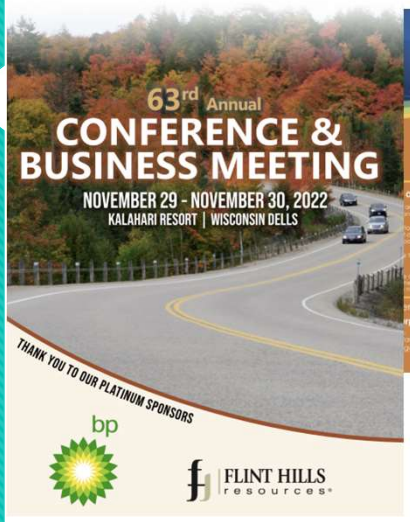
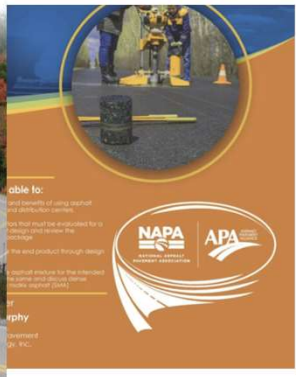
Structural Design of Private Market Asphalt Pavements

WAPA
WISCONSIN ASPHALT PAVEMENT ASSOCIATION





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Structural Design of Private Market Asphalt Pavements

WAPA

Concurrent Breakout Sessions

	Aloeswood Room	Marula Room	Aralia Room	Mangrove Room
Session 1: 1:30 – 2:30	Designing a Perpetual Pavement	Thin Asphalt Overlays	Cold Weather Paving	Workforce Development
Session 2: 2:45 – 3:45	Design of Private Market Pavements	Ethics Training	Cold Weather Paving	Environmental Product Declarations
Session 3: 4:00 – 5:00	Designing a Perpetual Pavement	Thin Asphalt Overlays	WisDOT Research Update	

5:00 – 6:00	Reception *sponsored by CWMF*
6:00 – 7:00	Dinner *sponsored by Astec Industries*
7:00 – close	Hospitality Suite *sponsored by Miller-Bradford & Risberg*

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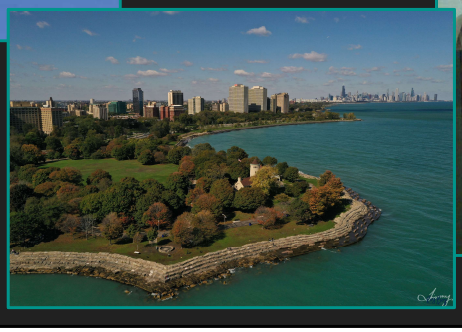
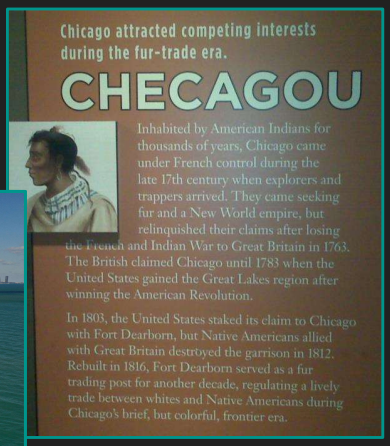
Where I'm Located





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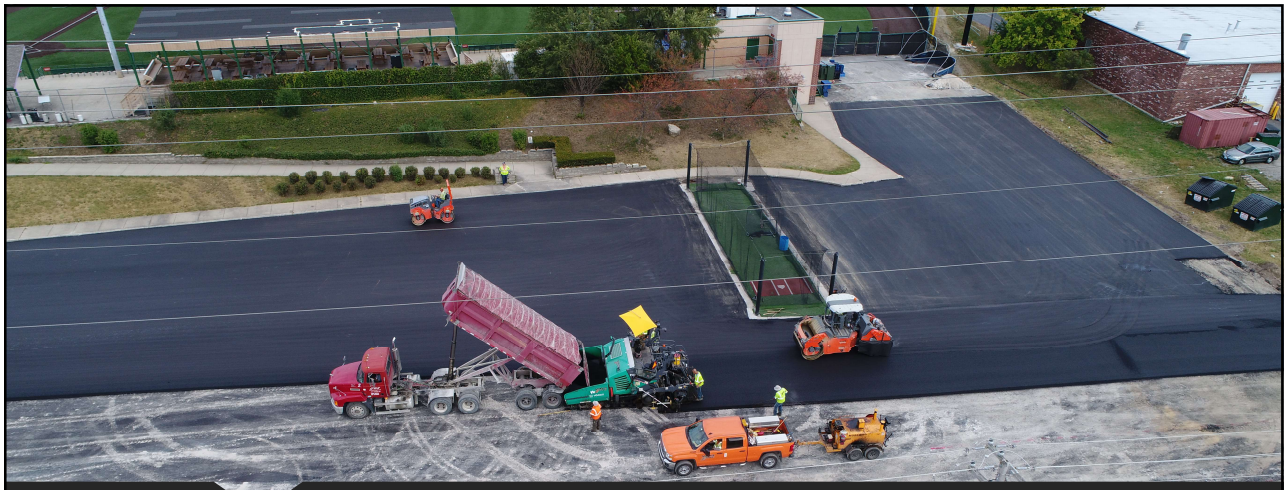
One Day
Three Pavers; One-4" thick lift of asphalt; 6,000 Tons

4

One Day

Two Pavers; One-4" thick lift of asphalt base; 2" thick lift of asphalt surface; 4,000 Tons

5



One Day
One Paver; One-4" thick lift of asphalt in lieu of 2.5" base and 1.5" surface plus tacking the longitudinal joint; 2,000 Tons

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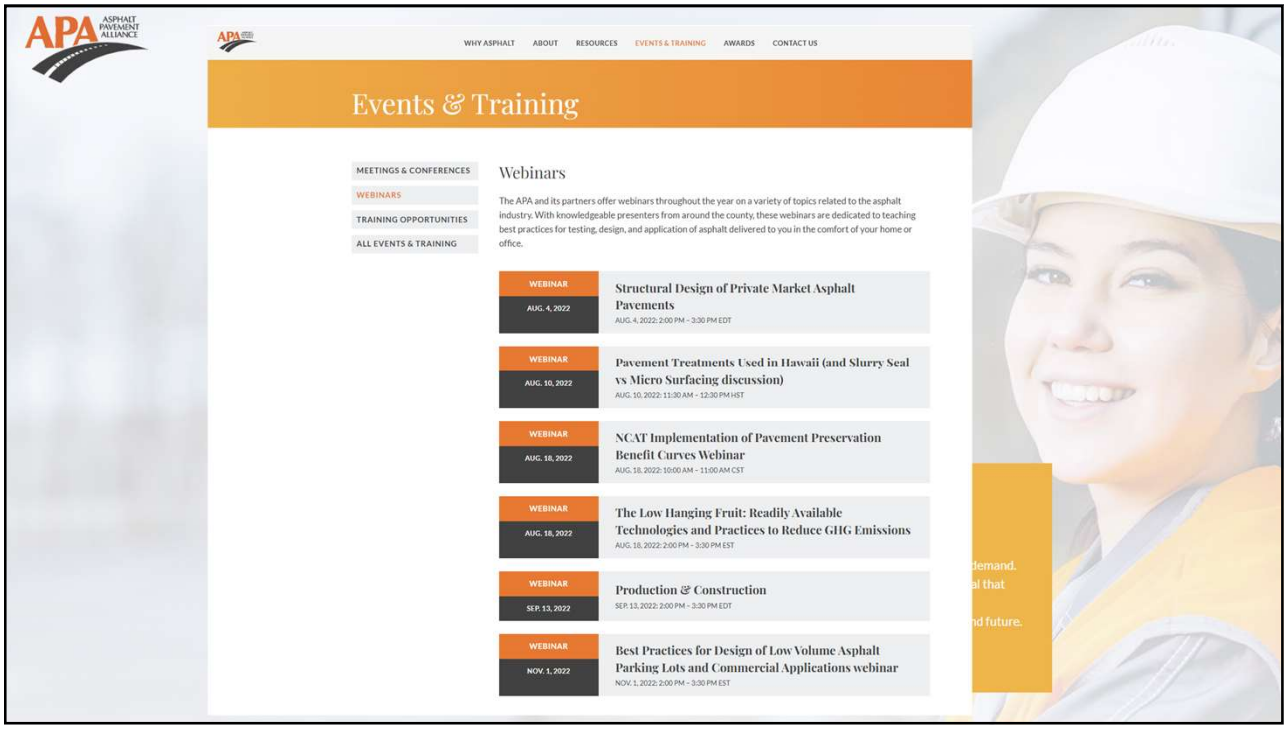
One Day
One Paver; One-2" thick lift of asphalt surface with hot joint; 2,000 Tons @ 30-ft. wide

7

Autobahn: Hot joint with two pavers

8



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Goals for Today

This discussion for civil and geotechnical engineers and architects who seek to learn more about designing asphalt pavement thicknesses, and contractors who want to build the asphalt market.

We'll explore proper design methodology and will offer best practices to ensure thickness design of proper long-lasting asphalt pavement parking lots, warehouses, and distribution centers (DCs).

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Objectives

1. Understand the value and benefits of using asphalt pavement for parking lots and distribution centers.
2. Determine the key factors that must be evaluated for a proper thickness pavement design and review the PAVExpress.com software package.
3. Learn ways to improve the end-product through design considerations.
4. Select the appropriate asphalt mixture for the intended use as all asphalts are not the same and we'll discuss dense graded, thin lifts, and stone matrix asphalt (SMA)

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Structural Design of Private Market Asphalt Pavements

Case Study at Various Points Throughout

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Perspective of bad Asphalt

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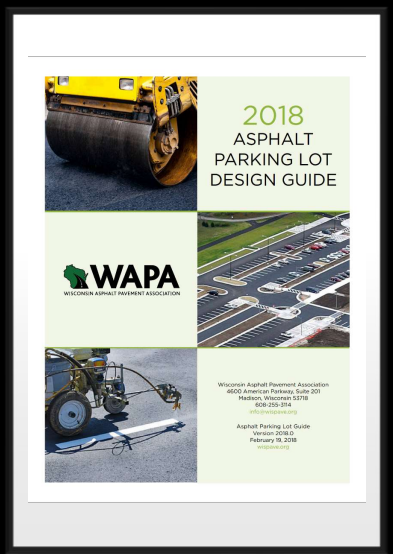

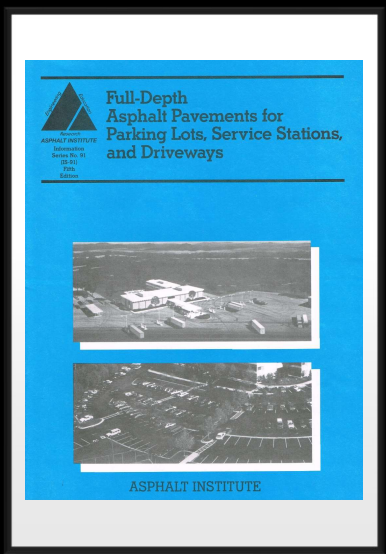

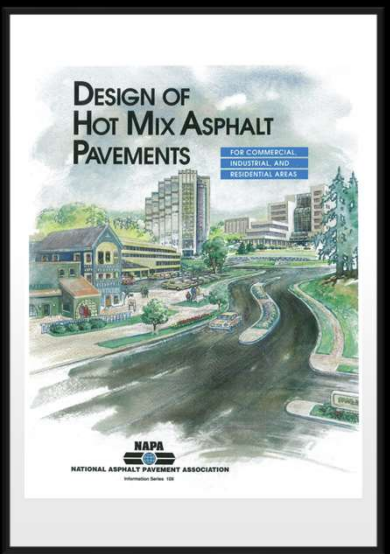

Special thanks to WAPA (Brandon and Deb), Danny Gierhart, Asphalt Institute, and Amy Miller of Asphalt Paving Alliance for sharing numerous ideas, slides, and references for today's presentation.

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What is the value of your asphalt parking lot?

