

# OHIO ASPHALT

*THE JOURNAL OF OHIO'S ASPHALT PROFESSIONALS*

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## TECHNICAL BULLETIN:

Cold Weather Paving

PAGE 10

.....

## TECHNICAL SEMINAR TOPICS:

Mix Type Selection to Optimize  
Pavement Performance

PAGE 20

.....

## Low-Volume Road Engineering

PAGE 22



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- 6 THE PRESIDENT'S PAGE  
'WHAT MORE RESILIENT PAVEMENT THAN A FLEXIBLE PAVEMENT?'
- 10 TECHNICAL BULLETIN  
COLD WEATHER PAVING
- 16 FPO SCHOLARSHIP PROGRAM  
A QUARTER CENTURY OF VISION & SUCCESS  
LONG RANGE STRATEGIC PLAN PROVIDES PATH FOR FUTURE LEADERS
- 20 TECHNICAL SEMINAR TOPICS, PART 7  
MIX TYPE SELECTION TO OPTIMIZE PAVEMENT PERFORMANCE
- 22 LOW-VOLUME ROAD ENGINEERING
- 24 FHWA ISSUES TECHBRIEF ON ASPHALT OVERLAYS FOR  
PAVEMENT PRESERVATION
- 25 MARK YOUR CALENDARS
- 26 INDEX TO ADVERTISERS

CONNECT ON



ON THE COVER: HARVESTED FIELDS, CHANGING LEAVES AND LONG SHADOWS ARE ALL SIGNS OF FALL IN NORTHWEST OHIO ALONG STATE ROUTE 199 IN WOOD COUNTY. THE RESURFACING OF S.R. 199 FROM ROACHTON ROAD TO S.R. 105 BY GERKEN PAVING INC. WAS A 2018 QUALITY AWARD-WINNING PROJECT. (PHOTO BY GERKEN PAVING INC.)



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## THE PRESIDENT'S PAGE



**CLIFFORD URSICH, P.E.**  
PRESIDENT & EXECUTIVE DIRECTOR

**“As a civil engineer, I see it somewhat frequently in trade magazines that engineers are rethinking infrastructure designs and systems. The motivation is, first, to use materials and systems less susceptible to damage from natural disasters. Second, when damage does occur, having the capability to quickly get infrastructure ‘up and running’ – particularly transportation infrastructure needed for emergency purposes, sustenance and commerce. The societal cost associated with failed infrastructure runs high, hence, the desire for resilience.”**

# ‘What More Resilient Pavement Than a Flexible Pavement?’

Last July, the National Asphalt Pavement Association reported the United States Senate Committee on Environment & Public Works unanimously approved America’s Transportation Infrastructure Act (ATIA) surface transportation reauthorization. At \$287 billion in highway spending, the ATIA would be the largest transportation reauthorization in history.

The legislation includes provisions to improve road safety, speed-up project delivery, reduce highway emissions, grow the economy and improve “resiliency” to disasters and extreme weather events like wildfires, hurricanes, flooding and mudslides.

One has to wonder how a transportation bill has much to do with wildfires, hurricanes, flooding and mudslides except for the fact that when such disasters happen a strategy is needed to ensure quick recovery that removes the impediment making possible the safe and free movement of people and goods. To that end it seems to be money well invested.

### DEFINING RESILIENCE

Not only has the concept of “resilience” shown up in Congress, it’s being routinely discussed among engineers of various disciplines. As a civil engineer, I see it somewhat frequently in trade magazines that engineers are rethinking infrastructure designs and systems. The motivation is, first, to use materials and systems less susceptible to damage from natural disasters. Second, when damage does occur, having the capability to

quickly get infrastructure “up and running” – particularly transportation infrastructure needed for emergency purposes, sustenance and commerce. The societal cost associated with failed infrastructure runs high, hence, the desire for resilience.

I’m unaware of a working definition or metric for judging infrastructure resilience – let alone our subset pavement resilience. Like the word “sustainability,” “resilience” can mean different things depending on context. However, Webster’s Dictionary helps some. I submit that the best means of judging infrastructure resilience – and pavement resilience more specifically – is by how well it achieves the desired outcome, which inferred in the ATIA highway reauthorization bill is: quick recovery.

**re•silience** \ ri-ˈzil-yəṇ(t)s\ – 1: 2:  
**an ability to recover from or adjust easily to misfortune or change.**

When we think of quickness (in construction), asphalt typically rises to our consciousness. After all, how often have we woken from a night’s slumber only to discover asphalt crews had worked through the night and renewed the paving surface for our morning commute? The media, years ago, coined this “stealth paving.” Ease of maintenance and speed at which asphalt pavements can be repaired are unquestionably the top reasons why road agencies choose asphalt. Certainly, that has some value when we consider resilience in a transportation network.

## RESILIENCE ECONOMICS

“Resilience” has economic implications. What’s resilience worth? How do we quantify value of a strategy? In keeping with the goal of quick recovery as inferred in the ATIA reauthorization act, speed of construction will be a large determiner of a strategy’s value. The greatest value will be from strategies that minimize user costs and inconvenience (system downtime). Speed of construction is paramount. Fortunately for asphalt, speed of construction is where we excel.

## RESILIENCE – IT’S ALREADY IN THE NAME

The asphalt industry has a leg up when it comes to resilience – it’s already in the name! The term “flexible pavement” comes right from the engineers’ textbook and describes a pavement system that by its nature adjusts and conforms to the foundation it rests upon – unlike “rigid pavement.” That’s not a triviality; it’s the core reason engineered deep-strength asphalt pavements in Ohio have been carrying interstate



loads in excess of 40 years without need for reconstruction. Being flexible makes asphalt versatile, long lasting – even perpetual. What more resilient pavement than a flexible pavement?

