

Questions?



www.flexiblepavements.org

ODOT Pavement Design Manual

<http://www.dot.state.oh.us/Divisions/Engineering/Pavement/Pages/Publications.aspx>



Section 200, Pavement Design Concepts

300, Rigid Pavement Design

400, Flexible Pavement Design contains instructions on thickness design, proper mix applications and layer build-ups.

500, Minor Rehabilitation

Typical Build-up for Parking Facilities

- Surface course – 1.25" 448, Type 1, PG 64-22
- Intermediate course – 1.75", 448, Type 2, PG 64-22
- Base course if required –
 - 3" to 6" , Item 301, PG 64-22 or
 - 4-7.75", Item 302, PG 64-22
 - 4" – 6", Item 304 Aggregate base

TABLE F: Thickness Selection Chart Using Untreated Granular Base

Design Thickness Using Class II Treated Base, Inches

Traffic Class	Design Period Years	Design ESAL	Design Thickness Using Class II Treated Base, Inches								
			Very Poor Subgrade ¹	Poor Subgrade ¹	Medium Subgrade	Good Subgrade	Very Good Subgrade				
			Asphalt Surface & Base ²	Asphalt Surface & Base ²	Asphalt Surface & Base ²	Asphalt Surface & Base ²	Asphalt Surface & Base ²	Asphalt Surface & Base ²	Minimum Granular Base	Minimum Granular Base	
I	5	3,000	3.0	4.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0
	10	3,000	3.0	4.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0
	15	5,000	3.5	4.0	4.0	0.0	3.5	0.0	0.0	3.0	0.0
	20	7,000	3.0	6.0	4.5	0.0	3.5	0.0	0.0	3.0	0.0
II	5	7,000	3.0	6.0	4.5	0.0	3.5	0.0	0.0	3.0	0.0
	10	14,000	3.5	6.0	3.0	6.0	4.0	0.0	0.0	3.0	0.0
	15	20,000	4.0	6.0	3.5	6.0	4.5	0.0	0.0	3.0	0.0
	20	27,000	4.5	6.0	3.5	6.0	4.5	0.0	0.0	3.0	0.0
III	5	27,000	4.5	6.0	3.5	6.0	4.5	0.0	0.0	3.0	0.0
	10	54,000	5.0	6.0	4.0	6.0	5.5	0.0	0.0	3.0	0.0
	15	82,000	5.5	6.0	4.5	6.0	6.0	0.0	0.0	3.5	0.0
	20	110,000	6.0	6.0	5.0	6.0	6.0	0.0	0.0	3.5	0.0
IV	5	270,000	6.5	8.0	5.5	8.0	5.0	8.0	6.0	5.5	0.0
	10	540,000	7.5	8.0	6.5	8.0	5.5	8.0	6.0	6.5	0.0
	15	820,000	8.0	8.0	7.0	8.0	6.0	8.0	6.0	7.0	0.0
	20	1,100,000	8.5	8.0	7.5	8.0	6.5	8.0	6.0	7.5	0.0

Use Full-Depth Asphalt, see Table D

Footnotes for Tables D, E and F:

- ¹ Very Poor and Poor subgrades should be replaced with higher quality materials. Guidelines for improving these soils to a higher classification are given in Section II B, Subgrade Evaluation.
- ² Hot Mix Asphalt composed of 1.5 inches of Hot Mix Asphalt surface mix plus binder or base mix. Mixes should meet requirements given in Sections I.C, Hot Mix Asphalt and III B, Quality Control.
- ³ Cement treated and lime-fly ash base courses should not be constructed less than six inches thick.



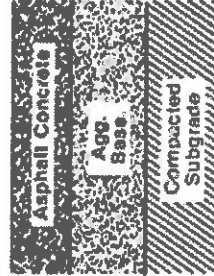

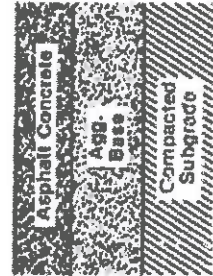
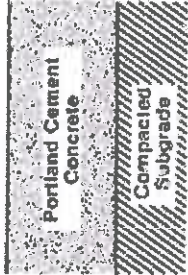

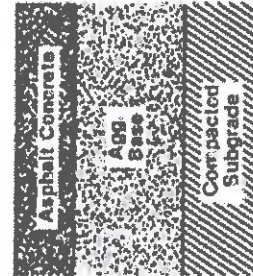

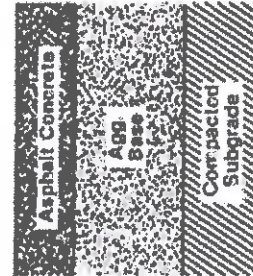
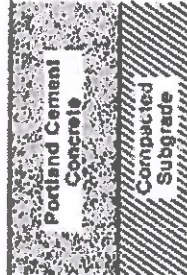