The International Parking Institute states that when a new parking lot is installed using hot mix asphalt pavement the average cost per stall is $4,500*

* International Parking Institute TPP-2013-12 Urban Parking as Economic Solution

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Pavement and Material Design

A. Traffic type and volume
B. Geotechnical borings
C. Asphalt Material: HMA / WMA / DGA / SMA
   i. Definition & Design
   ii. Right Material for Right Use
D. Cross Section Overview - Light Duty / Heavy Duty Considerations

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Loading Has Changed Dramatically

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ROADS vs. Parking lots

- Drainage: Surface and Subsurface
- Traffic
- Initial Design
- Construction Oversight
- Maintenance
- Appearance
- Pedestrian Access

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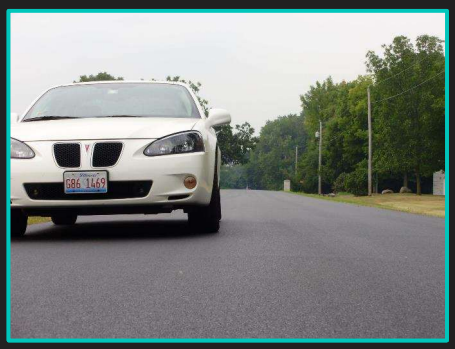
A. Traffic type and volume



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Commercial Parking Lots - Traffic

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What is an Equivalent Single Axle Load (ESAL)?

- Traffic Parameter Used for Design
- Relates to Number of Trucks / Day
- A Very Important Parameter

Historically called TF for Traffic Factor

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ESAL Coefficients

Road Class	PV	SU	MU
RIGID – I	0.15	143.81	696.42
II	0.15	135.78	567.21
III	0.15	129.58	562.47
IV	0.15	127.75	555.90
Flexible			
I	0.15	132.50	482.53
II	0.15	112.06	385.44
III & IV	0.15	109.14	384.35
IV<400	0.15	9.86	78.84

Traffic type and volume – Where We Goofed

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Traffic type and volume – Where We Goofed

- Just In Time Delivery
- Legal Loads
- Radial Tires
- Others by Class

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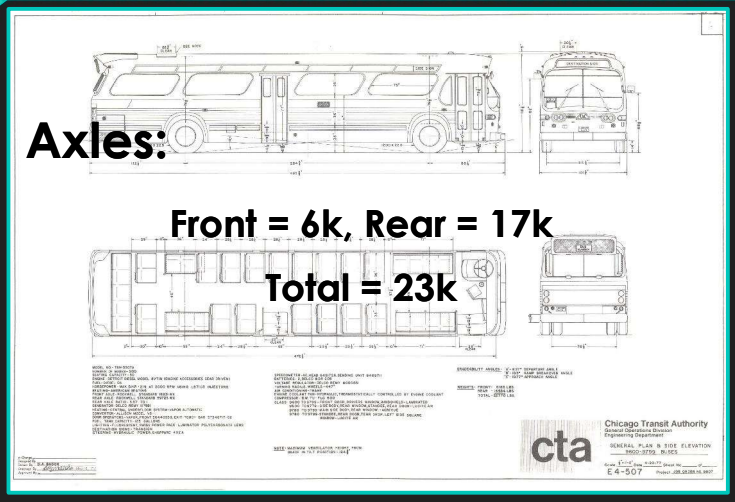
Bus Circa 1975



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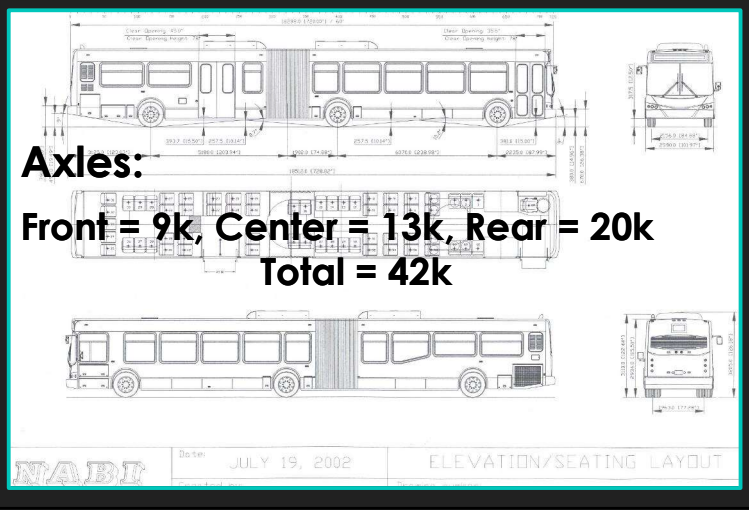
Bus Circa 2000



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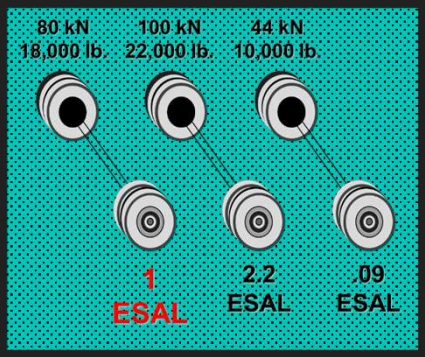
ESAL Comparison



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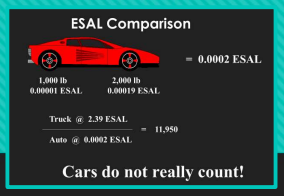
ESAL Comparison



67 kN
15,000 lb
0.48 ESAL
+
27 kN
6,000 lb
0.01 ESAL

151 kN
34,000 lb
1.10 ESAL
+
151 kN
34,000 lb
1.10 ESAL
+
54 kN
12,000 lb
0.19 ESAL

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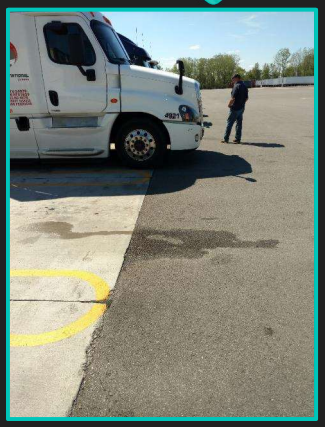
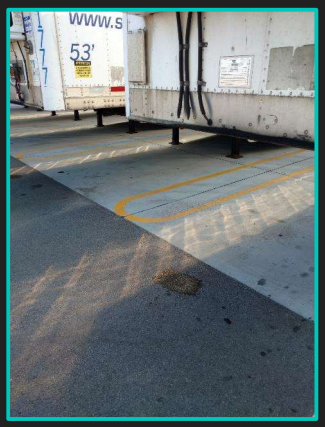
ESAL and Punching Shear are not related





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ESAL and Punching Shear are not related

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B. Geotechnical borings

Always remember that a boring is not coring.

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Geotechnical borings

- Borings obtain soil samples and existing pavement materials and thicknesses.
- Coring is done to verify thicknesses and to test asphalt.

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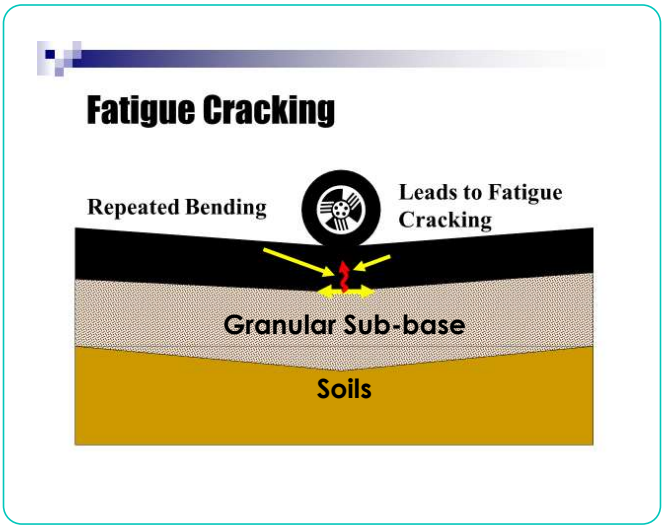
Geotechnical borings

Classify soils properly to design a structure that will reduce lowest lift strain.



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Sub-grade Support

- **Subgrade Support Rating (SSR) is a Conventional Design Requirement**
- **SSR is Determined by Geotechnical Engineer**
  i. **Poor**
  ii. **Fair**
  iii. **Granular**

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Sub-grade Support

- "Location, location, location" is / was the mantra for choosing a site to develop.
- Often the site chosen was problematic and if the subgrade condition required stabilization, the limit of the work was below the building pad and rarely extended to the parking lot.

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Field Testing Equipment/Tools

Chicago Testing Laboratory

chicagotestinglab.com

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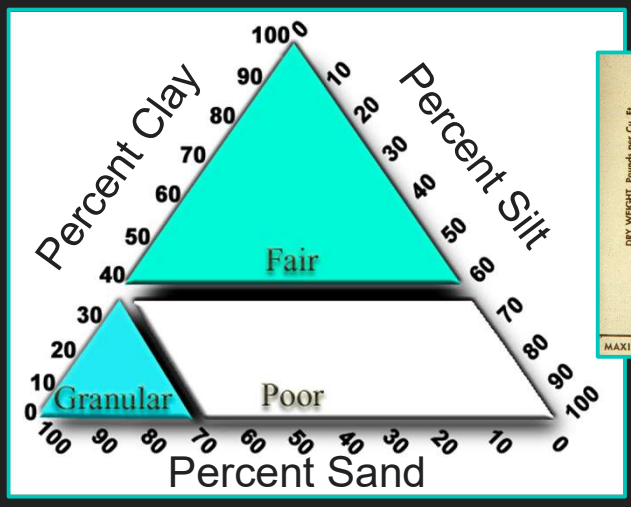
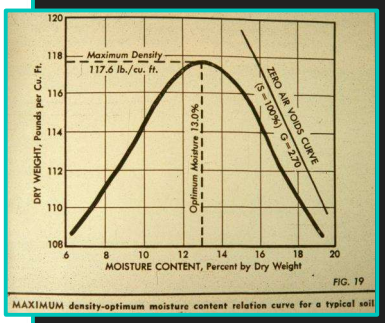
Sub-grade Support Rating (SSR) Chart





Just hire a geotechnical engineer

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We Need a Good Foundation

The first step prior to rehabilitating / reconstructing an existing parking lot is to validate the condition of the subgrade. An investment in a geotechnical study can provide information that is invaluable.

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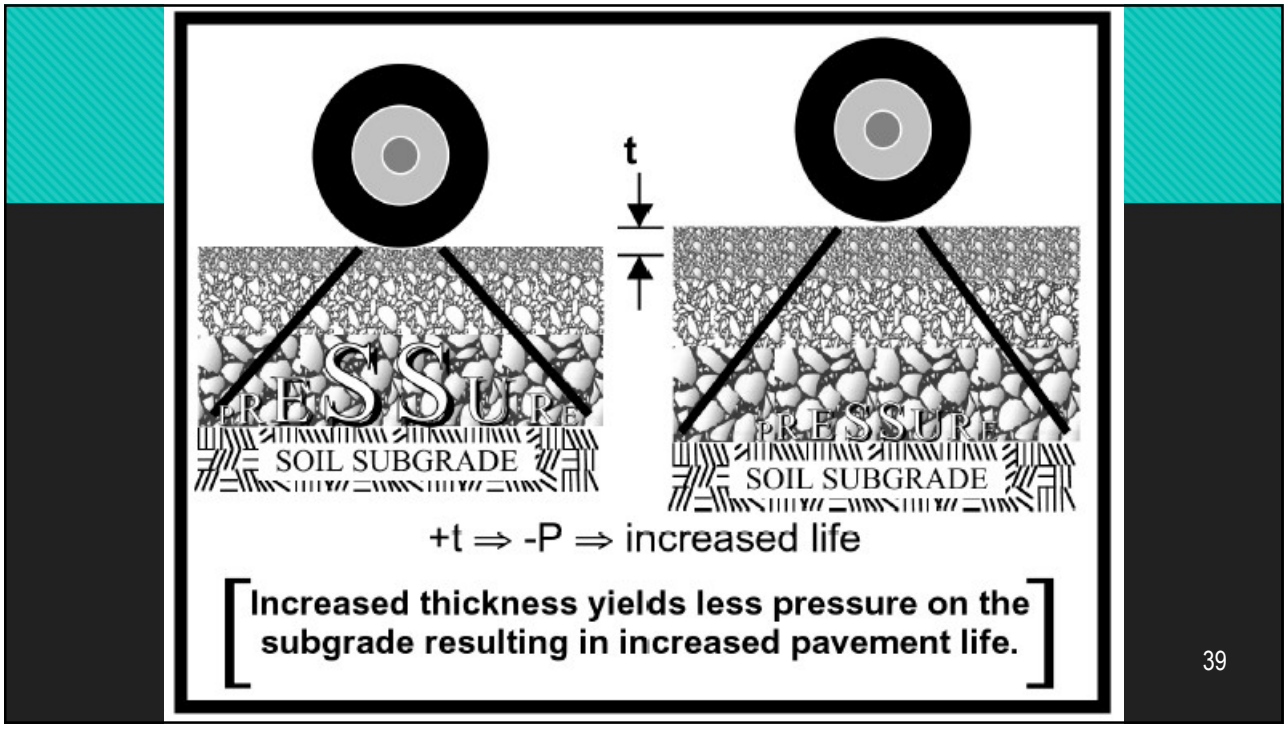

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Subsurface Drainage

Water within the pavement structure can come from:

- Surface – cracks and joints
- Adjacent landscaping
- Existing underground water supply
- Utility trenches and leaks

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Subsurface Drainage

Address subsurface drainage issues ASAP.