**O A**

# LETTERS TO THE EDITOR

As is my usual practice, whenever I receive the *Ohio Asphalt* magazine I immediately turn to the President's Page to see and hear what is new in the asphalt world. I do not have a degree in anything, but I have driven or been driven on the roads for 88 years and I believe I can contribute and suggest a terrific idea to improve and preserve the life of pavement.

I read that the New Jersey Dept. of Transportation recently said the state gets 14 years life from thin overlay on good roads vs. just seven years on bad roads. Well ... I propose the Asphalt Research Engineers get to work and develop a new product, namely FATLAY!! Then the states may choose their product according to their needs. They may choose overlays, inlays, thinlays ... or fatlays.

I hope you have a great day today.

**(Editor's note:** There you have it ladies and gents - the venerable Bernice Ursich, a.k.a. Mom)



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## Technical Bulletin: Cold Weather Paving 1, Oct. 2004 (Rev. 3 July 2019)

### Introduction

The issue of continuing to place asphalt concrete in cold weather comes up every autumn. Projects get delayed. The weather turns cold and damp. Specifications generally set weather and temperature limits beyond which paving is to be stopped; but, jobs often need to be completed in spite of the specification limits. Everyone starts to wonder whether they should continue to pave. The question is: "Will asphalt concrete pavement placed in cold weather perform adequately?"

A recent industry survey conducted and analyzed by a group of researchers at Auburn University<sup>1</sup> revealed the prevalence of this situation. The responses showed that in the north-central region of the country up to 5% of all projects get placed outside the normal paving season of April to November, and an even higher percentage are placed in adverse weather conditions overall.

The challenge of cold weather asphalt concrete paving is to achieve adequate compaction. There is general consensus that, if adequate density is obtained, the pavement will perform as expected. Thin courses and surface courses are at the greatest risk of low density and poor performance when placed in cold weather. Intermediate and base courses greater than 2 inches thick generally can be adequately constructed with little change in normal procedures.

### Compaction, Density, Voids, Impermeability & Durability

For durability and long-term performance, asphalt concrete pavements must be impermeable and have acceptable in-place air voids<sup>6</sup>. Asphalt pavement layers designed with dense-graded asphalt mixes are intended to be impermeable, and if they are not, pavement life is reduced. That's because, infiltration of water or air into a pavement can affect its durability. Infiltration of water may lead to moisture damage of the asphalt-aggregate bond and result in other forms of pavement distress such as raveling, cracking or rutting. Infiltration of air is likely to increase the potential for premature oxidation of the asphalt binder in the mix<sup>7</sup>.

Measures of compaction, density and air voids are all means of ensuring that a compacted pavement is impermeable. Unfortunately one density does not fit all mixes. Dense-graded asphalt concrete mixes are typically impermeable when in-place air voids are less than 8%; but, the size and interconnectedness of air voids influences permeability. Fine-graded mixes with natural sand-fine aggregates (e.g. Smoothseal, Thinlay, 404LVT) tend to be impermeable at lower densities and higher air voids, and are easier to compact than stiff, coarse-graded mixes with all crushed aggregates (e.g. 442, Type A).

Lift thickness also affects the ability to obtain adequate density. Studies have found that lift thickness affects in-place density and, hence, permeability. While historical guidance recommends a minimum ratio of lift thickness to nominal maximum aggregate size (t/NMAS) of 3, some have suggested that t/NMAS equal to 4 is preferred. In order to achieve adequate density and avoid permeability issues, appropriate recommendations for t/NMAS should be determined based on gradation and mix type<sup>6</sup>.

As a consequence of these facts, an owner and contractor must consider the mix type and lift thickness in determining the feasibility of obtaining adequate density under cold weather conditions.

### Time for Compaction

Cold weather compaction depends upon having enough time and enough rollers to obtain adequate density while the temperature of the asphalt concrete mat being placed is still within the compaction temperature range, approximately 275 to 175 degrees F.

What factors affect the time it takes for the mat to cool below 175 degrees F? All weather factors affect this time: air temperature, wind speed and the presence or absence of sunlight. The type and temperature of the surface on which the asphalt mix is to be placed is a factor too. But, the two most-important factors are the temperature of the mix and the thickness of the course being placed. It is generally accepted that, if conditions do not permit 10 minutes of time for compaction, adequate density may not be achievable.

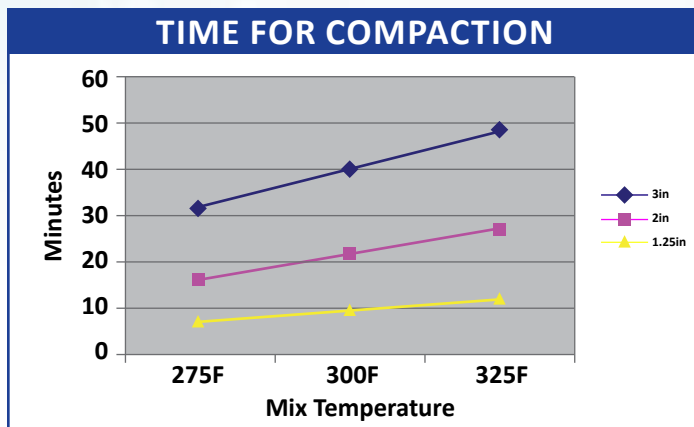


It is easy to determine this time for any set of conditions. Dickson and Corlew published cooling curves in 1970 from which you can read the time available for compaction for any given set of ambient and mix conditions. Examples of these charts are shown in the *Hot Mix Asphalt Paving Handbook*<sup>2</sup>. This task became even easier with the development of the PaveCool software by the Minnesota DOT (download PaveCool at <http://www.dot.state.mn.us/app/pavecool/index.html>). With the PaveCool software one can quickly determine the time available for compaction for any set of conditions and quickly compare the effects of changes in course thickness and mix temperature. Another tool is from NAPA (download MultiCool <http://www.asphaltpavement.org/multicool>). MultiCool has the capability of analyzing multiple layers.

