Mizzou

MAPA Asphalt Parking Lot Design

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MAPA
MISSOURI ASPHALT PAVEMENT ASSOCIATION

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MAPIL
Mizzou Asphalt Pavement & Innovation Lab

Introduction

Nearly all building structures incorporate some parking features to accommodate their workers, customers, and deliveries

Parking lots must hold up to the demands of regularly scheduled truck deliveries, trash trucks, as well as other occasional overloads

The state of Missouri did not have a robust and up-to-the-date guide for the asphalt design of the parking lots – these are referenced by PaveXPress (NAPA pavement design software, cloud-based)

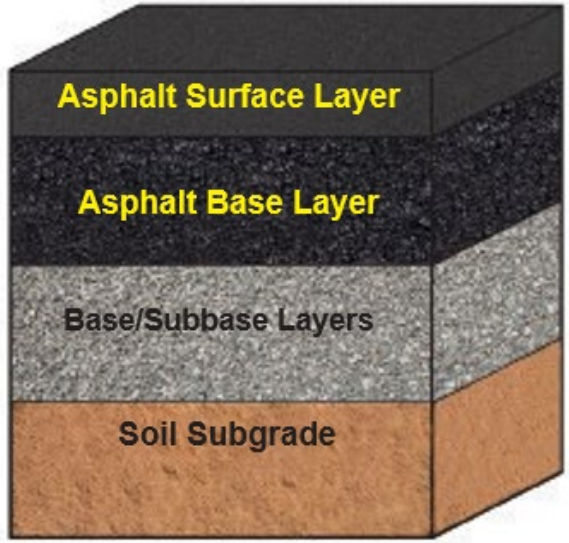
Methodology

The AASHTO method (1993) was implemented to design the structure of the asphalt parking lot pavements

Thickness design calculations and subsequently tabulated values were carried out on NAPA's PaveXPress software

This guide closely mirrors the parking lot design guide developed by the Plantmix Asphalt Industry of Kentucky (PAIKY)…thanks!

Pavement Cross-Section



Traffic Analysis

Light Traffic

Fewer than 1,500 vehicles per day, consisting of 98% passenger cars (PC) and 2% single unit trucks

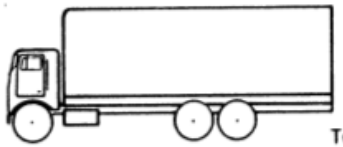
Moderate Traffic

AADT from 700 to 3,000, consisting of 92% PC with a mixture of single unit trucks (5%) and combination trucks (3%)

Heavy Traffic

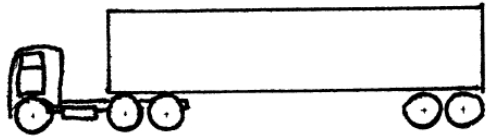
AADT greater than 3,000 and less than 24,000, consisting of 92% PC with a mixture of single unit trucks (5%) and combination trucks (3%)

(a) Three-Axle Single-Unit Truck



			Total
Weight (lb 000s)	16	32	48
ESALS			
Flexible	0.62	0.86	1.48
Rigid	0.60	1.50	2.10

(c) Five-Axle Tractor-Semitrailer (3-S2)



				Total
Weight (lb 000s)	12	34	34	80
ESALs				
Flexible	0.19	1.09	1.09	2.37
Rigid	0.17	1.95	1.95	4.07

Subgrade Properties – Inputs

Material Classification AASHTO Soil Class	Soil Description	Typical M_R (psi)	*California Bearing Ratio (CBR) (%)
A-1-a	Stone fragments, gravel and sand	40,000	74
A-1-b		38,000	68
A-2-4	Silty or clayey gravel and sand	32,000	52
A-2-5		28,000	42
A-2-6		26,000	38
A-2-7		24,000	33
A-3	Fine sand	29,000	45
A-4	Silty soils	24,000	33
A-5		20,000	25
A-6	Clayey soils	17,000	19
A-7-5		12,000	11
A-7-6		8,000	6

Subgrade Soil Inputs - Simplified

Type	Description
Weak	CBR is greater than or equal to 3 and less than 6
Moderate	CBR is greater than or equal to 6 and less than 9
Good	CBR is greater than or equal to 9

Treatment of Weak Subgrade Soils

- Removal and replacement
- Additional base layers, grid reinforcement
- Stabilization with a cementitious or asphaltic binder

Reliability Recommendations

TABLE 11.14 Suggested Levels of Reliability for Various Functional Classifications

Functional classification	Recommended level of reliability	
	Urban	Rural
Interstate and other freeways	85–99.9	80–99.9
Principal arterials	80–99	75–95
Collectors	80–95	75–95
Local	50–80	50–80

Note. Results based on a survey of AASHTO Pavement Design Task Force.
Source. After AASHTO (1986).

