

# **Chapter 16**

## **Design of Rigid Airport Pavements**

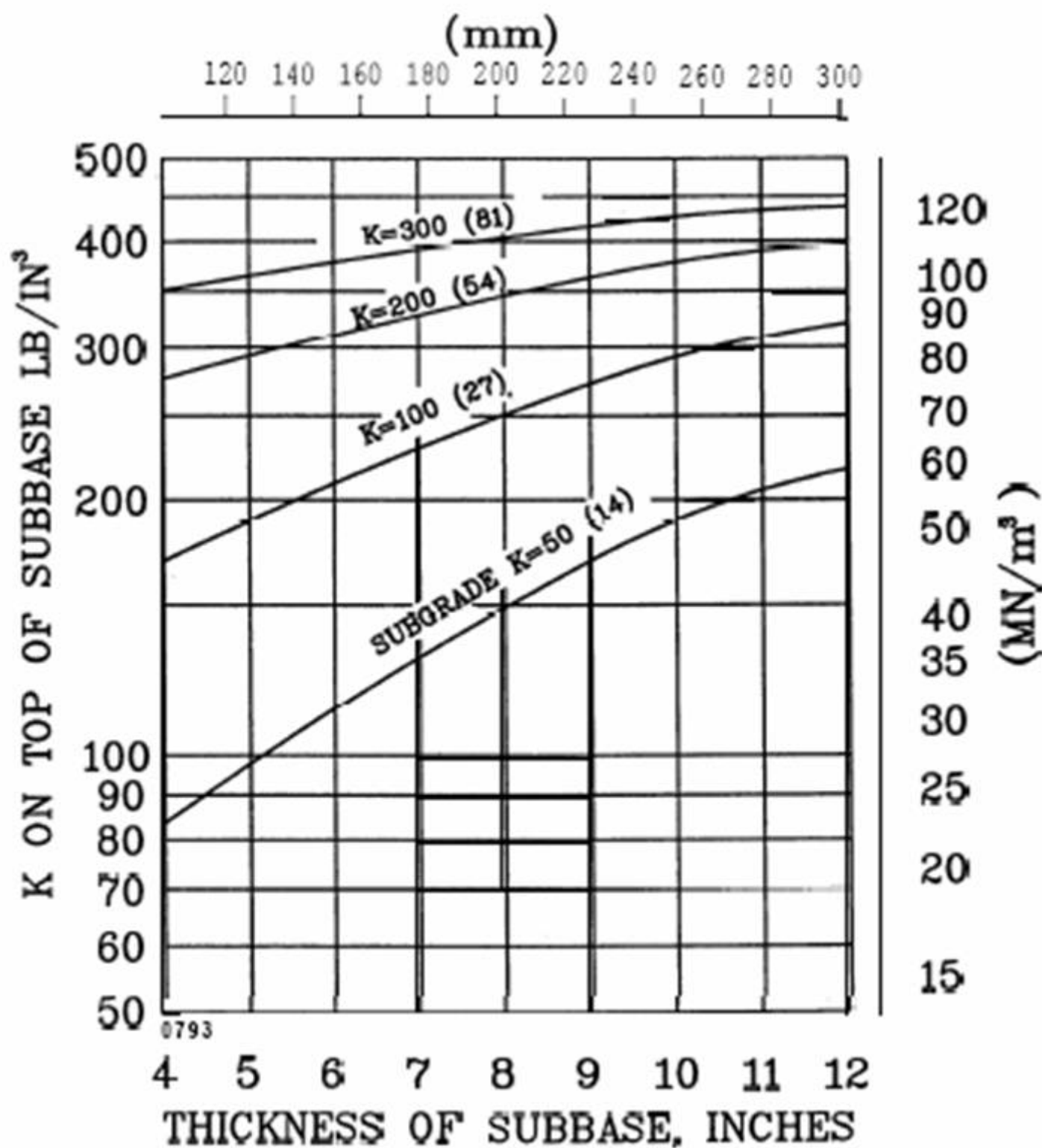


FIGURE 3-16 EFFECT OF STABILIZED SUBBASE ON SUBGRADE MODULUS

## **SUBBASE QUALITY.**

The standard FAA subbase for rigid pavements is 4 inches (100 mm) of Item P-154,

Subbase Course. In some instances it may be desirable to use higher quality materials or thicknesses of P-154 greater

than 4 inches (100 mm). The following materials are acceptable for use as subbase under rigid pavements:

Item P- 154 - Subbase Course

Item P-208 - Aggregate Base Course

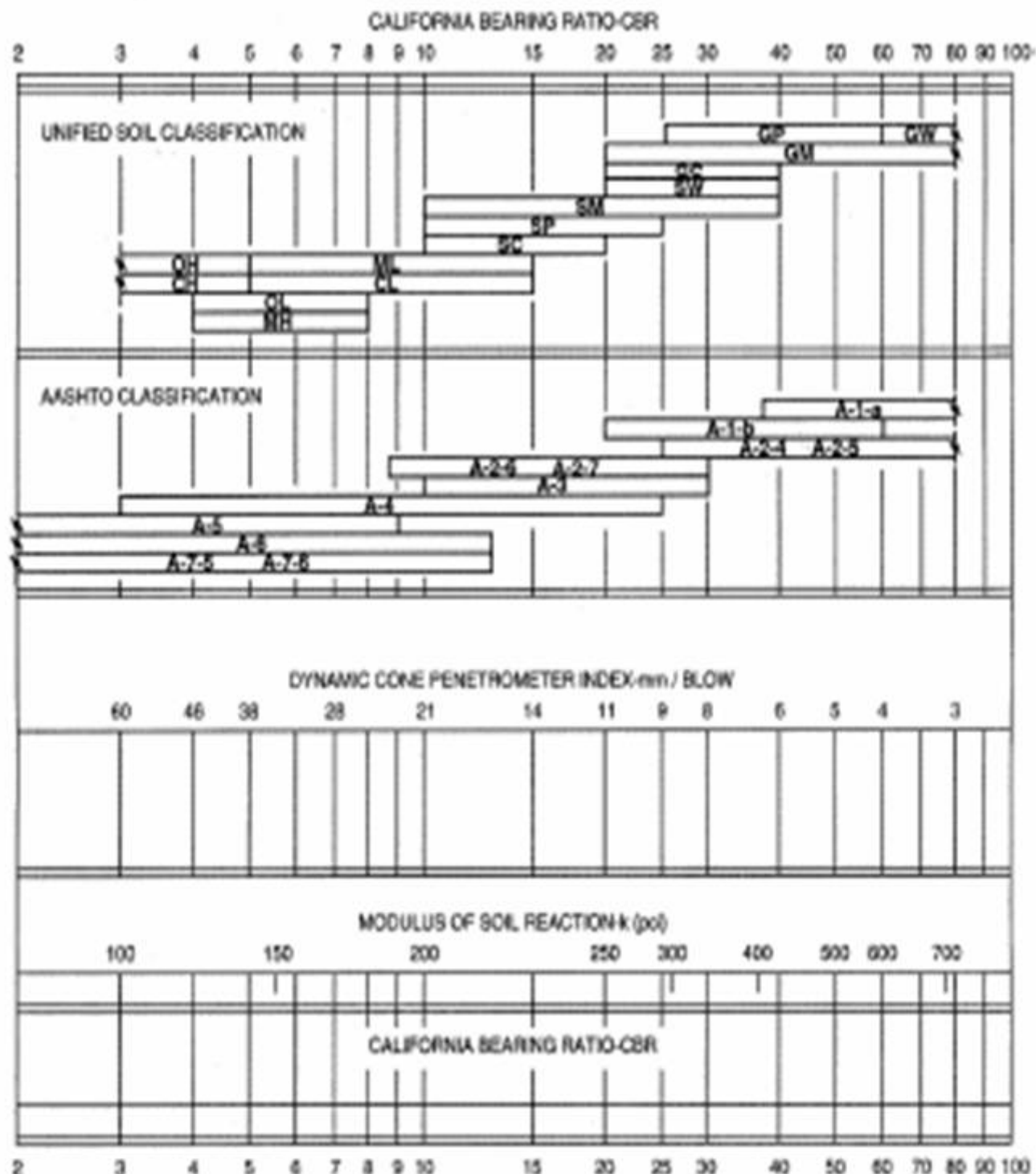
Item P-209 - Crushed Aggregate Base Course