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Subgrade Stabilization

- Lime
- Portland cement
- Fly ash
- Foamed liquid asphalt
- High float emulsions

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Improved Sub-grade

- Lime / Cement / Fly-Ash Modified Soil
- Granular Replacement

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IN-PLACE RECYCLING

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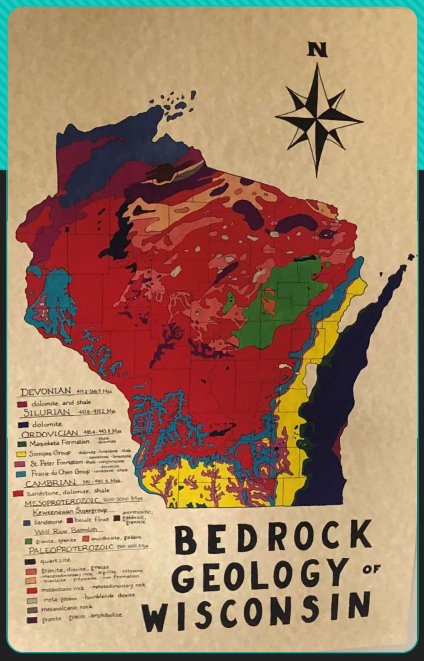
Aggregate Bases

- Dense graded
- Low quality
  - Bank run gravels
  - Milled asphalt
- High Quality
  - Fractured virgin aggregate
  - Crushed concrete



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Urban Area Soil Stabilization

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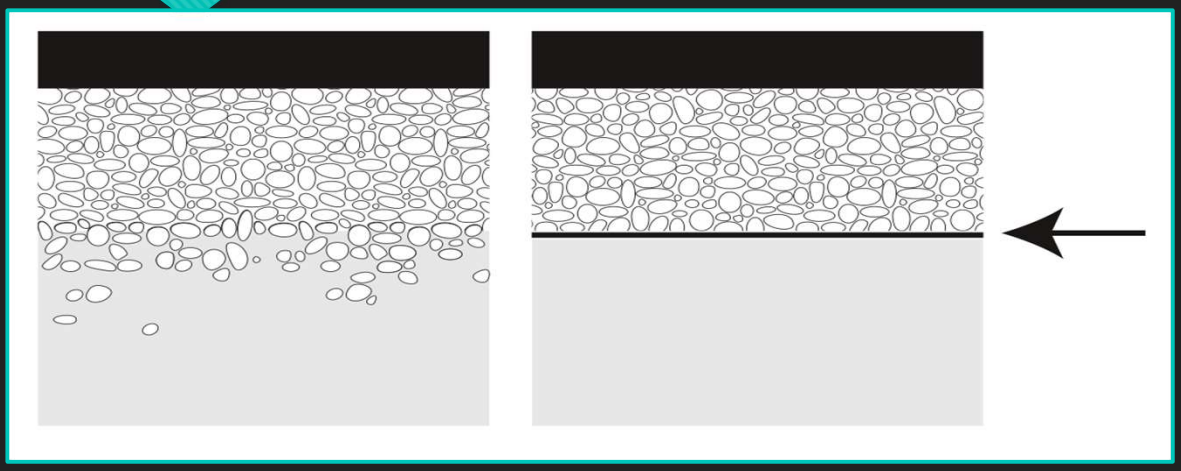
Separation / Reinforcement



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Pavement Materials

Untreated Aggregate Base

- Upper 6-inches should comply with Table 2
- Remainder should comply with ASTM D-2940 "Graded Material for Bases or Subbases for Highways and Airports"

TABLE 2 UNTREATED AGGREGATE BASE AND SUBBASE QUALITY REQUIREMENTS

Test	Test Requirements	
	Subbase	Base
CBR, minimum	20	80
or		
R-value, minimum	55	78
Liquid Limit, maximum	25	25
Plasticity Index, maximum, or	6	NP
Sand Equivalent, minimum	25	35
Passing No. 200 Sieve, maximum	12	7

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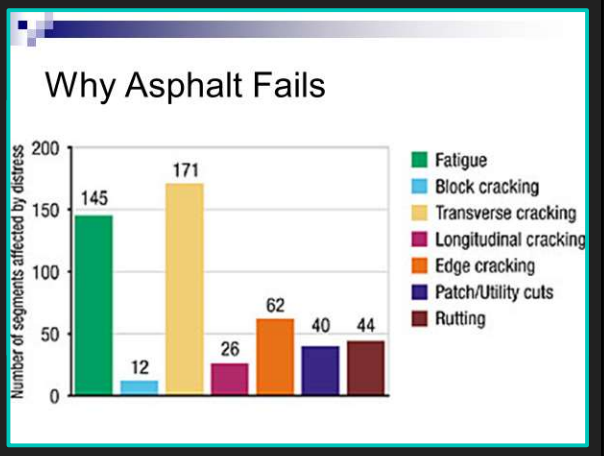
C. Asphalt Material: HMA / WMA / DGA / SMA

Maximum Particle Size

- Surface mixes between ½" & ¾"
- Intermediate mixes between ¾" & 1-½"
- Base mixes between 1" & 2"

There are lots of choices!!!



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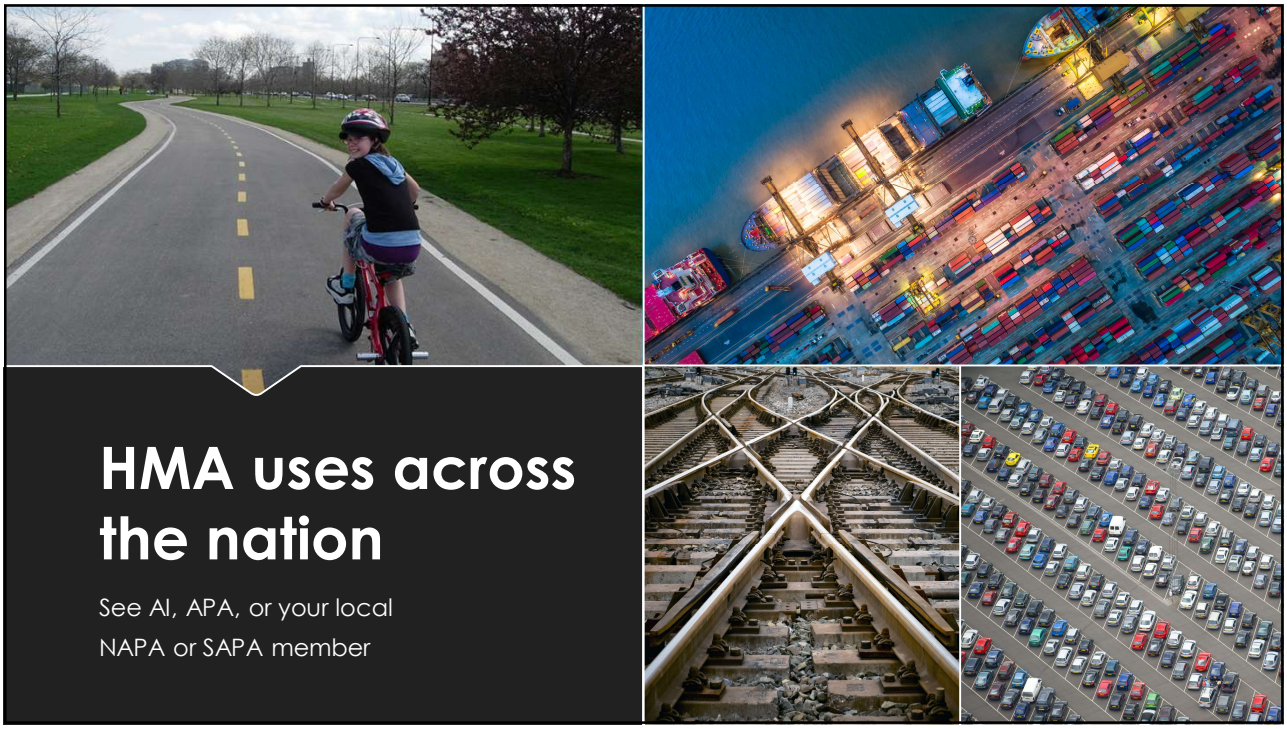

HMA uses across the nation

See AI, APA, or your local NAPA or SAPA member

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HMA uses across the nation

- Bike / Nature Trails
- Logging / Intermodal Yards
- Fish Hatcheries / Reservoirs
- Landfill Caps / Bridge Decks
- Railroad Beds
- Motor Speedways

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All Asphalt is the same

TRUE or FALSE?

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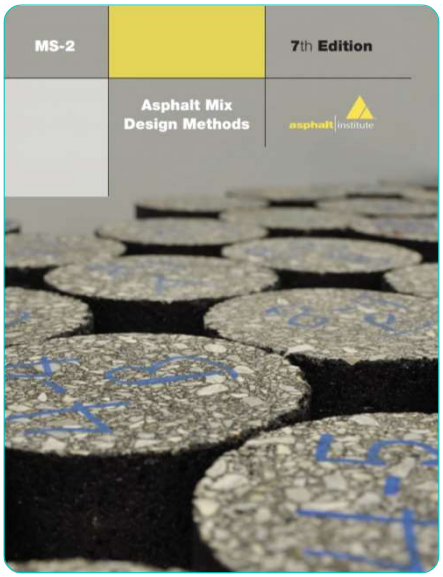
Universal Asphalt Mix Design Methods Manual

(require)



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Surface Course vs. Lower Lifts

- Size of aggregate
- Type of materials
- Lift thicknesses placed

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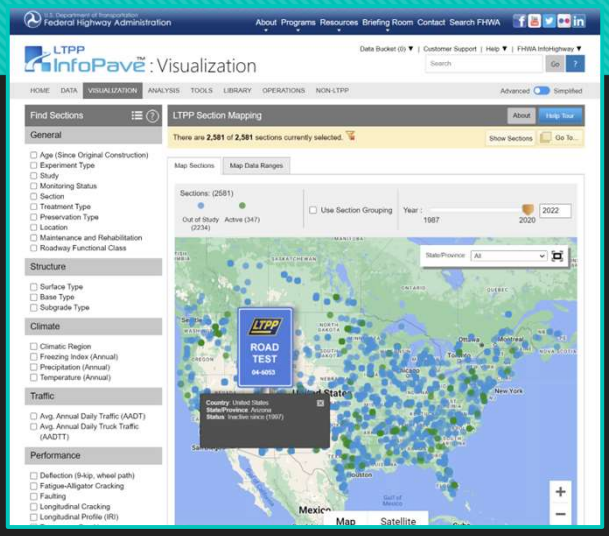
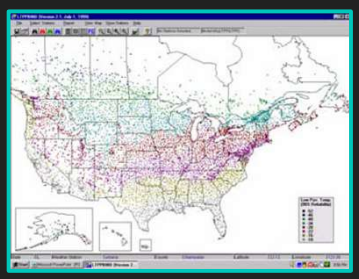
AC Mixture Temperature Map



LTPP InfoPave - LTPPBind Online (dot.gov)



LTPPBIND.EXE

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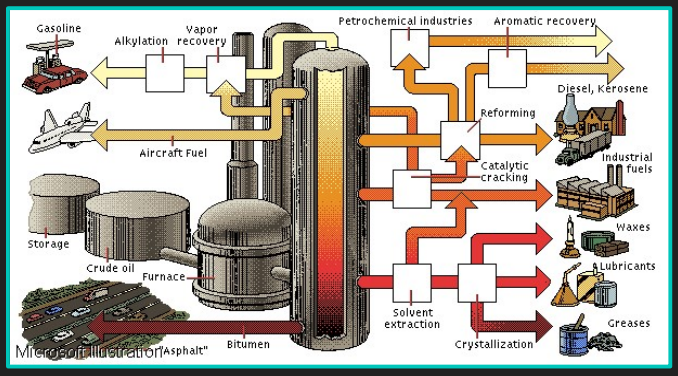
Crude Oil to End Product



Modified AC Helps

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When would a polymer-modified asphalt typically be used for highways?

