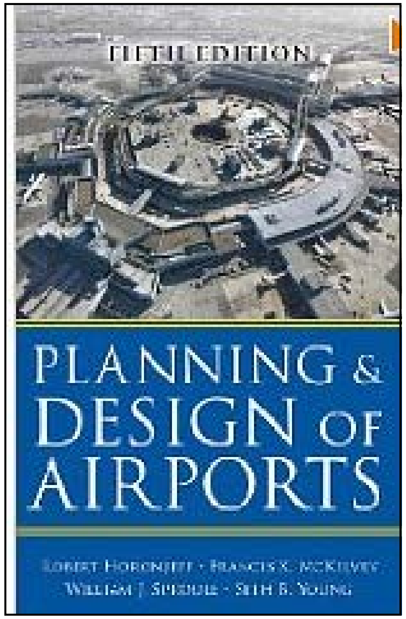
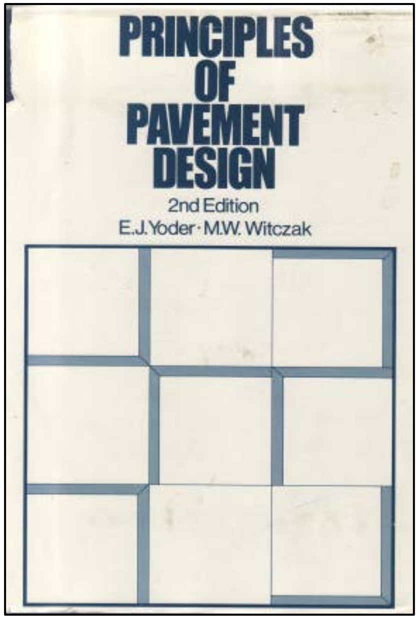
STRUCTURAL DESIGN OF FLEXIBLE AIRPORT PAVEMENTS

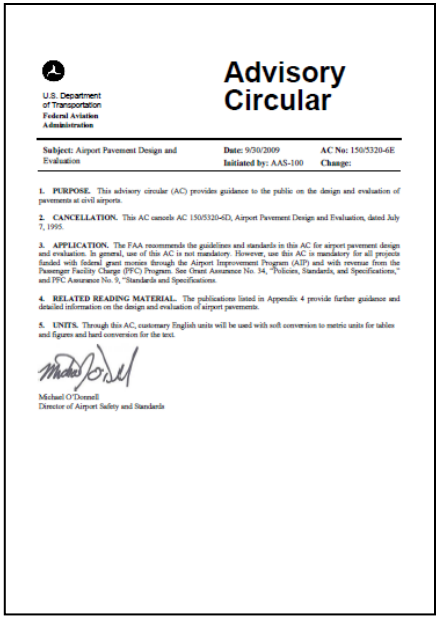
AIRPORT ENGINEERING
MODULE – 09
MAJ NADEEM

References

- **Planning and Design of Airports by Robert Horonjeff. and Francis X Mckelvey**
- **Principles of Pavement Design, Yoder and Witczak (1975)**
- **Airport Pavement Design and Evaluation, FAA Advisory Circular 150/5320-6D**







U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Airport Pavement Design and Evaluation	**Date:** 9/30/2009 **Initiated by:** AAS-100	**AC No:** 150/5320-6E **Change:**

1. **PURPOSE.** This advisory circular (AC) provides guidance to the public on the design and evaluation of pavements at civil airports.

2. **CANCELLATION.** This AC cancels AC 150/5320-6D, Airport Pavement Design and Evaluation, dated July 7, 1995.

3. **APPLICATION.** The FAA recommends the guidelines and standards in this AC for airport pavement design and evaluation. In general, use of this AC is not mandatory. However, use this AC is mandatory for all projects funded with federal grant monies through the Airport Improvement Program (AIP) and with revenue from the Passenger Facility Charge (PFC) Program. See Grant Assurance No. 34, "Policies, Standards, and Specifications," and PFC Assurance No. 9, "Standards and Specifications.

4. **RELATED READING MATERIAL.** The publications listed in Appendix 4 provide further guidance and detailed information on the design and evaluation of airport pavements.

5. **UNITS.** Through this AC, customary English units will be used with soft conversion to metric units for tables and figures and hard conversion for the text.

Michael O'Donnell
Director of Airport Safety and Standards

Pavements

- **Pavement is a covering of solid material/ materials, laid so as, to make a hard and convenient surface for travel of any kind of transport mode**
- **Pavement Engineering deals with the structural analysis, design, construction and maintenance of the way used for different modes**
- **Two basic types are Flexible Pavements and Rigid Pavements**

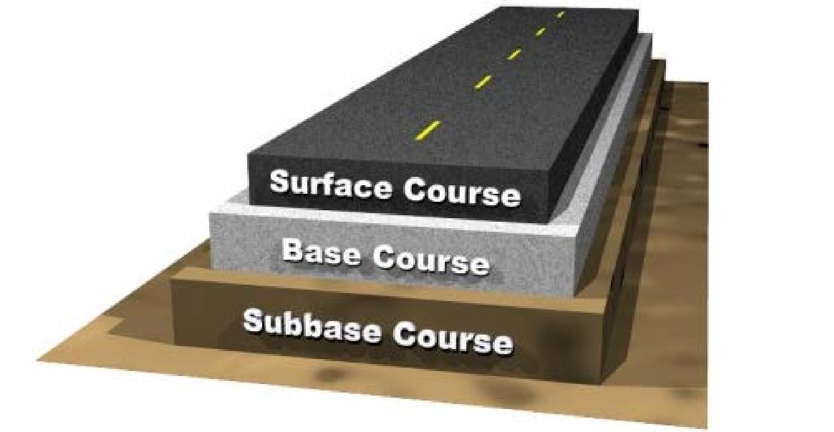
Types of Pavement

Flexible

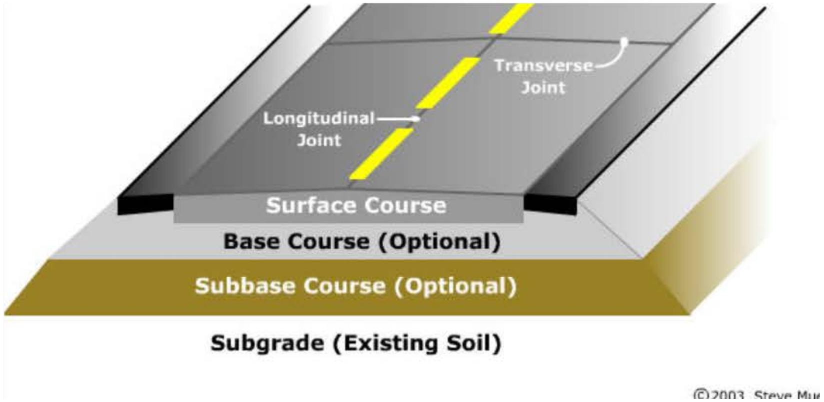
Rigid

Types of Pavement

Flexible Pavement

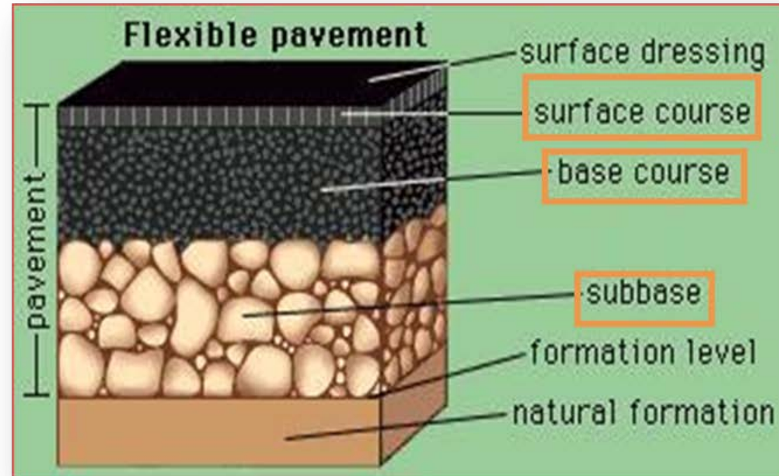


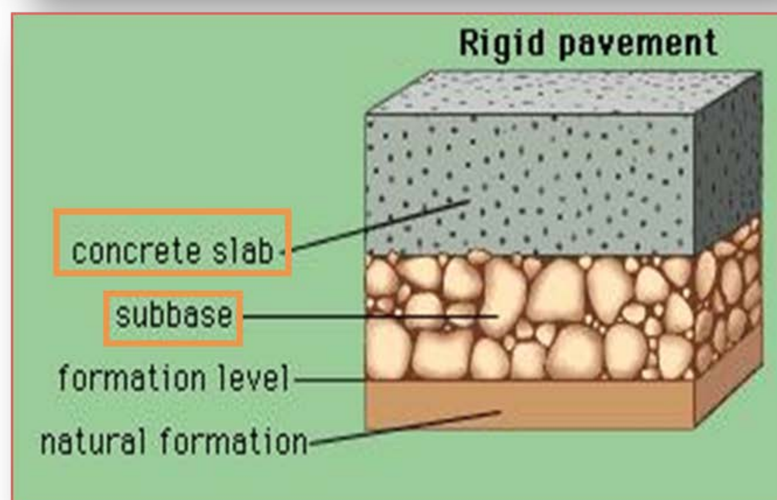
Rigid Pavement



Types of Pavement

- **Flexible pavements**
  - Constructed of bituminous and granular materials
  - Called "flexible" since the total pavement structure bends (or flexes) to accommodate traffic loads
- **Rigid pavements**
  - Constructed of Portland cement concrete
  - Called "rigid" since PCC's high modulus of elasticity does not allow them to flex appreciably
- **Composite pavements**
  - composed of both AC & PCC

