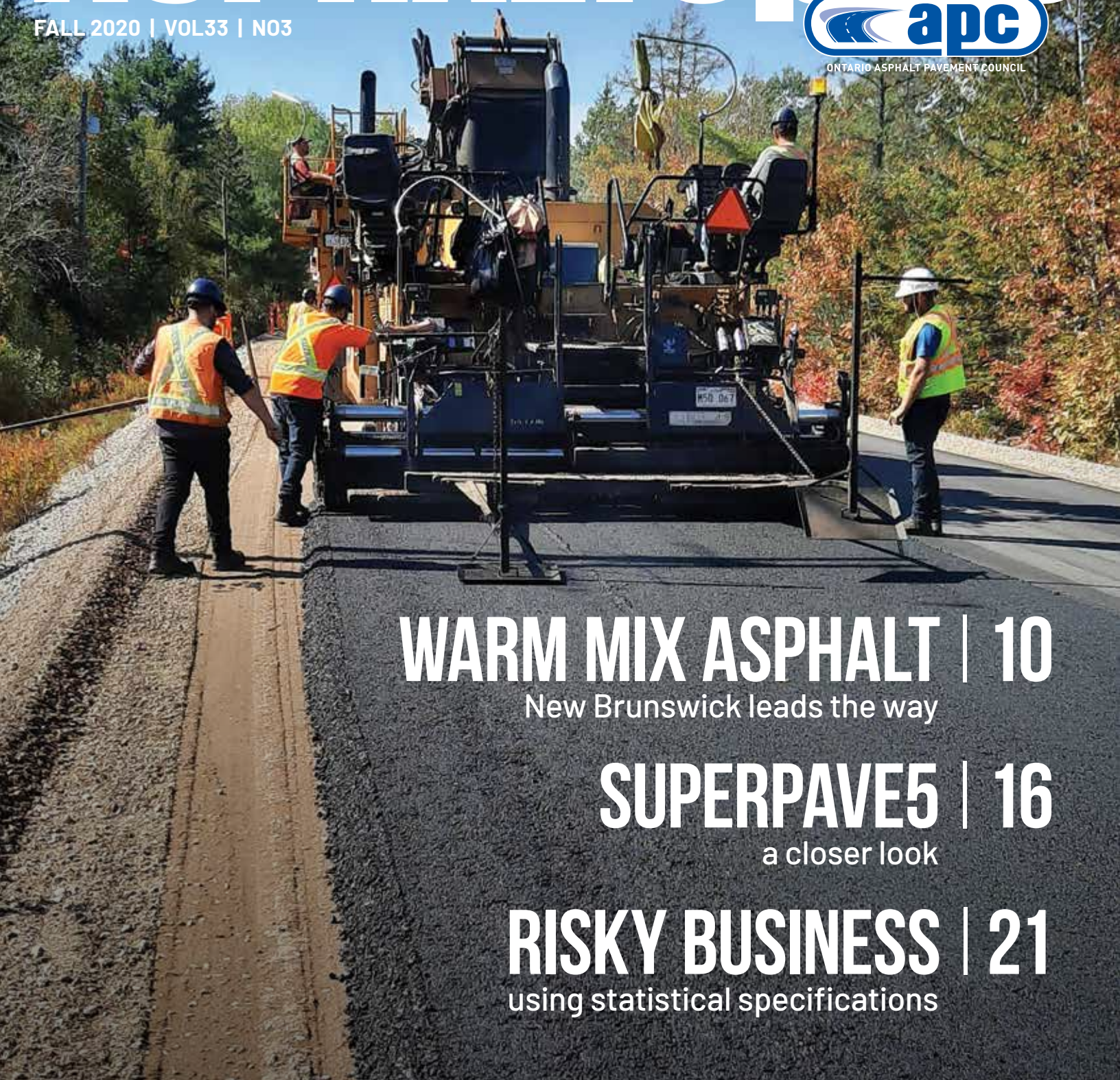


ASPHALT**topics**

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Route 101 outside of Welsford (south of Fredericton), New Brunswick. (DTI NB)

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CHAIR'S CORNER

Ivan Levac
Chair

Navigating COVID-19

I will begin by stating how fortunate I am, and what an honour it is, to represent OAPC'S directors, members and associates as the 2020 chair.

This year continues to be unprecedented. The extraordinary disruptions to our lives have created new challenges that only add to an already demanding work environment. With the province gradually easing restrictions since my last article, certain aspects of our work have more or less returned to normal. Other aspects have not and continue to create obstacles in our industry and society in general.

I will share my family's experience. My oldest son began coughing on a Thursday evening and needed to test negative and remain without symptoms for more than 24 hours prior to returning to school. Before he could return, my youngest son also began coughing and needed to go through the same process. Both tested negative but missed a week of school. During this period, my spouse and I were able to work from home to ensure the boys were cared for and missed very little of their schoolwork. Thankfully we had the ability to do that!

I share that story only to say that I fully recognize that for the majority of the workforce in our industry, working from home is not an option. Many construction workers are juggling ever-changing public guidelines and restrictions in addition to their job. I sincerely hope the public truly recognizes and appreciates construction workers, in particular seasonal workers, for their ability to overcome the logistical and operational challenges created by the COVID-19 pandemic.

Despite the pandemic, OAPC committees maintain their resolve to improve our industry. The Plant and Paving Committee published the *COVID-19 Asphalt Industry Best Practices Guide*. In addition to the ongoing Trillium Award, the committee is also implementing a Fundamentals of Asphalt Plant Operations course to help our membership train and develop staff.

