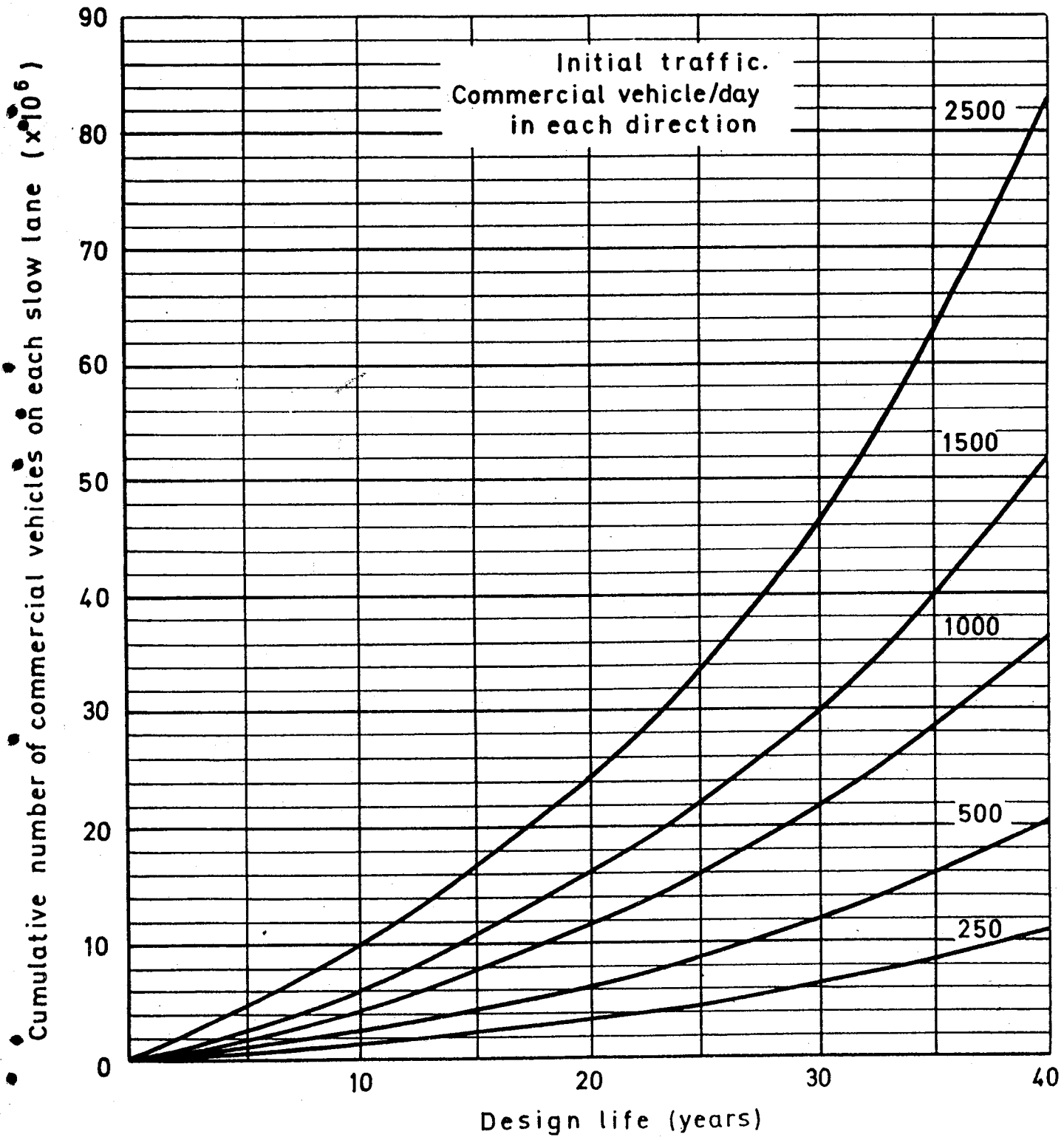


Figure 4 **Relation between cumulative number of commercial vehicles carried by each slow