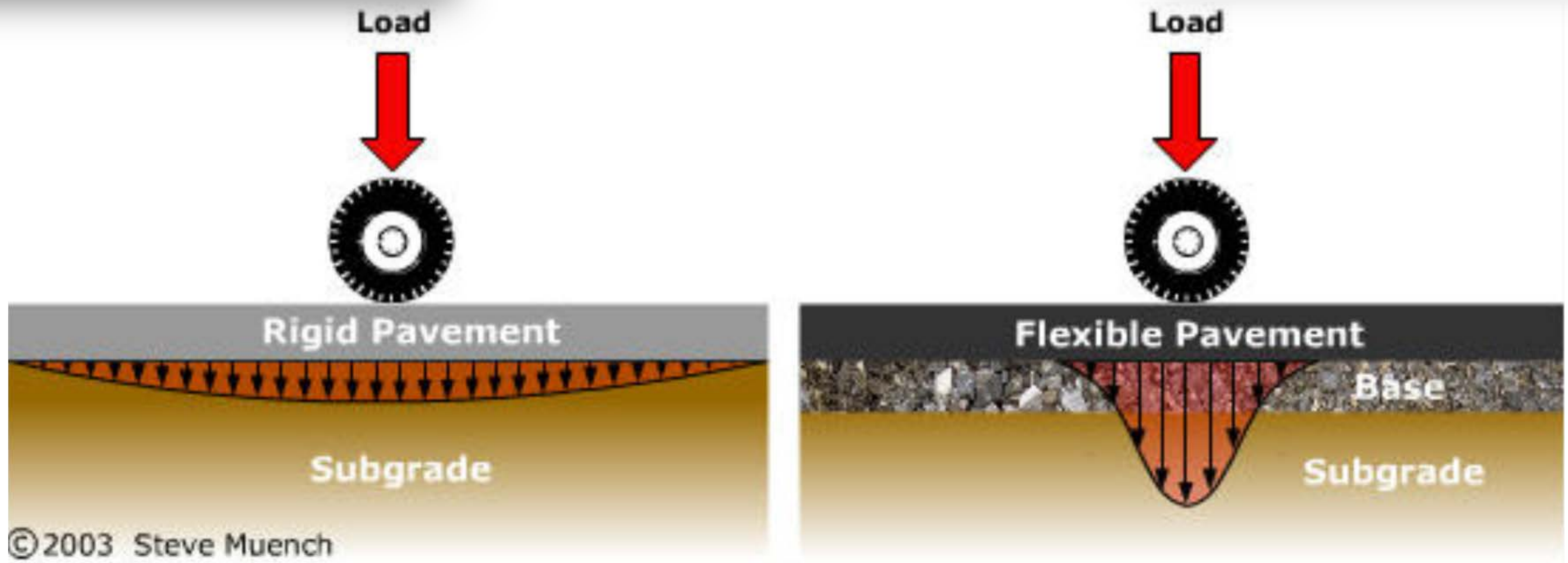


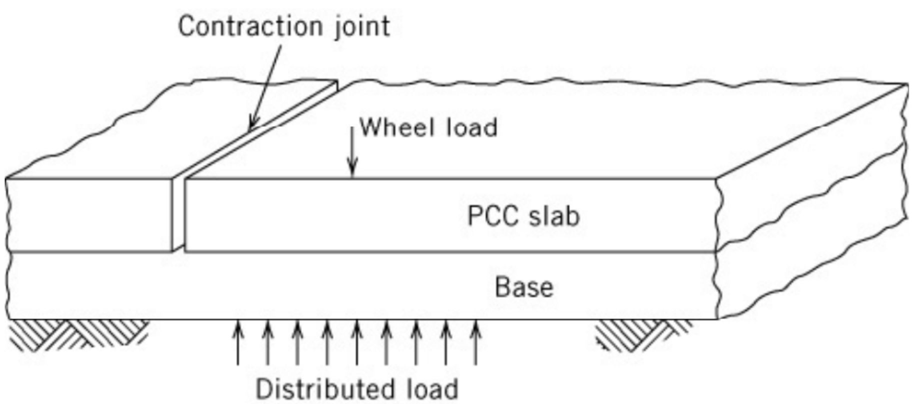


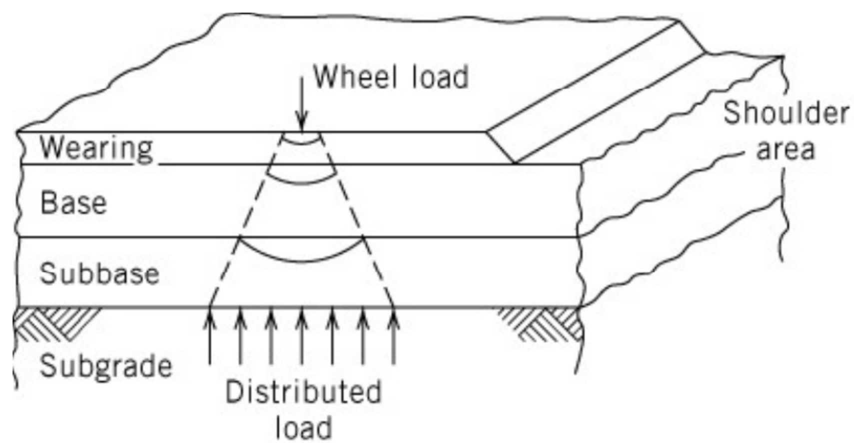
RIGID VS FLEXIBLE

Rigid pavement
- beam action distributes load over larger area beam

Flexible pavement
- deforms, load transferred







Flexible Pavements

- These are so named because the total pavement structure deflects, or flexes, under loading.
- A flexible pavement structure is typically composed of several layers of materials.
- Each layer receives the loads from the above layer, spreads them out, and then passes on these loads to the next layer below.
- A flexible pavement structure lies over prepared Sub Grade (Road Bed Soil)
- In order to take maximum advantage of this property, material layers are usually arranged in order of descending load bearing capacity with highest load bearing capacity material (and most expensive) on the top and the lowest load bearing capacity material (and least expensive) on the bottom

Flexible Pavements

Typical Flexible Pavement Structure

- **Asphalt Concrete Surface Course (AC Course). This is the top layer and the layer that comes in contact with traffic. It may be composed of one or several different Hot Mix Asphalt (HMA) sub layers.**
- **Base Course. This is the layer directly below the AC Course and generally consist of aggregates either stabilized or un-stabilized.**
- **Sub Base Course. This is the layer under the base course, may either be stabilized or un-stabilized.**
- **Natural or Treated Subgrade**

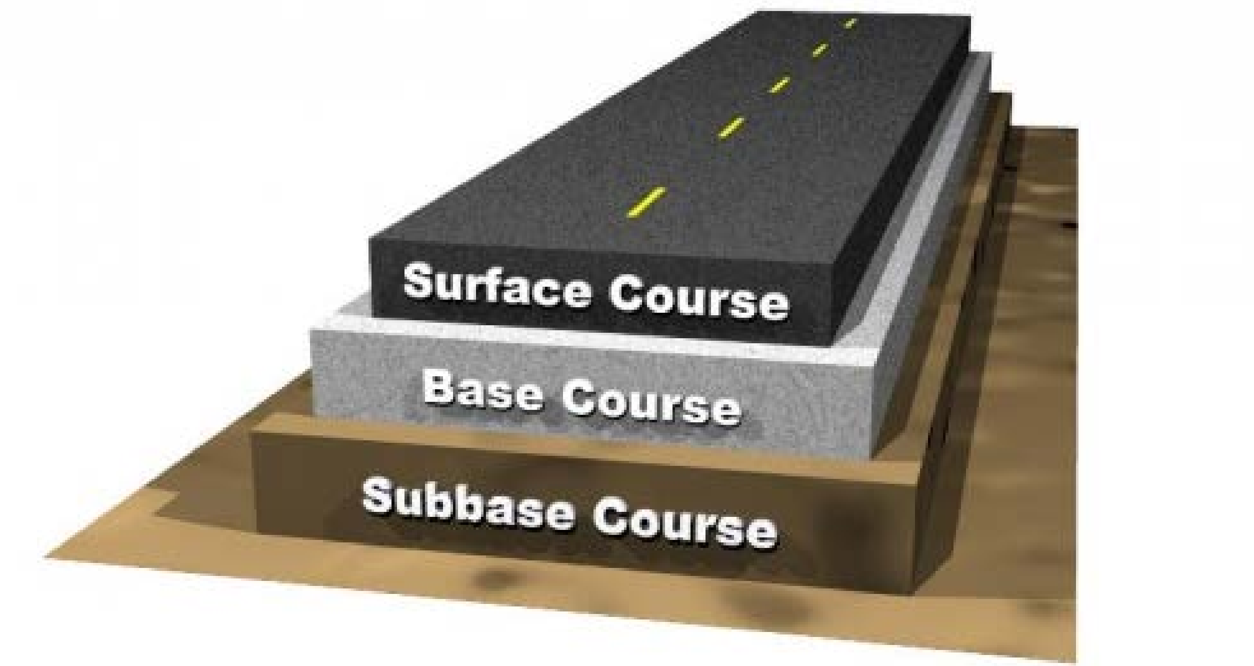
Flexible Airport Pavement Design

- **Corps of Engineering (CBR) method (CBR method): CBR test for subgrade evaluation**
- **FAA method: field performance data correlated to soil classification, also a CBR method**
- **Canadian DOT method: plate-bearing tests to evaluate subgrade support/repeated load triaxial tests for full-depth airport pavements**
- **Asphalt Institute method: theoretically oriented design**

California Bearing Ratio

$$CBR = \frac{p}{p_s} \cdot 100$$

- CBR is a penetration test used for eval of mechanical strength of road subgrades and base courses - dev by California DoT
- Test is performed by measuring the pressure required to penetrate a soil sample with a plunger of standard area. The measured pressure is then divided by the pressure required to achieve an equal penetration on a standard crushed rock material
- The harder the surface, the higher the CBR rating
- The CBR test is described in ASTM Standards D1883-05 (for lab-prepared samples) and D4429 (for soils in place in field), and AASHTO T193
- A CBR of 3 equates to tilled farmland, a CBR of 4.75 equates to turf or moist clay, while moist sand may have a CBR of 10. High quality crushed rock has a CBR over 80. The standard material for this test is crushed California limestone which has a value of 100