For the conditions specified, the following chart shows the time available for compaction for various combinations of course thickness and mix temperature at placement.

Conditions:

- 30 degrees F air and base temperature
- 5 mph wind
- clear and dry
- mid afternoon
- mid-December
- Columbus, OH
- binder grade, PG 64-22
- a single course being placed on an existing asphalt concrete surface



**Example:** At a Mix temperature of 275 degrees F and course thickness 1.25 inches, the time available for compaction is 7 minutes – too short to realistically achieve density. If the mix temperature is raised to 325 degrees F and all others factors are the same, the time available for compaction is 12 minutes. Now you have a chance of getting it compacted before it cools below a temperature in which the mix cannot be consolidated. If the mix temperature is held at 275 degrees F, but the course thickness is increased to 2 inches, the time available for compaction is 17 minutes. It can be readily demonstrated using PaveCool that for any cold weather temperature there is a combination of mix temperature and course thickness that will provide adequate time for compaction.

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Contractors responding to the aforementioned survey<sup>1</sup> indicated that achieving proper density in cold weather could be difficult, but was not impossible.

The other challenge to adequate cold weather construction is economic. Cold weather construction will cost more. Can the extra costs be recovered?

In the following sections of the document we will discuss the changes in procedures needed to obtain durable construction during cold weather and identify extra costs associated with these changes.

### Plant Production

Mix temperature is one of the most-influential factors on time

available for compaction. So, an obvious solution is to produce hotter mix. But how much can the mix temperature be raised without causing damage and what is the cost?

Asphalt binder suppliers normally recommend a mixing temperature based on viscosity tests. The NAPA publication on *Cold Weather Compaction*<sup>3</sup> suggests that it is probably safe to mix at a temperature 18 degrees F above the recommended temperature. Above that, one risks excessively aging the binder or placing too thin a coating on the aggregates. Raising the mix temperature takes extra fuel and lowers the production capacity of the plant. An examination of the plant production tables in the *Hot-Mix Asphalt Paving Handbook*<sup>2</sup> indicates that raising the mixing temperature 25 degrees F can reduce

the production capacity of the plant by 15% or more. Likewise, increased aggregate moisture contents reduce the production capacity even more dramatically. Given the combination of need for a higher mix discharge temperature and the presence of colder aggregates with higher moisture contents, it is easy to see that the plant production rate may be cut in half to produce mix in cold weather. Stated otherwise, twice as much fuel may be required to produce mix in cold weather.

### Hauling & Temperature Segregation

The next challenge is to get the mix into the paver with as much of that heat left as possible. The first thought is to tightly tarp the truck beds. However, research<sup>4</sup> has shown that tarping of loads has little effect on the average temperature of the load for normal haul times. So, why bother? This raises the topic of temperature segregation. Temperature segregation is the presence of masses of mix in the mat with temperature differentials that prevent uniform compaction. When a load is transported in cold weather without a tarp, the cold crust that forms on the load may be run through the paver as a cold spot in the mat that cannot be adequately compacted. There is little consensus as to how important this phenomenon is. Some believe this may be an important issue in the performance of pavements, and, as a result, there has been a recent proliferation in



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equipment for re-mixing material as it is fed to the paver. Others point out that we didn't know about this effect until the advent of the thermal imaging camera. If wasn't a problem before, is it now?

Until this issue is resolved, the recommendation is to tightly tarp the loads to prevent exposure to precipitation and limit heat loss. Loose, flapping tarps may actually increase heat loss. Tarping loads will not significantly reduce heat loss but may result in a mix with more uniform temperatures, thereby minimizing the effect of temperature segregation.

All of the foregoing speaks to the basic objective in cold weather paving – keep the total time from mixing to compaction as short as possible. Haul trucks should not be kept waiting to unload into the paver. Minimize the handling and exposure of the mix. Windrow paving and transfer devices that extend the time and further expose the HMA to the environment should probably be avoided. Move the material directly from the haul truck as a mass into the hopper of the paver.

### Placement

If the asphalt concrete course is to be placed on an aggregate base, the base must be solidly compacted, at or below optimum moisture and not frozen. Frozen or excess moisture saps the heat out of the mat rapidly and may contribute to soft spots in the base. If being placed over an existing paved surface, the surface must be dry. Instances have been reported where contractors have used jet racetrack dryers or infrared heaters to dry the surface before placement of the asphalt concrete. Tack coat material must be set. How do you get that slow-setting emulsion tack coat to break and dry in cold, damp weather? You could use PG binder, non-tracking tack or rapid-curing liquid asphalt for tack, if you can get it.

Areas that require handwork or feathering of the mix can probably not be placed rapidly enough to permit adequate compaction. Construction of this type of work must be avoided during cold weather or considered to be temporary. Construction of transverse joints must be placed with good technique, starting off

with the screed at the joint and on starting blocks, so that time is minimized and the need for handwork is eliminated. Paver speed should be regulated to allow the available rollers to complete compaction within the time and temperature constraints. Other operations should follow the best techniques as would be practiced under any conditions.