lane and design life – growth rate 6 per cent**

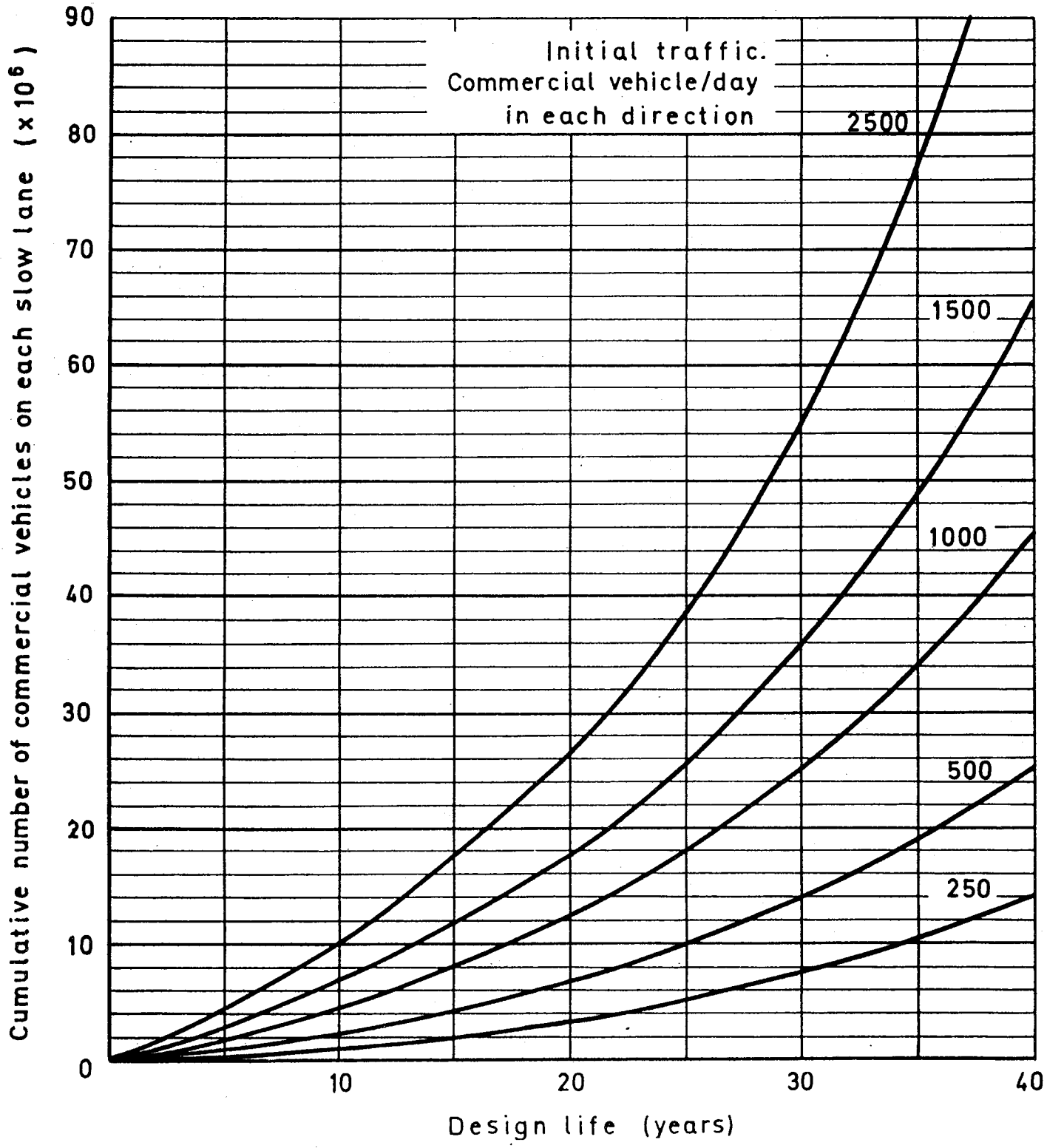
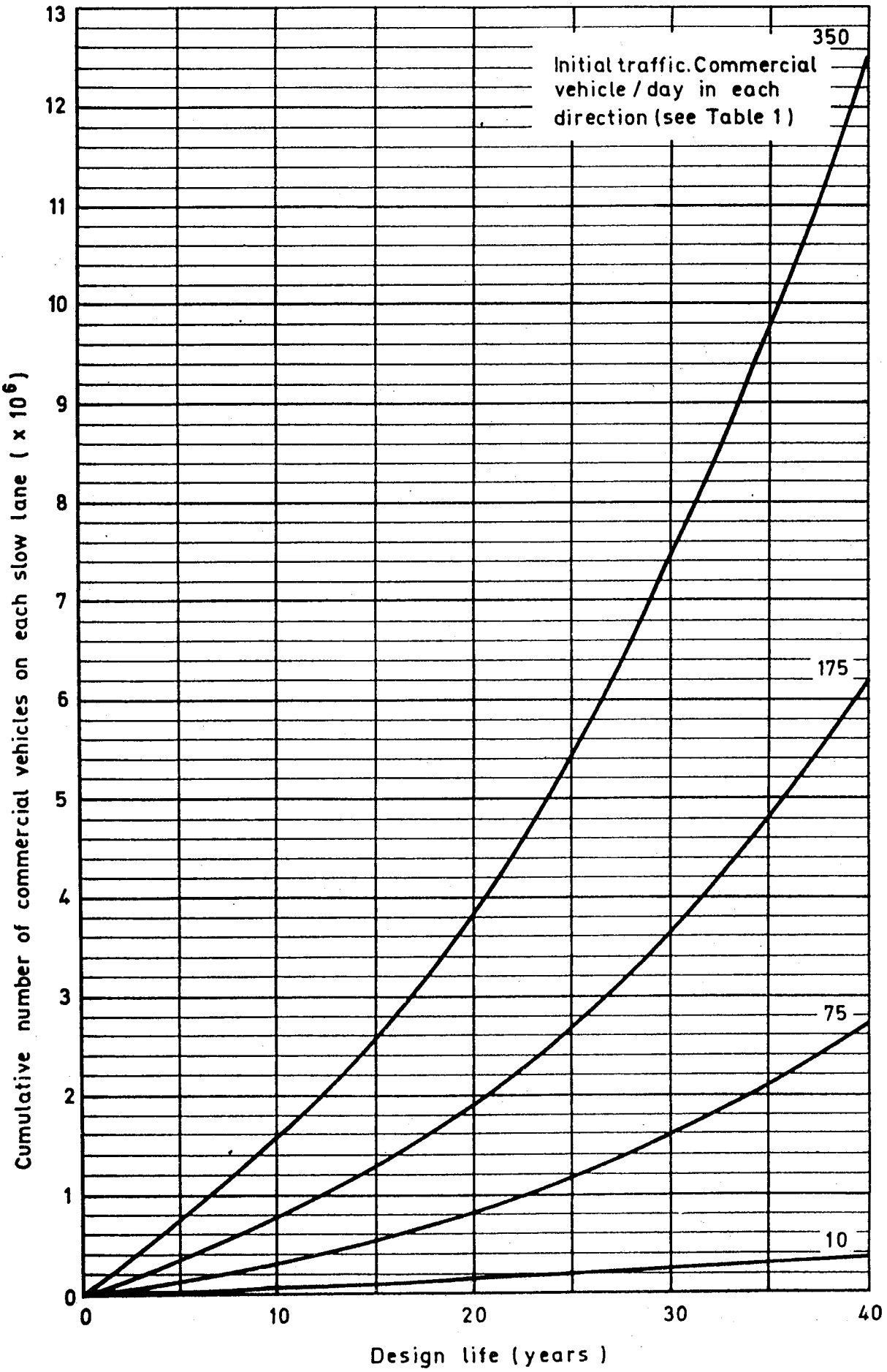