The Hot Mix Paving Committee, with support of the HMA Technical Working Group, continues to work with owners and associations to improve specifications to balance the realities of constructability and resources with the highest level of quality. Some initiatives they are actively involved with include contract specifications related to recovered asphalt cement testing, utilization of recycled asphalt pavement, and tack coat cure periods and application rates.

The Marketing Committee continues to work with ORBA to update many learning opportunities into electronic formats, as well as keeping communication flowing with monthly bulletins, social media blasts and *ASPHALTopics*. The COVID pandemic has created huge inconsistencies in permitting requirements for asphalt plants, and the Environment Committee is working tremendously hard trying to clarify and standardize requirements.

I hope you will enjoy reading the rest of this *ASPHALTopics* as much as I will. It is truly a great source of information and highlights the tremendous work performed by our council, staff, committees, and volunteers who care about promoting the value of quality asphalt! ■



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Doubra C. Ambaiowei

Technical Director

We are very pleased to now have the full ten factsheets published. Notwithstanding, we will continue to keep the quality message in focus. Please be sure to visit the OAPC and ORBA websites for these and more asphalt news, resources and advocacy initiatives.

With special thanks to our virtual Fall Asphalt Seminar speakers, this issue of *ASPHALTopics* features articles to further our understanding of warm mix implementation per New Brunswick's experiences, movements towards the Superpave 5 concept, and the application of statistical specifications and balancing risks. You can look forward to hearing directly from each speaker, including outcomes from our consultation review processes that are specific to bituminous specification updates and next steps from the Ontario Ministry of Transportation, at this year's virtual Fall Asphalt Seminar on November 26.

As you digest the contents of this issue, here is a gentle reminder that we need you. Collaboration cannot happen without communication. The technological advances and resources available in this era allow for efficient communication and innovation in our revised approach to problem-solving. Therefore, we look forward to your continuing interest and involvement in the council's activities and programs. Thank you for the continuing participation and engagement. Please stay safe! ■

What we have been up to

These are unprecedented and uncertain times. Through the upheaval we are enduring with the COVID-19 pandemic, OAPC hopes you are not only doing well, but continuing to keep safe while adhering to all applicable health and safety protocols.

Operationally speaking, the council continues to adopt collaboration as a necessary tool for long-term success, driver for innovation, and pathway for excellence in the collective quest for safe and quality asphalt roadways. This year we took on a number of important discussion subjects including barriers to widespread adoption of warm mix asphalt; concerns pertaining to the current End Result Specification; challenges with implementing the tack coat and joint painting specifications; and an action plan towards lowering number gyrations for Category D and E Superpave mixes.

Another focus was facilitating the second Asphalt Technical Symposium (ATS) which was held virtually on June 16, 2020. The ATS brought to fruition a key deliverable with the

formation of an Ontario Asphalt Expert Task Group (OAETG). Details of the OAETG and its mandate are outlined further on in this issue of *ASPHALTopics*.

Recognizing the impact of the COVID-19 pandemic on the industry and in the lives of its workforce, their families, and the general public, OAPC developed and published the *COVID-19 Asphalt Industry Best Practices Guide*. The guide details safety reminders and recommendations compiled from industry expertise to prevent or minimize the chance of contracting or transmitting COVID-19.

The Hot Mix Asphalt Safety Data Sheet (SDS), last updated in 2004, has also been updated to conform with the sixteen section recommendations of the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS). This document is now available for industry's guidance.

You will also notice that the last three *Top 10 List – Ways to Get More Durable HMA Pavements* factsheets 3, 4 and 10 accompany this issue of *ASPHALTopics*.

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MARCOM MATTERS

Abigail Wright Pereira

Marketing and Communications Director

Normalcy in the new normal

As I write this column, the U.S. presidential election is just one day away. According to the calendar on my kitchen wall, we are on day 237 since our world launched into the era of COVID-19. Up until a couple weeks ago, every evening I would tune into the PBS News Hour to keep up to date on the latest news coming from my home country. Now, for the past week, instead of watching the news, I have begun watching a documentary series on hominids and the evolution of human kind. Perhaps focusing my attention on a time and place far removed from current news and events is a way of coping.

The seismic shifts we have all undertaken in the way we go about everyday life and how we work has tested our adaptability and resiliency. While watching the series on early humans, it strikes me that for millions of years, humans have been adapting in quite remarkable ways to not only survive, but to thrive, and

to achieve homeostasis. Homeostasis is defined as “the ability to maintain a relatively stable internal state that persists despite changes in the world outside.”¹ Within us all we have an internal compass to find our ‘magnetic north’ when we are faced with a new normal.

During the past eight months, ORBA and OAPC have quickly adapted our programming to offer timely information that our members and stakeholders need, not only related to the pandemic but also addressing societal issues and ongoing industry challenges. In October, we wrapped up our ORBA webinar series which covered a diverse range of topics: *Leveraging Occupational Health and Safety Management Systems in Times of Crisis*; *Smart Technologies and Innovations for Adapting to the New-Normal*; *Welcoming Diversity and Inclusion in our Workforce* (a three-part series); *Tools in your*

Toolbox: Strategies for Building Mental Health in the Construction Industry; and *Top 10 List of Ways to Get More Durable HMA Pavements – The Responsible Use of RAP*. Webinar recordings can be downloaded from our archive library on ORBA’s [website](#). We develop our webinars based on feedback we receive from our members and stakeholders. If you have ideas for webinars in 2021 or have expertise in an area and would like to be a presenter, please reach out to us.