### Rolling

The goal is to compact the mat while the mix is still within the compaction temperature range, 275 to 175 degrees F. The number, type and capacity of the rollers should be selected to accomplish adequate compaction within the time available, based on environmental conditions. More rollers and higher capacity rollers operating right behind the paver will be



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necessary to accomplish the compaction in the short time available. The use of rubber tired rollers may be the answer in obtaining density quickly. However, special care must be used to heat the tires to prevent mix pickup. Use the skirts around the tires. Contractors have fitted heaters within the skirt enclosures to pre-heat the tires and ducted the engine exhaust inside the skirt enclosures to keep the tires hot. Silicone-based additives are on the market for mixing into the water used to prevent mix pick-up on the tires. The provision of additional rollers and their operators, heating of tires and special-release additives all represent additional costs of cold weather paving that must be accounted for.

### Specifications & Quality Assurance

Is it worth extra cost and effort to place asphalt concrete in cold weather? Ultimately, only the person paying the bill can answer that question. If a decision is made to place the asphalt concrete in spite of the cold temperatures, it usually costs a lot less to do the job right the first time than it does to do it over. Research out of Washington State has indicated that even a few percentage points less density results in double-digit percentage losses in durability (life of the pavement). So, if you're the

owner, it probably makes sense to invest the extra cost to get adequate density, if you absolutely have to have the work completed in cold weather.

How do you handle the extra cost and payment for this extra effort? The usual way is by change order, but scarce, suitable working days can be lost while such things are negotiated and processed. If an owner anticipates that such a situation might occur on his project, it may be worthwhile to set up an alternate bid item for the extra cost of cold weather paving in order to establish in advance a price for the extra work needed to adequately place and compact asphalt concrete in cold weather. Issues such as changes to course thickness and mix type would have to be addressed and some quality assurance or acceptance measures might have to be altered. If the project were to be a density acceptance project (ODOT, Item 446 or 448 with density QC) then the effectiveness of the contractor's compaction procedures would be revealed by the acceptance cores. If, however, the method of acceptance is another basis, then some other measure for verifying the effectiveness of the contractors placement and compaction procedures would have to be established in the specifications. The owner may require



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the placing of a control or test strip, to ensure that minimum acceptable density results from the contractor's proposed procedures. For information on constructing a control strip, see reference 5.

### Warm Mix Asphalt Technology

The asphalt paving industry has developed warm mix asphalt (WMA) technologies to produce asphalt concrete paving mixtures at significantly lower mixture and placement temperatures. Several different technologies using either additives or coating processes are currently in the marketplace. For a complete description of this developing technology visit [www.warmmixasphalt.org](http://www.warmmixasphalt.org).

Early experience with these WMA technologies shows potential for easier compaction at lower temperatures. Quicker compaction can aid with asphalt paving in cold weather. WMA may provide another tool for coping with the challenge of paving in cold weather.

### Summary & Conclusions:

Asphalt paving can be successfully accomplished in cold weather without compromising the performance of the pavement, but expect costs to be higher. The goal is to ensure adequate time to finish compacting the mix, while it is still in the compaction temperature range (275 to 175 degrees F). Time available for compaction is most dependent upon the temperature of the mix and the thickness of the layer being placed and less dependent upon the environmental conditions. Making adequate time available for compaction can be accomplished by taking steps to alter these dependent variables and to minimize the time of exposure of the mix between mixing and compaction. Specific actions may include any or all of the following as necessary:

- Increase the mix temperature
- Increase the layer thickness and/or change the mix type to a fine-graded mix that can be more easily compacted and is likely to be impermeable at lower density/higher air voids (caution: adequate rutting resistance for the traffic is always the first consideration in selecting mix type)
- Minimize haul time
- Work the rollers as close to the paver as possible
- Use more and/or higher capacity rollers
- Use warm mix asphalt

Handwork and feathering can probably not be adequately performed in cold weather. So, these operations should be avoided; or, if necessary, the results should be considered as temporary surfaces to be replaced in suitable conditions.

Of course, placing a thin HMA course in cold weather should be avoided, if possible. Placing a relatively thick intermediate course, which can be used as the temporary wearing surface until proper conditions return for placing a thin surface course, will involve little change to construction procedures and less risk of poor performance.

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6. NCHRP Report 531, Relationship of Air Voids, Lift Thickness, and Permeability in Hot Mix Asphalt Pavements
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R.B. Mallick, et.al.

*All reasonable care has been taken in preparation of this Bulletin. However, Flexible Pavements of Ohio can accept no responsibility for the consequence of any inaccuracy that it may contain.*



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# FPO SCHOLARSHIP PROGRAM A QUARTER CENTURY OF VISION & SUCCESS

## Long Range Strategic Plan Provides Path for Future Leaders

As you think of all the advancements in the flexible pavements industry over the past quarter century, you cannot overlook what has occurred during that time on university campuses across Ohio.

Just as the industry has made vast improvements in the quality of materials and technologies from the base to surface levels of its pavements, there has been much improvement in the preparation of future industry professionals from the ground up thanks to the Ohio Asphalt Pavement Industry Scholarship Program.

A look at college curriculums in Ohio as they relate to instruction in asphalt technologies was nearly non-existent prior to the mid-1990s. With the inception of Flexible Pavements of Ohio's Asphalt Pavement Industry Scholarship Program, college students, who are studying civil engineering and construction management at Ohio universities, are being offered courses such as Pavement Analysis and Design 437, Design and Construction of Flexible Pavements 4552, Pavement Engineering 565 and more.