Figure 5 **Roads in residential and associated developments: relation between cumulative number of commercial vehicles carried by each slow lane and design life**



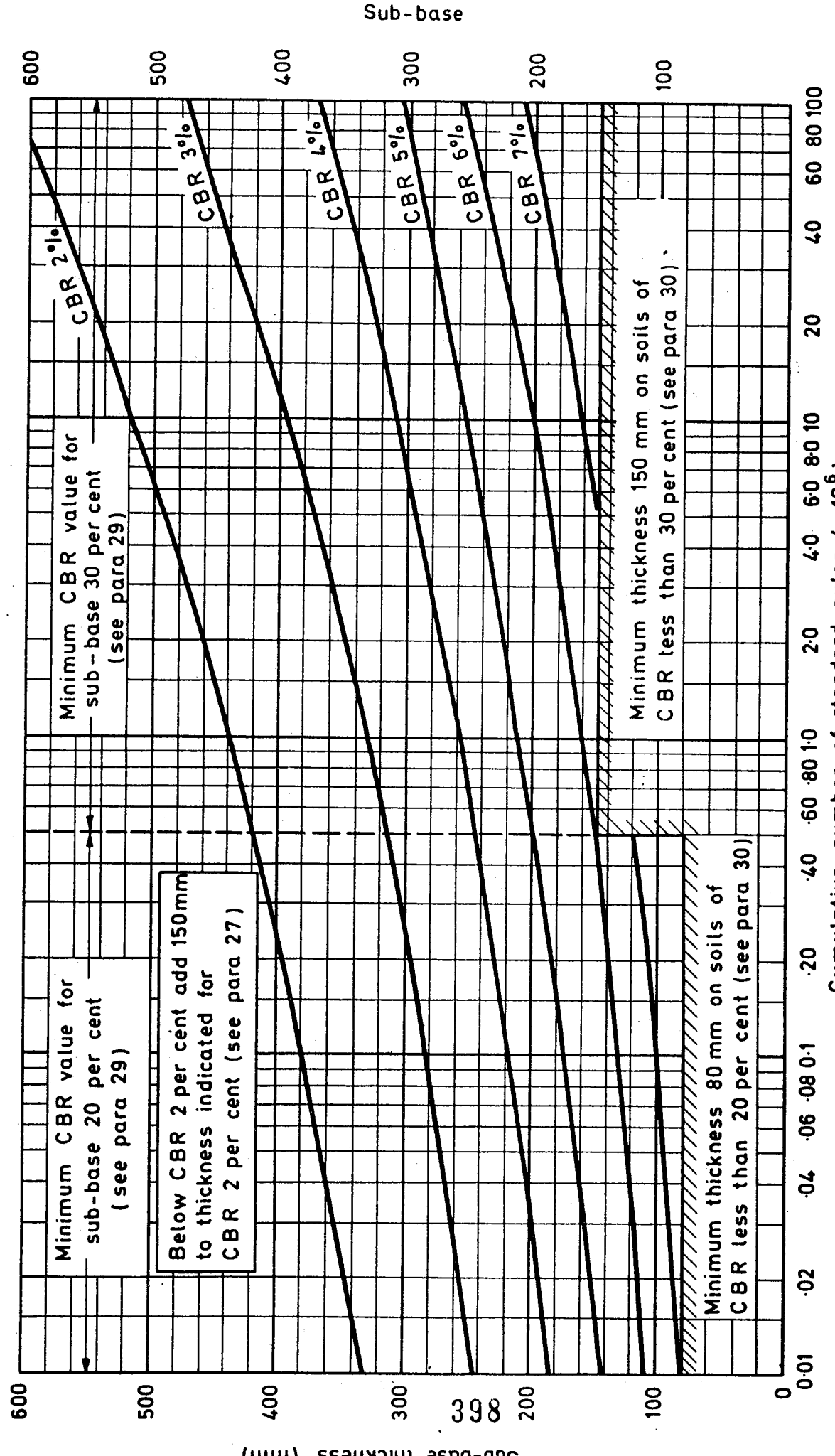


Figure 6 Thickness of sub-base

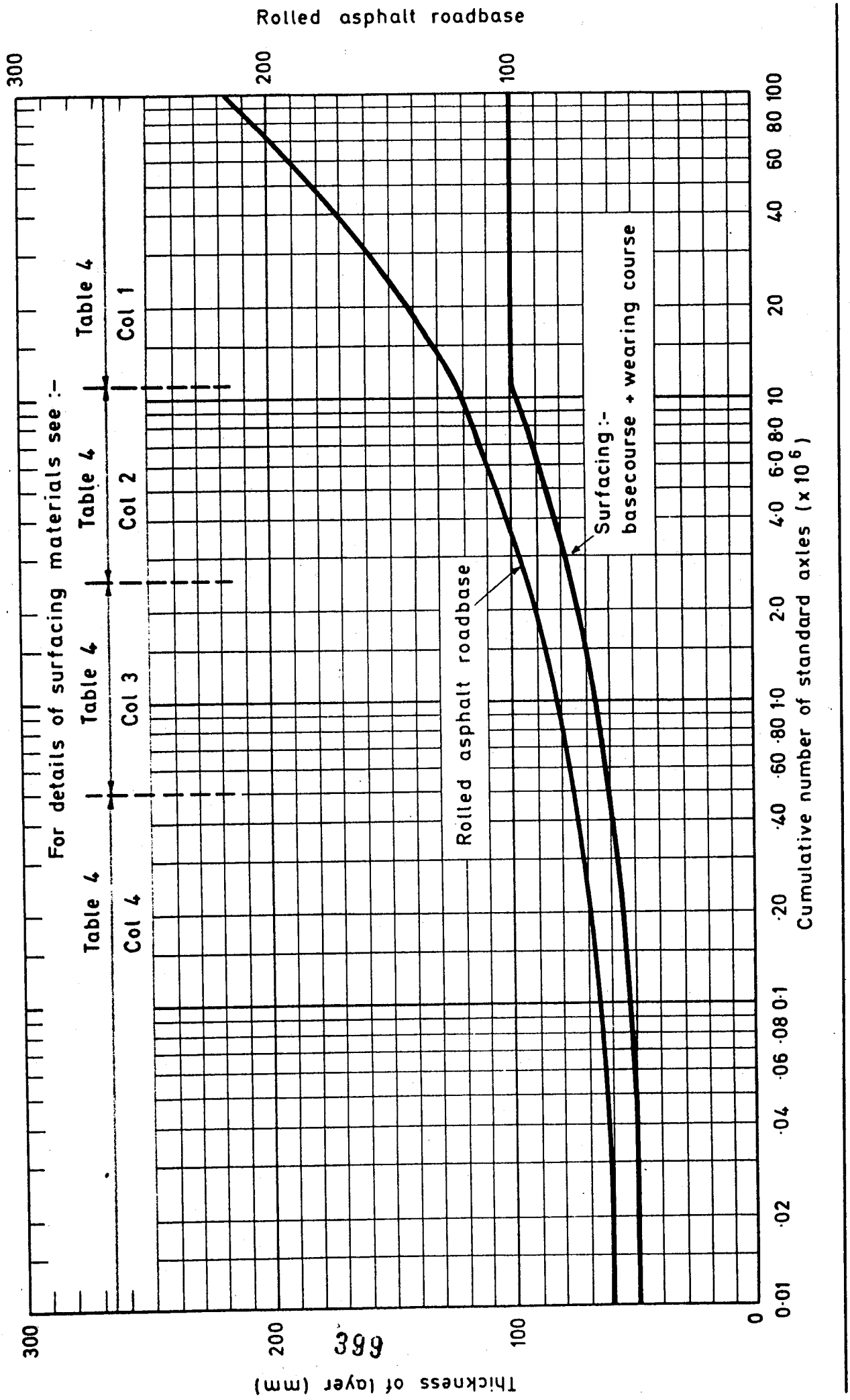