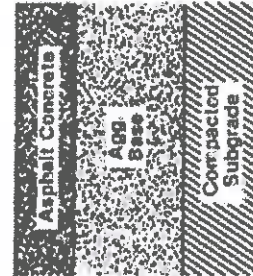

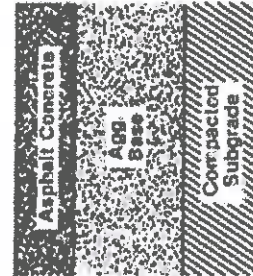
CAUTION:

Layer thicknesses in these tables are not intended to account for the possibility of frost heave. Refer to "Soil conditions" in Section I.A and to Section II.B. The designer should ensure that all layers above the depth of frost penetration consist of HMA or other materials not susceptible to frost heave. Where this is uneconomical because frost penetration is extremely deep, recommendations of local geotechnical engineers should be followed.

TABLE D: Full-Depth Hot Mix Asphalt Thickness Selection Chart

Traffic Class	Design Period Years	Design ESAL	Full Depth Asphalt Thickness, inches				
			Very Poor Subgrade ¹	Poor Subgrade ¹	Medium Subgrade	Good Subgrade	Very Good Subgrade
I	5	3,000	4.5	3.5	3.0	3.0	3.0
	10	3,000	4.5	3.5	3.0	3.0	3.0
	15	5,000	5.0	4.0	3.0	3.0	3.0
	20	7,000	5.5	4.5	3.5	3.0	3.0
II	5	7,000	5.5	4.5	3.5	3.0	3.0
	10	14,000	6.0	5.0	4.0	3.0	3.0
	15	20,000	6.5	5.5	4.5	3.0	3.0
	20	27,000	6.5	6.0	4.5	3.0	3.0
III	5	27,000	6.5	6.0	4.5	3.0	3.0
	10	54,000	7.0	6.5	5.5	4.0	3.0
	15	82,000	7.5	7.0	6.0	4.5	3.5
	20	110,000	8.0	7.0	6.0	4.5	3.5
IV	5	270,000	9.0	8.0	7.0	5.5	4.0
	10	540,000	10.0	9.0	8.0	6.5	5.0
	15	820,000	10.5	9.5	8.5	7.0	5.5
	20	1,100,000	11.0	10.0	9.0	7.5	6.0

TABLE 1
Parking Lot Pavement Thicknesses
For Passenger Cars

Sect. No.	Portland ⁽¹⁾ Cement Concrete	Full Depth ⁽²⁾ Asphalt Concrete	Asphalt ⁽²⁾ Concrete With Agg. Base
1	5" 	Good to Excellent Subgrade⁽³⁾ - CBR - 17	
		4" 	3" 
		4" 	3" 
2	6" 	Medium Subgrade - CBR - 8	
		4 1/2" 	3" 
		4 1/2" 	6" 
3	6" 	Poor Subgrade - CBR - 3	
		4 1/2" 	3" 
		4 1/2" 	6" 

¹ These thickness requirements are based on the AASHTO recommendation for a minimum pavement thickness of 6 inches with a sand gravel subbase for passenger car and light commercial vehicle usage (AASHTO *Interim Guide for Design of Pavement Structures*, 1972, Revised 1981, Wash., D.C.) and local government agency design practices permitting a 5-inch minimum pavement thickness for public parking lots for passenger cars on good to excellent subgrades.

² These thickness requirements are based on The Asphalt Institute's *Thickness Design Procedures, (Thickness Design-Asphalt Pavements for Highways and Streets, The Asphalt Institute Manual Series No. 1 (MS-1) Sept. 1981, Wash., D.C.)*. These thickness requirements meet or exceed AASHTO recommendations. (AASHTO *Interim Guide for Design of Pavement Structures*, 1972, Revised 1981, Wash., D.C.)

³ More detailed information on the load-bearing characteristics of varying soil types is presented in The Asphalt Institute's *Soils Manual (MS-10)*

From the Flexible Pavements of Ohio, Asphalt Pavement Design and Construction Guide, Section 2.2, Page 1

Recommended Minimum Thickness Designs (in inches) for pavements designed for cars

Subgrade Support	Full Depth Asphalt	with aggregate base	aggregate	asphalt
Poor (CBR 3)	6.5	6.0	4.5	
Fair (CBR 5)	5.5	6.0	3.5	
Good (CBR 7)	5.0	6.0	3.0	

Note: these design are intended to ensure that only surface maintenance and not structural repair will be needed in the future

Practical Applications

There are various pavement design recommendations in different publications from credible sources. Here we will emphasize the recommendations contained in the Asphalt Pavement Design And Construction Guide, published by Flexible Pavements of Ohio and mention the recommendations of the Asphalt Institute and the National Asphalt Pavement Association.