Item P-21 1 - Lime Rock Base Course

Item P-304 - Cement Treated Base Course

Item P-306 - Econocrete Subbase Course

Item P-401 - Plant Mix Bituminous Pavements

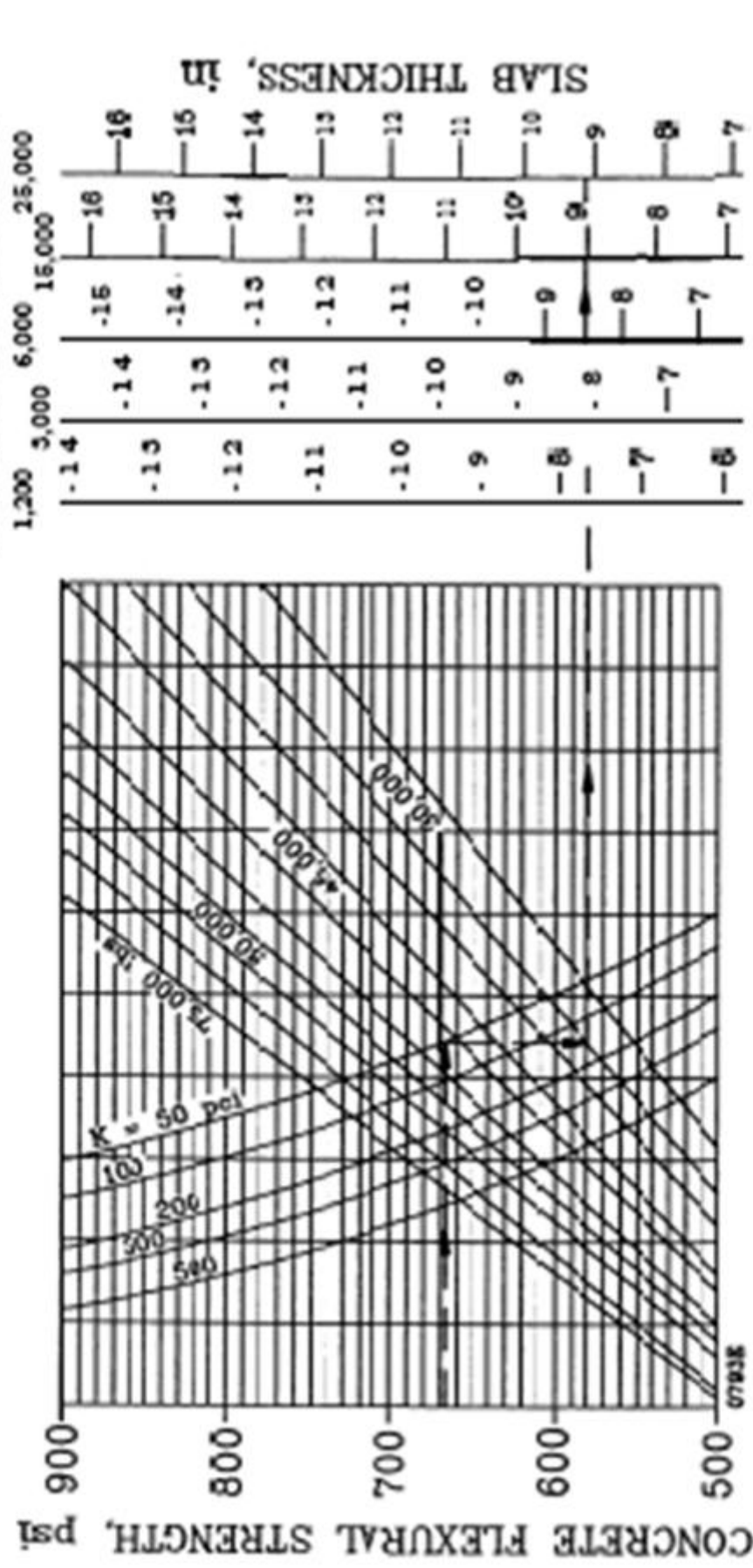


NOTE: CORRELATIONS NOT TO BE USED FOR DESIGN. AFTER  
PORTLAND CEMENT ASSOCIATION "THICKNESS DESIGN  
FOR CONCRETE HIGHWAY AND STREET PAVEMENTS"  
PACKARD, ROBERT G., 1984.  
DESIGN LIMIT FOR k IS 500.

Figure 5-3. Approximate relationships of soil classification and soil strength

## SINGLE WHEEL GEAR

## ANNUAL DEPARTURES



Not B:

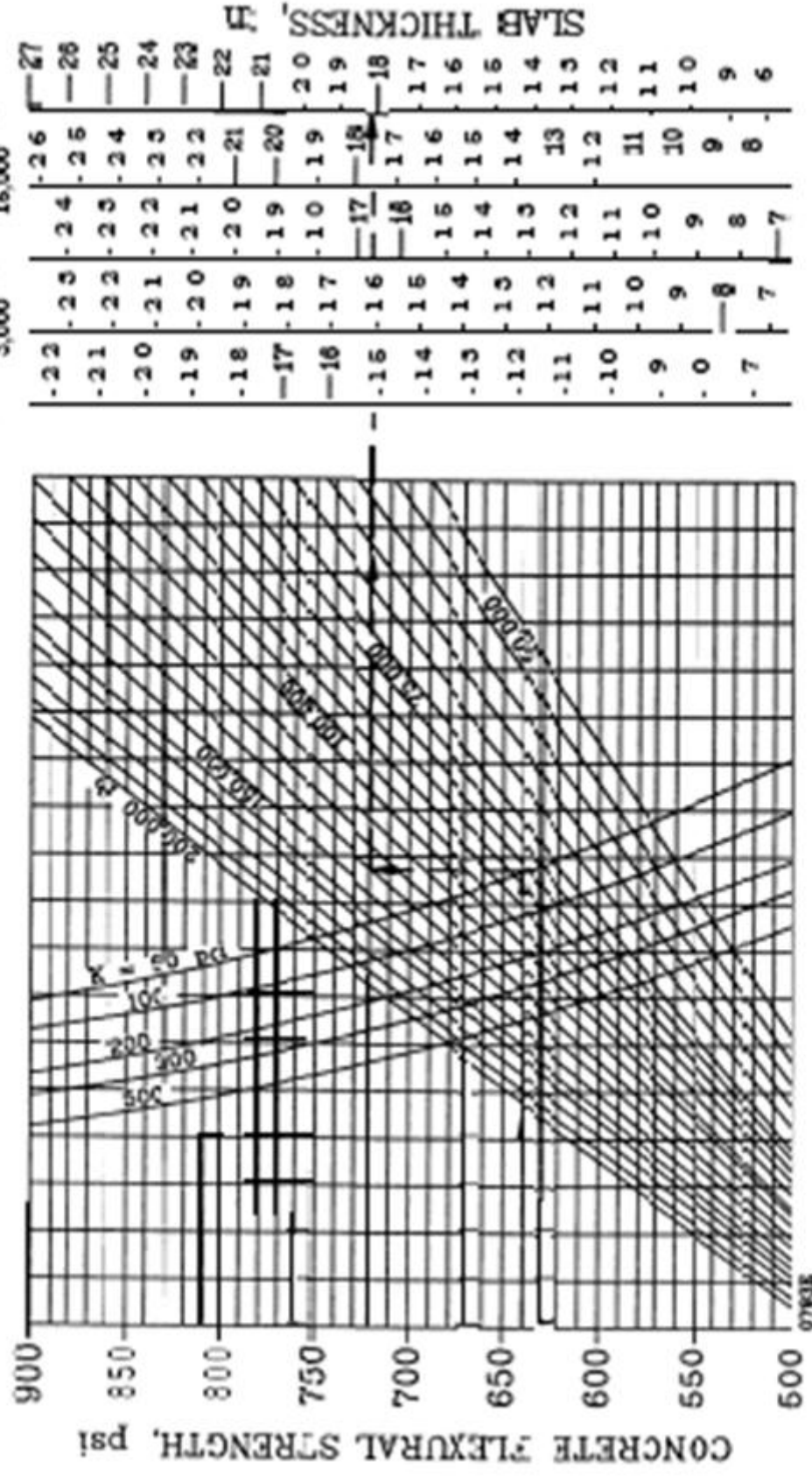
1 inch = 25.4 mm      1 psi = 0.0069 MN/m<sup>2</sup>  
1 lb = 0.454 kg      1 pci = 0.272 MN/m<sup>3</sup>

FIGURE 3-17. RIGID PAVEMENT DESIGN CURVES, SINGLE WHEEL CLEAR

# DUAL WHEEL GEAR

ANNUAL DEPARTURES

1,000 3,000 6,000 15,000 25,000



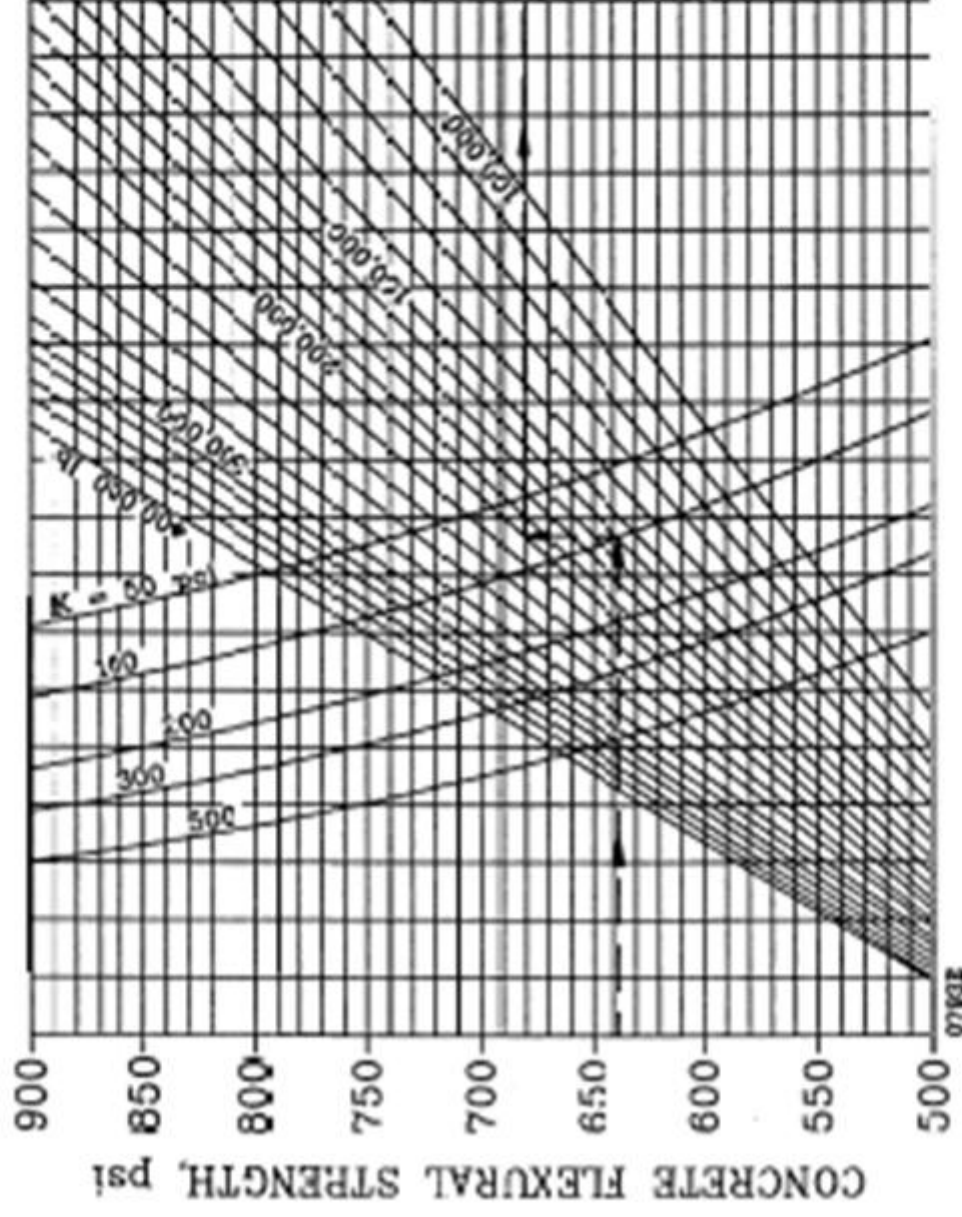
NOTE:

1 inch = 25.4 mm      1 psi = 0.0703 MPa

FIGURE 3-18. RIGID PAVEMENT DESIGN CURVES, DUAL WHEEL GEAR.



# DUAL TANDEM GEAR



ANNUAL DEPARTURES  
1,000 3,000 6,000 15,000 25,000

SLAB THICKNESS, in

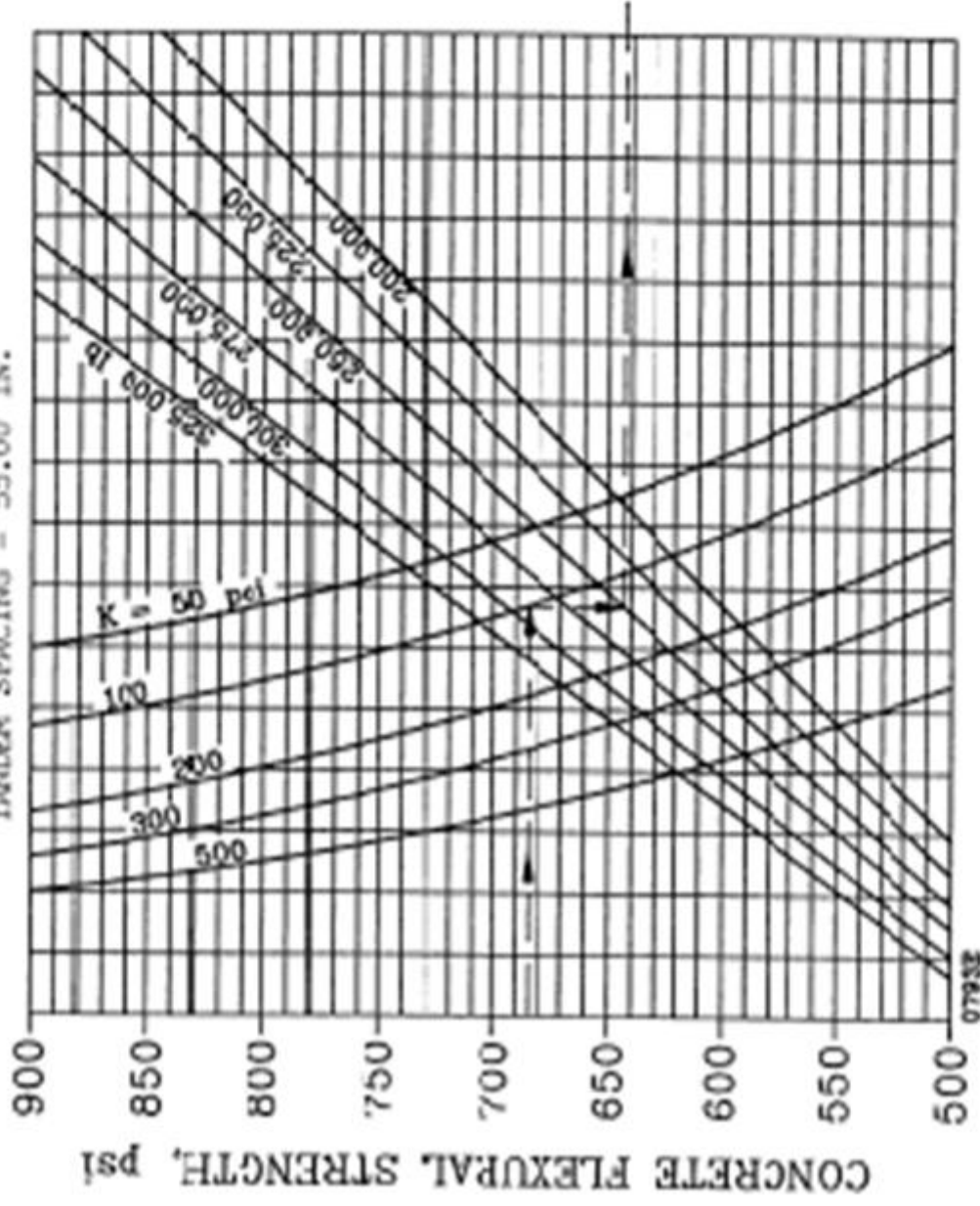
NOTE:

1 inch = 25.4 mm      1 psi = 0.0069 MN/m<sup>2</sup>  
1 lb = 0.454 kg      1 pci = 0.272 MN/m<sup>3</sup>

FIGURE 3-19. RIGID PAVEMENT DESIGN CURVES, DUAL TANDEM GEAR

# A-300 MODEL B2

CONTACT AREA = 207.47 SQ. IN.  
 DUAL SPACING = 34.99 IN.  
 TANDEM SPACING = 55.00 IN.



NOTE:

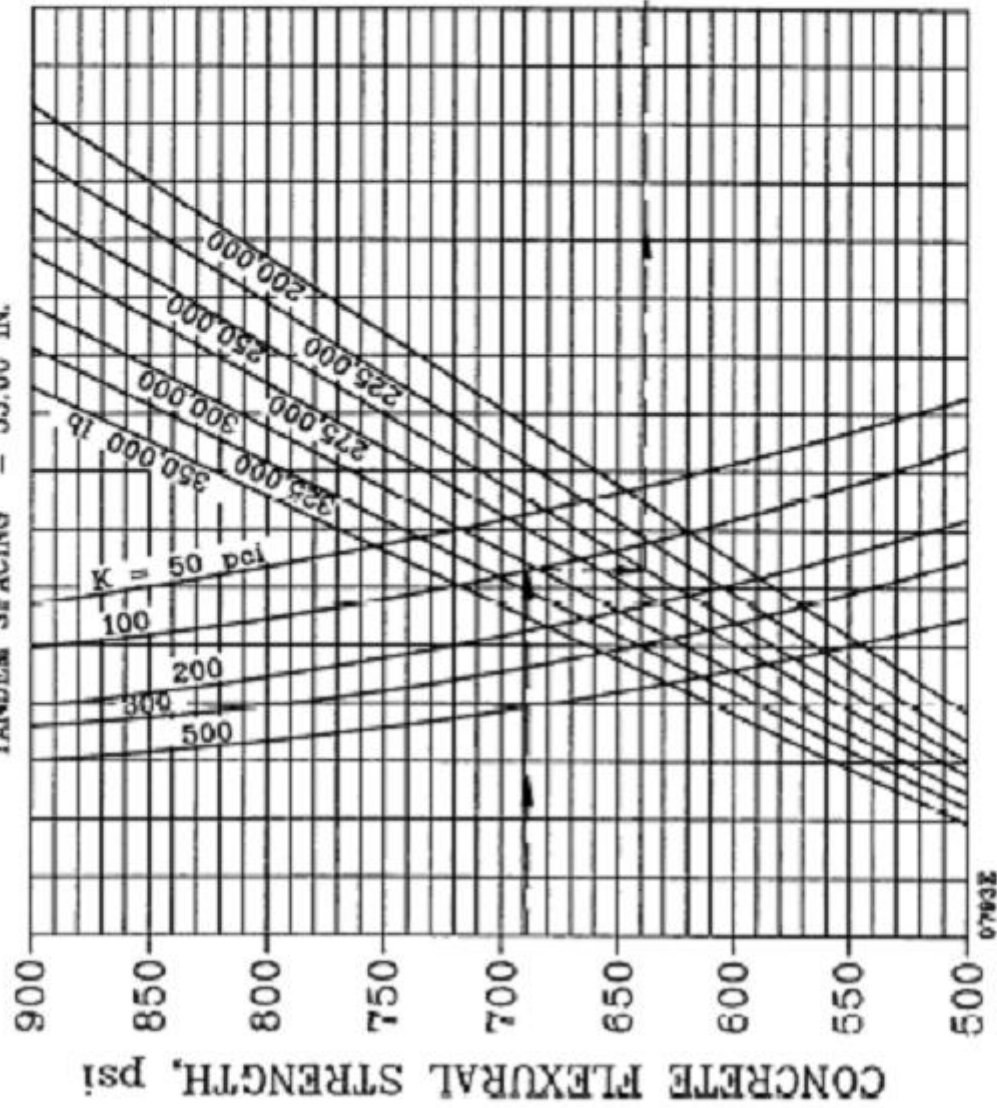
1 inch = 25.4 mm      1 psi = 0.0069  $\text{N/mm}^2$   
 1 lb = 0.454 kg      1 pci = 0.272  $\text{MN/m}^2$