On November 26, we will be hosting the 29th annual Fall Asphalt Seminar. For the first time in the seminar’s history, it will be a virtual event. The Fall Asphalt Seminar has always capped off the year as the top asphalt educational seminar to attend, and this year will be no exception. Highlights from the 2020 program, *Innovation & Collaboration – Paving the Way for Excellence*, include presentations from key note speakers Matthew Sweezie, Paving Engineer, Construction Branch, Department of Transportation and Infrastructure, New Brunswick, who will present on New Brunswick’s experience with the implementation of warm mix asphalt, and Gerry Huber, Associate Director of Research, Heritage Research Group, who will provide insight into the Superpave5 concept.

If you have not yet registered for the Fall Asphalt Seminar, there is still time. Simply go to ORBA’s website under [Events](#). And if you miss the seminar, a recording will be available.

As we plan for 2021, 2020 has taught us to stay nimble and adaptable. Our programming and platforms will evolve with one purpose: to provide the support, information and resources required for our industry to continue to thrive in an ever-changing world. ■

¹ Lanese, N. (2019, July 15) *What is Homeostasis?* Retrieved from <https://www.livescience.com/65938-homeostasis.html>



NEW BRUNSWICK LEADS THE WAY

by James Careless



CK IN WMA

The benefits and challenges of using warm mix asphalt (WMA), as opposed to hot mix asphalt (HMA), is of continuing interest to asphalt producers and paving companies seeking better, safer, and greener ways to pave. Ontario stakeholders are also interested in WMA and how its usage on this province's roads could be expanded.»



T

he province of New Brunswick has extensive experience in using WMA on its more than 18,000 km of provincial expressways and secondary roads. To benefit from that province's WMA knowledge, OAPC invited Matthew Sweezie to be one of the keynote speakers at the virtual Fall Asphalt Seminar on November 26, 2020.

Sweezie, Paving Engineer with the New Brunswick Department of Transportation and Infrastructure (DTI), is responsible for the quality control/quality assurance of DTI's paving contracts and projects, including the development of DTI's construction specifications, policies, and standards.

NEW BRUNSWICK'S ROADS IN CONTEXT

Climactically speaking, New Brunswick's roadways do not face the same temperature extremes as those in Ontario due to its coastal location on the Atlantic Ocean. The comparatively warm ocean waters help to mitigate the impact of cold weather systems, ensuring that average winter ground temperatures in New Brunswick are less severe than in Ontario.

That said, parts of New Brunswick do receive significant snowfalls which leads to freeze-thaw cycles being experienced by the province's roadways. Add de-icing salt and plowing, as well as the wear-and-tear caused by vehicles in high traffic corridors, and the paving wear issues faced by the DTI are similar to those in this province.

A GROWING COMMITMENT TO WMA

New Brunswick's DTI started using WMA around 2008 on a few of its paving projects to assess its performance and how well it worked with the province's road construction and maintenance program. "We have been impressed with WMA's performance compared to HMA as a result," says Sweezie. "This is why the province has increased the use of WMA versus HMA on an annual basis."

Today, the DTI is using WMA for all of its capital and municipal paving projects. "We have gone 100 per cent WMA," Sweezie says. "We aren't calling for HMA in any of our tenders. And we are using WMA on our highways, our arterials and low volume roads, and on bridge decks. That's how well WMA is working for us."

Warm mix asphalt base and surface mix placed with a PG 58H-28 binder on Route 7 in the Grand Bay-Westfield area just north of Saint John, New Brunswick.



WHY NB HAS ADOPTED WMA

There are compelling reasons driving New Brunswick's decision to use WMA for all of its provincial paving jobs including WMA's reduced impact on the environment. Compared to HMA, producing WMA requires less energy, generates less heat, and produces fewer emissions. "WMA is a greener choice all around, one that is better for the planet and the people who work with asphalt in the plant and on the roads," Sweezie says.

"As well, the lower heat levels used to produce WMA mean that you're not oxidizing the binders during production," he adds. "The result is an asphalt mix that retains more of its intended qualities and lasts longer in usage because the binders have not been overheated." In the DTI's experience, the durability of WMA doesn't just match HMA's performance on the province's roadways; it exceeds it.

In addition, WMA remains workable for a longer period of time than HMA does at the work site. "Because WMA is a lower temperature mix in comparison to HMA, it doesn't lose heat as fast because the difference between its heat and that of the ambient air isn't as large," says Sweezie. This gives the province's paving crews more leeway to work with the WMA product without compromising its quality. It also extends the number of weeks that the DTI pave in New Brunswick each year.

Compaction is another area where WMA performs well for New Brunswick. The DTI has compiled research that shows that WMA provides better compaction than HMA as well as delivering a more consistent product overall. "If you take the same aggregate mix, the same road project, the same time of year, the same crew and the same equipment, you will see better compaction results when you use WMA compared to HMA," Sweezie says.

In the DTI's experience, WMA doesn't just match HMA's performance on the province's roadways; it exceeds it.

"We are also seeing superior performance and durability in longitudinal joints formed with WMA compared to HMA," he continues. "What we are not seeing is inferior roadway lifespans using WMA versus HMA. WMA does everything that HMA does, and adds the benefits I've mentioned as well."

Finally, using WMA results in less heat-related damage to asphalt production plants, transport vehicles, and paving equipment. The lower temperature is also what reduces emissions.