Figure 7 **Rolled asphalt roadbase: minimum thickness of surfacing and roadbase**

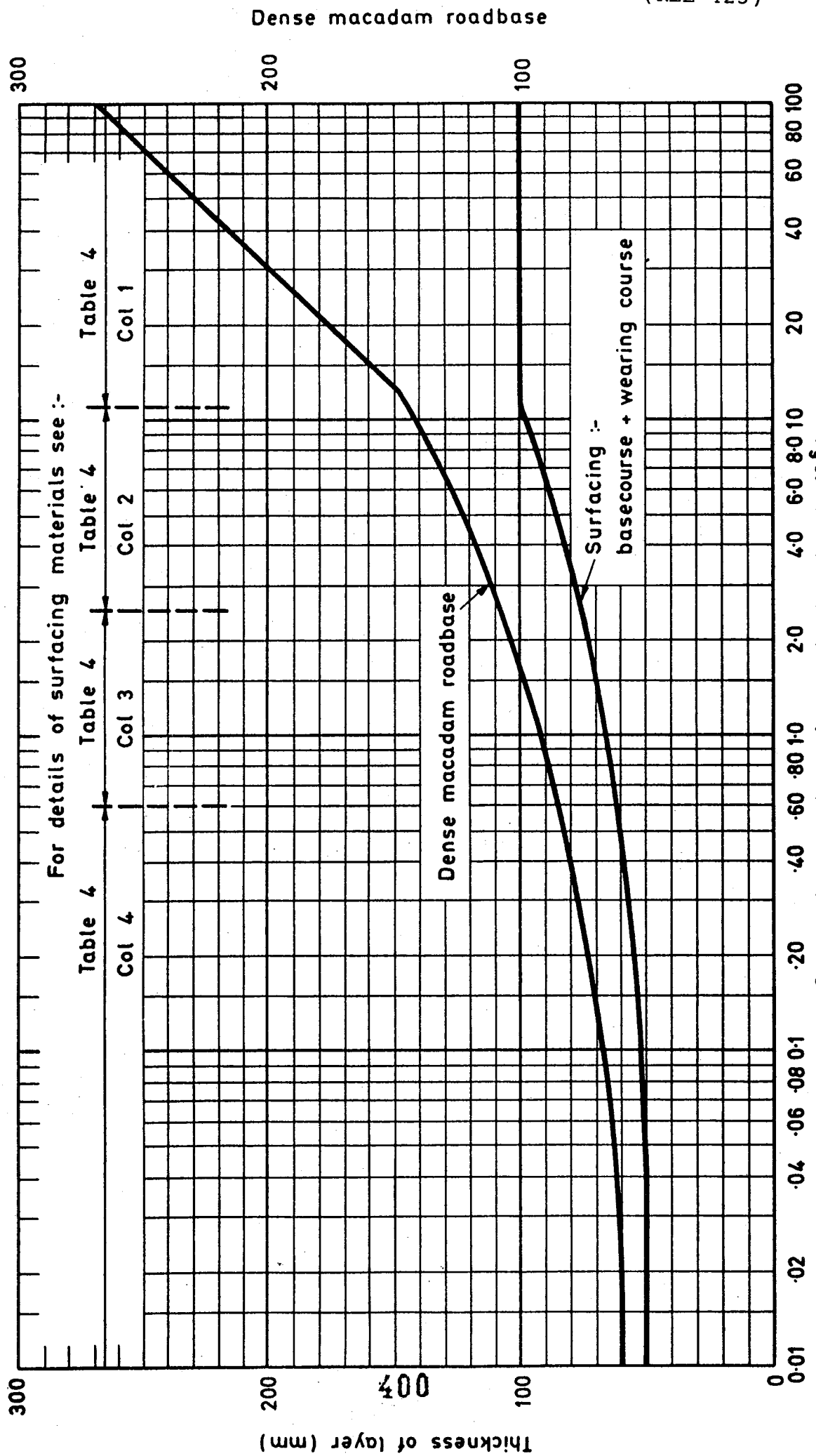