FIGURE 3-20. RIGID PAVEMENT DESIGN CURVES, A-300 MODEL B2



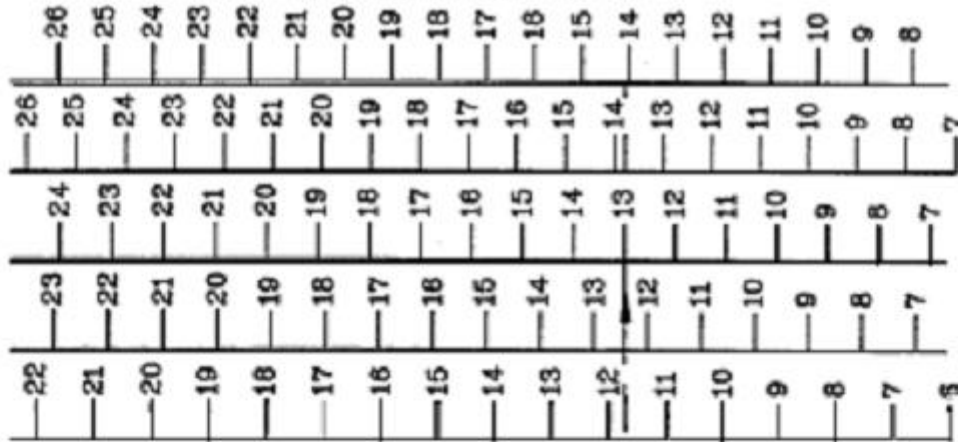
# A-300 MODEL B4

CONTACT AREA = 217.08 SQ. IN.  
 DUAL SPACING = 36.17 IN.  
 TANDEM SPACING = 55.00 IN.



ANNUAL DEPARTURES  
 1,200 3,000 6,000 15,000 25,000

SLAB THICKNESS, in



NOTE:

1 inch = 25.4 mm      1 psi = 0.0069 MN/m<sup>2</sup>  
 1 lb = 0.454 kg      1 pci = 0.272 MN/m<sup>3</sup>

FIGURE 3-21. RIGID PAVEMENT DESIGN CURVES, A-300 MODEL B4

# B-747-100, SR, 200 B, C, F

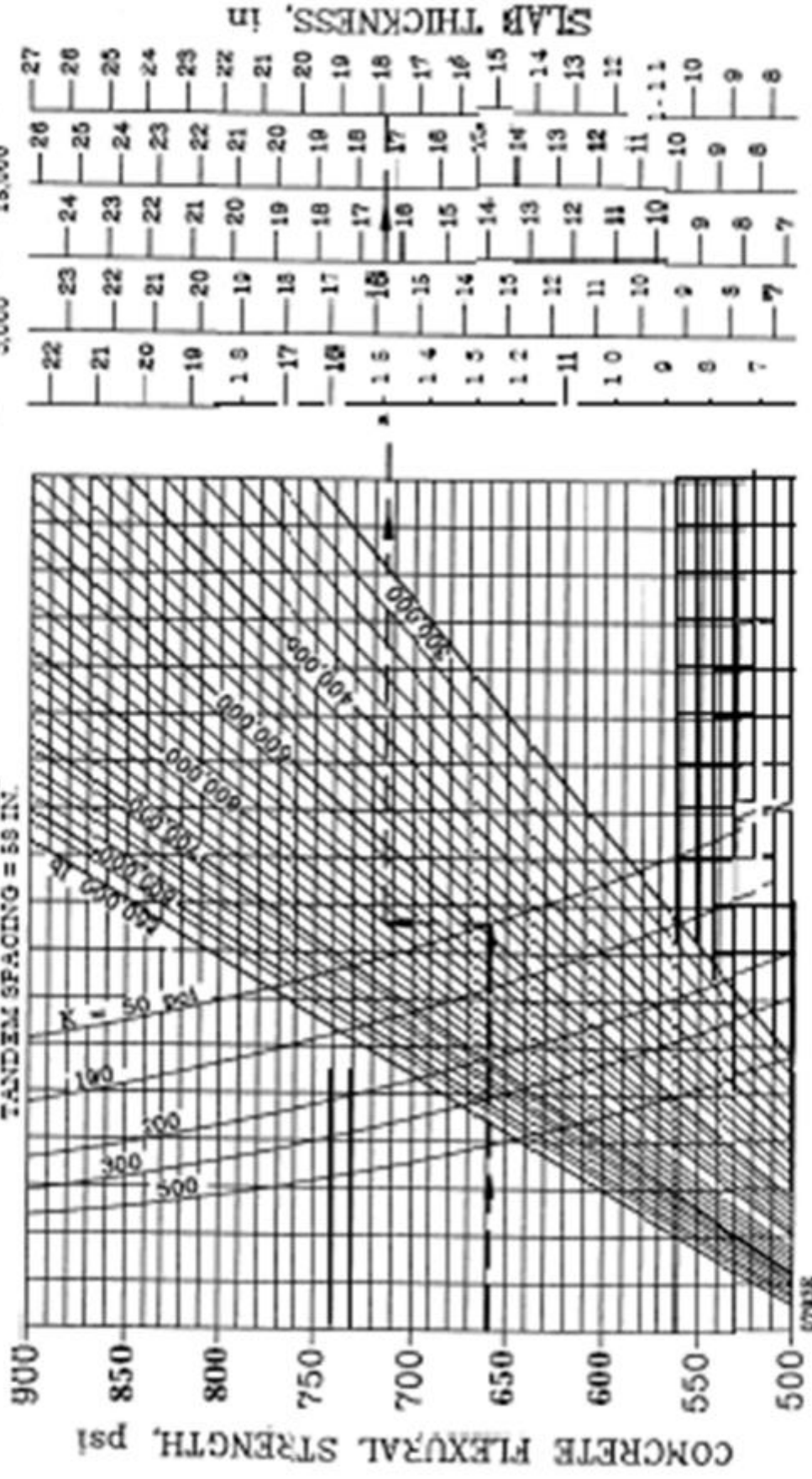
CONTACT AREA = 245 SQ. IN.

DUAL SPACING = 44 IN.

TANDEM SPACING = 55 IN.

## ANNUAL DEPARTURES

1,200 5,000 15,000 25,000



NOTE:

1 inch = 25.4 mm

1 lb = 0.454 kg

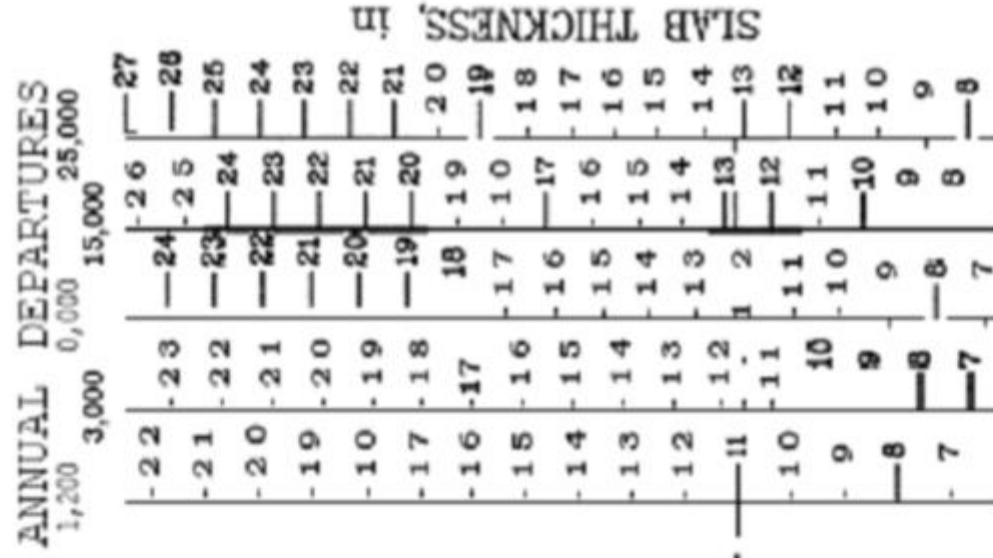
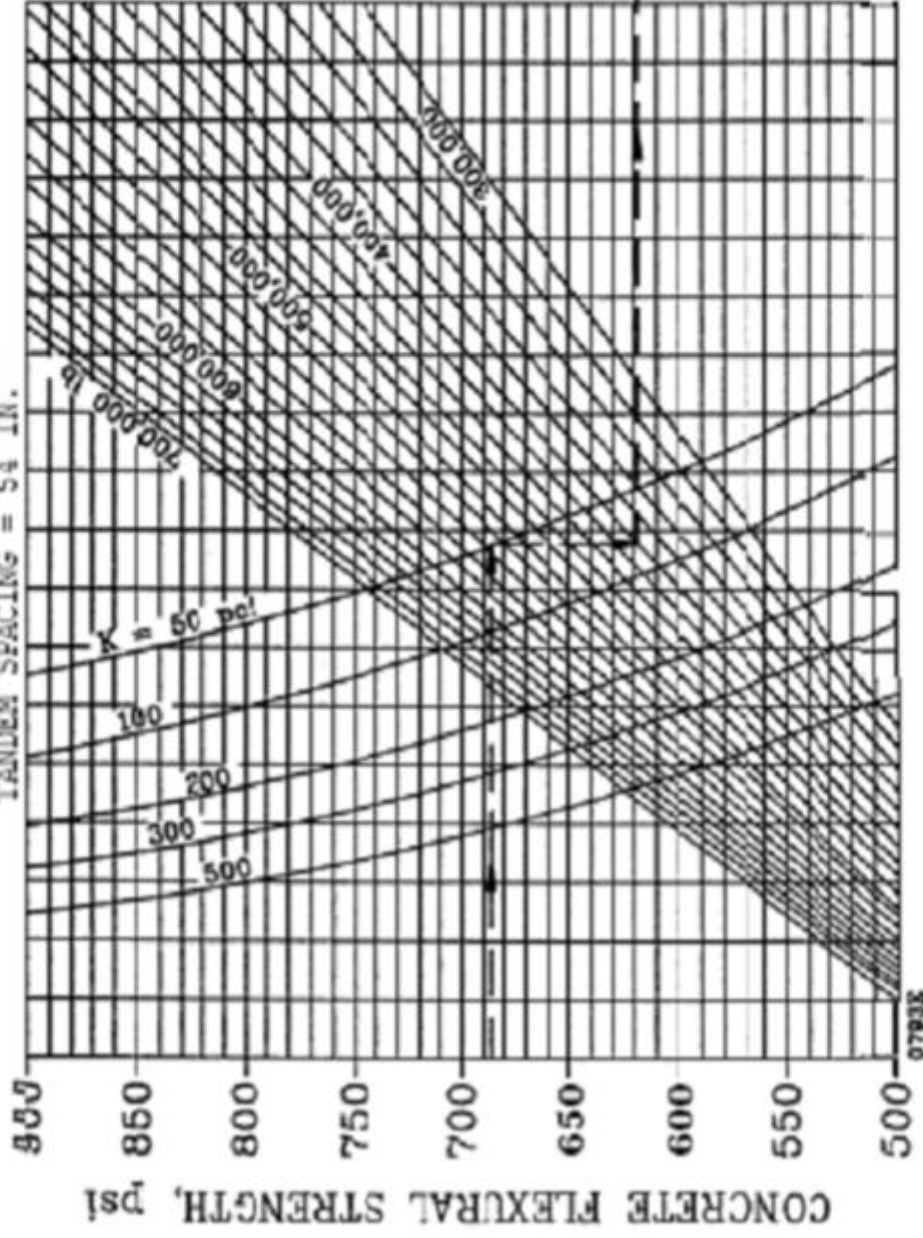
1 psi = 0.0069 MPa