Overall, WMA has proven itself to be a worthy – even superior – paving product on New Brunswick's roadways.

THE DTI'S APPROACH TO WMA ADDITIVES

New Brunswick takes an informed, hands-off approach to WMA additives and binders. On the one hand, the DTI has a list of approved WMA products

which is updated continuously as new suppliers come forward with new products that are evaluated. On the other hand, the province leaves it to the additive/binder manufacturers to decide what chemicals and production specifications they want to use.

"Mixing and compaction temperatures are where we set specific standards," Sweezie says. "In the mixing stage, we follow the manufacturer's WMA recommendations. But on the paving site, we specify a maximum temperature behind the screed of 125 degrees Celsius. We will bump that up to 135 degrees if we are using modified binders in the WMA."

For PG grades and time-of-year considerations in using WMA compared to HMA, the DTI uses the same specifications for WMA as they would for HMA. "When it comes to time-of-year considerations, we can »



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work with WMA longer into the fall – past October 15 – by increasing the temperature behind the screed.”

LIMITED USAGE OF RAP IN NB WMA

In general, the DTI uses PG 58S-28 binders in its WMA. This includes instances where the province has added RAP (recycled asphalt pavement) to the mix in order to recycle at least some of the existing roadbed rather than transport it to a landfill.

Overall, the DTI has limited experience in using RAP in its WMA paving projects. “We’ve done one job in each of the last two years adding RAP to WMA,” says Sweezie. “Both were surface mixes where our specifications for using RAP were 15 per cent, plus or minus 5 per cent.”

The province’s decision to stay with its PG 58S-28 binder, rather than use another binder more suited to substantial RAP inclusion, explains why RAP stayed below 20 per cent in both cases. “We’re not using WMA to

allow ourselves to increase how much RAP we’re using in the mix,” Sweezie explains. “We are just using RAP as a part of our WMA, and doing so in a way that allows us to retain the benefits of our original formulation.”

IMPACT ON MUNICIPAL GOVERNMENTS

The DTI’s choice of WMA over HMA is influencing paving decisions being made by municipal governments in New Brunswick. “When it comes to paving standards and practices, the municipalities generally fall in line with what DTI is doing,” says Sweezie. This leadership is primarily done by example. The DTI doesn’t have any specific WMA emission standards in place that municipalities have to comply with, but its list of approved WMA additives and binders does inform their purchasing and contracting decisions.

This said, the province is willing to encourage compliance with its standards when such a campaign



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makes sense. “For example, two years ago we made a push when we adopted the MSCR (Multiple Stress Creep Recovery) binder specifications,” Sweezie says. “That’s the first time when we encouraged the municipalities either to get on board with us or develop their own specifications, and I think we had a good success with that.”

Mindful of its status as a smaller province, New Brunswick has worked together with Nova Scotia, Prince Edward Island, and Newfoundland & Labrador to develop common specifications wherever possible. This makes it easier to share suppliers and contractors across provincial borders, boosting their economic strength while giving provincial road



Placing warm mix base mix (WMA-B) using PG 58S-28 on Route 101 outside of Welsford (south of Fredericton), New Brunswick.

agencies more companies to choose from during contract bids. This also benefits municipalities, especially when it comes to accessing other paving approaches such as WMA.

Although the DTI is not compelling New Brunswick municipalities to adopt WMA, the department's own practices and standards in this area are influencing the purchasing decisions made by lower levels of government. As well, the push for common standards throughout the Maritime provinces is making the adoption of WMA an easier and more logical choice for individual towns and cities in this region.

ADVICE TO OTHER PROVINCES

Matthew Sweezie is proud of New Brunswick's role in adopting WMA. "I think we're a leader in the adoption of warm mix," he says. "I know that we don't have the tonnage of other provinces, but when it comes to percentages of roads paved using WMA, we are out in front in Canada. We achieved this position because we haven't seen any negative impacts from using WMA instead of HMA."

This said, Sweezie understands the reluctance of any government road agency to commit itself fully to a material. "I would recommend giving WMA a try, but you don't have to do it all at once," he advises. "After all, New Brunswick started out small in its WMA efforts, and we only went 100 per cent to WMA after many years of seeing how well it performed on our roads."

"We're big fans of an asphalt mix that compacts and handles better, doesn't age the binders prematurely during production, and is better for the environment," he adds. "That is what WMA does for New Brunswick, which is why we have moved to WMA exclusively after almost 20 years of successful usage." ■

James Careless is an Ottawa-based freelance writer with credits in the National Post, Toronto Star, and AI's Asphalt magazine.

But that is the way we have always done it!

In the last 50 years, some form of the following discussion has probably occurred many times. I know because I asked the same question when I was starting in the industry.

YOUNG ENGINEER:

"OK, so we design the mix at 4 per cent air voids and construct it to 8 per cent. I don't get it."

EXPERIENCED ENGINEER:

"Traffic will compact it to 4 per cent. Or, at least, that is what I was told when I started in the industry."

The concept of designing at 4 per cent dates back at least to development of the Marshall method of mix design in the early 1940s. Today, asphalt mixes designed using the Superpave method still carry the shadow of Marshall mix design in that the design air voids are 4 per cent and in-place air voids, depending on compaction specifications, are about 7 or 8 per cent.