FAA METHOD

FLEXIBLE PAVEMENT DESIGN

FAA - Flexible Pavement Design

Pavement layers (courses) have been standardized and given item numbers

- **Asphalt Concrete Course (AC). P401 Dense Graded Hot Mix AC Course**
- **Base Course**
  - **Item P-208—Aggregate Base Course**
  - **Item P-209—Crushed Aggregate Base Course**
  - **Item P-211—Lime Rock Base Course**
  - **Item P-304—Cement Treated Base Course**
  - **Item P-306—Concrete Subbase Course**
  - **Item P-401—Plant Mix Bituminous Pavements**
  - **Item P-403—HMA Base Course**
  - **P-211, P-304, P-306, P-401, and P-403 are stabilized based courses**
- **Sub Base Course.** Subbases are typically required when flexible pavement is to be supported by soils of CBR value less than 20
  - **Item P-154—Subbase Course**
  - **Item P-210—Caliche Base Course**
  - **Item P-212—Shell Base Course**
  - **Item P-213—Sand Clay Base Course**
  - **Item P-301—Soil Cement Base Course**

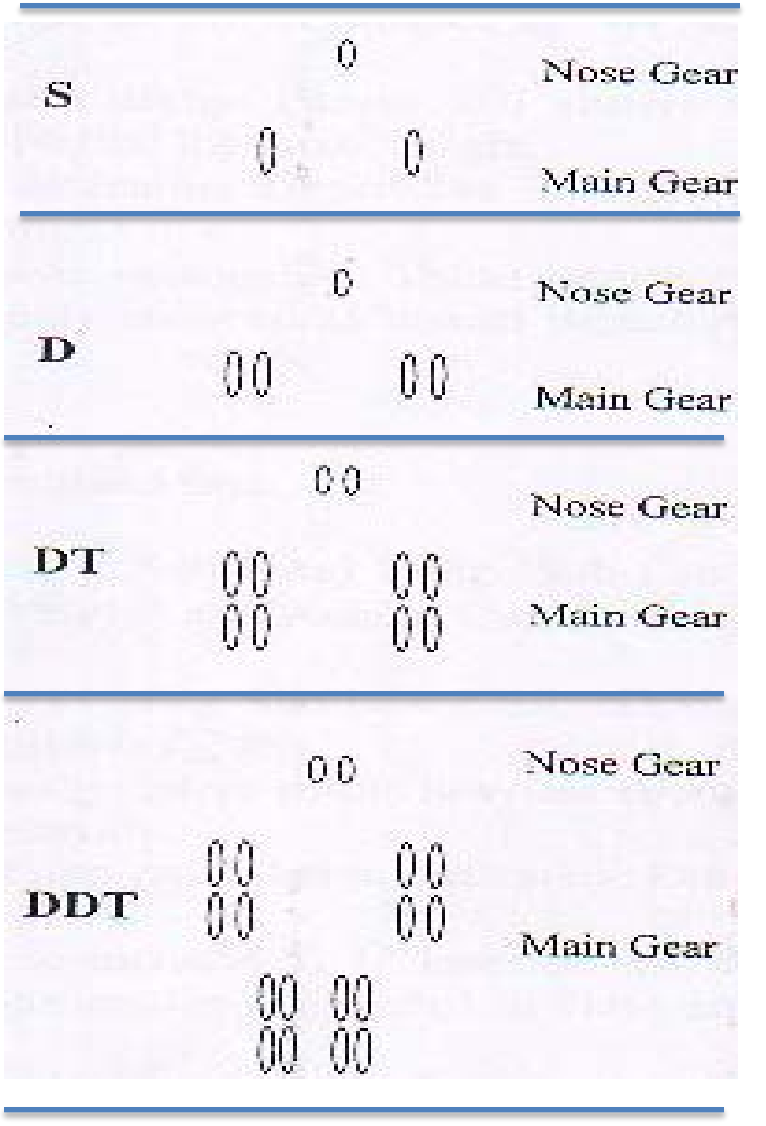
Designed 20 years structural life

FAA - Flexible Pavement Design

- Design curves are based on CBR method of design
- Inputs on design curves are CBR, annual departures and gross weight (MSTOW)
- If input is sub-grade CBR, it gives total thickness (AC+ Base + Sub Base)
- If input is sub base CBR, gives 'AC -Base' thickness.
- AC thickness is given on each design curve
- Base course thickness is checked against minimum base course required

Aircraft Gear Configuration

- **Single Wheel**
- **Dual Wheel**
- **Dual Tandem Wheel**
- **Double Dual Tandem**



Several Typical Aircrafts

Type of Plane	Max Gross Weight (lb × 10^3)	Type of Gear	Main Gear Dimension (in.)	Max Load Each Main Assembly (lb × 10^3)	Tire Pressure (psi)
Boeing 707-320C	336.0	Twin-tandem	56 × 34.5	157.0	180
Boeing 707-120B	258.0	Twin-tandem	56 × 34	120.0	170
Boeing 737	111.0	Twin	30.5	25.8	148
Boeing 727-100	170.0	Twin	34.0	76.9	166
Boeing 747	713.0	Double twin-tandem	58 × 44	166.5	204
Convair Cv 880	185.0	Twin-tandem	45 × 21.5	87.0	150
Lockheed L1011-I	411.0	Twin-tandem	70 × 52	195.0	175
McDonnel–Douglas DC10-10	413.0	Twin-tandem	54 × 64	194.0	175
McDonnel–Douglas DC 8-43	318.0	Twin-tandem	55 × 30	148.0	177
McDonnel–Douglas DC 9-15	91.5	Twin	24	42.4	127
Concorde	388.0	Twin-tandem	66 × 26.4	184.3	184
BAC 1-11-500	100.0	Twin	21	47.5	174

Aircraft Considerations

- 95% of gross weight is considered on main (landing) gear, equally distributed on all wheels.
- Singles (S), dual (D) and dual tandem (DT) gear configurations have 2,4 and 8 wheels respectively.
- Some of DT and all Double dual tandem (DDT) are wide body (WB) aircrafts i.e. B-747-100 (DDT) , B-767, DC-10, L-1011(DT)
- WB aircrafts will always be considered as having DT landing gear and 300,000 lbs gross weight
- MSTOW is considered for the design purpose
- Separate design curves for S, D, DT and for each of wide body Aircraft i.e. some DT and all DDT
- Tire pressure: 75 to 200 psi (515 to 1,380 kPa)
- Traffic volume → Departures

Design Problem – Flexible Pavement

- Sub Grade Site CBR = 7
- Aircrafts Data

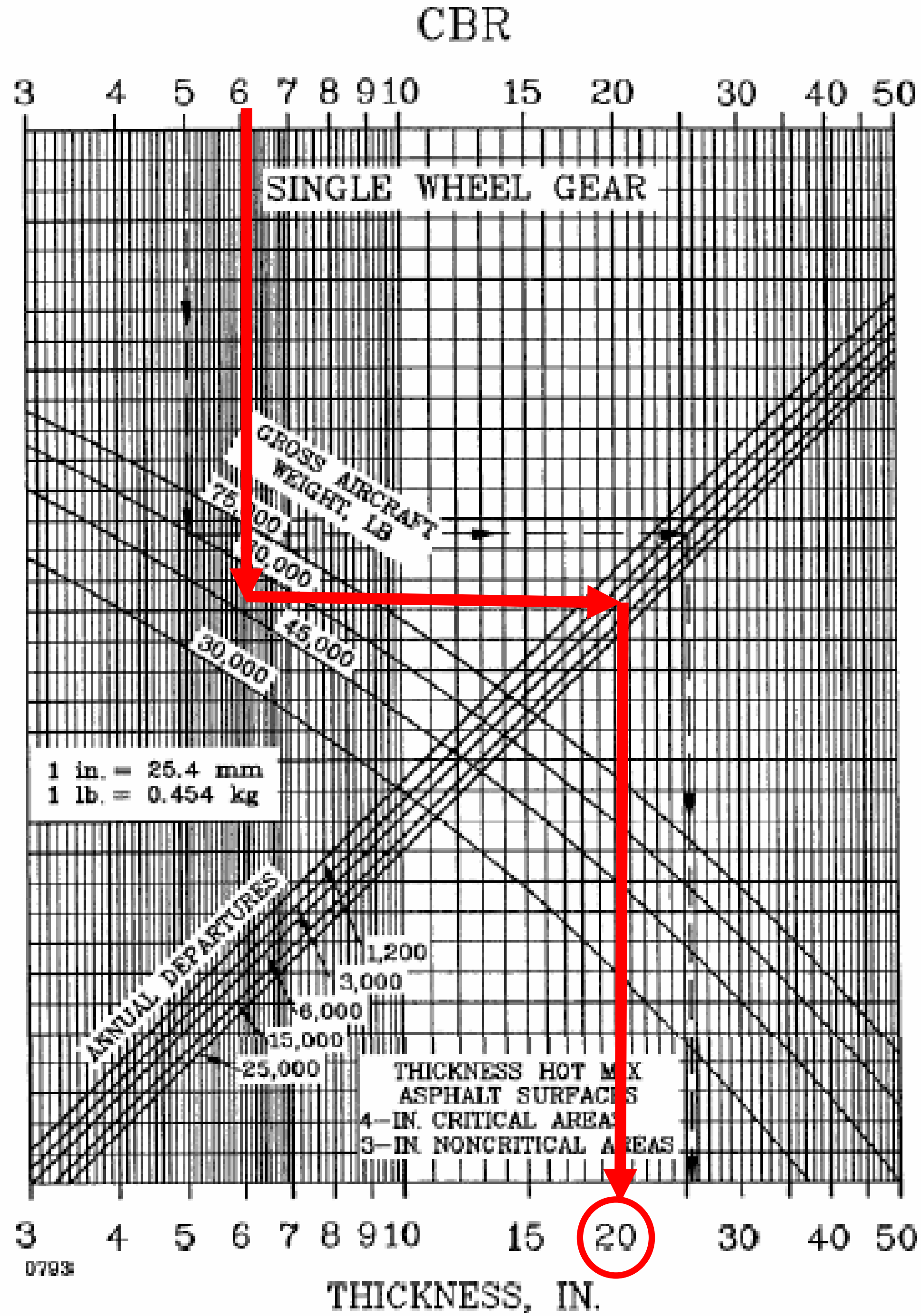
Aircraft	Gear Configuration	Average Annual Departures	Gross Weight (lbs)
• F-27-500	S	25,000	45,000
• 727-200	D	2,700	180,000
• 707-320B	DT	1,050	327,000
• A300-B4	DT	1,700	300,000
• B747-100	DDT	1000	700,000

Design Step-1

Determination of Design Aircraft

- Sub Grade Design CBR ≤ 85% Sub Grade Site CBR
- Minimum Design Sub grade CBR = 3
- Use 'Sub Grade Design CBR' and determine Pavement Thickness for each aircraft in the aircraft mix, using respective design curve
- Aircraft requiring max thickness is design aircraft

F-27-500



CBR
3 4 5 6 7 8 9 10 15 20 30 40 50
SINGLE WHEEL GEAR
GROSS AIRCRAFT WEIGHT, LB
75,000
60,000
45,000
30,000
1 in. = 25.4 mm
1 lb. = 0.454 kg
ANNUAL DEPARTURES
1,200
3,000
6,000
15,000
25,000
THICKNESS HOT MIX ASPHALT SURFACES
4-IN. CRITICAL AREAS
3-IN. NONCRITICAL AREAS
3 4 5 6 7 8 9 10 15 20 30 40 50
0793
THICKNESS, IN.