AASHTO M 323 - Table 1

	Adjustment to High-Temp Grade		
	Traffic Load Rate		
ESALs (M)	Standing	Slow	Standard
< 0.3	-	-	-
0.3 - < 3	2	1	-
3 - < 10	2	1	-
10 - < 30	2	1	-
≥ 30	2	1	1

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HMA is Asphalt, Rock & Sand

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Rocks and Sand

- **Rocks** (Coarse Aggregate)
  i. Friction
  ii. Hardness
  iii. Quality (Sodium Sulfate, et. al.)
- **Sand** (Fine Aggregate)
  i. Sharp and angular
  ii. No Clay

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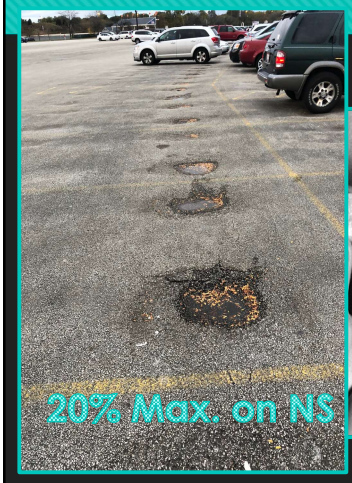
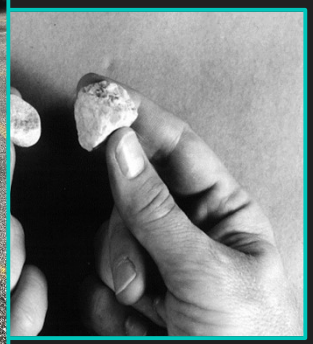
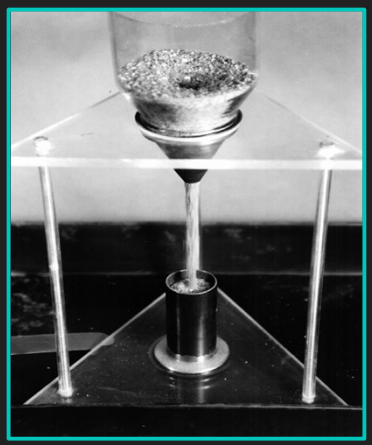
Coarse and Fine Aggregate Angularity







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Reclaimed Asphalt Pavement (RAP)

- Excellent value to all involved.
- Performs equal to virgin mix up to 30%.
- Demonstrates environmental stewardship.
- Requires quality control just like virgin mixtures.

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Compaction Levels of Asphalt Mixes

N_{des}	
50	Low Volume
75	Medium Volume
100	High Volume

} Polymers

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Voids in the Mineral Aggregate

VMA is the volume of effective asphalt plus air voids

- Pavement durability
- Aggregate gradation
- Mixture economics

VMA = Effective Volume of AC + Air Voids

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Importance of VMA to Compaction Efforts and Pavement Performanc

Improve	Improve Mechanical Stability
Improve	Improve Resistance to Permanent Deformation
Reduce	Reduce Moisture / Air Penetration
Improve	Improve Fatigue Resistance
Reduce	Reduce Low-Temperature Cracking Potential

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The Answer to Your Prayers

TYPICAL AC VALUES @ 4.0% AIR VOIDS

NMAS	VMA	0% ABS.	1% ABS.	2% ABS.
9.5 mm (3/8")	15.5	5.0%	5.6%	6.2%
12.5 mm (1/2")	14.5	4.6%	5.2%	5.8%
19.0 mm (3/4")	13.5	4.2%	4.8%	5.4%

Add 0.2% to above AC values to achieve 3.5% Air Voids and Pass Hamburg (Rutting) as well as SCB / i-FIT (Cracking)

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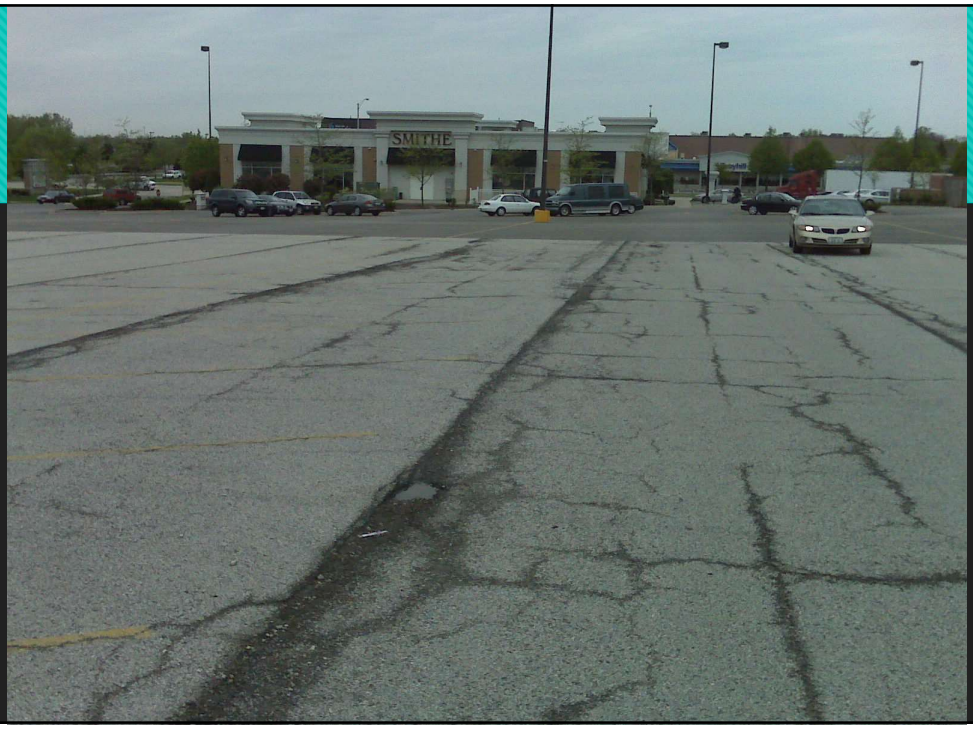

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2018 ASPHALT PARKING LOT DESIGN GUIDE CHAPTER 3 — CONSTRUCTION

Table 3.1. Pavement Thickness for Traffic Class I

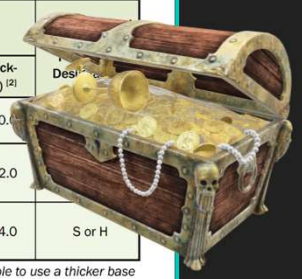
20-Year Design ESALs	Typical Use	Asphalt Mixture Type	Subgrade Type		Asphalt with Crushed Aggregate Base		Recommended Surface Layer PG Binder Designation
			Rating	Description	Total Asphalt Thickness (in.)	Base Thickness (in.) [1]	
			Good-to-	Gravels and coarse sands.	3.0	6.0 – 8.0	S

Without Proper Asphalt Content and VMA, This All Self-Destructs

Table 3.2. Pavement Thickness for Traffic Class II

20-Year Design ESALs	Typical Use	Asphalt Mixture Type	Subgrade Type		Asphalt with Crushed Aggregate Base		
			Rating	Description	Total Asphalt Thickness (in.)	Base Thickness (in.) [2]	Desi
< 2 million	Low-volume roadways Subdivision streets Collector streets Town roads County roads **Parking lots (≥50 stalls)**	LT	Good-to-excellent	Gravels and coarse sands. SSV ≥ 5.0	3.0 – 3.5	6.0 – 10.(	
			Medium	Clays and silts with low plasticity. SSV = 4.0 - 4.9.	3.5 – 4.0	6.0 – 12.0	
			Poor	Clays and silts with high plasticity; sugary (incompactable) sands. SSV = 2.5 - 3.9.	4.0 – 4.5	9.0 – 14.0	S or H

[1], [2]. Because a parking lot asphalt pavement is likely to be re-constructed in the future without replacing the base, it may be desirable to use a thicker base course than those specified here. Consider adding up to four inches when considering base thickness for parking lot pavements.



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Ignore These Recommendations and We'll be Talking Again…

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Various Asphalt Uses Throughout the Nation

- Intermodal Yards
- Airfields
- Bike / Hike Trails
- Motor Speedways
- Waste Treatment
- Fish Hatcheries / Cover Asphalt

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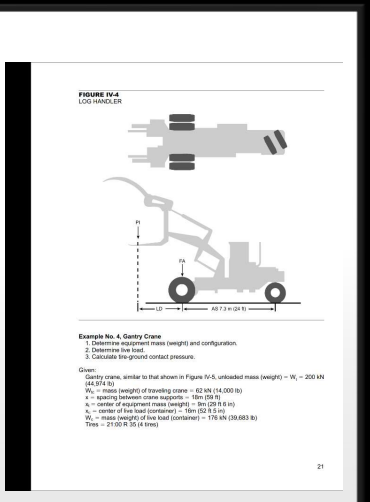
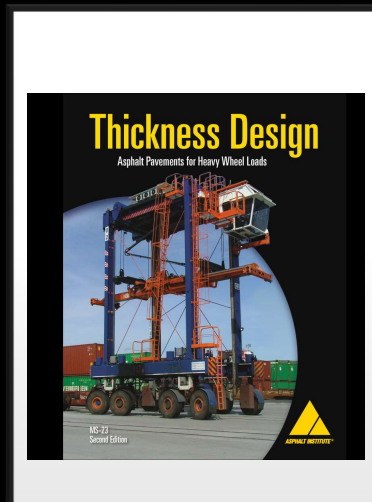


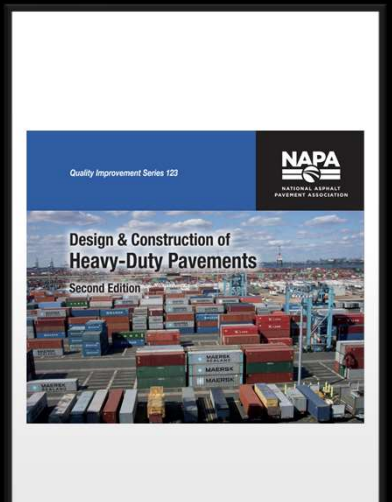
FIGURE IV-4
LOG HANDLER

Example No. 4, Gantry Crane
1. Determine equipment mass (weight) and configuration.
2. Determine live load.
3. Calculate tire-ground contact pressure.

Given:
Gantry crane, similar to that shown in Figure IV-5, unloaded mass (weight) = W_1 = 200 kN (44,974 lb)
W_{1a} = mass (weight) of traveling crane = 62 kN (14,000 lb)
s = spacing between crane supports = 18m (59 ft)
s_1 = center of equipment mass (weight) = 9m (29 ft 6 in)
s_2 = center of live load (container) = 16m (52 ft 5 in)
W_2 = mass (weight) of live load (container) = 176 kN (39,683 lb)
Tires = 21.00 R 35 (4 tires)

21





71

Intermodal Yards

72

Commercial Truck Yards

73

Log Yard

74

Intermodal Facilities Require SMA Surface

75

Rut Testing, current day: Hamburg Wheel

AASHTO T324

- Lab samples compacted to ~7% voids
- Field samples can be cores or slabs
- 122°F water bath temperature
- Minimum number of wheel passes specified by agency and is typically dependent on PG Grade
- Example: 12.5 mm (0.5 in) maximum rut depth at 20,000 passes

Chicago Testing Laboratory

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76

A Methodical Approach to Addressing Asphalt Cracking

Volumetric's:
Recycling; PG / Rejuvenators / Contabro / G_{sb}

Voids in the Mineral Aggregate = Air Voids + Effective Volume of AC per Asphalt Institute MS-2, current edition

Mix Selection:
SMA or Dense-Graded or Combination

Full-Depth | Rehabilitation | Overlay

LCCA Objective:
Traffic and Climate

MEPDG | Perpetual Pavement | AASHTO '93 | Mitigate Reflective Cracking | Surface Restoration

Mandatory (M) or Optional (O):
(M): Blending Required for ABR > 15%
(M): Lift thicknesses and surface preparation
(M): QC / Production / Workmanship Education

Cracking Tests (M) | Thickness Design (M) | Cracking Tests (M) | Cracking Tests (O)

Timothy R. Murphy (2018)
Masters Project

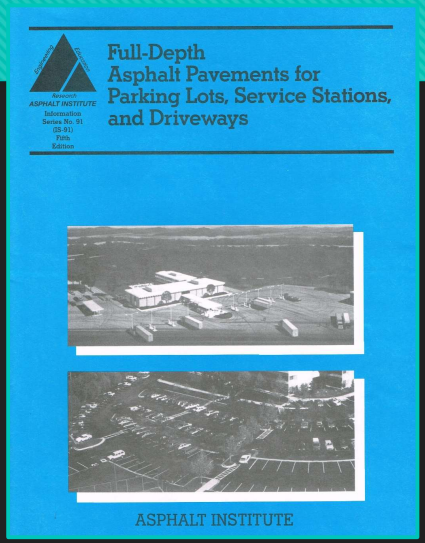
77

D. Cross Section Overview and Considerations

Light Duty (LD) v. Heavy Duty (HD)

78

Thickness Design

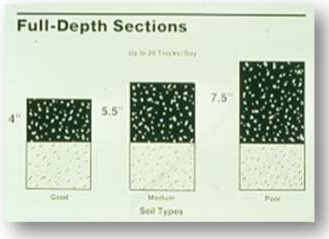


The Asphalt Institute has an information series publication (IS-91)on full-depth asphalt pavements for parking lots, service stations, and driveways. It is a bit dated (originally published in 1965, 5th Edition 1994), but still has solid information.