Designs for Parking Facilities

- In thin pavements, those designed for light loads, stresses imposed by environmental changes, expansion and contraction due to moisture and temperature changes and freeze and thaw, assume equal importance with those that result from vehicle loads. Thin asphalt pavements are less able to withstand these dimensional changes than thick, heavy-duty pavements. Thus, experience dictates that driveway pavements be governed by some minimum thickness of asphalt that can resist these forces of nature.

Municipal Standard Pavement Designs

Average Daily Traffic	# heavy trucks/day	ESALs (20-year design)	Typical Application	Typical Pavement Build-up, Poor Soil note 1	Typical Pavement Build-up, Good Soil and Drainage note 1
0-500	<25	25-500	Minor streets and residential streets with no future extensions	1-1/2" Type 1 1-1/2" Type 2 3-1/4" 301 6" 304 notes 1, 4, 6	Same
501-1,000	<25	50-500	Non through residential streets with no future extensions	1-1/2" Type 1 1-1/2" Type 2 3-1/4" 301 6" 304 notes 1, 4, 6	Same
1,001-1,500	<175	100-500	Through residential streets	1-1/2" Type 1 1-1/2" Type 2 3-1/4" 301 6" 304 notes 1, 4	1-1/2" Type 1 1-1/2" Type 2 3-1/4" 301 6" 304 notes 1, 4, 6, 7
>1,500	<1,000	1,500	Arterial streets	1-1/2" 442 12.5mm Type A (446) (PG76-22M) 2-1/2" 442 15mm Type A (446) (PG76-22M) 6" 302 6" 302 notes 1, 4, 5, 6, 7	1-1/2" 442 12.5mm Type A (446) (PG76-22M) 2-1/2" 442 15mm Type A (446) (PG76-22M) 6" 302 6" 302 notes 1, 4, 5, 6, 7
N/A	<2,000	500	Heavy industrial streets	1-1/2" 442 12.5mm Type A (446) (PG76-22M) 2-1/2" 442 15mm Type A (446) (PG76-22M) 6" 302 6" 304 notes 1, 4, 5, 6, 7	1-1/2" 442 12.5mm Type A (446) (PG76-22M) 2-1/2" 442 15mm Type A (446) (PG76-22M) 6" 302 6" 304 notes 1, 4, 5, 6, 7
N/A	Designed for the heaviest legal trucks	N/A (Populans)	Portugal Pavement	1-1/2" 442 12.5mm Type A (446) (PG76-22M) 2-1/2" 442 15mm Type A (446) (PG76-22M) 6" 302 6" 304 notes 1, 4, 5, 6, 7	1-1/2" 442 12.5mm Type A (446) (PG76-22M) 2-1/2" 442 15mm Type A (446) (PG76-22M) 6" 302 6" 304 notes 1, 4, 5, 6, 7

Notes:

- 1 - Soil support poor, CBR < 3, good, CBR = 7, good drainage means both surface and sub-surface drainage is provided
- 2 - From City of Columbus standards
- 3 - All binder grades PG64-22, except where noted. (PGXX-XXM designates polymer modified binder)
- 4 - If agency preference is to use hot-deep asphalt on the sub-grade, design the 6" crushed aggregate base (from 304) and increase the capped-base thickness by 2"
- 5 - These surface and intermediate courses are highly rut-resistant materials. If high-stress conditions (starting, stopping, turning heavy vehicles) are not expected, use conventional materials. 1-1/2" Type 1H (PG70-22M), 1-3/4" Type 2 (heavy) (PG64-22) and increase thickness of the 302 course accordingly.
- 6 - These pavement build-ups are intended for new construction of substantial quantity. All of these materials are suitable or practical for production in small quantities. There are alternatives for small quantities that can provide adequate rutting resistance. Consult your producer for recommendations.
- 7 - Large, heavy traffic projects can economically benefit from and should receive a detailed size and binder analysis and a specific pavement design.

Standard Pavement Designs and Mix Types Catalogs of Designs

Generic guidance on thickness, mix types and layers:

- Asphalt Institute, IS-139, etc.
- National Asphalt Pavement Association, IS-109

FPO, ODOT specific mix types and Layers

Review handout - Municipal Standard Pavement
Designs

Catalogs of Pavement Designs