Design Step-1

Determination of Design Aircraft

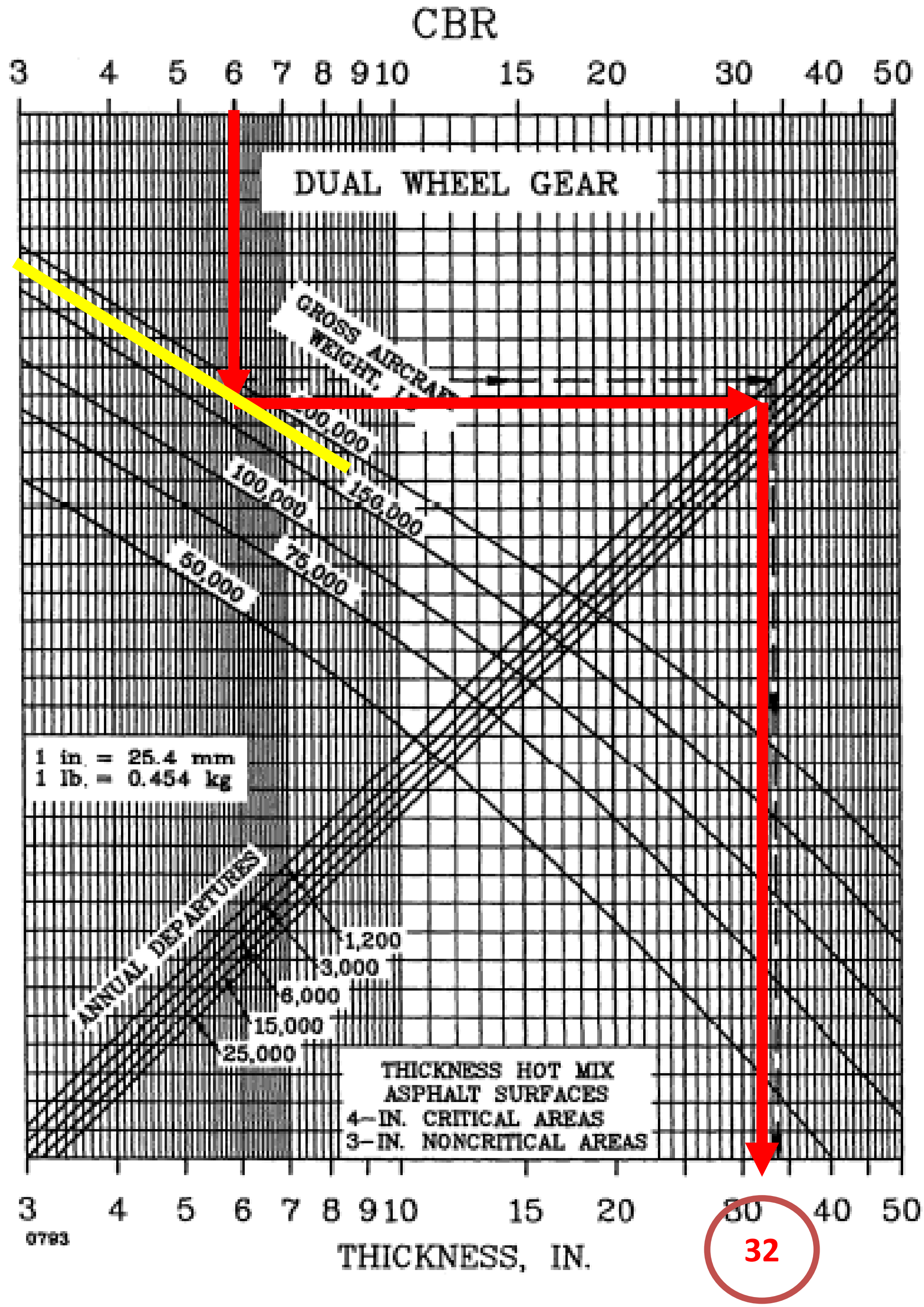
- Sub Grade Design CBR = 0.85 x 7 =5.95 ~ 6
- Use 'Sub Grade Design CBR' and determine pavement thickness for each aircraft in the 'aircraft mix, using respective design curve.

Aircraft	Gear Config	AADs	Gross Wt (lbs)	T(inches)
• F-27-500	S	25,000	45,000	20
• 727-200	D	2,700	180,000	
• 707-320B	DT	1,050	327,000	
• A300-B4	DT	1,700	300,000	
• B747-100	DDT	1000	700,000	

AADs = Average Annual Departures

T = Total pavement thickness above sub-grade

727-200


CBR
3 4 5 6 7 8 9 10 15 20 30 40 50
DUAL WHEEL GEAR
GROSS AIRCRAFT WEIGHT, LB
200,000
150,000
100,000
75,000
50,000
1 in. = 25.4 mm
1 lb. = 0.454 kg
ANNUAL DEPARTURES
1,200
3,000
6,000
15,000
25,000
THICKNESS HOT MIX
ASPHALT SURFACES
4-IN. CRITICAL AREAS
3-IN. NONCRITICAL AREAS
3 4 5 6 7 8 9 10 15 20 30 40 50
0793
THICKNESS, IN.
32

Design Step-1

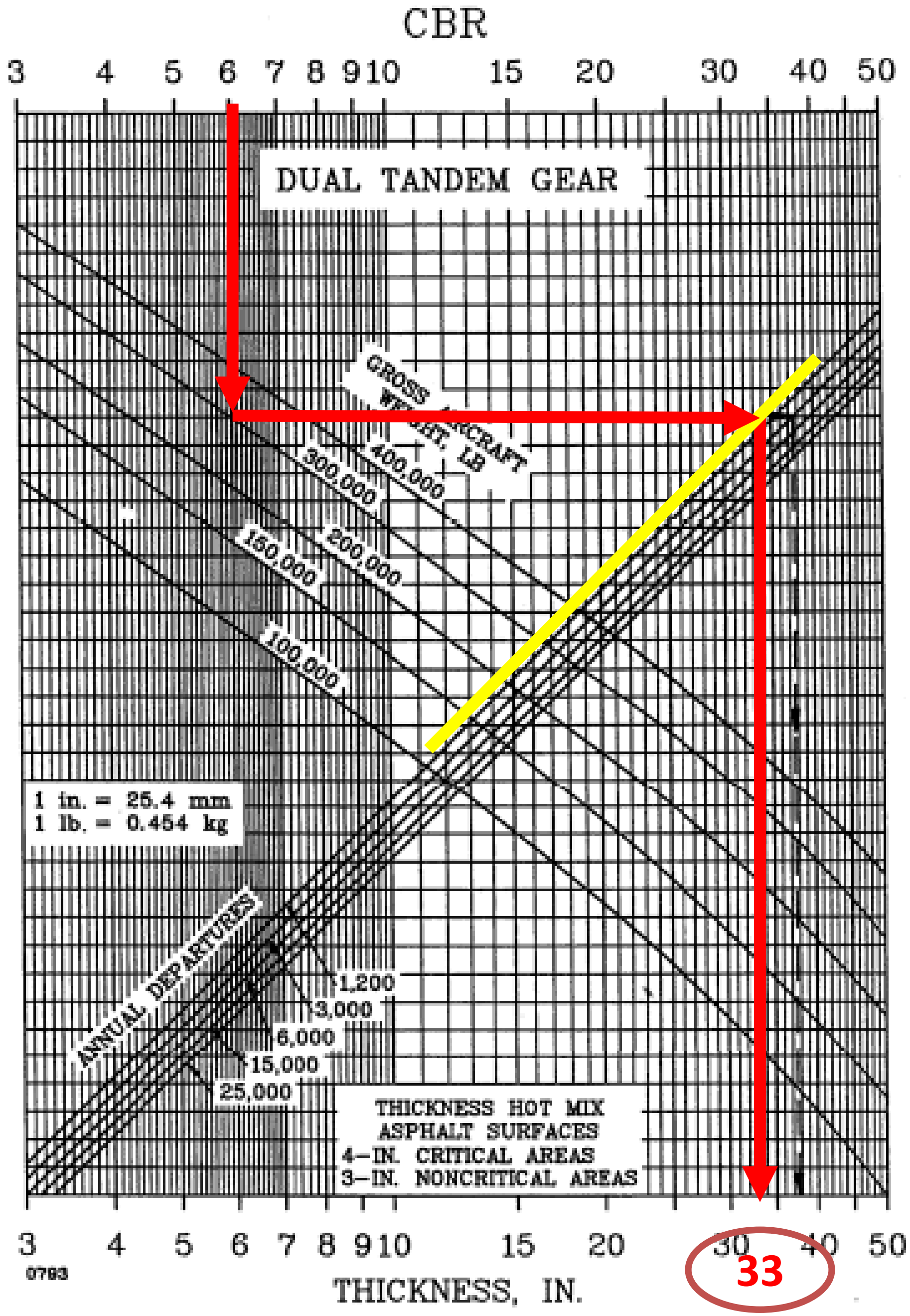
Determination of Design Aircraft

- Sub Grade Design CBR = 0.85 x 7 =5.95 ~ 6
- Use 'Sub Grade Design CBR' and determine pavement thickness for each aircraft in the 'aircraft mix, using respective design curve.