79

Full-Depth Sections, IS-91

- Up to 20 trucks / day
- Soil conditions must be determined
- Control Truck Route



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80

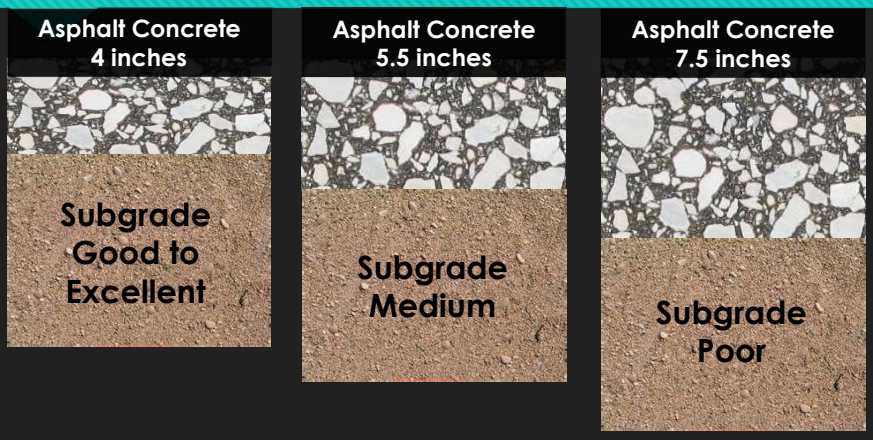
Asphalt Institute IS-91 Simplified Traffic Approach

Passenger Cars  	**Table 1, Column A:** Parking lots up to 200 stalls with lightweight truck traffic **Table 1, Column B:** Parking lots 200 to 500 stalls with heavier truck traffic, but not industrial traffic
Trucks  	**Table 2, Column A:** Parking lots up to 20 heavy trucks per day, entrances & traffic lanes used by heavy trucks **Table 2, Column B:** Parking lots 20 to 400 heavy trucks per day, entrances & traffic lanes used by heavy trucks, loading and unloading areas

81

Asphalt Institute IS-91 Table 2 Guidelines

Asphalt Directly on Top of Subgrade
Up to 20 Heavy Trucks* per Day

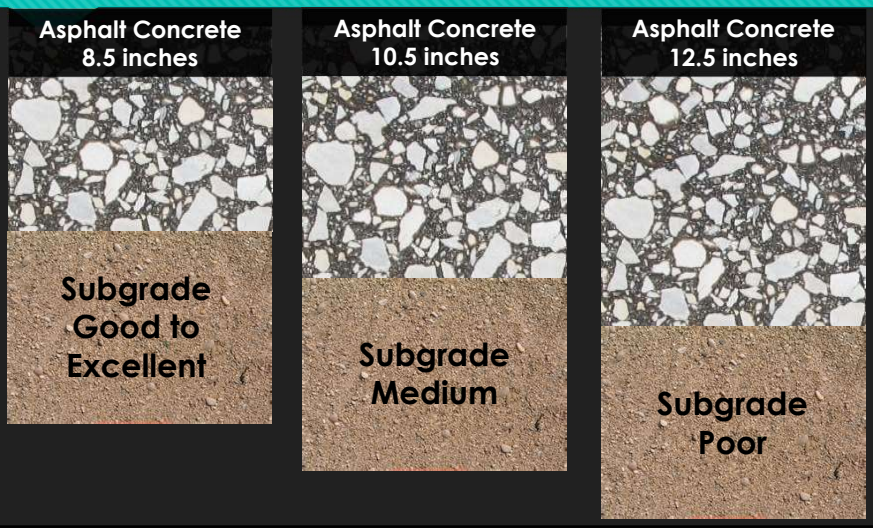


* Heavy trucks are commercial vehicles, normally 2-axle, 6-tire vehicles or larger. Pickup and light panel trucks are excluded. Trucks with heavy-duty, wide-base tires are included

82

Asphalt Institute IS-91 Table 2 Guidelines

Asphalt Directly on Top of Subgrade
20 to 400 Heavy Trucks* per Day



83

Commentary on IS-91 Table 2 Guidelines

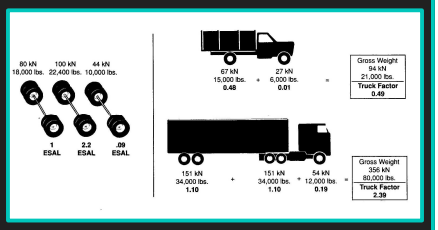
Give Consideration and credit for:

- Improving soils
- Drainage
- Adding an aggregate layer @3 or 4:1 for equal structural number

e.g.: Asphalt SN = 0.44, Aggregate SN = 0.12 +/-
Asphalt SN increases with polymer

84

Full-Depth Sections, IS-181



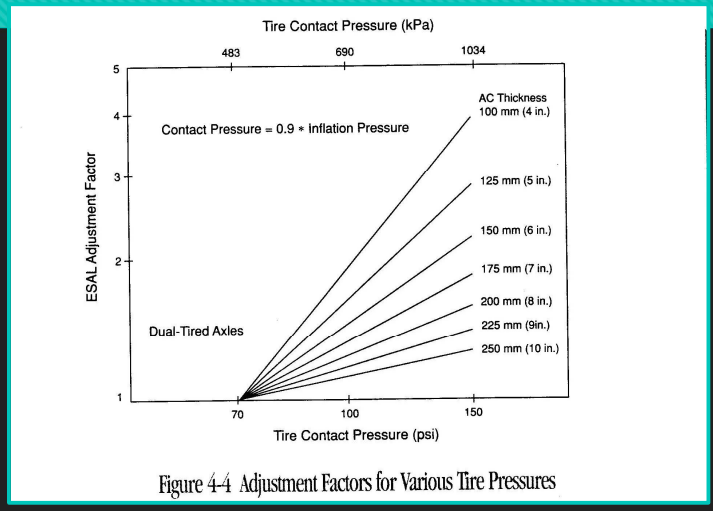
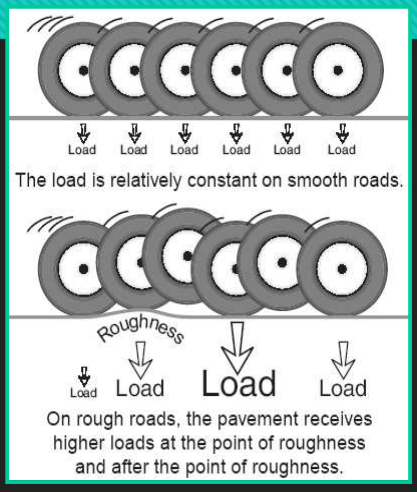


Figure 4-4 Adjustment Factors for Various Tire Pressures

85

Entrances Must be Thickened

Dynamic loads increase damage by a factor of ten!



86

Entrances Must be Thickened

87

Variable loads require variable thicknesses for new facilities and repair work (patches)

TRUE or FALSE?

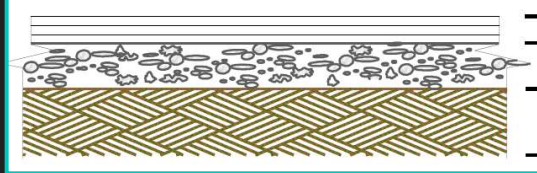
Light duty vs. Heavy duty

88

Pavement Thickness Design

Heavy Duty (HD) and Light Duty (LD) and / or Parking

Hot Mix Asphalt Surface Course (min. 1-½" compacted thickness)
Hot Mix Asphalt Intermediate / Base Course (per soil conditions and loading)
Crushed Stone Sub-base (AASHTO #53, typical; min. 3" to max. 6" compacted thickness)



	HD / LD
HMA Pavement Structure	6" / 3"
Aggregate Sub-Base	3" / 6"

89

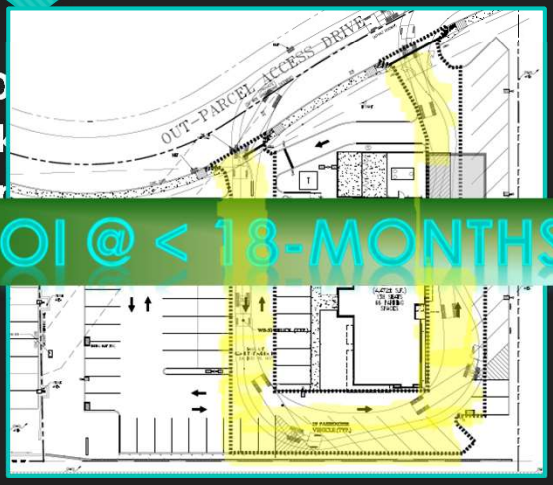
Cross Section Overview and Considerations

LD v. HD

A. Track

B. Cour

C. U



ROI @ < 18-MONTHS

90

Asphalt Thickness

Commercial Industrial Parking Lots: Target 5"-plus Compacted Thickness

- 3" lower layer (or more)
- 2" surface course

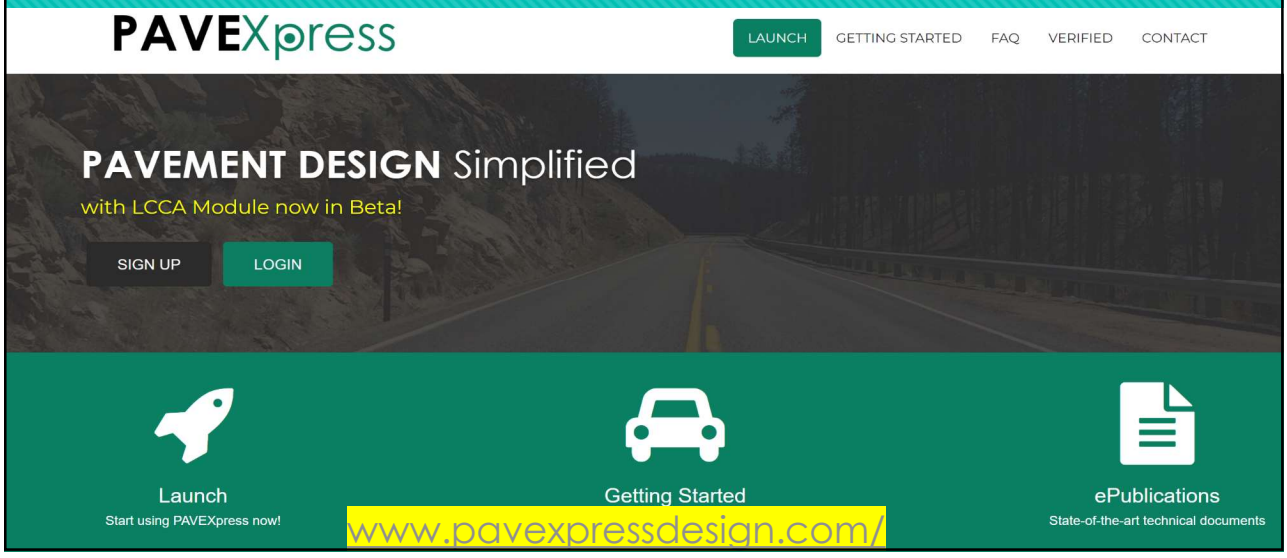
94

Asphalt Intermediate Layer

- Needed for thicker pavement sections
- Installed on top of lower layer
- HMA aggregate size – 12.5mm or larger

95

Historical Full-Depth Sections (Asphalt Institute, IS-91) to Current Full-Depth Sections (PAVEXpress)



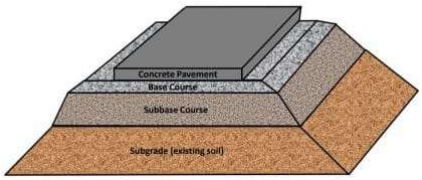
96

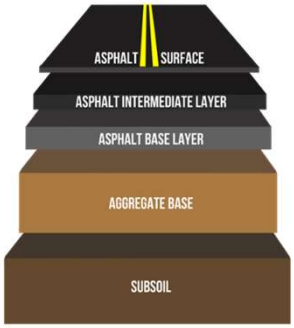
Practical Pavement Design Considerations

Both PAVEXpress (empirical) and AASHTOWare Pavement (ME) have their pros and cons

Smaller agencies and consultants tend to prefer the free empirical pavement design methodologies to the annual expense of the mechanistic-empirical design software

The rest of this presentation will discuss what PAVEXpress can do and go through some example pavement designs using PAVEXpress





97

What Is PAVEXpress?