Before the Superpave method of design was developed, Marshall design was ubiquitous. For those of you who have never heard this word before, I will save you the time looking it up as I did the first time I heard it. Ubiquitous means commonly used, available everywhere. Even outside of North America, Marshall mix design is nearly a universal standard, everywhere except in France.

SUPERPAVE ROOTS AND LCPC

In the 1970s, after seeing the Texas gyratory compactor during a 1959 visit to the U.S., the French national highway agency, then known as Laboratoire Central des Ponts et Chaussées (LCPC), developed a mix design method based around a gyratory compactor inspired by the Texas gyratory. In the LCPC method there is a range of

A look at Superpave5

by Gerry Huber

allowable design air voids, but designs are typically done at 5 per cent. Compaction on the road is targeted to 95 per cent maximum density (5 per cent in-place air voids).

The Superpave method of mix design is built around the Superpave gyratory compactor. The origin of this compactor goes back to the Texas gyratory compactor, but also incorporates research from development of the LCPC gyratory compactor. Considering the links to both compactors and to volumetric analysis, Superpave can trace its roots back more than 100 years to the Richardson method of mix design that was done in the late 1890s.

During the Strategic Highway Research Program, from which Superpave was developed, there was discussion about setting up Superpave in a similar fashion to LCPC, that is, design to 5 per cent, compact to 5 per cent. However, it was decided that for ease of implementation Superpave should be patterned after the Marshall method as much as possible and the idea was shelved.

Fast forward to the early 2010s. Why do we continue to live in the shadow of the Marshall method of design? Theoretically, it should be possible to adapt the French concept of 5 per cent design and 5 per cent construction, to Superpave. If Superpave mixes can be compacted to 5 per cent air voids, it should be possible to reduce the rate of asphalt binder aging and, if applied correctly, pavements should last longer with no additional cost. How is that for cost benefit!

Heritage Research Group (HRG) proposed the idea to the Indiana Department of Transportation (INDOT), INDOT funded the research, and Purdue University with HRG performed it.

The first of three trial sections was built in 2013. After five years, the improvement in performance was significant enough that INDOT contracted twelve Superpave5 projects in 2018, began implementation in 2019 (about half the HMA produced) and completely adopted Superpave5 as a standard specification for all projects in 2020.

WHAT IS SUPERPAVE5?

Superpave5 uses a design air void content of 5 per cent instead of the current Superpave requirement of 4 per cent. In order to maintain the same current minimum asphalt content, the Voids in the Mineral Aggregate (VMA) is increased by one per cent from the current values contained in AASHTO M323.

Specifications for aggregate properties (fractured faces, Fine Aggregate Angularity, gradation bands) stay the same but design lab compaction effort (N_{design}) is changed. »

CONTROLLING BOTH

In the 1980s before the Strategic Highway Research Program, the most common asphalt pavement issue was rutting. Today, 25 years after introduction of Superpave, asphalt pavement rutting is not the most common performance issue. Cracking is more common.

Can we control both? Can we maintain the current rutting resistance of Superpave and improve the resistance to age cracking, WITHOUT INCREASING COST?

YES, WE CAN!!

COMPARING SUPERPAVE4 AND SUPERPAVE5

Design air voids for Superpave5 are 5.0% instead of 4.0%. VMA requirements are 1.0% higher than listed in AASHTO M-323.

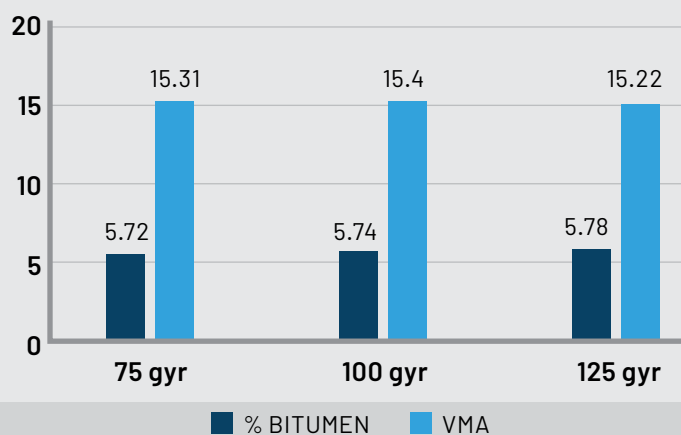
Superpave4 Superpave5

AIR VOIDS	4.0	5.0	AIR VOIDS
V_{be}	11.0	11.0	V_{be}
	15.0	16.0	

For example, for a 9.5 Nominal Maximum Aggregate Size mix, Superpave4 VMA is 15.0% minimum (4.0% air voids plus 11.0% minimum effective asphalt content or V_{be}). For Superpave5 minimum VMA is 16.0%.

A common myth that laboratory compactive effort (N_{design}) will change asphalt content is just that, a myth (see figure below). Three mixes designed at different gyrations each have the same asphalt content because each has the same VMA and air voids. The VMA specification does not change with design compaction, but N_{design} does impact rutting resistance.

WHAT IS THE IMPACT OF N_{design}



The Purdue research showed for mixtures compacted to the same in-place density that the higher the N_{design} the greater the rut resistance. For these designs, the 125-gyr mixture has about 40 per cent more rut resistance than the 75-gyr mixture.

The research also showed that higher in-place density has higher rut resistance. In this example, the 75-gyr mixture compacted to 5 per cent in-place air voids has more rut resistance than the 125-gyr mixture compacted to 7 per cent in-place air voids.