Aircraft	Gear Config	AADs	Gross Wt (lbs)	T(inches)
• F-27-500	S	25,000	45,000	20
• 727-200	D	2,700	180,000	32
• 707-320B	DT	1,050	327,000	
• A300-B4	DT	1,700	300,000	
• B747-100	DDT	1000	700,000	

AADs = Average Annual Departures

T = Total pavement thickness above sub-grade


CBR
3 4 5 6 7 8 9 10 15 20 30 40 50
DUAL TANDEM GEAR
GROSS AIRCRAFT WEIGHT, LB
400,000
300,000
200,000
150,000
100,000
1 in. = 25.4 mm
1 lb. = 0.454 kg
ANNUAL DEPARTURES
1,200
3,000
6,000
15,000
25,000
THICKNESS HOT MIX ASPHALT SURFACES
4-IN. CRITICAL AREAS
3-IN. NONCRITICAL AREAS
3 4 5 6 7 8 9 10 15 20 30 40 50
0793
THICKNESS, IN.
33

707-320B

Design Step-1

Determination of Design Aircraft

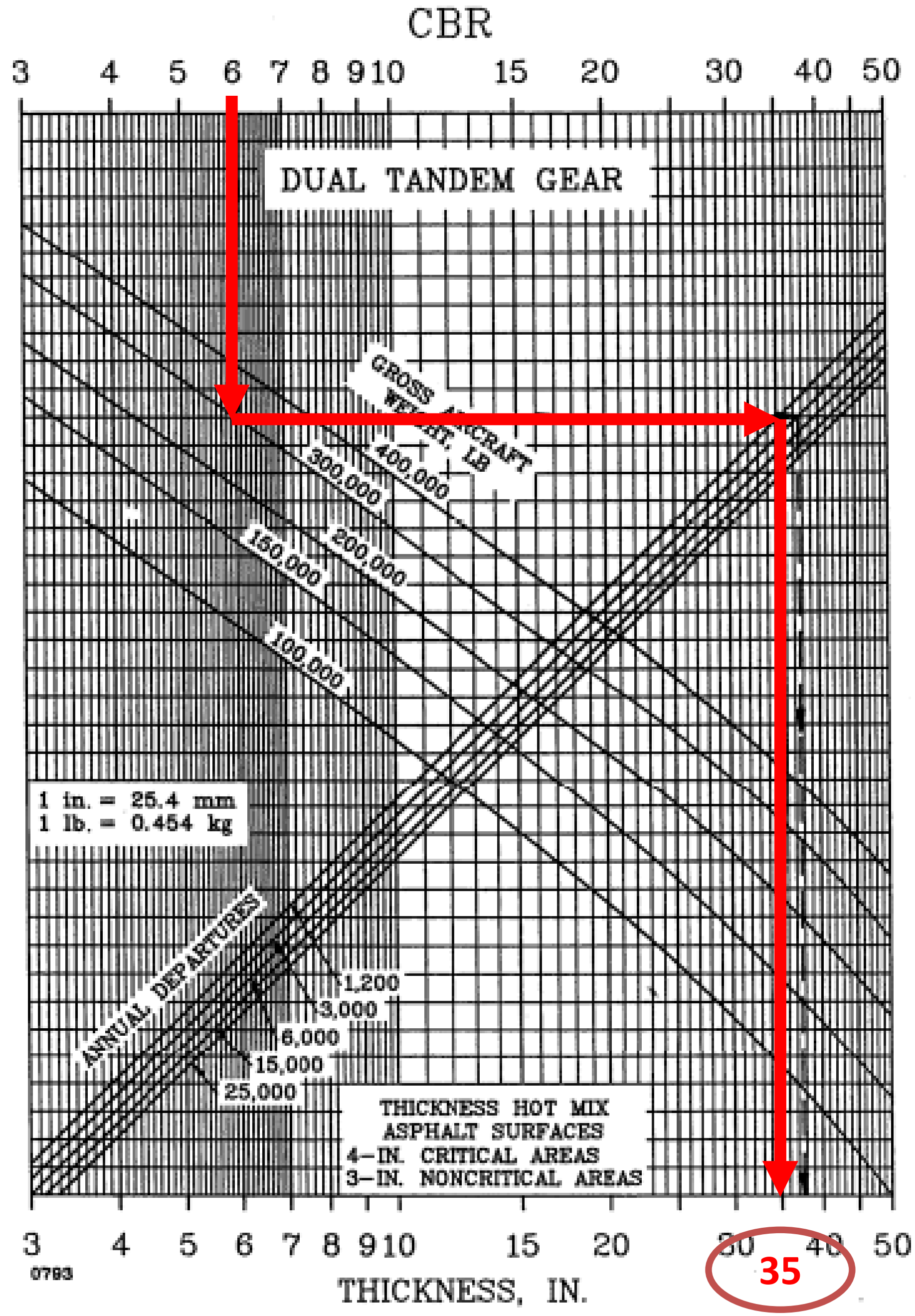
- Sub Grade Design CBR = 0.85 x 7 =5.95 ~ 6
- Use 'Sub Grade Design CBR' and determine pavement thickness for each aircraft in the 'aircraft mix, using respective design curve.

Aircraft	Gear Config	AADs	Gross Wt (lbs)	T(inches)
• F-27-500	S	25,000	45,000	20
• 727-200	D	2,700	180,000	32
• 707-320B	DT	1,050	327,000	33
• A300-B4	DT	1,700	300,000	
• B747-100	DDT	1000	700,000	

AADs = Average Annual Departures

T = Total pavement thickness above sub-grade

A300-B4


CBR
3 4 5 6 7 8 9 10 15 20 30 40 50
DUAL TANDEM GEAR
GROSS AIRCRAFT WEIGHT, LB
400,000
300,000
200,000
150,000
100,000
1 in. = 25.4 mm
1 lb. = 0.454 kg
ANNUAL DEPARTURES
1,200
3,000
6,000
15,000
25,000
THICKNESS HOT MIX ASPHALT SURFACES
4-IN. CRITICAL AREAS
3-IN. NONCRITICAL AREAS
3 4 5 6 7 8 9 10 15 20 30 40 50
0793
THICKNESS, IN.
35

Design Step-1

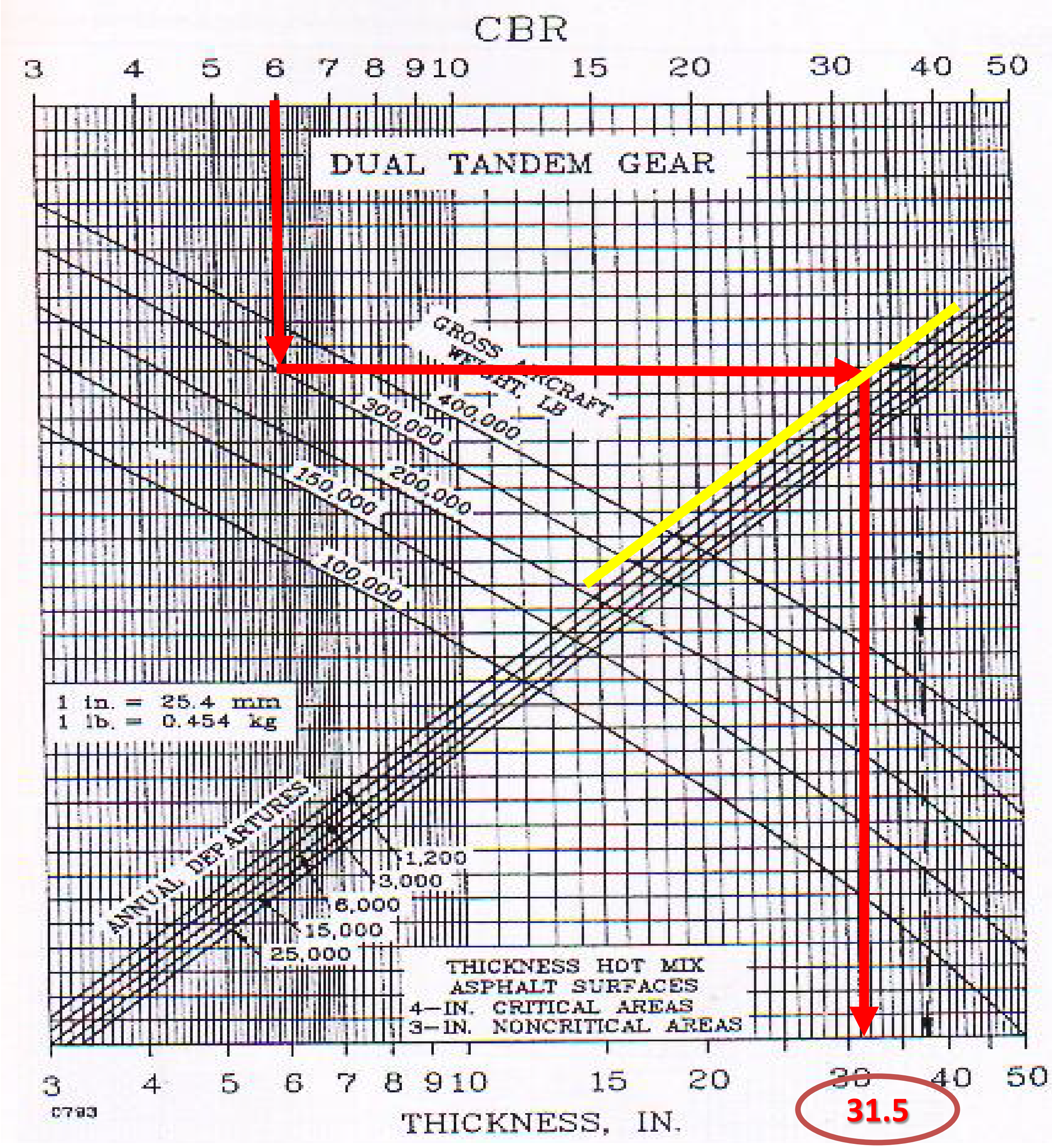
Determination of Design Aircraft

- Sub Grade Design CBR = 0.85 x 7 =5.95 ~ 6
- Use 'Sub Grade Design CBR' and determine pavement thickness for each aircraft in the 'aircraft mix, using respective design curve.