Recommended Layer Thicknesses (15 Year Design Life)

Subgrade Strength	Layer Type	Light Traffic	Moderate Traffic	Heavy Traffic
Weak, CBR 3	Asphalt Layers, Total (inches)	3	4.5	7
	Aggregate Base Layer (inches)	6	8	10
Moderate, CBR 6	Asphalt Layers, Total (inches)	2.75	4.25	6.5
	Aggregate Base Layer (inches)	6	8	10
Good, CBR 9	Asphalt Layers, Total (inches)	2.5	4	6
	Aggregate Base Layer (inches)	6	8	10

Recommended Layer Thicknesses (30 Year Design Life)

Subgrade Strength	Layer Type	Light Traffic	Moderate Traffic	Heavy Traffic
Weak, CBR 3	Asphalt Layers, Total (inches)	5	7.5	9
	Aggregate Base Layer (inches)	6	8	10
Moderate, CBR 6	Asphalt Layers, Total (inches)	4.25	7	8
	Aggregate Base Layer (inches)	6	8	10
Good, CBR 9	Asphalt Layers, Total (inches)	3.5	6	7
	Aggregate Base Layer (inches)	6	8	10

Asphalt Mixtures

The official MoDOT mixture designations for surface mixtures are as follows:

» Bituminous Pavement Mixture PG64-22, (BP-1), commonly used for parking lot paving
» Bituminous Pavement Mixture PG64-22, (BP-2), commonly used for parking lot paving
» Bituminous Pavement Mixture PG64-22, (BP-3), rarely used for parking lot paving
» Bituminous Pavement Mixture PG64-22, (Surface Leveling, rarely used for parking lot paving)

The aggregate gradation requirements for these mixtures are specified in Sections 401.3 and 402.3 of the MoDOT Standard Specifications. Lift thicknesses for these mixes are specified in MoDOT EPG Sections 450.3 and 450.4, but the use of a 1.5-inch minimum lift thickness is recommended to promote good density for parking lot applications.

Construction and Quality Workmanship

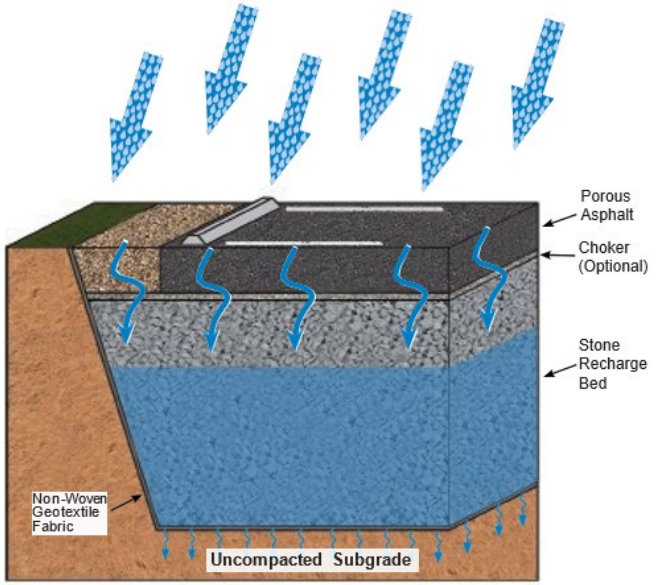
Including:

- Working Platform
- Proper Lift Thicknesses
- Proper Environmental Conditions
- Proper Compaction
- Attention to Minimize Segregation

Porous/Sustainable Asphalt Pavement

- Porous asphalt pavements are designed to retain stormwater events
- A sustainable feature that will minimize any water discharge from the site and greatly reduce erosion and flash flooding

An excellent example of a highly sustainable parking lot design can be found on the American Society of Civil Engineering (ASCE) Foundation website: https://www.ascefoundation.org/asce-sustainable-parking-lot-project . The ASCE Sustainable Parking Lot project involved a significant overhaul of the ASCE headquarters parking lot in Reston, VA, which was renovated in 2020 using low-impact development (LID) practices to reduce outflow and to improve stormwater quality discharged to the watershed. A sustainable asphalt mixture design provided by the Mizzou Asphalt Pavement and Innovation Laboratory (MAPIL) using recycled, Engineered Crumb Rubber (ECR) and RAP was also featured. See also: http://bit.ly/asceparkinglotvideo



Thank You!

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Questions?