1 psi = 0.272 MN/m<sup>2</sup>

FIGURE 3-22. RIGID PAVEMENT DESIGN CURVES, B-747-100, SR, 200 B, C, F

# B-747 SP

CONTACT AREA = 210 SQ. IN.  
DUAL SPACING = 43.25 IN.  
TANDEM SPACING = 54 IN.



NOTE:

1 inch = 25.4 mm  
1 lb = 0.454 kg

1 psi = 0.0069 MN/m<sup>2</sup>  
1 pci = 0.272 MN/m<sup>3</sup>

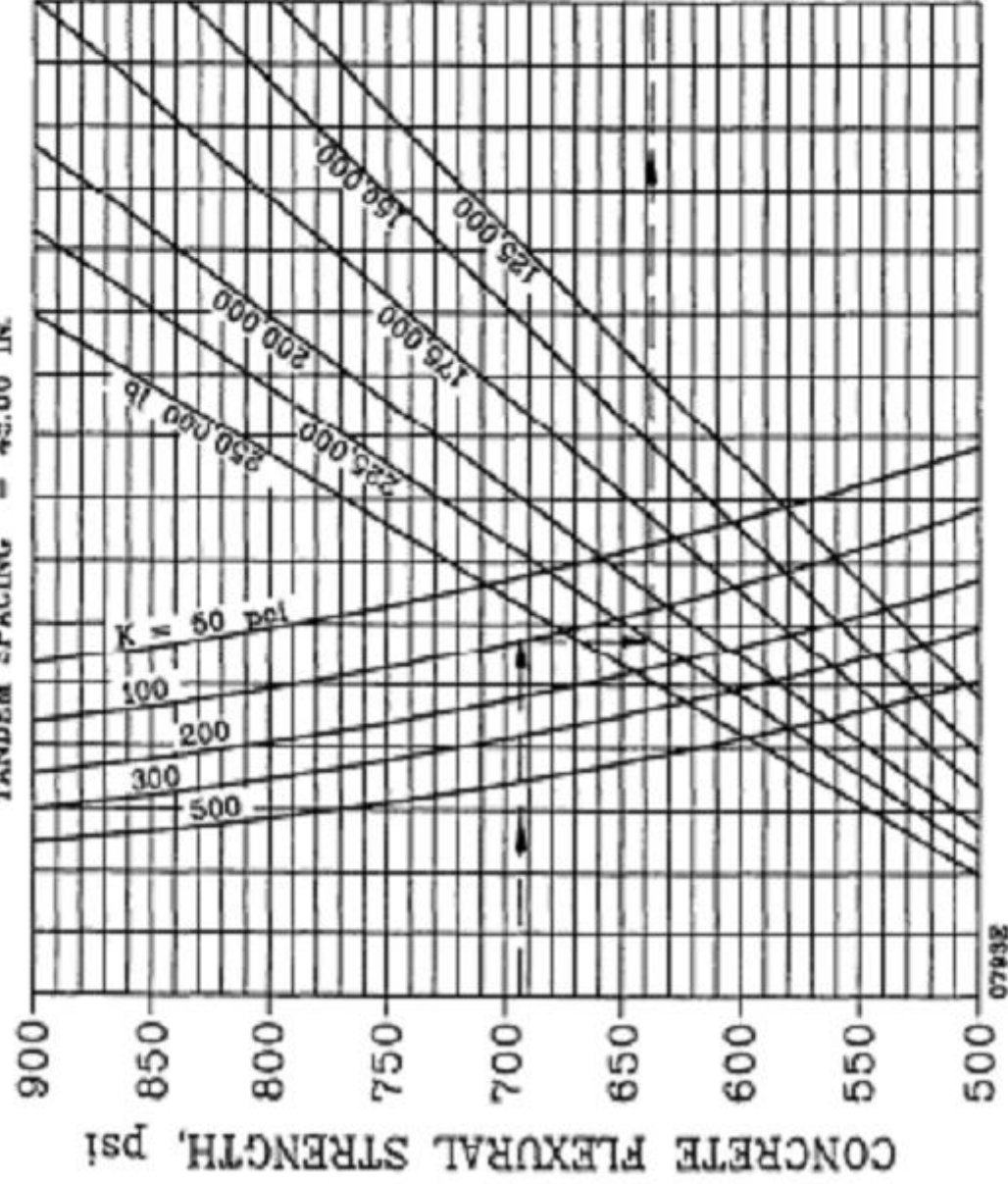
FIGURE 3-23. RIGID PAVEMENT DESIGN CURVES, B-747-SP



B-757

CONTACT AREA = 160.35 SQ. IN.  
 DUAL SPACING = 34.00 IN.  
 TANDEM SPACING = 43.00 IN.

ANNUAL DEPARTURES  
 1,200 3,000 6,000 15,000 25,000



NOTE:

1 inch = 25.4 mm

1 lb = 0.454 kg

1 psi = 0.0069 MN/m<sup>2</sup>1 pci = 0.272 MN/m<sup>3</sup>

FIGURE 3-24. RIGID PAVEMENT DESIGN CURVES, B-757

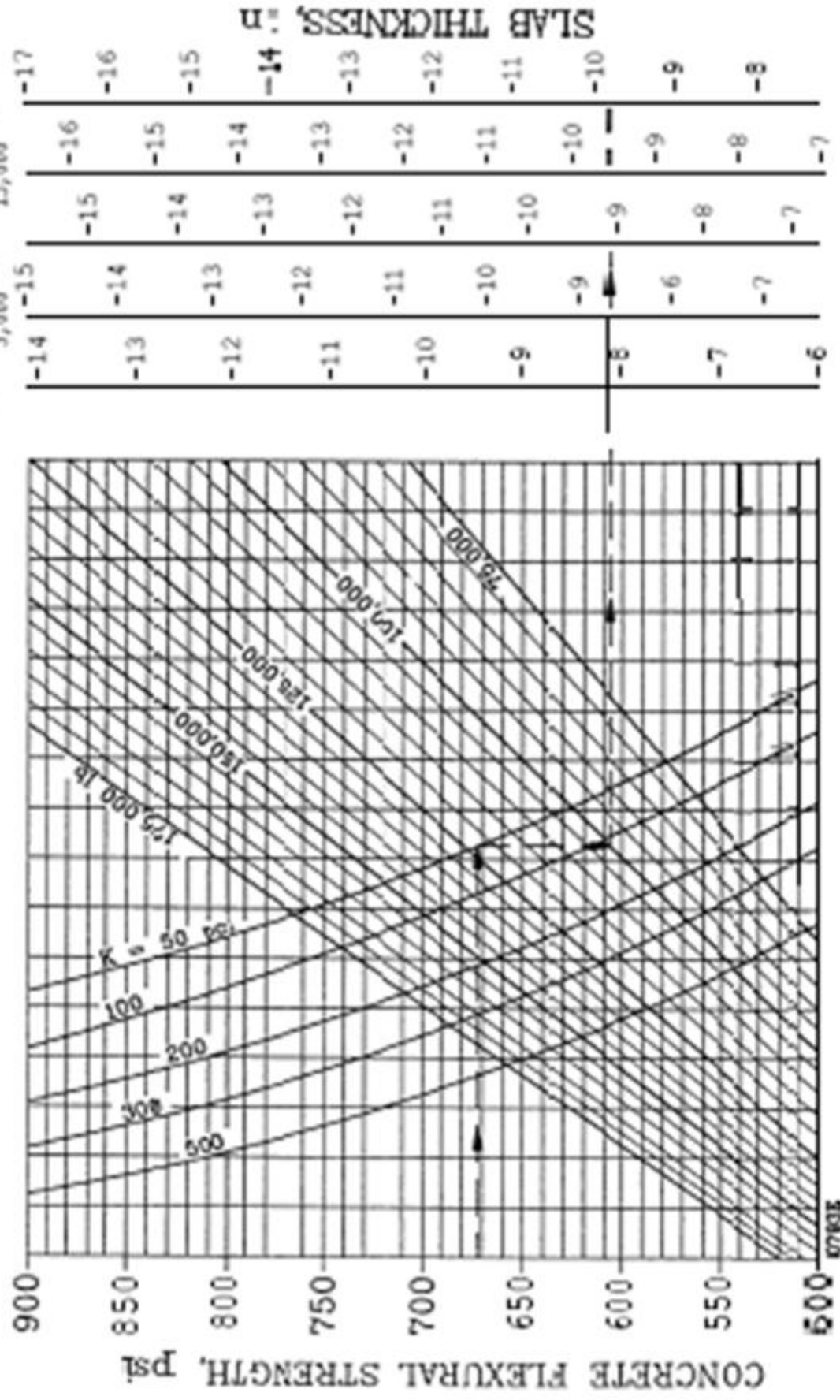


C-130

CONTACT AREA = 440 sq. in.  
TANDEM SPACING = 60 in.

ANNUAL DEPARTURES

1,200 3,000 6,000 15,000 25,000



NOTE:

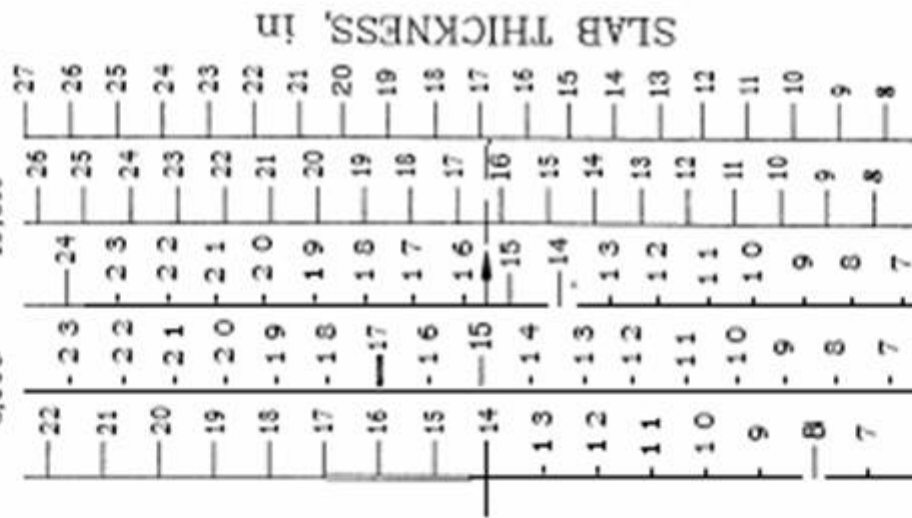
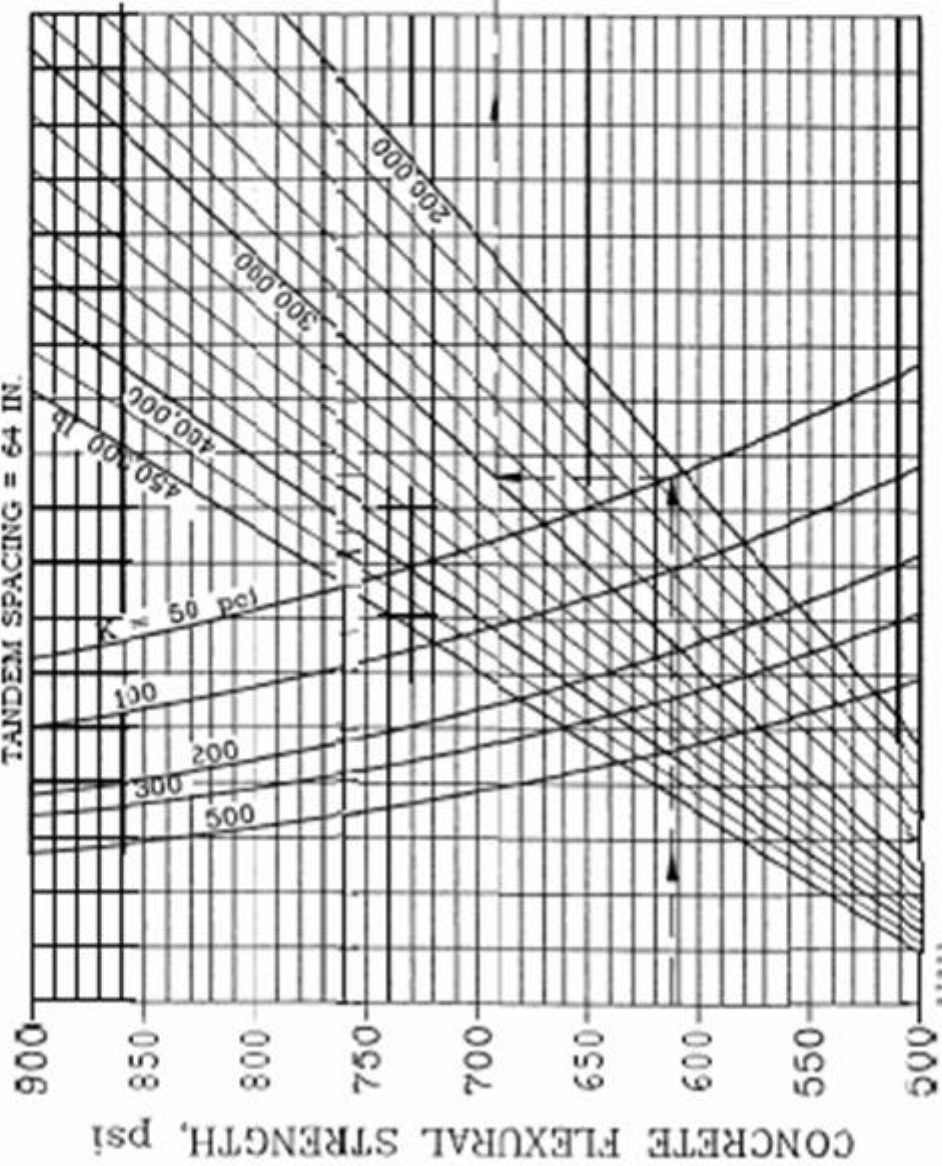
1 inch = 25.4 mm      1 psi = 0.0069  $\frac{N}{mm^2}$   
1 lb = 0.454 kg      1 pci = 0.272  $\frac{N}{mm^2}$

FIGURE 3-26 RIGID PAVEMENT DESIGN CURVES, C-130



## DC-10-10, 10CF

CONTACT AREA = 294 SQ. IN.  
DUAL SPACING = 54 IN.  
TANDEM SPACING = 64 IN.



NOTE:

1 inch = 25.4 mm

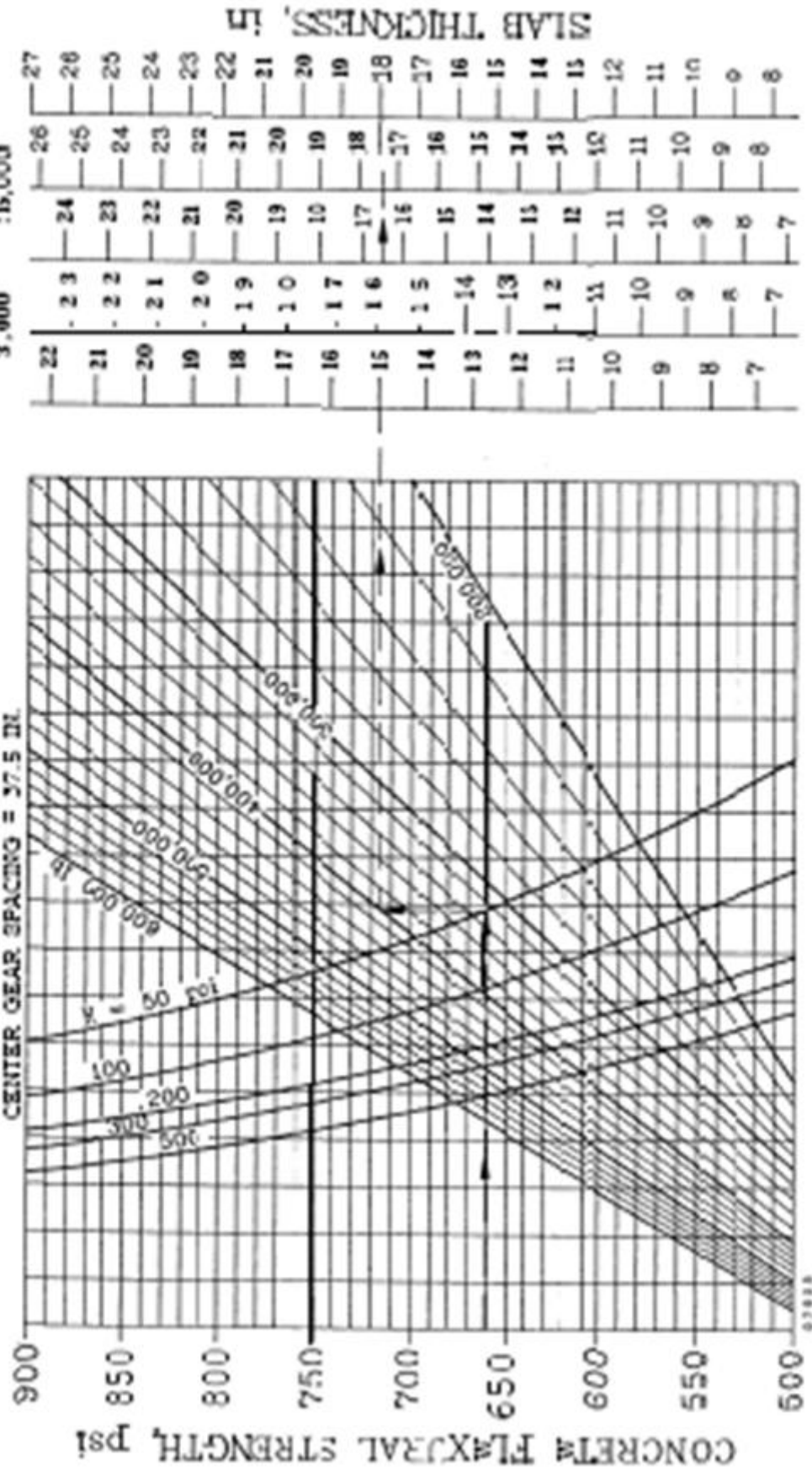
 $1 \text{ lb} = 0.454 \text{ kg}$ 
$$1 \text{ psi} = 0.0069 \text{ MN/m}^2$$