For the 2019-2020 academic year, coursework in asphalt technologies is being offered at 11 Ohio universities – which includes the addition of Cleveland State University.

The genesis of the Ohio Asphalt Pavement Industry Scholarship Program was the 1994 Long Range Strategic Plan, which formed the scholarship program that:

- Encourages students to gain knowledge in flexible pavements by requiring scholarship recipients to enroll in at least one course in asphalt pavement technology
- Promotes the offerings of training by colleges and universities in asphalt pavement technology by creating a student demand for the course
- Provides close ties among the asphalt industry and universities to not only raise the awareness of asphalt pavement technology in the academic community but to also foster asphalt pavement-related research
- Create a workforce trained in asphalt technology

As a result of the 1994 Long Range Strategic Plan, the Ohio Asphalt Pavement Industry Scholarship Program began the following year. Since 1995, and with the addition of the 22 recipients of 2019-2020 scholarships, 487 students have benefitted from the program. This fall, Ohio Asphalt Pavement Industry Scholarship recipients will receive one-year scholarships of \$1,000 or \$2,000 – bringing the total amount given since 1995 to \$665,099.

Just as much has happened in the last 25 years with advancements in the flexible pavements industry, many changes have occurred in the scholarship program since FPO's 1994 Long Range Strategic Plan formed the Ohio Asphalt Pavement Industry Scholarship Program. Changes include the inclusion of construction management and construction engineering programs in scholarship eligibility; the granting of scholarships to graduate students majoring in asphalt pavement technology; and additional donors expanding the number of scholarships awarded.

**See scholarship fund contributors, page 18**



2019-2020

# FPO ASPHALT PAVEMENT INDUSTRY SCHOLARSHIP RECIPIENTS

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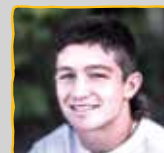
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# FPO ASPHALT PAVEMENT INDUSTRY SCHOLARSHIP FUND CONTRIBUTORS

The following companies and individuals have contributed to endow the Ohio Asphalt Pavement Industry Scholarship Fund through the National Asphalt Pavement Association Research & Education Foundation (NAPAREF):

Osama Abdulshafi, Ph.D.  
Barrett Paving Materials Inc.\*  
Bowers Asphalt & Paving Inc.  
Wayne & Debbie Brassell  
Burgett Family/Kokosing  
Construction Co. Inc.\*  
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H.P. Streicher Inc.  
Thomas Asphalt Paving Co.  
Valley Materials Inc.  
William H. Fair, P.E.

\*Denotes pledges of \$50,000  
or more

## 2020-2021 FPO SCHOLARSHIP ENTRY DATES SET

Flexible Pavements of Ohio is pleased to announce the 25th year of its Ohio Asphalt Scholarship Program. The period for submitting online applications for the 2020-2021 academic year will be Dec. 1, 2019 through Jan. 31, 2020. During this period, students may find information about the program and apply using the online application on the Flexible Pavements of Ohio website at: <http://www.flexiblepavements.org/scholarships/asphalt-scholarships-program>.

The college scholarship program is available to undergraduate civil engineering and construction management/engineering students in their sophomore or junior years who will be juniors or seniors during the 2020-2021 academic year. Scholarship recipients must agree to take a course in asphalt pavement technology before graduating. Graduate civil engineering students studying asphalt pavement technology are also eligible.





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## Technical Seminar Topics, Part 7

# Mix Type Selection to Optimize Pavement Performance

*(Editor's note: This is a continuation of our Technical Seminar series on Composite Rehabilitation.)*

The final topic in our Technical Seminar series of articles will be Mix Type Selection to Optimize Pavement Performance. We will review mix selection for heavy- and medium-traffic applications. In subsequent issues, we will conclude the discussion of heavy and medium mix selection by addressing mix selection for projects with unique or unusual characteristics, and we'll review some fine-graded surface course options for your project. We'll then complete this series by reviewing mix selection options for low-volume or light-traffic roadways.

Selection of the most-appropriate asphalt concrete (Surface and Intermediate) for your composite pavement rehabilitation project will typically be based on the number of daily trucks, i.e. Type B and C opening day trucks, on your route. The Ohio Department of Transportation (ODOT) defines Type B trucks as multi-unit vehicles such as semi-tractor trailers. Type C trucks are defined as single-unit trucks (dual tired with either single or tandem rear axles) and busses.

The ODOT Pavement Design Manual (PDM) further defines projects with more than 1,500 trucks on opening day as heavy-traffic routes and stipulates Item 442 - Superpave Asphalt Concrete as the appropriate mix to be used for heavy-traffic applications.

Let's briefly review the Superpave mixes that could be used on your project if you had trucks that qualified as heavy-traffic.

The most-common heavy-traffic intermediate course is an Item 442 19mm mix using a PG64-28 binder. Lift thickness for this mix ranges

from 1.75 inches (minimum) to 3 inches. To minimize segregation, improve density and reduce permeability it is very important to place this mix at 1.75 inches or greater. The Superpave specification also provides a 9.5mm intermediate course. This mix is primarily for use as a scratch course and not as common as a 19mm intermediate in heavy-traffic applications. For heavy-traffic surface courses, the Superpave specification provides a 12.5mm mix with a modified PG70-22M polymer. The lift thickness for a 12.5mm surface course ranges from a minimum of 1.5 inches to 2.5 inches.