Aircraft	Gear Config	AADs	Gross Wt (lbs)	T(inches)
• F-27-500	S	25,000	45,000	20
• 727-200	D	2,700	180,000	32
• 707-320B	DT	1,050	327,000	33
• A300-B4	DT	1,700	300,000	35
• B747-100	DDT	1000	700,000	

AADs = Average Annual Departures

T = Total pavement thickness above sub-grade



B747-100 DDT

WB Aircraft therefore, it will be considered as DT with 300 kips gross wt

Design Step-1

Determination of Design Aircraft

- Sub Grade Design CBR = 0.85 x 7 =5.95 ~ 6
- Use 'Sub Grade Design CBR' and determine pavement thickness for each aircraft in the 'aircraft mix, using respective design curve.

Design Aircraft

Aircraft	Gear Config	AADs	Gross Wt (lbs)	T (inches)
F-27-500	S	25,000	45,000	20
727-200	D	2,700	180,000	32
707-320B	DT	1,050	327,000	33
A300-B4	DT	1,700	300,000	35
B747-100	DDT	1000	700,000	31.5

AADs = Average Annual Departures
T = Total pavement thickness above sub-grade

Design Step-2

- **Determine Wheel load for each aircraft in the mix using formula**
- **Single Wheel Load =**

= Gross Wt x 0.95 / number of main gear wheels

- **Wheel Load for the design aircraft is referred as 'W_1'**
- **Wheel Load for all other aircrafts is referred as 'W_2'.**

Design Step-2

Determination of Wheel Loads ‘W_1’ and ‘W_2’

- Design Aircraft = A300-B4 (DT)

Aircraft	Gear Config	Gross Wt (lbs)	Wheel Load (lbs) ‘W_1’ and ‘W_2’
F-27-500	S	45,000	W_2 = 45000 x 0.95/ 2 =21375
727-200	D	180,000	W_2 = 180,000 x 0.95/ 4 =42750
707-320B	DT	327,000	W_2 = 327,000 x 0.95/ 8 =38831
A300-B4	DT	300,000	W_1 = 300,000 x 0.95/ 8 =35625
B747-100	DDT	700,000	W_2 = 300,000 x 0.95/ 8 =35625

WB Aircraft (B747-100) will be considered as DT with 300 kips gross wt

Design Step-3

- **Using Table-1 (for conversion factors), convert annual departures of each aircraft in the mix in terms of departures of landing gears of Design Aircraft (R_2).**

TABLE 1: CONVERSION FACTORS TO BE USED FOR CONVERTING ONE LANDING GEAR TYPE TO ANOTHER

To convert from	To	Multiply departures by
Single wheel	Dual wheel	0.8
Single wheel	Dual tandem	0.5
Dual wheel	Dual tandem	0.6
Double dual tandem	Dual tandem	1.0
Dual tandem	Single wheel	2.0
Dual tandem	Dual wheel	1.7
Dual wheel	Single wheel	1.3
Double dual tandem	Dual wheel	1.7

Design Step-3

Equivalent Departures in term of Design ac Landing Gear (R_2)

- Design Aircraft = A300-B4 (DT)

Aircraft	Gear Config	AADs	Conversion Factor (to DT)	Equivalent DT Dep (R_2)
F-27-500	S	25,000	0.5	25000 x 0.5 =12500
727-200	D	2,700	0.6	1620
707-320B	DT	1,050	1	1,050
A300-B4	DT	1,700	1	1,700
B747-100	DDT	1000	1	1000

WB Aircraft (B747-100) will be considered as DT with 300 kips gross wt

Design Step-4

$$\text{Log } R_1 = \log R_2 \times \left(\frac{W_2}{W_1}\right)^{1/2}$$

Determination of Equivalent Annual Departures in terms of Design Aircrft (R_1)

- **Use Log (R1) = Log (R2) x $\sqrt{(W2 / W1)}$ and determine departures in terms of Design Aircraft (R_1) for each aircraft in the mix**
  - **R1–equivalent annual departures of the design aircraft**
  - **R2–annual departures expressed in design aircraft landing gear configuration**
  - **W1–wheel load of the design aircraft**
  - **W2–wheel load of the aircraft being converted**
- **Sum up R1 i.e. (Σ R1), roundup or down reasonably. These equivalent departures will be used for design. Commonly referred as annual departures subsequently**

Design Step-4

Determination of Equivalent Annual Departures in terms of Design Aircraft (R_1)

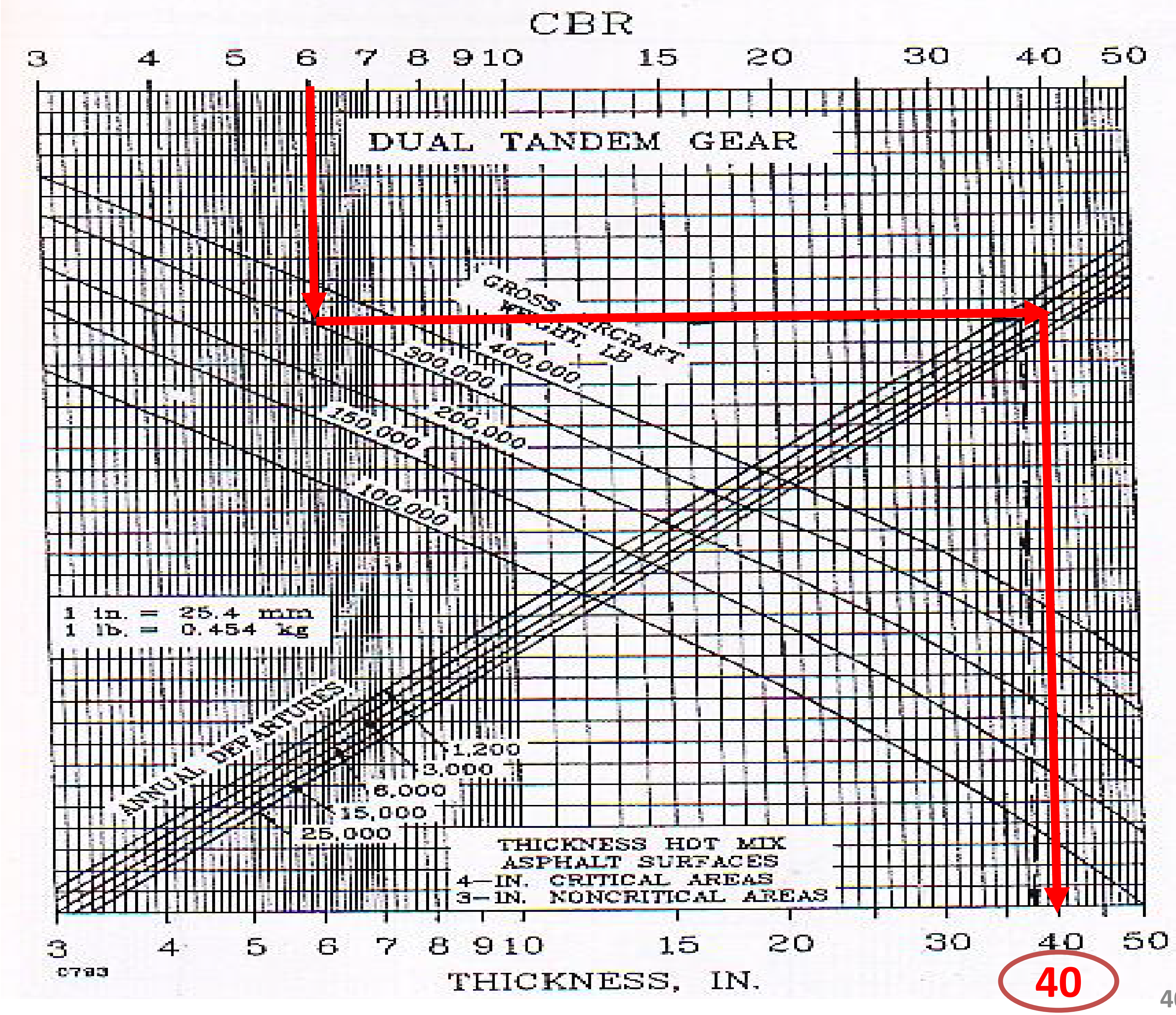
- **Design Aircraft = A300-B4 (DT)**

Aircraft	AADs	Equivalent DT Departures (R_2)	Wheel Load (lbs) 'W_1' and 'W_2'	Eqvt. Annual Departures (R_1)
F-27-500	25,000	12500	W_2 =21375	1491
727-200	2,700	1620	W_2 = 42750	3280
707-320B	1,050	1,050	W_2 = 38831	1426
A300-B4	1,700	1,700	W_1 = 35625	1700
B747-100	1000	1000	W_2 = 35625	1000
ΣR_1 = Design Annual Departures				8897

Design Step-5

Determination of Pavement Thicknes (T) (AC+ Base + Sub Base) Using Calculated Design Annual Departures and Gross Wt of Design Aircraft

- **The design should be completed with 8897 Design Annual departures of a 300,000 lbs (300 kips) aircraft with DT gear configuration.**
- **Design Sub-grade CBR = 6**


CBR
3
4
5
6
7
8
9
10
15
20
30
40
50
DUAL TANDEM GEAR
GROSS AIRCRAFT WEIGHT, LB
400,000
300,000
200,000
150,000
100,000
1 in. = 25.4 mm
1 lb. = 0.454 kg
ANNUAL DEPARTURES
1,200
3,000
6,000
15,000
25,000
THICKNESS HOT MIX ASPHALT SURFACES
4—IN. CRITICAL AREAS
3—IN. NONCRITICAL AREAS
3
4
5
6
7
8
9
10
15
20
30
40
50
THICKNESS, IN.
C793
40