The research phase of Superpave5 determined how much the design gyrations should be reduced to allow in-place compaction to 5 per cent voids and to ensure that rut resistance does not decrease. The answer? Fifty gyrations for all design traffic greater than three million Equivalent Single Axle Loads (ESALs) and thirty gyrations for design traffic of less than three million.

The bottom line is that a Superpave5 mixture designed using 50 gyrations and compacted to 5 per cent in-place air voids has approximately the same rut resistance as a Superpave4 mixture designed using 100 gyrations and compacted to 7 per cent in-place air voids.

The promise of Superpave5 is asphalt mixes that contain the same amount of asphalt binder, are compactable to 5 per cent in-place air voids, and have the same rut resistance. But can they be built? And, with the lower in-place air voids, will they age more slowly?

Three trial projects were constructed, one each in 2013, 2014 and 2016. Average density for the standard Superpave4 mixes was 92.5 per cent, 91.8 per cent and 93.3 per cent respectively (7.5 per cent, 8.2 per cent and 6.7 per cent air voids). For the

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Superpave5 mixes the average density was 95.9 per cent, 94.7 per cent and 95.5 per cent (4.1 per cent, 5.3 per cent and 4.5 per cent air voids).

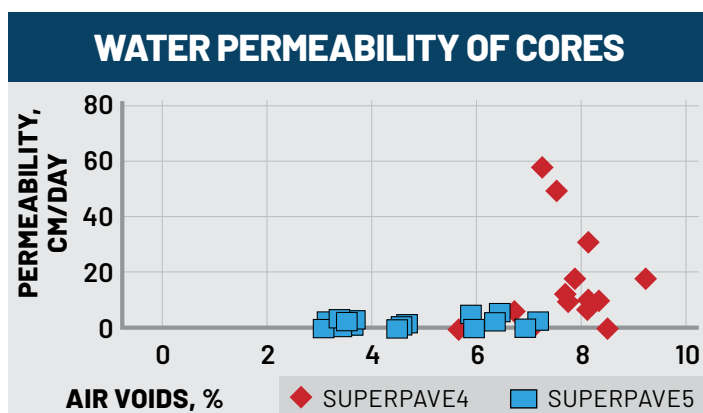
They can be built! In each of the three projects, the rolling train was kept the same for the Superpave5 as for the Superpave4. The laboratory research was based on equalizing the amount of field compaction for Superpave5 mixes and the trial projects confirmed that higher density can be achieved with the same field compaction.

FIELD PERFORMANCE

The first trial section, built in 2013, was evaluated five years after construction in 2018. The road carries 13,400 Average Annual Daily Traffic (AADT) and 19 per cent heavy trucks. The project required milling and replacing two lifts of HMA. The Superpave5 trial was located only on the surface mixture and was 2.2 miles long in the southbound lane. The adjacent 2.2 mile length in the northbound lane was used to compare Superpave4. Both mixtures were 9.5 mm Nominal Maximum Size mixtures. In 2018, at age 5 years, cores were taken between the wheel paths at three locations in the Superpave4 mixture and three locations in the Superpave5 mixture.

Permeability of the cores was measured in the lab and the relationship between permeability and in-place air voids is shown in the figure on the right. When in-place voids are higher than 7 per cent, permeability increases rapidly. Note that the distribution of in-place air voids for the Superpave4 cores (5.5 to 9.0 per cent) overlaps with the Superpave5 distribution (3.0 to 7.1 per cent).

The first question was, "How much has the asphalt binder aged?" In the original construction, both the Superpave5 and Superpave4 contained PG70-22 with 20.2 per cent of asphalt



binder replacement from post-consumer asphalt shingles. (As a side-note, today INDOT limits asphalt shingles to 3 per cent. In 2013, the specifications allowed up to 7 per cent shingles.)

Asphalt binder was recovered from each location. The average of the three Superpave4 sample locations was PG 100.0-16.2. For the three Superpave5 sample locations, the average was PG 94.0-21.0. Asphalt binder in the Superpave5 sections had aged 6°C less on the high temperature grading and 4.8°C less on the low temperature grading.

Delta T_c is a new asphalt binder parameter that relates to environmental cracking. Delta T_c is the difference between the low temperature grade as identified by stiffness, S , and slope, m . A value of -3 or greater has been identified as not susceptible to cracking. Between -3 and -5 there is risk of cracking and less than -5 is considered prone to cracking. The average delta T_c for Superpave5 is -3.6 and for Superpave4 is -8.3. »

The photo shows Superpave4 on the left side and Superpave5 on the right side. Block cracking is visible between the low temperature transverse cracks across the road on the left side (Superpave4 section). There is no block cracking on the right side (Superpave5).



Superpave5 mixes contain the same amount of asphalt binder and have the same rut resistance, but are more compactable, age less, and are more resistant to cracking – all at no additional cost.

Pavement condition data was collected with an automated van. Cracking, rutting and smoothness (International Roughness Index or IRI) was collected. Smoothness was about the same for the Superpave4 and Superpave5 sections: both were very smooth with an IRI of 53 and 47 inches per mile. Reflective low temperature cracking

occurred in both sections: 341 and 299 ft per 100 foot section. Average rut depth was 0.14 inches for the Superpave5 and 0.13 inches for the Superpave4, so both are basically the same.

The main performance difference was surface cracking. The Superpave4 section was covered with extensive block cracking about 12 to 18 inches in size. The Superpave5 section had almost none. This observation is consistent with the delta T_c of the asphalt binder.