A free, online tool to help you create and evaluate pavement designs and overlays using key engineering inputs, based on the AASHTO 1993 and 1998 supplement pavement design process.

- **Free** - no cost to use
- **Accessible** - via the web and mobile
- **Standards Based** - AASHTO and/or industry standard practices
- **User-friendly** - streamlined user interface and user experience
- **Collaborative** - share, save, and print
- **Interactive** - help and resources

www.PAVEXpress.com

98

99

PAVEXpress Resources

asphalt institute

PAVEXpress with LCCA Module now in Beta!

Logout

Home My Projects

Resources

The following resources accompany the PaveXpress Simplified Pavement Design Tool

State DOTs

State Asphalt Pavement Associations

Parking Lot Design Guides

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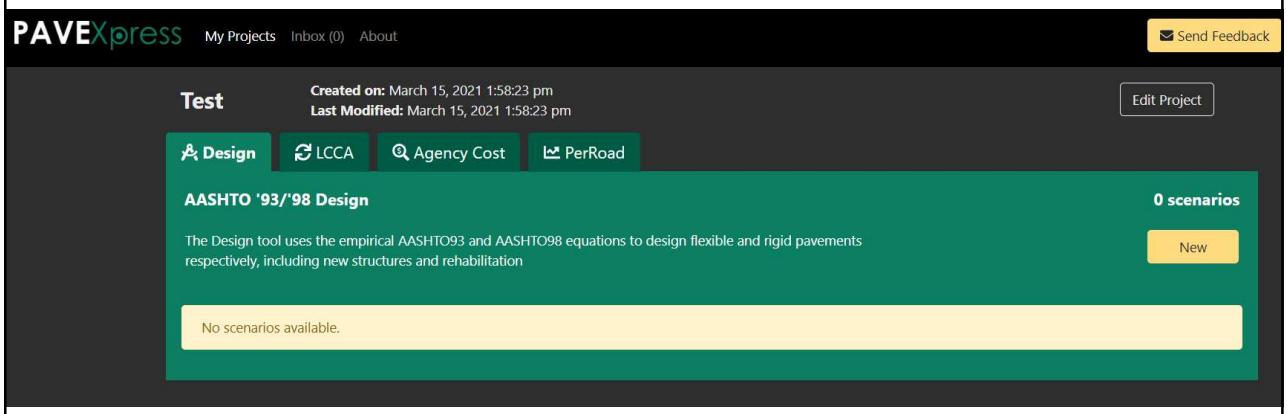
- All State DOT website links (52, including DC and PR)
- All State Asphalt Pavement Association links (38)
- Parking Lot Design Guides from SAPAs (13)

www.PAVEXpress.com

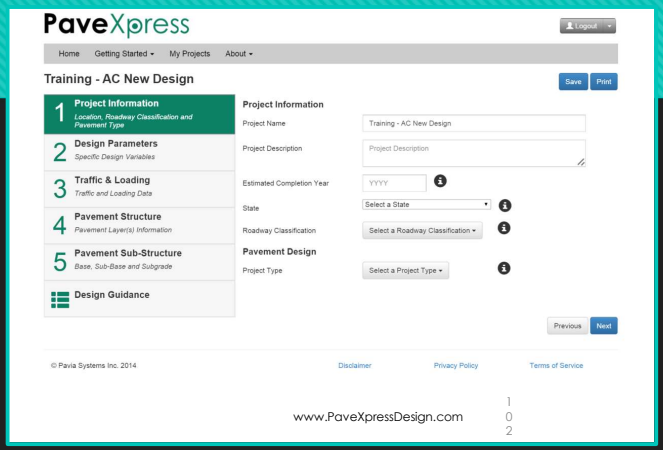
100

What Can You Do With PAVEXpress?



- New Asphalt, 1993 AASHTO Design Guide
- New Concrete, 1998 Supplement
- Porous Asphalt
- AC Overlay on Asphalt, 1993 Guide
- AC Overlay on Concrete or Composite
  (Not implemented)

101



Screen 1

102

1 Project Information

Location, Roadway Classification and Pavement Type

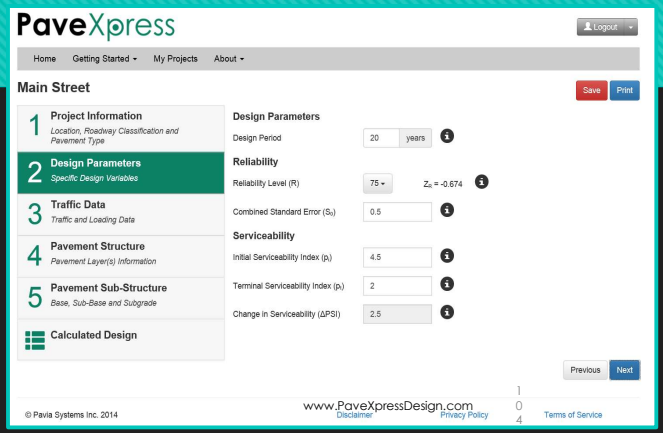
6) **Project Type** drop-down box allows the user to indicate the type of pavement being designed:

- New Asphalt, 1993 AASHTO Design Guide
- New Concrete, 1998 Supplement
- AC Overlay on Asphalt, 1993 Guide
- AC Overlay on Concrete or Composite
  (No Design Performed)

Screen 1

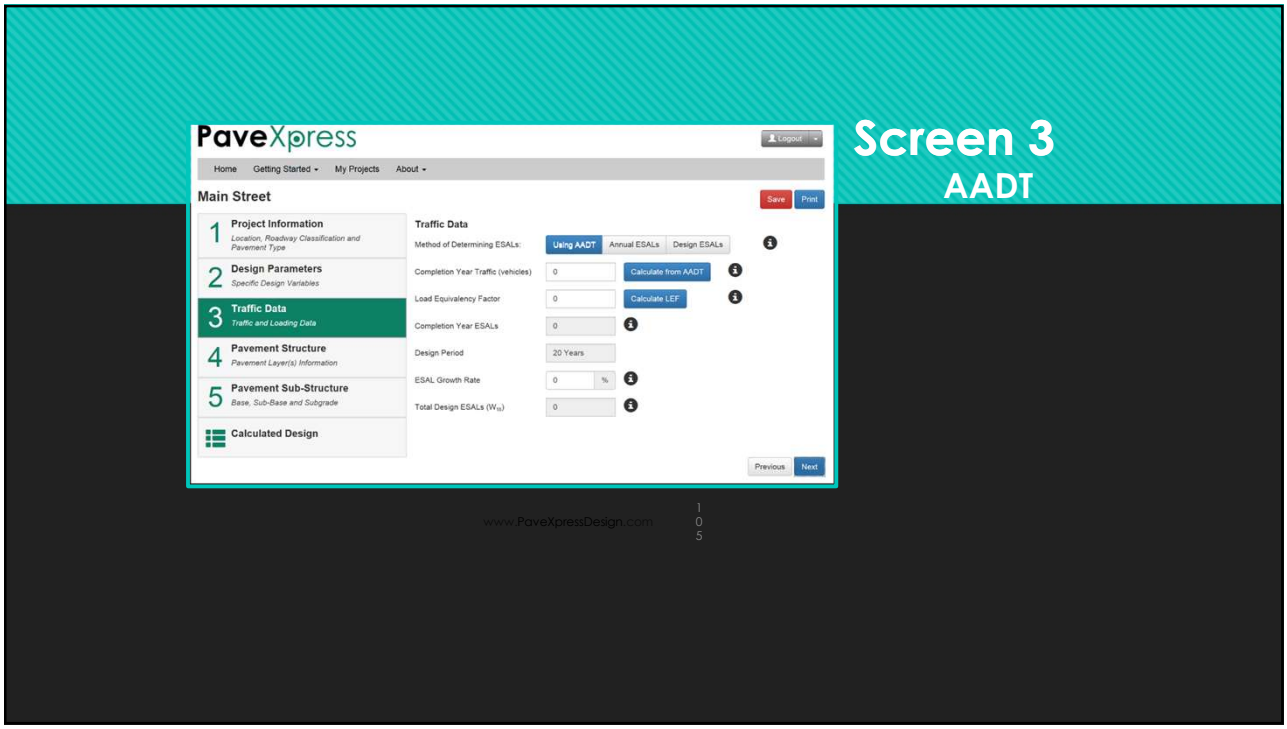
This presentation will focus on New Asphalt designs