$$1 \text{ pci} = 0.272 \text{ kN/m}^2$$

FIGURE 3-27. RIGID PAVEMENT DESIGN CURVES, DC 10-10, 10CF

## DC-10-30, 30CF, 40, 40CF

CONTACT AREA = 331 SQ. IN.  
DUAL SPACING = 54 IN.  
TANDEM SPACING = 64 IN.  
CENTER GEAR SPACING = 77.5 IN.



ANNUAL DEPARTURES:

1,200	9,000	25,000
3,000	15,000	

SLAB THICKNESS, IN

Left Scale (Inches)	Right Scale (Inches)
7	8
8	9
9	10
10	11
11	12
12	13
13	14
14	15
15	16
16	17
17	18
18	19
19	20
20	21
21	22
22	23
	24
	25
	26
	27

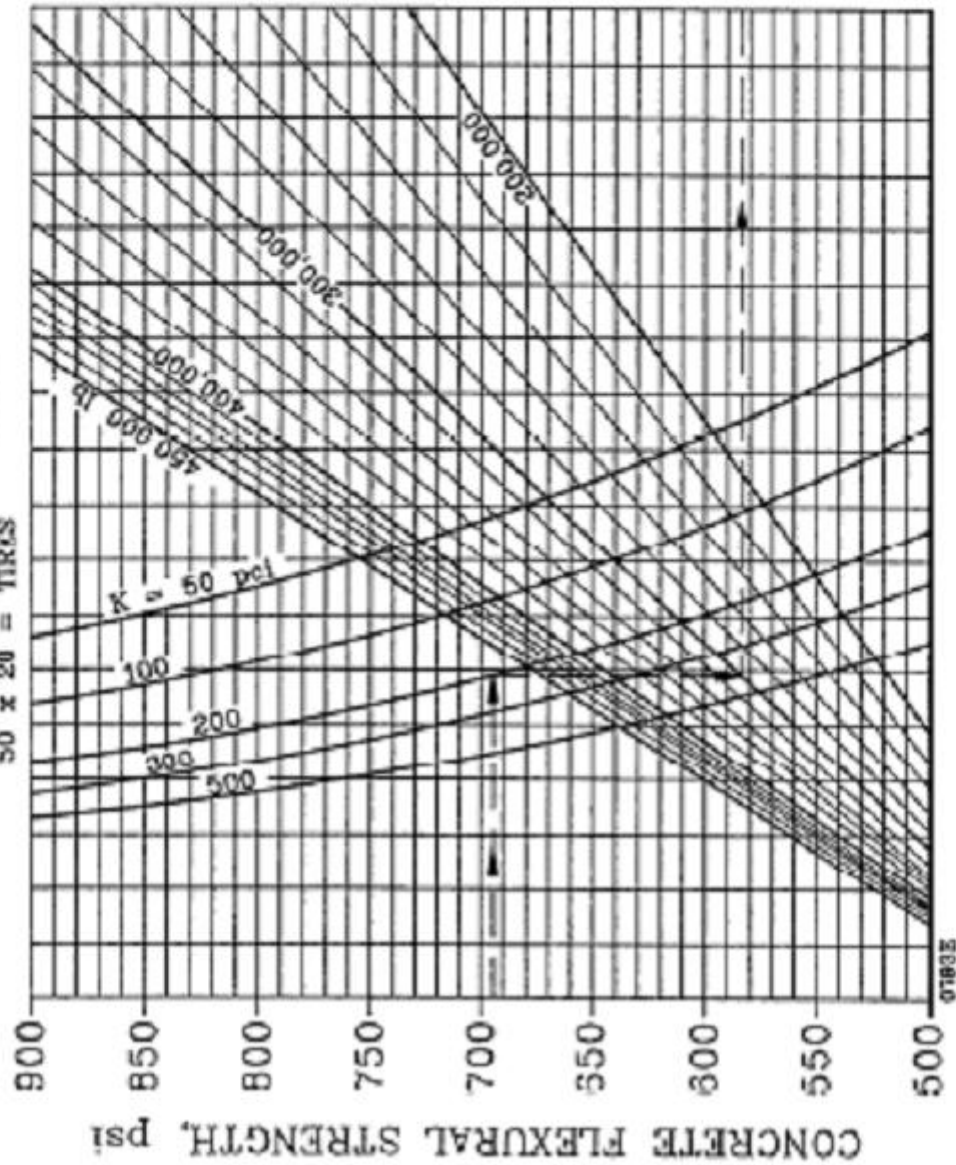
NOTE:

1 inch = 25.4 mm ; psi = 0.0069 MN/m<sup>2</sup>
$$1 \text{ lb} = 0.454 \text{ kg} \quad 1 \text{ pci} = 0.272 \text{ MN/m}^2$$
$$1 \text{ psi} = 0.0069 \text{ MN/m}^2$$
$$f_{pci} = 0.272 \text{ MN/m}^2$$

FIGURE 1-28. RIGID PAVEMENT DESIGN CURVES, DC 18-30, 30CF, 40, 40CF

$L-1011-1, 100$ 

CONTACT AREA = 285.00 SQ. IN.  
DUAL SPACING = 52.00 IN.  
TANDEM SPACING = 70 IN.  
50 x 20 = TIRES



ANNUAL DEPARTURES

1,200	3,000	25,030
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SLAB THICKNESS, in

Left Scale (in)	Right Scale (in)
7	6
8	7
9	8
10	9
11	10
12	11
13	12
14	13
15	14
16	15
17	16
18	17
19	18
20	19
21	20
22	21
	22
	23
	24
	25
	26
	27

NOTES:

1 in. = 25.4 mm      1 psi = 0.0069 MN/m<sup>2</sup>  
1 lb = 0.454 kg      1 pci = 0.272 MN/m<sup>2</sup>

FIGURE 3-29. RIGID PAVEMENT DESIGN CURVES, L-1011-1, 100



# L-1011-100, 200

CONTACT AREA = 337 SQ. IN.  
DUAL SPACING = 62 IN.  
TANDEM SPACING = 70 IN.