Also note that all Superpave mixes include a Type A or Type B designation, which indicates aggregate gradation and angularity. Type A aggregate is more common because it provides a high-quality crushed aggregate for maximum stability and resistance to deformation or rutting. Type B aggregate is less common but it is specified when an aggregate with less restrictive crush requirements is acceptable, maximum stability/rut resistance is not required, or where Type A aggregate availability is limited or unusually expensive.

For medium-traffic applications, defined by ODOT as a route or a section with less than 1,500 Type B & C opening day trucks, ODOT recommends Item 441 - Asphalt Concrete. Item 441 mixes typically use PG 64-22 binder and a combination of natural and manufactured aggregates with finer gradation requirements than Superpave specifications.

Item 441 provides a Type 2 intermediate mix that is similar in application to a Superpave 19mm mix. A Type 2 intermediate mix adds strength



and stability and can be placed at a lift thickness ranging from a minimum of 1.75 inches to 3 inches. Similar to 19mm mixes, Type 2 intermediate mixes should always be placed at 1.75 inches or greater to minimize segregation, improve density and decrease permeability. Type 1 intermediate is also available for medium-traffic applications. This mix is primarily intended to be used as a scratch or leveling course with lift thickness, in most cases, ranging from 1 to 1.5 inches. Type 1 intermediate also tends to be more popular than Type 2 intermediates on medium-traffic routes, in most cases, simply due to lower traffic demands and thinner overlays.

Based upon the mixes described, a typical 3-inch +/- composite pavement rehabilitation treatment for heavy-traffic would specify Item 442 Superpave Asphalt Concrete, and would most often consist of 1.75 inches of 19mm intermediate and 1.5 inches of 12.5mm surface. A similar medium-traffic rehabilitation treatment would specify Item 441 Asphalt Concrete and consist of either 1.75 inches of Type 2 or 1-inch Type 1 intermediate with a 1.25-inch Type 1 Surface.

### Tip:

Refer to ODOT PDM Section 400, Figure 406-1 for the *Asphalt Concrete Quick Reference Guide*. This guide is a great reference for designers and specifiers and provides minimum and maximum lift thickness for all ODOT asphalt concrete materials. The guide also indicates if a mix can be tapered to 0 inches and whether or not a uniform lift thickness is required (typically related to density acceptance).

So, if ODOT's *Pavement Design Manual* is followed, all projects with heavy-traffic will use standard Item 442 Superpave Asphalt Concrete and projects with medium-traffic will use Item 441 Asphalt Concrete. Right?

For many projects in Ohio, this relatively simple approach is acceptable and appropriate. But there are exceptions, unique characteristics or borderline conditions where mix selection could deviate from the Standard Item 442 and 441 mixes described above.

A few words of caution may be in order, particularly when dealing with medium-traffic Item 441 mixes and high-stress locations. Mix adjustments or modifications for these conditions could be critical to project success. Asphalt concrete for high-stress locations will be addressed in more detail in our next article.

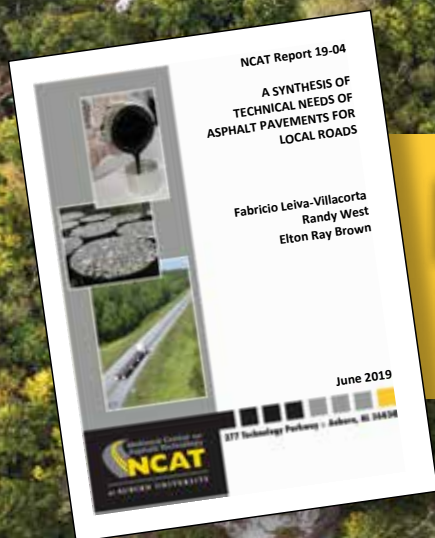
Remember, we're discussing mix selection to "optimize performance." So, our goal is to determine the best and most appropriate mix to meet or exceed the performance objectives for your particular project. Discussed in the next issue of *Ohio Asphalt* will be options to modify or adjust Item 441 or Item 442 mixes for unique conditions – including high-stress locations. Also reviewed will be fine-graded surface course alternatives that may be attractive and appropriate for select projects.

Asphalt Concrete Quick Reference Guide page 1			406-1 January 2019 Reference Section 406	
Item	Minimum Lift	Maximum Lift	Taper to 0**	Uniform Thickness Required
301 Asphalt Concrete Base	3"	6"	No	No
301 Asphalt Concrete Base	4"	7.75"	No	No
424 Fine Graded Polymer Asphalt Concrete, Type A	0.625" (5/8)	1"	No	Yes
424 Fine Graded Polymer Asphalt Concrete, Type B	0.75"	1.25"	No	Yes
441 AC Surface Course, Type 1 (448)	1"		No	No
441 AC Surface Course, Type 1 (446)	1"		No	Yes
441 AC Intermediate Course, Type 1 (448)	1"		Yes	No
441 AC Intermediate Course, Type 2 (448)	1.75"		Yes	No
441 AC Intermediate Course, Type 2 (446)	1.75"		No	Yes
442 AC Surface Course, 12.5mm, Type A or B (446)	1.5"		No	Yes
442 AC Surface Course, 9.5mm, Type A or B (446)	1"		No	Yes
442 AC Surface Course, 12.5mm, Type A or B (446)	1.5"		No	Yes
442 AC Surface Course, 9.5mm, Type A or B (446)	1"		No	Yes
442 AC Surface Course, 12.5mm, Type A or B (446)	1.5"		No	No
442 AC Surface Course, 9.5mm, Type A or B (448)	1"		No	No
442 AC Intermediate Course, 19mm, Type A or B (446)	1.75"		No	Yes
442 AC Intermediate Course, 19mm, Type A or B (448)	1.75"		Yes	No
442 AC Intermediate Course, 9.5mm, Type A or B (448)	1"		Yes	No
443 Stone Matrix Asphalt Concrete, 12.5mm (446)	1.5"	2"	No	Yes
443 Stone Matrix Asphalt Concrete, 12.5mm (447)	1.5"	2"	No	Yes