INDOT MOVES FORWARD

Additional trial projects were used to evaluate construction variability (air voids, VMA, compaction) of Superpave5 as compared to Superpave4. Standard deviation of these properties was the same for Superpave5. Indiana uses a Percent Within Limits (PWL) statistical specification and so acceptance criteria were set for Superpave5 by adjusting the target values for air voids, VMA and in-place density.

In 2018, INDOT tendered 12 projects to include Superpave5 which allowed a cross section of contractors to gain experience designing and constructing Superpave5 mixtures. In January 2019, INDOT changed their standard specifications which came into force for all projects tendered after September 2019. During the 2019 construction year, contractors were given the option to switch mixtures from Superpave4 to Superpave5 and about half of the asphalt mixture produced in 2019 was Superpave5. Complete implementation has occurred in 2020.

So can we design a mixture that is more compactable, ages less, and is more resistant to cracking WITHOUT increasing asphalt binder content? The answer is "Yes". We can reduce cracking, maintain rut resistance, and do so at NO additional cost. ■

Gerry Huber is Associate Director of Research at the Heritage Research Group in Indiana.

This is a revised and updated version of the article that appeared in Asphalt magazine in May 2019.



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STATISTICAL SPECIFICATIONS

A RISKY BUSINESS

by
**David
Newcomb**

According to the U.S. Federal Highway Administration¹, there are five types of transportation construction specifications: 1) Method, 2) End-Result, 3) Quality Assurance, 4) Performance Related, and 5) Performance-Based. Only the first three of these have been commonly used historically, and we will focus on those.

Method specifications are rarely found now as they require the use of specific materials and means to construct a project under the direction of an agency. As long as a contractor follows the “method”, the agency has little recourse but to accept the resulting performance.

End-Result specifications (ERS) assign the entire responsibility and methodology of delivering a product to the contractor. In its most basic form, the contractor establishes quality control (QC) at its own discretion, and the agency accepts the product based upon prescribed sampling and testing of the final product, or Quality Assurance (QA). Payment is established on the basis of the contractor's ability to meet the end-result requirements. Quality Assurance specifications are very similar to ERS specifications except that they recognize the reality of materials and testing variability, and they require the contractor to perform QC testing and the agency to perform QA testing at certain frequencies.

The Ontario Ministry of Transportation (MTO) uses a combination of ERS with QA in their Special Provision No. 103F03 to specify hot mix asphalt (HMA) and warm mix asphalt (WMA). The ERS attributes used to determine payment are the designated large size aggregate, the per cent passing the 4.75 mm sieve, the per cent passing the 75 μ m sieve; the asphalt content; air voids; field compaction; and, voids in mineral aggregate. Each of these attributes is assigned a pay factor (PF) for determining its contribution to the final quality of the HMA according to its Percent Within Limits (PWL).

The pay factors for the aggregate sizes are averaged into a single PF for the gradation (PF_G) which is then added to the pay factor for asphalt content (PF_{AC}) and divided by two to produce PF_{GAC} , giving the gradation and asphalt content equal weight. The mix pay factor, PF_M , is calculated by the PF_{GAC} plus the PF_{VOIDS} divided by two. Finally, the PF_M and the pay factor for compaction (PF_C) are summed and divided by two to determine the final pay factor for mix and compaction, PF_{MC} . This results in pay factors which are weighted in importance with compaction having the greatest impact followed by voids, asphalt content, and gradations of the included sieve sizes. The pay factors are dependent upon the percent of results falling within a set limit, or PWL.

PWL is a statistical process for determining the compliance of a producer in the manufacture of HMA at a certain level of quality and variability. The process should allow for recognition of the variability inherent in the production of the material, and in the QA sampling and testing. PWL assumes that the attributes used in the specification are normally distributed with respect to their values, and therefore have a mean and standard deviation as shown for density in Figure 1 (a). In this case, the means (averages) are the same but the blue standard deviation is much greater than the red showing that the blue process has less control, all other things being equal. Figure 1 (b) illustrates the case where the

means are different, but the variability between the two processes is the same. In this instance, the blue process has a lower quality.

It would take hundreds, if not thousands, of data points to develop graphs that are as clean as the ones illustrated in Figure 1. So, when we take data from four, five, or ten sublots, we make an assumption that they are representative of the distributions shown in Figure 1. This is a legitimate course of action as long as a consistent process was

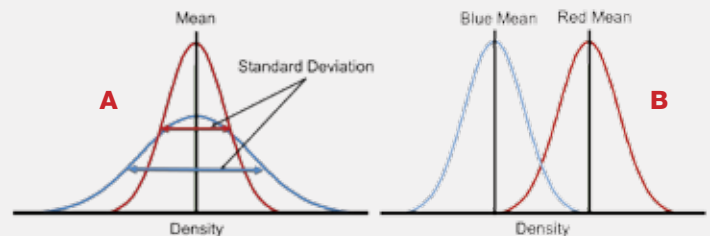


Figure 1. Concepts of Mean and Standard Deviation.

maintained throughout the production of the lot of material. However, with so few data points, there is always a danger that the wrong conclusions are drawn regarding the quality of the material. If the data show that the material is better than it actually is, then it is the buyer taking the risk of a shorter pavement life. Conversely, if the contractor is penalized for substandard quality when, in fact, the material is acceptable, then they are subjected to the seller's risk.