103

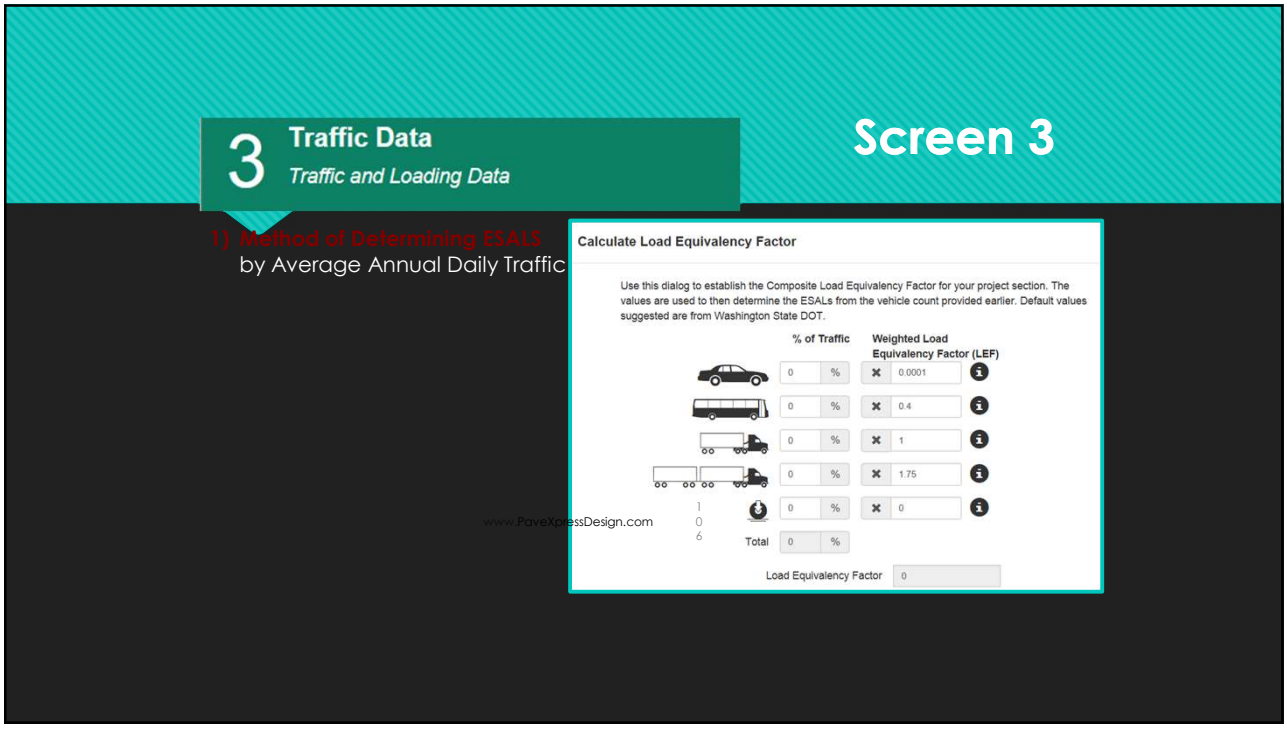


Screen 2

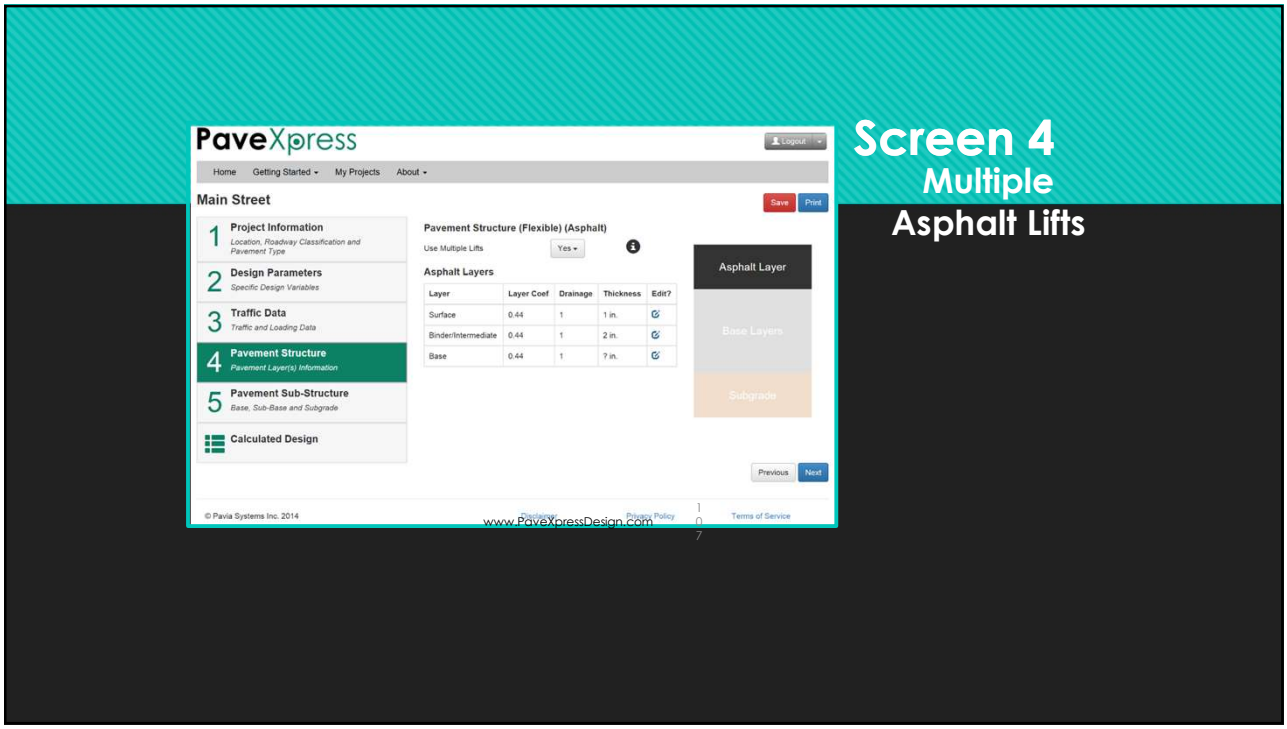
104


PaveXpress
Logout
Home
Getting Started
My Projects
About
Main Street
Save
Print
1 Project Information
Location, Roadway Classification and Pavement Type
2 Design Parameters
Specific Design Variables
3 Traffic Data
Traffic and Loading Data
4 Pavement Structure
Pavement Layer(s) Information
5 Pavement Sub-Structure
Base, Sub-Base and Subgrade
Calculated Design
Traffic Data
Method of Determining ESALs:
Using AADT
Annual ESALs
Design ESALs
Completion Year Traffic (vehicles)
Calculate from AADT
Load Equivalency Factor
Calculate LEF
Completion Year ESALs
Design Period
20 Years
ESAL Growth Rate
Total Design ESALs
Previous
Next
Screen 3
AADT
www.PaveXpressDesign.com
105

105


3 Traffic Data
Traffic and Loading Data
Screen 3
1) Method of Determining ESALS
by Average Annual Daily Traffic
Calculate Load Equivalency Factor
Use this dialog to establish the Composite Load Equivalency Factor for your project section. The values are used to then determine the ESALs from the vehicle count provided earlier. Default values suggested are from Washington State DOT.
% of Traffic
Weighted Load Equivalency Factor (LEF)
0.0001
0.4
1
1.75
Total
Load Equivalency Factor
www.PaveXpressDesign.com
106

106


PaveXpress
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My Projects
About
Main Street
Save
Print
1 Project Information
Location, Roadway Classification and Pavement Type
2 Design Parameters
Specific Design Variables
3 Traffic Data
Traffic and Loading Data
4 Pavement Structure
Pavement Layer(s) Information
5 Pavement Sub-Structure
Base, Sub-Base and Subgrade
Calculated Design
Pavement Structure (Flexible) (Asphalt)
Use Multiple Lifts
Yes
Asphalt Layers
Layer
Layer Coef
Drainage
Thickness
Edit?
Surface 0.44 1 1 in.
Binder/Intermediate 0.44 1 2 in.
Base 0.44 1 ? in.
Asphalt Layer
Base Layers
Subgrade
Previous
Next
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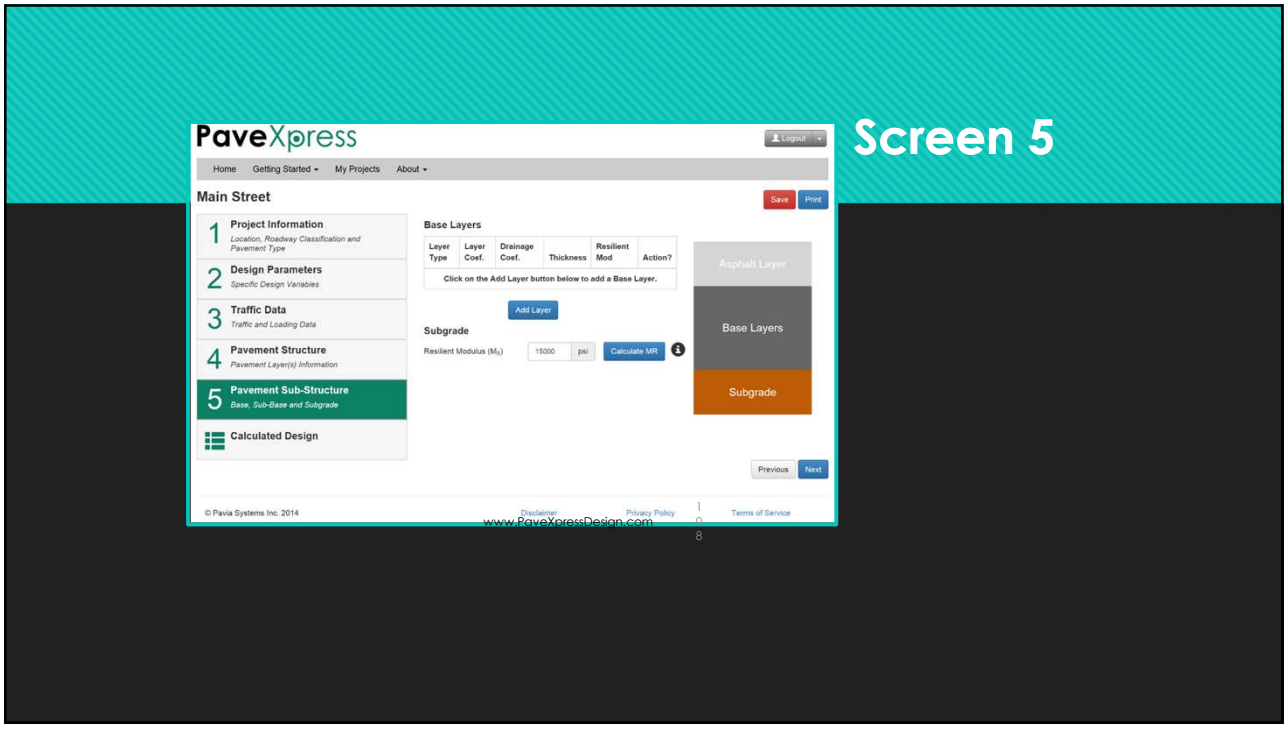
Screen 4
Multiple
Asphalt Lifts

107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1 Project Information
Location, Roadway Classification and Pavement Type
2 Design Parameters
Specific Design Variables
3 Traffic Data
Traffic and Loading Data
4 Pavement Structure
Pavement Layer(s) Information
5 Pavement Sub-Structure
Base, Sub-Base and Subgrade
Calculated Design
Base Layers
Layer Type
Layer Coef.
Drainage Coef.
Thickness
Resilient Mod
Action?
Click on the Add Layer button below to add a Base Layer.
Add Layer
Subgrade
Resilient Modulus (MR)
15000
psi
Calculate MR
Asphalt Layer
Base Layers
Subgrade
Previous
Next
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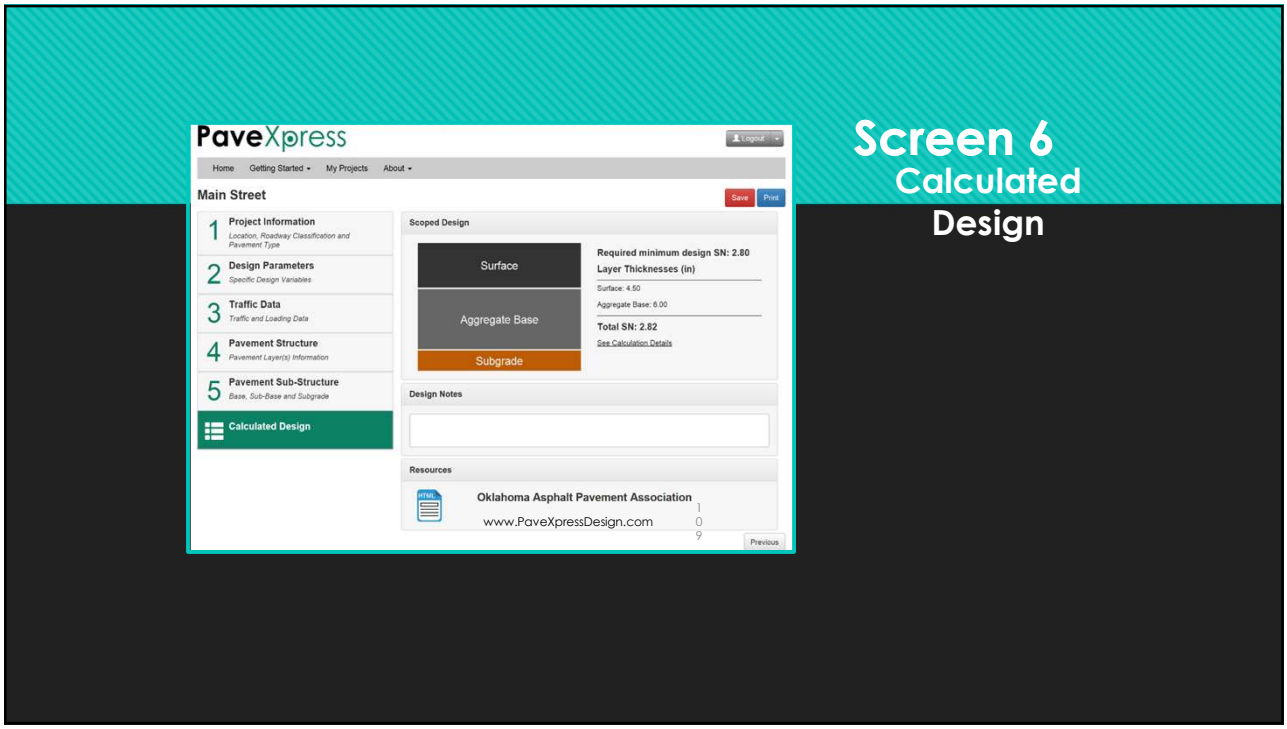
Screen 5

108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My Projects
About
Main Street
Save
Print
1 Project Information
Location, Roadway Classification and Pavement Type
2 Design Parameters
Specific Design Variables
3 Traffic Data
Traffic and Loading Data
4 Pavement Structure
Pavement Layer(s) Information
5 Pavement Sub-Structure
Base, Sub-Base and Subgrade
Calculated Design
Scoped Design
Surface
Aggregate Base
Subgrade
Required minimum design SN: 2.80
Layer Thicknesses (in)
Surface: 4.50
Aggregate Base: 6.00
Total SN: 2.82
See Calculation Details
Design Notes
Resources
Oklahoma Asphalt Pavement Association
www.PaveXpressDesign.com
Previous
Screen 6
Calculated
Design

109


PaveXpress
A Simplified Pavement Design Tool
PaveXpress
Introduction
Resources
Welcome T.!
www.PaveXpressDesign.com

110

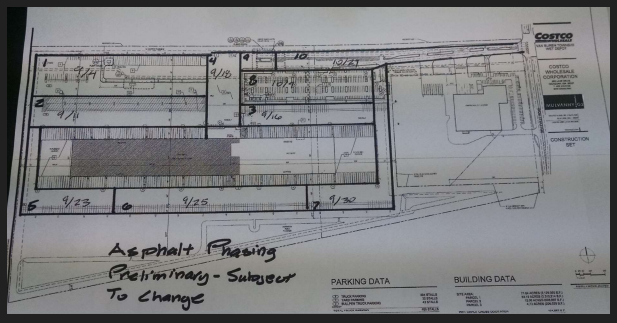
Trust but Verify – Testing of Materials

Require Quality Control and Quality Assurance: ensure sampling, testing, reporting, and sharing of results occurs contemporaneously