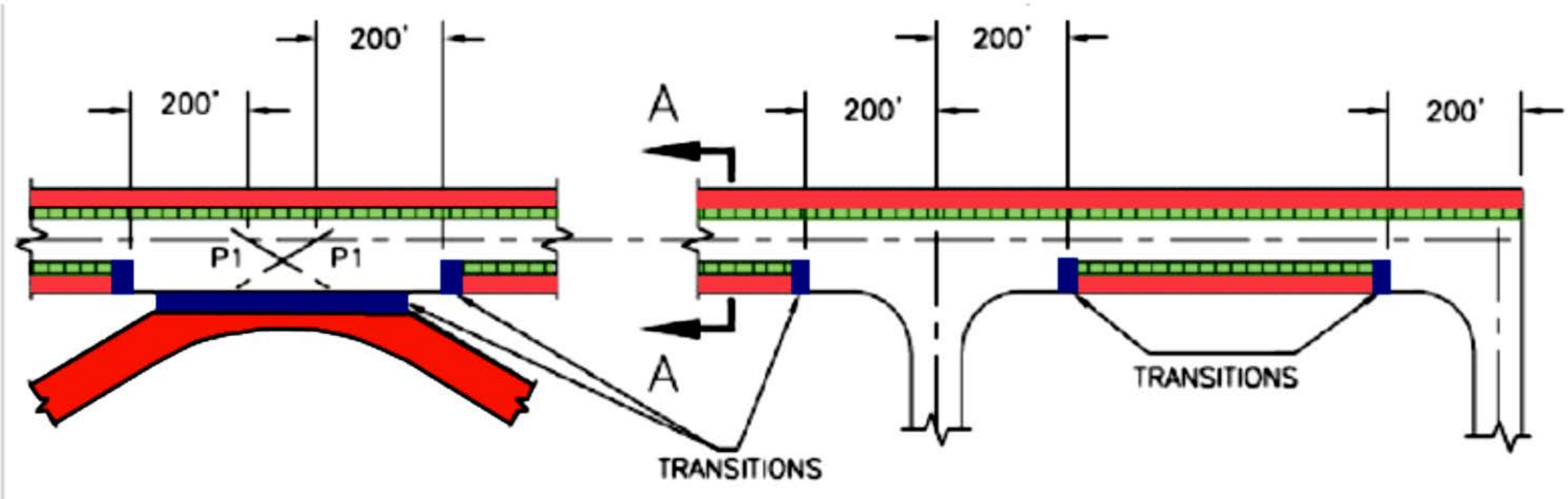
Design Step-5

Determination of Pavement Thickness (T) (AC+ Base + Sub Base) Using Calculated Design Annual Departures and Gross Wt of Design Aircraft

- **The design should be completed with 8897 Design Annual departures of a 300,000 lbs (300 kips) aircraft with DT gear configuration.**
- **Design Sub-grade CBR = 6**
- **Total Pavement Thickness = 40”**
- **HMA Surface = 4” (critical areas)**
- **HMA Surface = 3” (non-critical areas)**
- **Edge = 2” (standard)**

Typical Cross Section

Variable sections permitted on runway pavements



Full pavement thickness

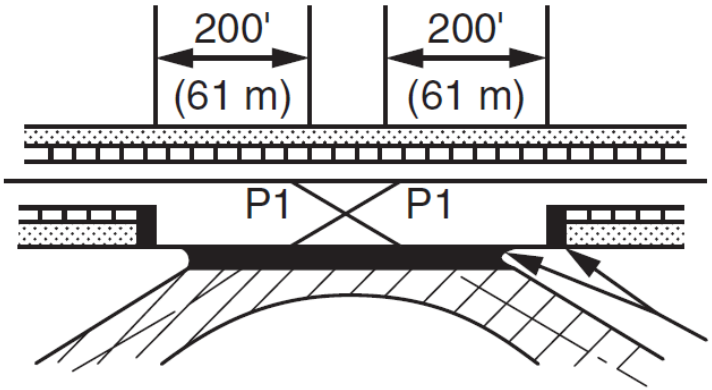
Outer edge thickness (based on 1% of normal traffic)

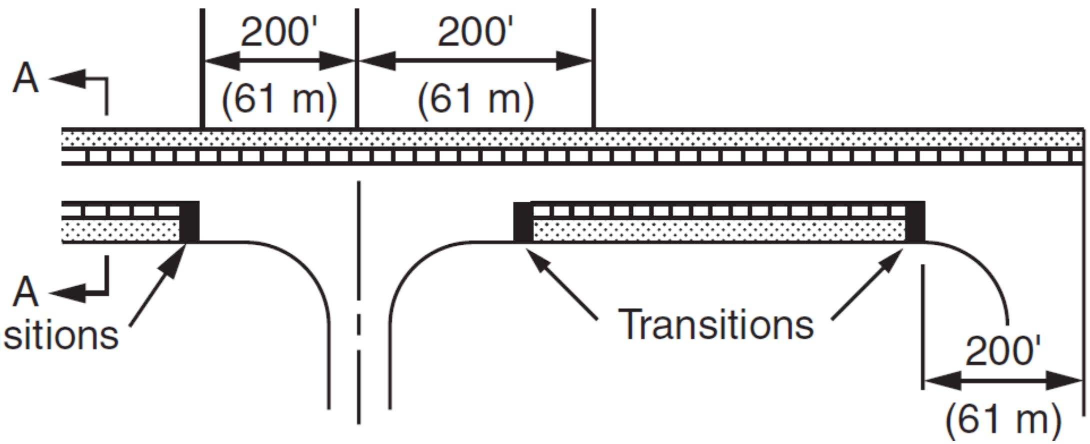
Pavement thickness tapers to outer edge thickness