## ANNUAL DEPARTURES

1,200 6,000 25,000  
3,000 15,000

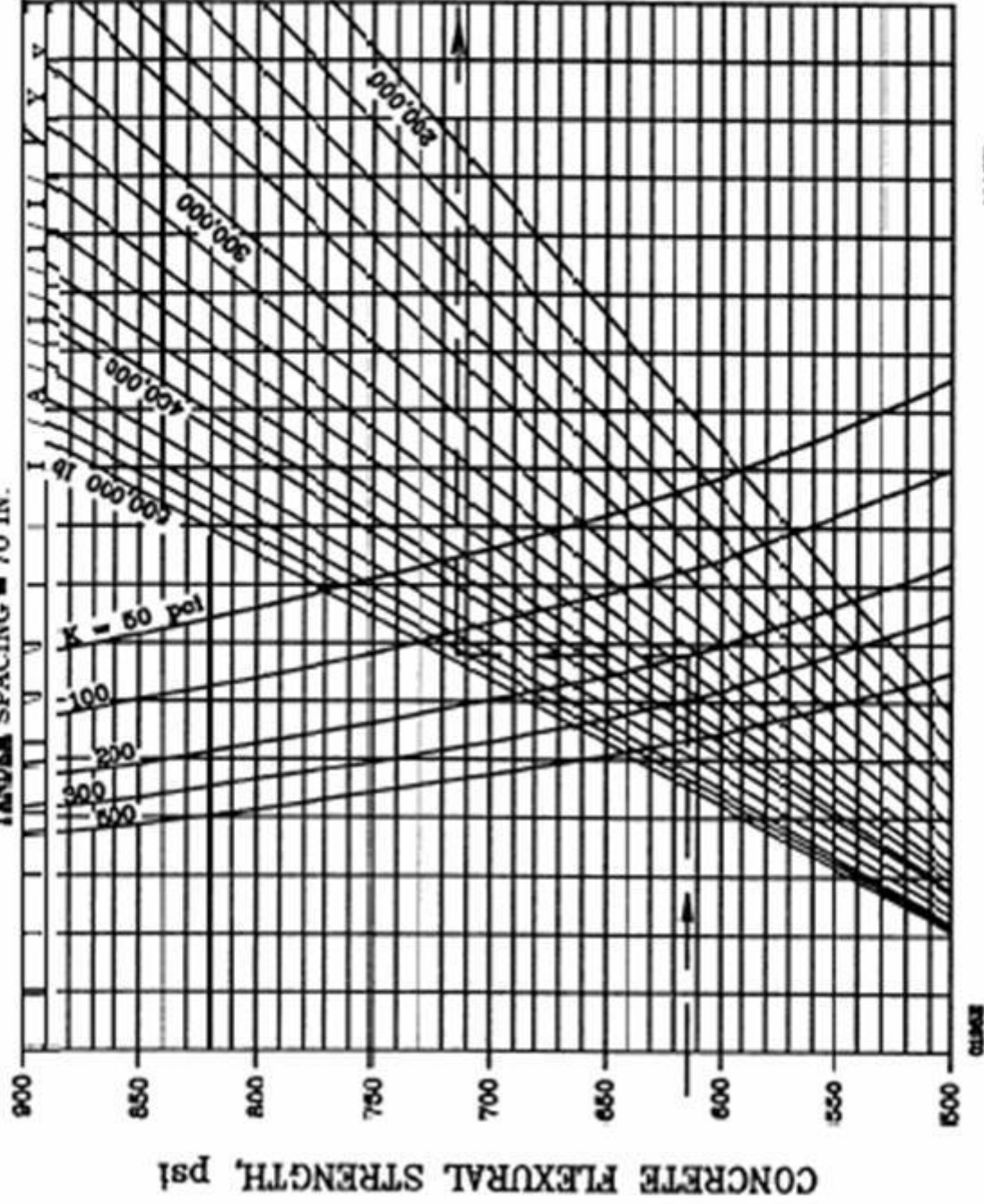


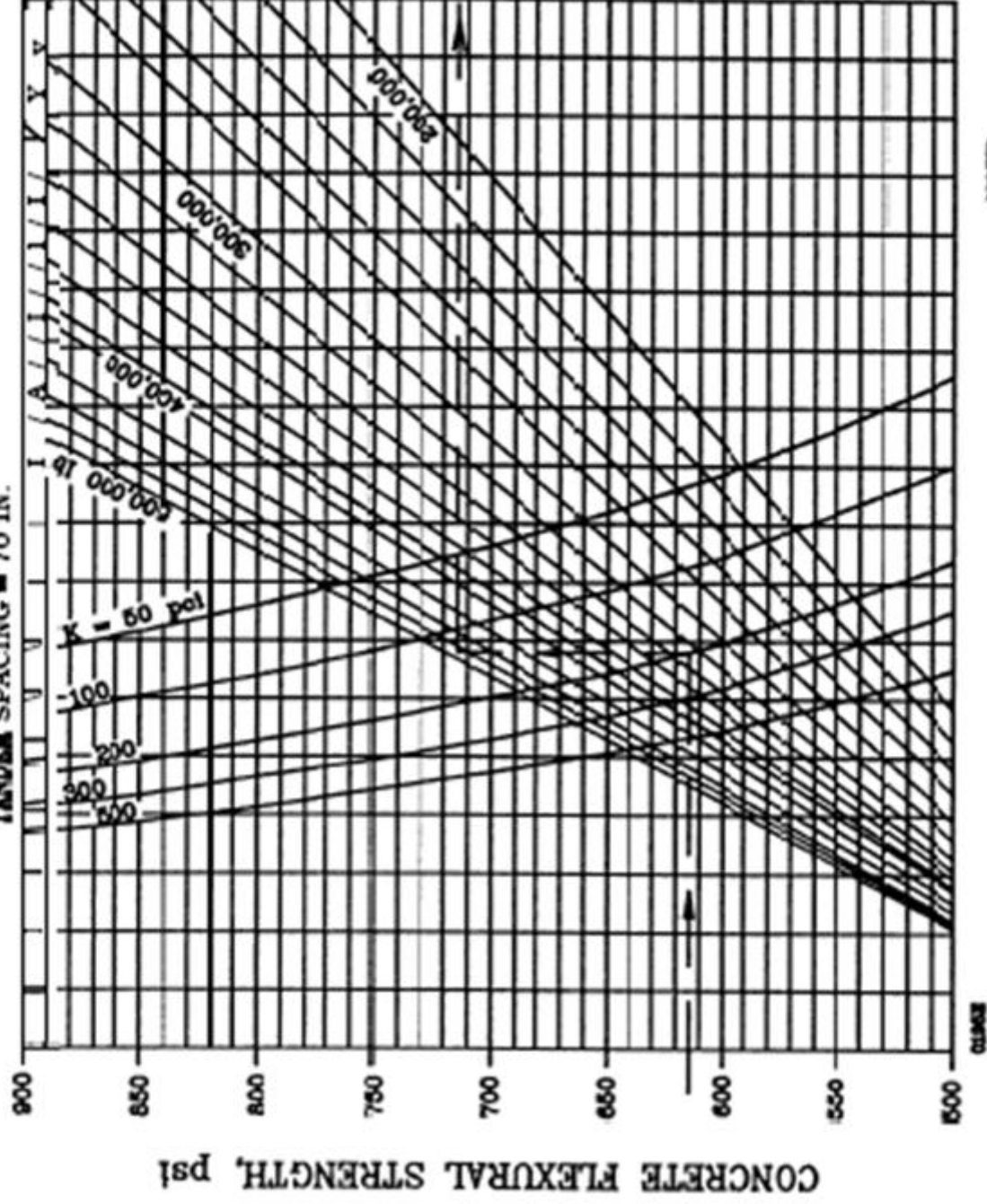
FIGURE 3-30. RIGID PAVEMENT DESIGN CURVES, L-1011-100, 200

# L-1011-100, 200

## ANNUAL DEPARTURES

CONTACT AREA = 337 SQ. IN.  
DUAL SPACING = 62 IN.  
TANDEM SPACING = 70 IN.

1,200 6,000 25,000  
3,000 15,000



SLAB THICKNESS, in

22	23	24	25	26	27
21	22	23	24	25	26
20	21	22	23	24	25
19	20	21	22	23	24
18	19	20	21	22	23
17	18	19	20	21	22
16	17	18	19	20	21
15	16	17	18	19	20
14	15	16	17	18	19
13	14	15	16	17	18
12	13	14	15	16	17
11	12	13	14	15	16
10	11	12	13	14	15
9	10	11	12	13	14
8	9	10	11	12	13
7	8	9	10	11	12
6	7	8	9	10	11
5	6	7	8	9	10
4	5	6	7	8	9
3	4	5	6	7	8
2	3	4	5	6	7
1	2	3	4	5	6
0	1	2	3	4	5
-1	-2	-3	-4	-5	-6
-2	-3	-4	-5	-6	-7
-3	-4	-5	-6	-7	-8
-4	-5	-6	-7	-8	-9
-5	-6	-7	-8	-9	-10
-6	-7	-8	-9	-10	-11
-7	-8	-9	-10	-11	-12
-8	-9	-10	-11	-12	-13
-9	-10	-11	-12	-13	-14
-10	-11	-12	-13	-14	-15
-11	-12	-13	-14	-15	-16
-12	-13	-14	-15	-16	-17
-13	-14	-15	-16	-17	-18
-14	-15	-16	-17	-18	-19
-15	-16	-17	-18	-19	-20
-16	-17	-18	-19	-20	-21
-17	-18	-19	-20	-21	-22
-18	-19	-20	-21	-22	-23
-19	-20	-21	-22	-23	-24
-20	-21	-22	-23	-24	-25
-21	-22	-23	-24	-25	-26
-22	-23	-24	-25	-26	-27

NOTE:  $1 \text{ lb} = 0.454 \text{ kg}$   $1 \text{ psi} = 0.00689 \text{ MPa}$

FIGURE 3-30. RIGID PAVEMENT DESIGN CURVES, L-1011-100, 200

## DESIGN EXAMPLE.

a rigid pavement is to be designed for dual tandem aircraft having a gross weight of 350,000 pounds (160 000 kg) and for 6,000 annual equivalent departures of the design aircraft. The equivalent annual departures of 6,000 include 1,200 annual departures of B-747 aircraft weighing 780,000 pounds (350 000 kg) gross weight. The subgrade modulus of 100 PC1 (25 MN/m<sup>3</sup>) with poor drainage and frost penetration is 18 inches (460 mm). The feature to be designed is a primary runway and requires 100 percent frost protection. The subgrade soil is CL. Concrete mix designs indicate a flexural strength of 650 PSI (4.5 MN/m<sup>2</sup>) can be readily produced with locally available aggregates. The gross weight of the design aircraft dictates the use of a stabilized subbase. Several thicknesses of stabilized subbases should be tried to determine the most economical section. Assume a stabilized subbase of P-304 will be used. Try a subbase thickness of 6 inches (150 mm). Using

Figure 3-16, a 6-inch (150 mm) thickness of P-304 would likely increase the foundation modulus from 100 PC1 (25 MN/m<sup>3</sup>) to 210 PC1 (57 MN/m<sup>3</sup>). Using Figure 3-19, dual tandem design curve, with the assumed design data, yields a concrete pavement thickness of 16.6 inches (422 mm). This thickness would be rounded off to 17 inches (430 mm). Since the frost penetration is only 18 inches (460 mm) and the combined thickness of concrete pavement and stabilized subbase is 23 inches (585 mm), no further frost protection is needed. Even though the wide body aircraft did not control the thickness of the slab, the wide bodies would have to be considered in the establishment of jointing requirements and design of drainage structures. Other stabilized subbase thicknesses should be tried to determine the most economical section.