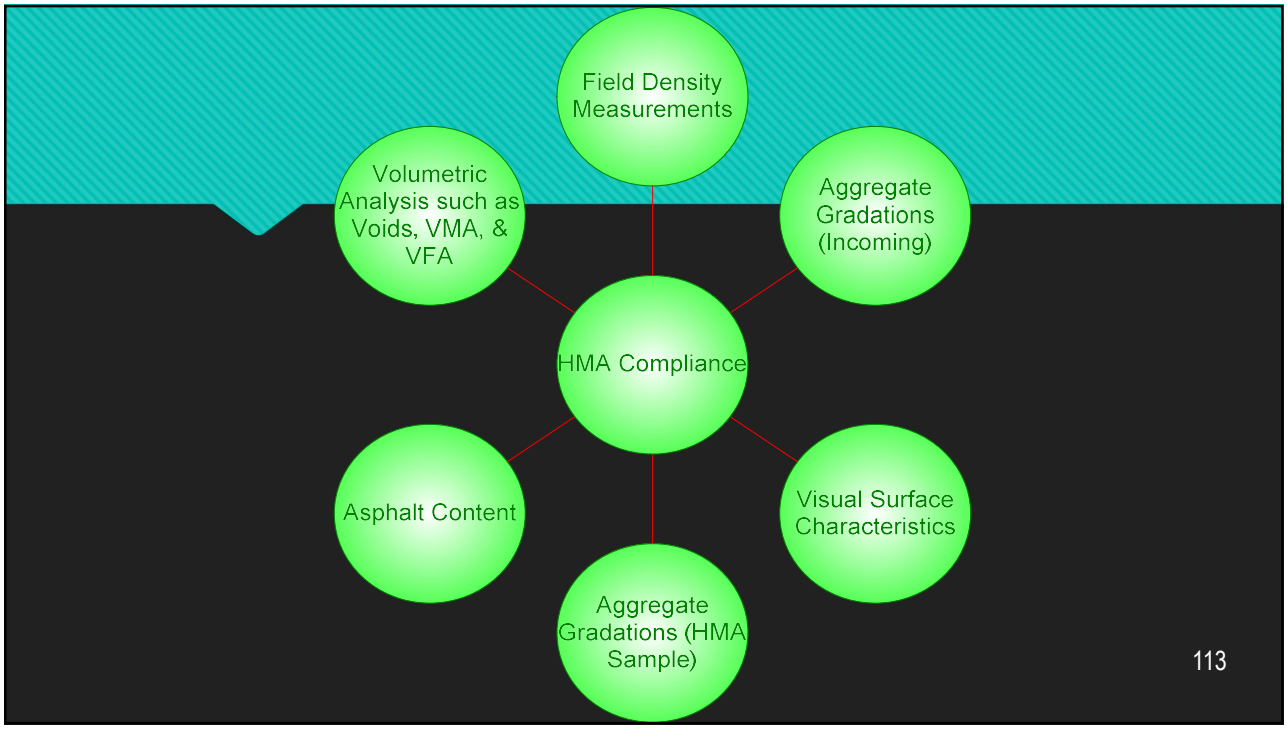
111

Asphalt Lifts and Locations

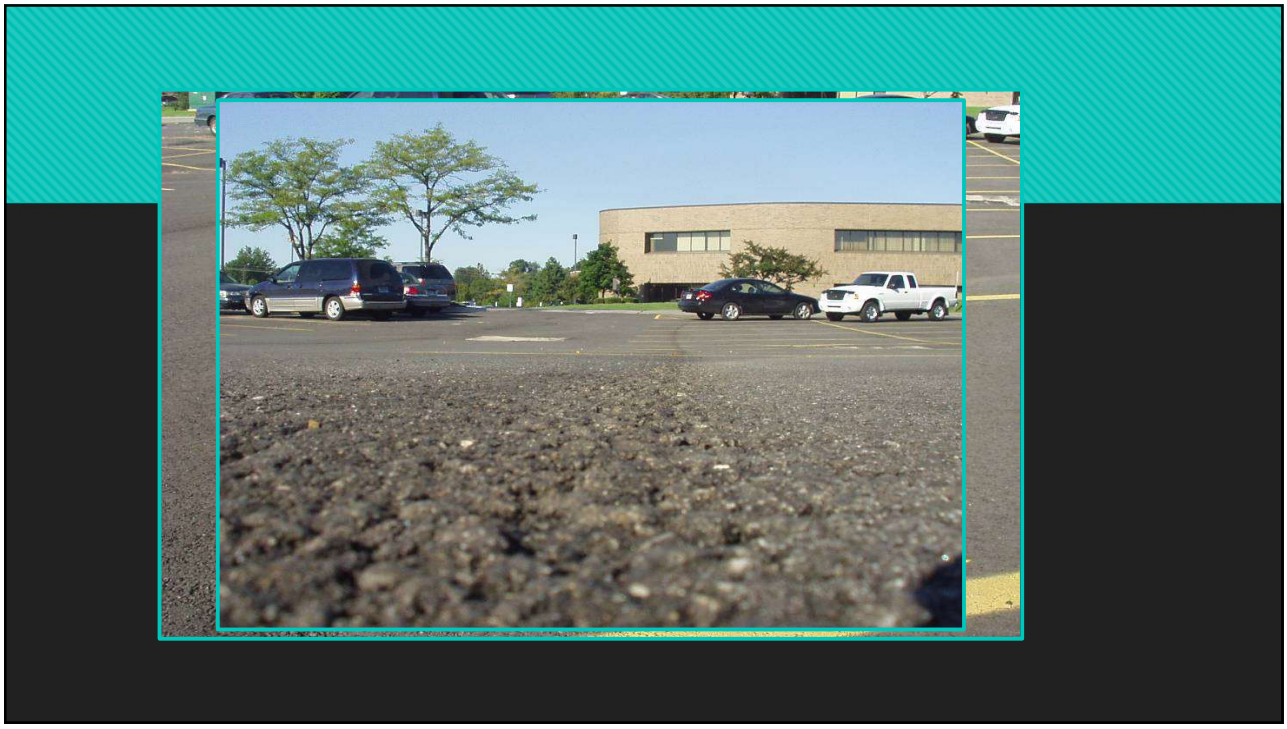
- Ensure 2 to 4 times the MAS for every lift.
- Ensure paving plan is approved.



112


Field Density Measurements
Volumetric Analysis such as Voids, VMA, & VFA
Aggregate Gradations (Incoming)
HMA Compliance
Asphalt Content
Visual Surface Characteristics
Aggregate Gradations (HMA Sample)
113

113



114

QC / QA Laboratory

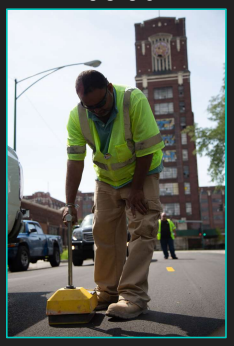
115

115

Field Testing for Compaction Compliance

Coring

Nuclear



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How to Maintain

4 Maintenance

Timely and consistent maintenance of a parking lot helps achieve the maximum life for the facility. The tools below will help ensure that the investment pays long-term dividends for the owner while providing users with a safe and attractive entry to the establishment.

Crack Sealing

All pavements will crack, and due to Wisconsin's extreme freeze/thaw cycles, it is extremely important to deal with cracks when they first appear in the pavement's life. Therefore, the first and most important of all maintenance activities is crack sealing.

The ideal time to do this maintenance is early spring when the cracks will be at their widest. As the ambient temperatures increase, the cracks will shrink and drive the crack filler deeper into the pavement. It may also be timely to perform crack sealing in the late fall to protect pavements against snow and ice damage. Crack sealing pavement cracks minimizes water infiltration into the pavement structure, and is a critical step in extending the service life of asphalt pavements.

Minor Repairs

As the pavement ages and isolated failures occur, these should be repaired as part of ongoing maintenance. The process is straightforward: identify the areas, saw-cut and remove the damaged pavement, over-excavate and stabilize the underlying subgrade as needed, fill in the area with asphalt mix, and compact. Alternatively, repairs may be conducted using infrared heaters or milling operations, depending on the type and severity of the damage.

Overlays

An asphalt overlay can be considered a maintenance technique if it is used early in the life cycle of a pavement to extend the time to reconstruction or replacement. This consists of repairing the isolated failed areas within the existing pavement structure followed by the installation of a new asphalt surface over the existing pavement. Please note:

- Milling of the existing surface in whole or part can be used to maintain elevations and drainage patterns.
- A leveling layer may be needed to re-establish smoothness prior to the overlay.
- Overlays should be constructed at a minimum of 1.5 inches.

Sealers

Asphalt sealers have been considered as a viable addition to a parking lot maintenance program, but they are only effective in certain circumstances.

If used, sealers should be applied early in the life of the parking lot and reapplied as necessary to provide protection against oxidation of the asphalt surface. Additionally, sealers can provide aesthetic benefits by giving the parking lot a new black look and allowing new pavement marking to stand out.

It is cautioned, however, that sealers are sometimes applied to old asphalt surfaces with the hope that this will extend the pavement life and delay replacement. This far exceeds the capabilities of sealers. Sealers are a surface treatment and as such they will wear off quickly under high traffic volumes and effectively do nothing for a pavement that is failing or has failed.

WAPA 2018

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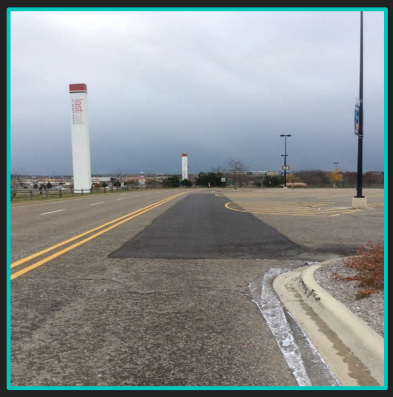
HMA Repairs



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PROACTIVE Pavement Management

Scenario:

- Your client invests ~$700K in a new parking lot with 163 stalls
- Validate the cost effectiveness of being PROACTIVE

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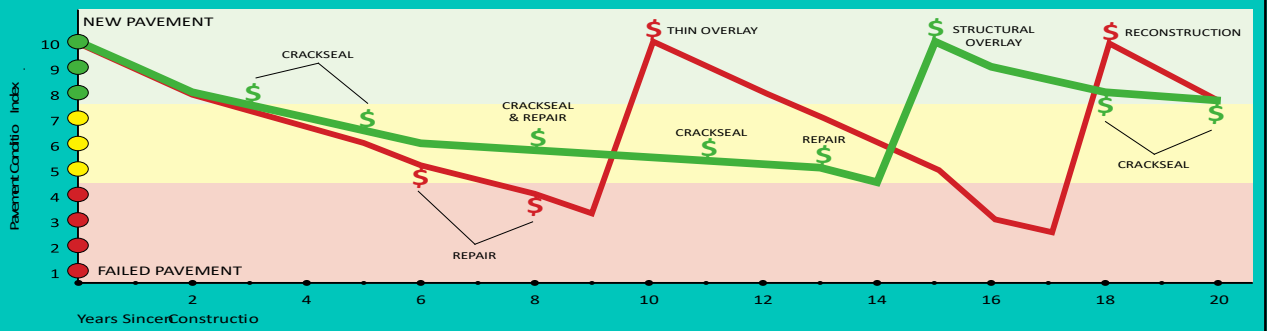
PAVEMENT MANAGMENT STRATEGY

PROACTIVE vs. REACTIVE



20-Year Ownership Expense

	REACTIVE	PROACTIVE
Total:	$387,500.00	$208,500.00
Per SY:	$77.50	$41.70
Per Stall:	$2,348.48	$1,263.64
Per Year:	$19,375.00	$10,425.00

* Data based on a 5,000 SY parking lot with 163 stalls.

120

Objectives

1. Understand the value and benefits of using asphalt pavement for parking lots and distribution centers.
2. Determine the key factors that must be evaluated for a proper thickness pavement design and review the PAVEXpress.com software package.
3. Learn ways to improve the end product through design considerations.
4. Select the appropriate asphalt mixture for the intended use as all asphalts are not the same and we'll discuss dense graded, thin lifts, and stone matrix asphalt (SMA)

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Summary

- Design Life
- Traffic
- Sub-grade
- Pavement Cross-section
- Environment
- Materials
- Workmanship

Pavement Thickness Design Success is Predicated on Achieving These Requirements

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TEACHING - TRAINING - TROUBLESHOOTING - TESTIFYING

Timothy R. Murphy, P.E.
PRESIDENT

Corporate Office:
7649 South State Street
Chicago, IL 60619
Office & Cell: 773.874.9800
Fax: NOPE
Email: tmurphy@murphypavetech.com
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Commercial and Industrial Asphalt Pavements

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