Figure 8 **Dense macadam roadbase: minimum thickness of surfacing and roadbase**

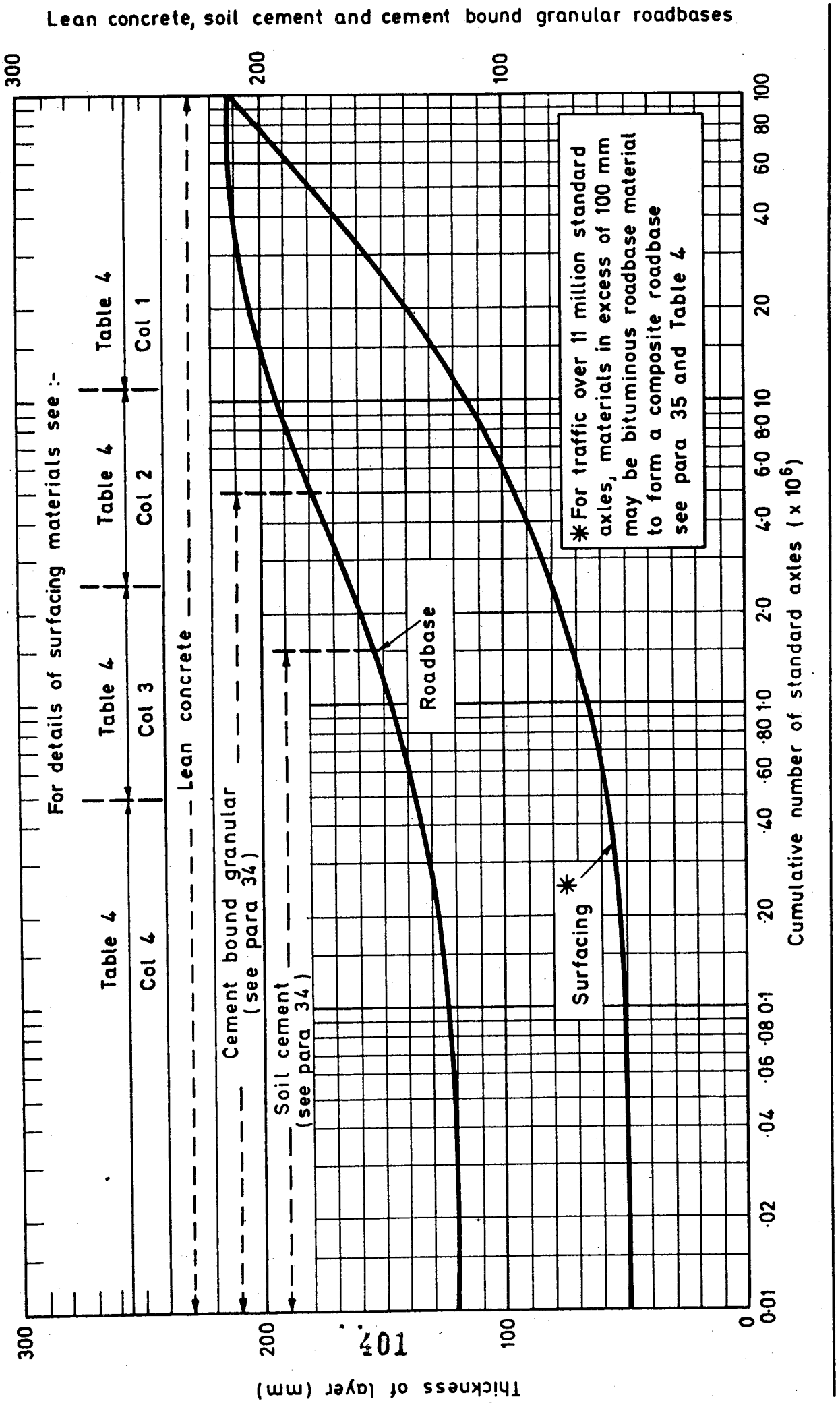