Asphalt Concrete Quick Reference Guide page 2			406-1 January 2019 Reference Section 409	
Item	Minimum Lift	Maximum Lift	Taper to 0**	Uniform Thickness Required
803 Rubberized Open Graded Asphalt Friction Course	0.75"	0.75"	No	Yes
826 AC Surface Course, Type 1, (448), Fiber A, B, or C	1"	1.5"	No	No
826 AC Intermediate Course, Type 2 (448), Fiber A, B, or C	1.75"	3"	No	No
826 AC Intermediate Course, 442 12.5mm, (448), Fiber A, B, or C	1"	1.5"	Yes	No
826 AC Intermediate Course, 442 19mm, (448), Fiber A, B, or C	1.75"	3"	Yes	No
857 AC with Gilsonite, Surface Course, Type 1 (designed for <1500 trucks)	1"	1.5"	No	**
857 AC with Gilsonite, Surface Course, Type 1 (designed for >1500 trucks)	1.5"	2.5"	No	**
857 AC with Gilsonite, Intermediate Course, Type 2	1.75"	3"	No	**
859 AC with Verglinit	1"	2.5"	No	Yes

\*A "Yes" value in this column indicates the material can be specified at a 0" minimum in variable depth applications such as a rut fill course or it can be feathered to 0" at the beginning and end of paving. A "No" value indicates the minimum lift thickness is required at all times and a butt joint is required at the beginning and end of paving (intermediate courses may taper and end as shown in the butt joint detail in BP-3.1).

\*Acceptance and the need for a uniform lift thickness for item 857 depends on the total quantity of material used. If the total quantity is 250 tons (250 metric tons) or greater, 446 acceptance is used and a uniform lift thickness is required. Less than 250 tons (250 metric tons), 448 acceptance is used and a variable lift thickness is allowed.



# LOW-VOLUME ROAD ENGINEERING

**A recent National Center for Asphalt Technology (NCAT) report (NCAT Report 19-04) should be of interest to engineers responsible for low-traffic volume roads (LVRs).**

The report, "A Synthesis of Technical Needs of Asphalt Pavements for Local Roads," provides guidance on many of the challenges in the design, construction and management of LVRs. The report confirms that the needs for LVRs, especially asphalt concrete materials, are quite different from high-traffic highways and are not well served by the usual state specification materials intended for those heavy-traffic highways. The report identifies the need for simple guides for these issues and especially for materials for LVRs.

For design of overlays and rehabilitation or LVRs pavements, the report recommends using PAVExpress, a free online design tool that can be accessed through the FPO website at <http://www.flexiblepavements.org/technical-resources/pavement-design-resources/pavement-design-resources>.

Among the report's recommendations for asphalt concrete materials are:

- Higher percentages of natural sands may permit more economical and workable mixes
- Aggregate gradation ranges should be limited to smaller maximum particle sizes to aid compaction and to improve resistance to water intrusion
- Binder grade should be selected based on climate and not for traffic considerations
- Volumetric mix design criteria should be adjusted to achieve higher asphalt contents for improved compact ability, lower permeability and improved cracking resistance

The 37-page NCAT report can be downloaded at <http://eng.auburn.edu/research/centers/ncat/files/technical-reports/rep19-04.pdf>.

Fortunately, in Ohio, many of these issues have been or are being addressed. Asphalt concrete material specifications have been developed and are being used to improve surface performance on LVRs. Research has and continues to take place to confirm design parameters and materials specifications for LVRs through the Ohio's Research Initiative for Locals (ORIL) research program.

Flexible Pavements of Ohio (FPO) has developed asphalt concrete specifications specifically for use on LVRs and Technical Bulletins have been created that describe their appropriate use. Technical Bulletins and specifications for 404LVT and Thinlay Asphalt concrete can be found on the FPO Technical Resources website at <http://www.flexiblepavements.org/technical-resources/technical-resources>.

In addition, an ORIL research project (SJN 134991) conducted by Ohio University identified appropriate AASHTO 93 design layer coefficients, which can be used with PAVExpress for various reclaimed materials commonly used in the rehabilitation of LVRs. This report was summarized in the Summer 2016 edition of *Ohio Asphalt*, which can be found at [http://www.flexiblepavements.org/sites/www.flexiblepavements.org/files/ohio-asphalt-pdf/14173\\_ohio\\_asphalt\\_summer\\_2016.pdf](http://www.flexiblepavements.org/sites/www.flexiblepavements.org/files/ohio-asphalt-pdf/14173_ohio_asphalt_summer_2016.pdf). The full report can be found on the ORIL website: <https://cdm16007.contentdm.oclc.org/digital/collection/p267401ccp2/id/13560>.

So, if you are an engineer responsible for LVRs, we recommend that you read the NCAT report and use the asphalt concrete materials specifically available for LVRs to achieve project success and improve the performance of your low-volume pavements.