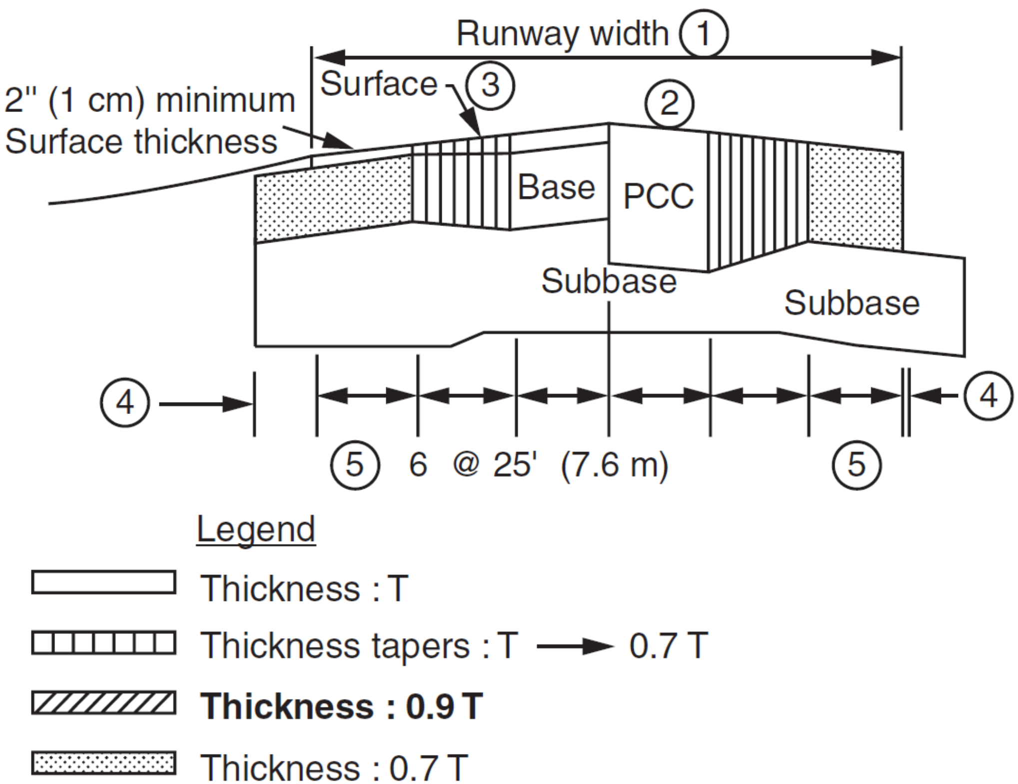
Transitions

Design using arrival traffic only

Typical Cross Section



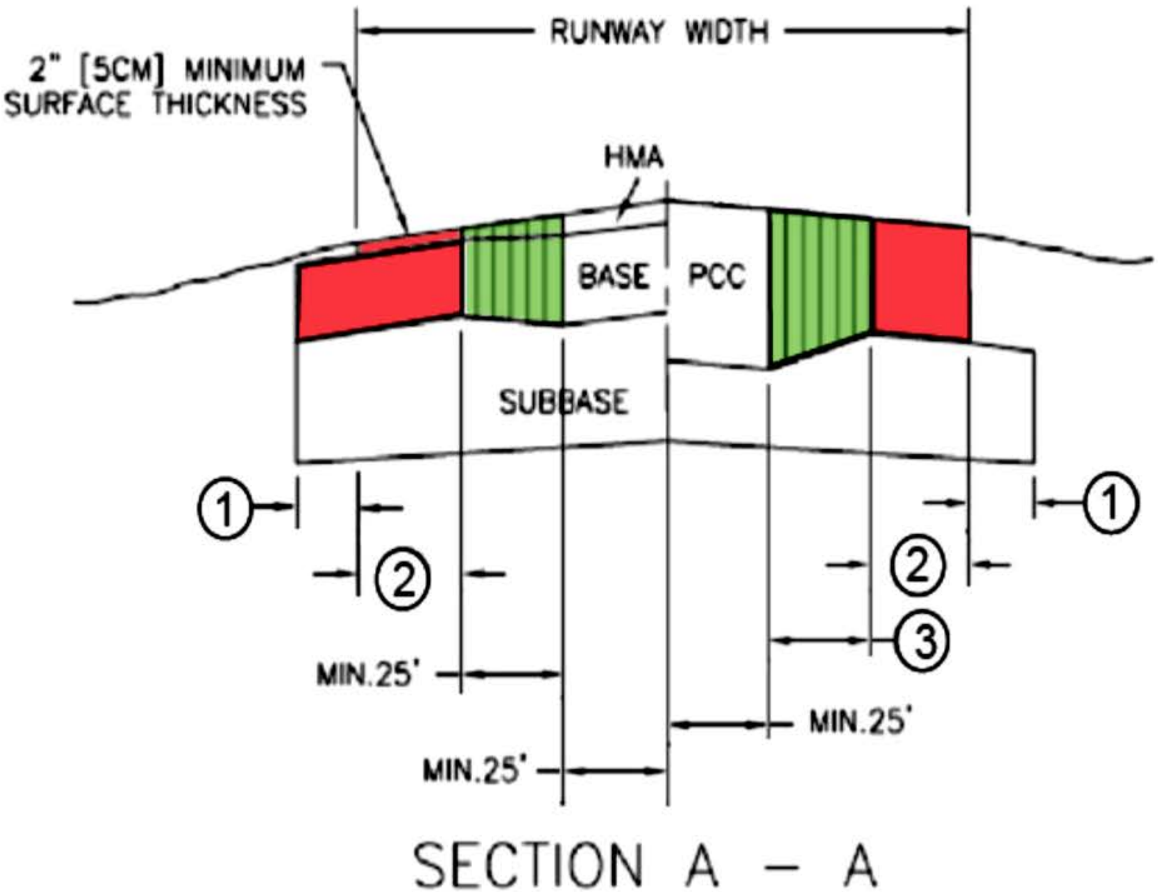




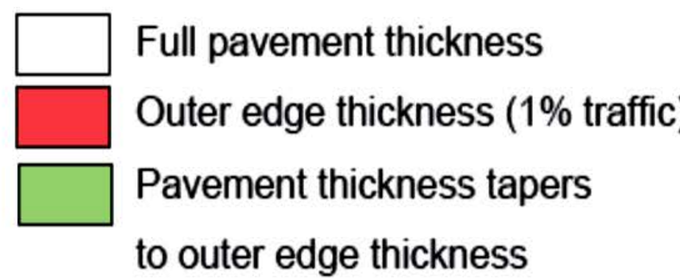
1. Runway widths in accordance with applicable advisory circular
2. Transverse slopes in accordance with applicable advisory circular
3. **Surface, base, PCC, etc., thickness** as indicated on design chart.
4. 4 Minimum **12" (30 cm)** up to **30" (90 cm)** allowable.
5. For runways wider than **150' (45.7 m)** this dimension will increase.

Typical Cross Section

Variable sections permitted on runway pavements



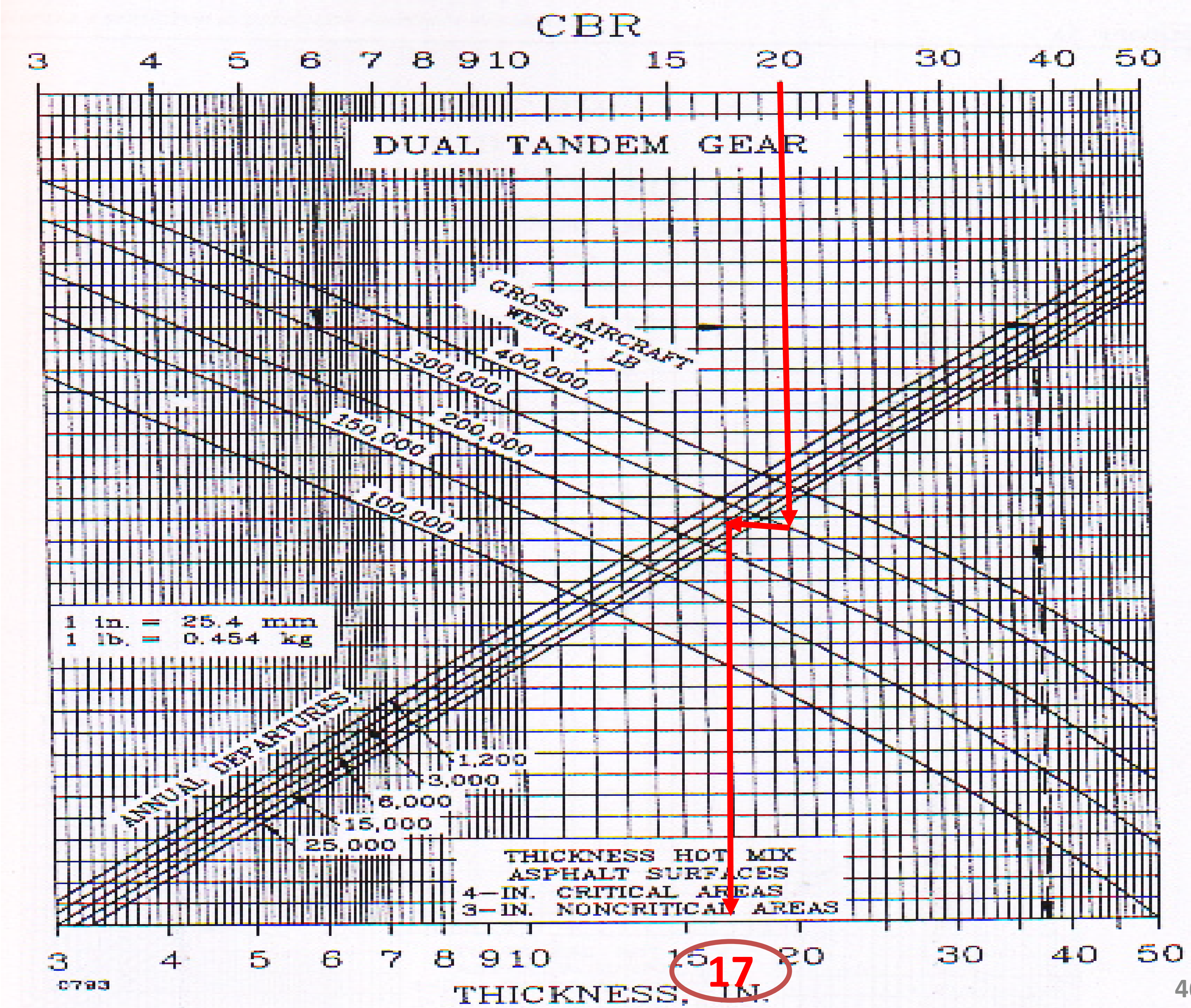
1. Minimum 12" up to 36"
2. For runways wider than 150', this dimension will increase.
3. Width of tapers and transitions on rigid pavements must be an even multiple of slabs, minimum one slab width.



Design Step-6

Determination of Pavement Thicknes (AC + Base) Using Calculated Design Annual Departures and Gross Wt of Design Aircraft

- **The design should be completed with 8897 Design Annual departures of a 300,000 lbs (300 kips) aircraft with DT gear configuration.**
- **Assume, Design Sub-base CBR = 20**


CBR
3 4 5 6 7 8 9 10 15 20 30 40 50
DUAL TANDEM GEAR
GROSS AIRCRAFT WEIGHT, LB
400,000
300,000
200,000
150,000
100,000
1 in. = 25.4 mm
1 lb. = 0.454 kg
ANNUAL DEPARTURES
1,200
3,000
6,000
15,000
25,000
THICKNESS HOT MIX ASPHALT SURFACES
4—IN. CRITICAL AREAS
3—IN. NONCRITICAL AREAS
3 4 5 6 7 8 9 10 15 20 30 40 50
17
C793
THICKNESS, IN.

Design Step-6

Determination of Pavement Thicknes (AC + Base) Using Calculated Design Annual Departures and Gross Wt of Design Aircraft

- **The design should be completed with 8897 Design Annual departures of a 300,000 lbs (300 kips) aircraft with DT gear configuration.**
- **Assume, Design Sub-base CBR = 20**
- **Pav Thickness above Sub-base (i.e. AC + Base) = 17”**
- **Total Pavement Thickness = 40”**
- **HMA Surface (AC) = 4” (critical areas)**
- **Sub-base = 40-17= 23” and base = 17-4 = 13”**

Design Step-7

Determination of Thickness of All Individual Layers

Surface Type	Critical Area (T)	Non-critical Area (0.9 T)	Edge (0.7 T)
Surface: HMA (AC)	4	4	4
Base	13	12	10
Sub-base	23	21	16
Total	40	37	30

Design Checks

- If ΣR_1 (Annual Departures) > 25,000 then use Table-2 to increase T, 1" increase will be accounted for in AC and rest will be proportionally distributed in Base and Sub base.
- Check for minimum base course thickness from Table 3; increase if required without increasing total pavement thickness "T".
- Mathematical rounding is must. Interpolation allowed

TABLE 2: PAVEMENT THICKNESS FOR HIGH DEPARTURE LEVEL	
Annual Departure Level	Percent of 25,000 Departure Thickness
50,000	104
100,000	108
150,000	110
200,000	112

TABLE 3: MINIMUM BASE COURSE THICKNESS

Design aircraft	Design Load Range (Lbs)	Minimum Base Course Thickness (inches)
• Single wheel	30,000 – 50,000	4
	50,000 – 75,000	6
• Dual wheel	50,000 – 100,000	6
	100,000 – 200,000	8
• Dual Tandem	100,000 – 250,000	6
	250,000 – 400,000	8
• 757, 767	200,000 – 400,000	6
• DC-10, L1011	400,000 – 600,000	8
• B-747	400,000 – 600,000	6
	600,000 – 850,000	8
• C-130	75,000 – 125,000	4
	125,000 – 175,000	6

Factors for Increase in Thickness

RECOMMENDED EQUVELENCY FACTOR RANGES FOR STABILIZED BASE (FAA STANDARD GRANULAR BASE IS P-209)	
P-306 E concrete Sub base Course	1.2 – 1.6
P-304 Cement Treated Base Course	1.2 – 1.6
P-401 Plant Mix Bituminous pavement	1.2 – 1.6

RECOMMENDED EQUVELENCY FACTOR RANGES FOR STABILIZED SUB BASE (FAA STANDARD GRANULAR SUB BASE IS P-154)	
P-301 Soil cement Base Course	1.0 –1.5
P-304 Cement Treated Base Course	1.6 – 2.3
P-401 Plant Mix Bituminous pavement	1.7 –2.3

Design Checks

- ΣR_1 (Annual Departures) 8897 < 25,000: OK
- No need to increase T.
- Base Thickness = 13” > minimum base course thickness (8” for DT up to 400 kips): OK
- No need to increase base course thickness.

THANKS