Figure 9 **Lean concrete, soil cement and cement-bound granular roadbases: minimum thickness of surfacing and roadbase**

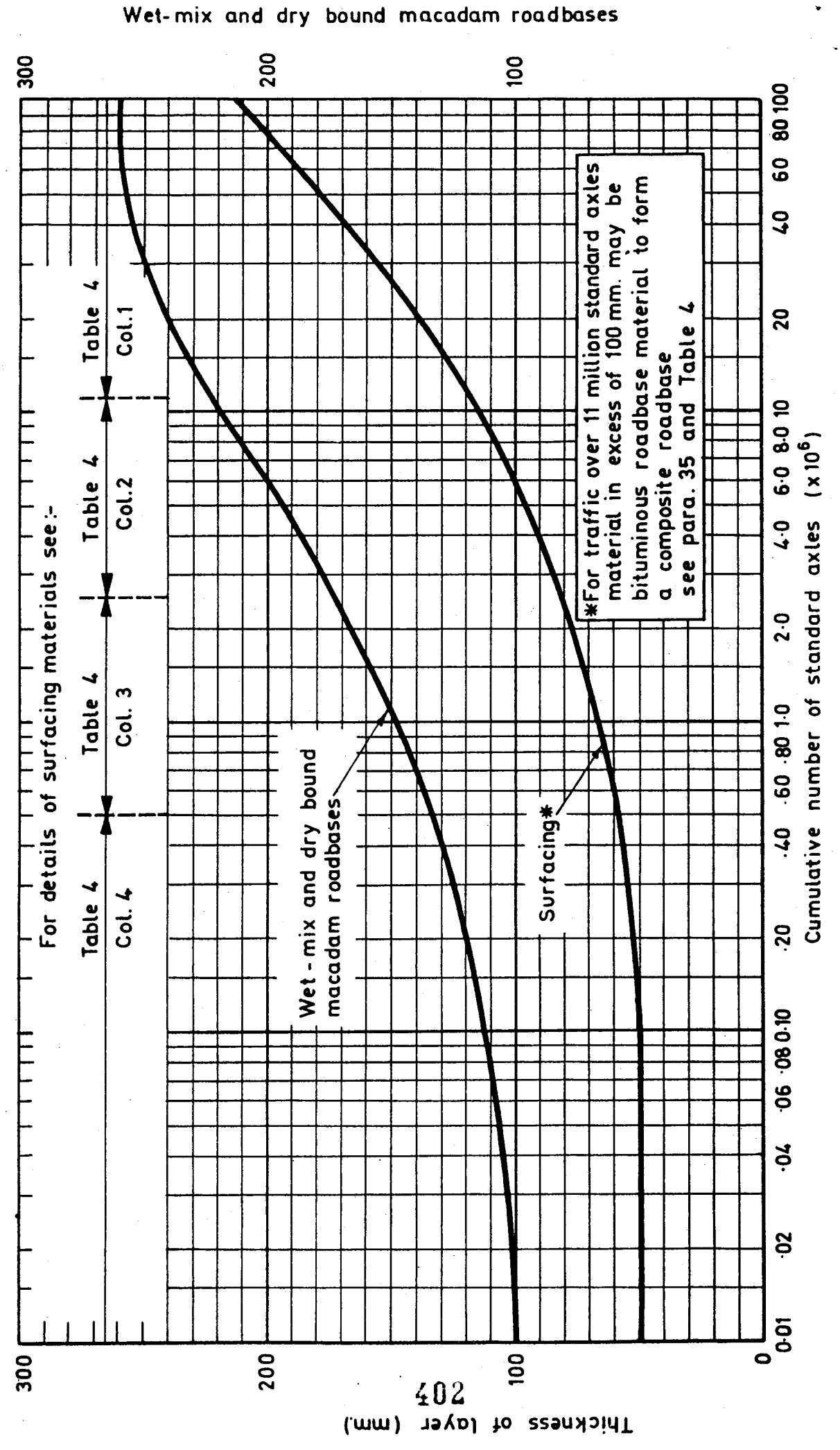


Figure 10 Wet-mix and dry-bound macadam roadbases: minimum thickness of surfacing and roadbase