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# FHWA Issues TechBrief on Asphalt Overlays for Pavement Preservation



The Federal Highway Administration (FHWA) has issued a new (June 2019) TechBrief (FHWA-HIF-19-053) on "The Use of Thin Asphalt Overlays for Pavement Preservation," which agencies may find useful in

understanding the concepts of pavement preservation and the most advantageous use of thin asphalt concrete overlays (Thinlays) as a pavement preservation treatment (PPT) within such a strategy.

The TechBrief contains guidance on:

- The benefits and limitations of thin overlays
- When to use thin overlays, including a discussion of factors to be considered in preservation project development
- Mix design considerations
- Construction practices and quality control, including discussions of expected performance (life) of properly used thin asphalt overlays

Sections 1, 3 and 5 of the TechBrief explain the best applications of a PPT. This guidance may be helpful to agencies in selecting an appropriate treatment for their pavement conditions, traffic and climate. In general, the TechBrief stresses the importance of restricting PPTs to pavements that are in good structural condition in order to get optimum performance.

Section 2 discusses the benefits of using a thin asphalt overlay as a PPT:

- Improve surface smoothness and achieve a better ride
- Reduce wheel path rutting to improve safety
- Reduce water intrusion to maintain the pavement structure

- Restart the surface aging process (i.e. refresh the wearing surface) and slow asphalt binder property changes in the existing asphalt pavement (e.g. stiffness that can result in cracking)
- Decrease pavement surface noise

The TechBrief acknowledges that because of the difficulty of quantifying the smoothness and the ride and noise from the surface texture, the agency/agencies considering those levels of service benefits are in a better position of making PPT decisions. It is important to remember that ride and texture are the most-important factors to the road users. The TechBrief states that research is developing analysis procedures to quantify and compare service value benefits, which agencies can use to improve the cost-benefit ratio.

While Section 4, which deals with asphalt mix design, may be of interest to mix design technicians, it perhaps won't be very helpful to pavement managers. Fortunately, in Ohio we have a choice of mixes that have already been developed specifically for thin overlays. The premium material is ODOT Item 424, Fine-Graded Polymer Asphalt Concrete. We also have available Thinlay Asphalt Concrete, ODOT Item SS 860 (or FPO's Thinlay Specification) and FPO Specification 404LVT.

Section 5 discusses project development and pavement structure design. The TechBrief explains the need for adequate evaluation of a candidate project before selecting a PPT. The TechBrief explains that thin asphalt overlays used as PPT are not normally selected to strengthen a pavement. However, when applied appropriately to a pavement in good structural condition, a thin overlay does add strength to the pavement.

Section 6 of the FHWA TechBrief pertains to construction practices and quality control, which should be of interest to owners and inspectors as well as paving contractors. Of particular interest are the cautions about ensuring proper compaction. The TechBrief emphasizes that density measurement cannot be used on thin lifts, and as a consequence, the development and consistent use of an adequate rolling pattern is necessary. The other critical issue mentioned is that thin lifts have very little time available for compaction before they cool, and so the rolling must be completed quickly.

Section 7 presents information on the expected performance of thin asphalt overlays used as pavement preservation treatments.

The list of references in the TechBrief contains a wealth of information for those designing a pavement preservation program. Of particular local interest is the study performed for ODOT/FHWA by Dr. Chou at the University of Toledo, "Effectiveness of Thin Hot Mix Asphalt Overlay on Pavement Ride and Condition Performance."

*The TechBrief can be downloaded at [https://www.fhwa.dot.gov/pavement/pub\\_details.cfm?id=1093](https://www.fhwa.dot.gov/pavement/pub_details.cfm?id=1093).*



# Mark Your Calendars

## Asphalt Pavement Technical Seminars

These seminars will provide practical information on designing, specifying and constructing asphalt pavements for local roads, streets, driveways and parking lots. If you construct, inspect, manage or maintain local or private transportation infrastructure these seminars have the information you need to ensure a successful, long-lasting asphalt pavement.

### Northeast Ohio

**October 17, 2019**

Holiday Inn Independence, 6001 Rockside Rd., Independence, OH 44131

### Southwest Ohio

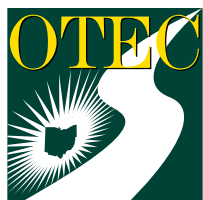
**October 22, 2019**

Colas NACTECH Research Laboratory, 7374 Main St, Cincinnati, OH 45244

### Northwest Ohio

**October 24, 2019**

Holiday Inn Toledo-Maumee, 1705 Tollgate Dr., Maumee, OH 43537



## Ohio Transportation Engineering Conference

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Visit the OTEC website for up-to-date conference information as well as archived material from previous conferences at <https://otec.transportation.ohio.gov/>.

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## Ohio Asphalt Paving Conference February 5, 2020

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# ADVERTISERS INDEX

Asphalt Materials Inc. ....	8	The Gerken Companies .....	5	SealMaster .....	12
Asphalt Shingle Grinding Service LLC ....	23	John R. Jurgensen Company .....	5	The Shelly Company .....	14
BOCA Construction .....	15	Kokosing Construction Company Inc. ....	23	Shelly & Sands Inc. ....	26
Columbus Equipment Company .....	3	The McLean Company .....	BC	Southeastern Equipment Company Inc. IBC	
Columbus Equipment Company .....	IFC	The McLean Company .....	13	Transtech Systems Inc. ....	11
Ebony Construction Company .....	19	Northstar Asphalt Inc. ....	19	Unique Paving Materials Corporation .....	8
Hahn Loeser & Parks LLP .....	26	Ohio CAT .....	8		



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