The only way to reduce the risk to both the seller (contractor) and the buyer (agency) is to test more samples of the material. However, as just mentioned, there are practical considerations regarding the number of tests that can actually be performed in QA. Thus, in order to offset the seller's risk to the contractor, incentive payments are made to achieve a balance. The buyer's risk is minimized by the achievable, yet high quality levels, set in the specifications. Incentives in the PWL system may be achieved through the use of pay factors with a value greater than one, and these may vary depending upon the importance of a given attribute from 1.02 to 1.05.

Some may argue that incentives on ride quality should satisfy the idea of balancing risks, but ride quality focuses on paving practices and not the quality of the asphalt mixture attributes. Using ride quality alone as an incentive could lead a producer to shift their focus from quality production to paving to maximize their pay. This was the experience of one Department of Transportation in the western U.S.

In the application of statistical specifications, it is important to recognize that we are dealing with probabilities, not certainties. This leads to risks for both the buyer and the seller, and these risks need to be offset for both parties. First, the agency should have expectations of minimum acceptance levels for important attributes, and disincentives when those expectations are not met. Likewise, in order to balance the contractor's risk that quality material may be rejected, incentives are needed to ensure that pay factors are equitable. ■

David Newcomb is Division Head, Materials & Pavements at Texas A&M Transportation Institute.

¹ Federal Highway Administration (2003) Major Types of Transportation Construction Specifications Report. <https://www.fhwa.dot.gov/construction/specs.cfm>. AASHTO Highway Subcommittee on Construction Quality Construction Task Force.



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CONTRIBUTE TO SAFE,
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ROADWAYS

by **Doubra Ambaiowei**

Safe and quality asphalt roadways, acquired through proper design and construction and timely maintenance, remain a prime objective for all stakeholders in the road building industry.

However, this pursuit can be challenged by low-bid contract practices, limited budgets, increasing traffic volumes, climate-change, use of substandard materials, proliferation of specifications, and other factors. Industry-practitioners recognize that these challenges must be addressed. They require that we consistently strive for the best strategies that can guarantee good quality roadways, fair value for the work undertaken, and a healthy competitive market that enables innovation.

The Ontario Asphalt Pavement Council (OAPC), through its Quality of Asphalt Review, provided a framework of recommendations on the best approaches to ensure long-term value for safe and quality asphalt roadways. The Quality of Asphalt Review was commissioned in the fall of 2017 and completed in the summer of 2018. It was managed by KPMG and included analysis conducted by the Texas A&M Transportation Institute (TTI).

The framework focuses on ten relatively straightforward technical facts to serve as reminders in the quest for durable asphalt pavements. They include:

1. DO YOUR HOMEWORK

Evaluate existing pavement conditions meticulously and perform proper pavement designs to determine the appropriate thickness. Select the right mix and Performance Graded Asphalt Cement (PGAC) for the project.

2. ENCOURAGE MIXES THAT HAVE HIGHER ASPHALT CEMENT (AC) CONTENT

Studies have shown that mixes with higher AC outperform those with lower AC content. Three approaches to get more AC in HMA mixes are: the concept of gyrations depending on the mix type and design traffic; the Superpave 5 concept which uses a design air void content of 5 per cent instead of the current requirement of 4 per cent; and, regressing air voids as part of a balanced mix design.

3. SPECIFY A FINER GRADATION FOR YOUR MIX TYPE

Finer Superpave mixes typically have higher AC content and are more durable and less prone to segregation.

4. DON'T OVERHEAT THE MIX

Overheating the mix will result in premature oxidation which may lead to cracking. Specifying warm mix asphalt (WMA) may help alleviate these concerns during late season paving.

5. INCLUDE ADEQUATE SURFACE PREPARATION IN THE PLANS

Contract documents should allow for suitable surface preparation to ensure the construction of smooth roads.

6. ENSURE AN ADEQUATE BOND

Proper tack coat application ensures that the pavement will perform as designed and help mitigate premature cracking. Good tack coating will also improve compaction.

7. PROVIDE PROPER PAVEMENT DENSITY

Compacting the mat to the required specification limits will ensure long-term durability, lower oxidation (due to long-term aging), and reduce permeability.

This is a revised and updated version of the article that appeared in Heavy Equipment Guide in March 2020.



8. PRODUCE MIX THAT IS UNIFORM AND CONSISTENT

HMA that is produced to consistently meet the Job Mix Formula (JMF) and the specification requirement will perform better.

9. USE RECLAIMED ASPHALT PAVEMENT (RAP) RESPONSIBLY

RAP should be utilized in accordance with contract requirements. For higher percentages of RAP, i.e. greater than 15 to 20 per cent, a softer PGAC should be incorporated in the mix.

10. COMPLETE QUALITY ASSURANCE (QA) TESTING AND INSPECTION

Proper QA and inspection conducted by qualified technicians and inspectors should be part of any paving project to ensure long-term performance.

Detailed discussions on this high-level summary are available in factsheets and technical articles published by OAPC and can be found on the council's [website](#). Collectively they provide industry-practitioners, especially asphalt producers, paving contractors, and designers, with a concise quality checklist towards designing, maintaining, rehabilitating and constructing safer, smoother and well-performing asphalt roadways.

Adaptive strategies to the impacts of climate change should also be considered in the design, production, and placement operations of asphalt roadways. The effects of changes in temperature and rainfall, along with extreme weather events such as flooding, will be felt widely, and road safety is no exception. The consequences of climate change, if not properly tackled, could accelerate the deterioration of asphalt

roadways and increase the risks of severe damage. These scenarios further degrade experiences for road agencies, industry-practitioners and the public. ■

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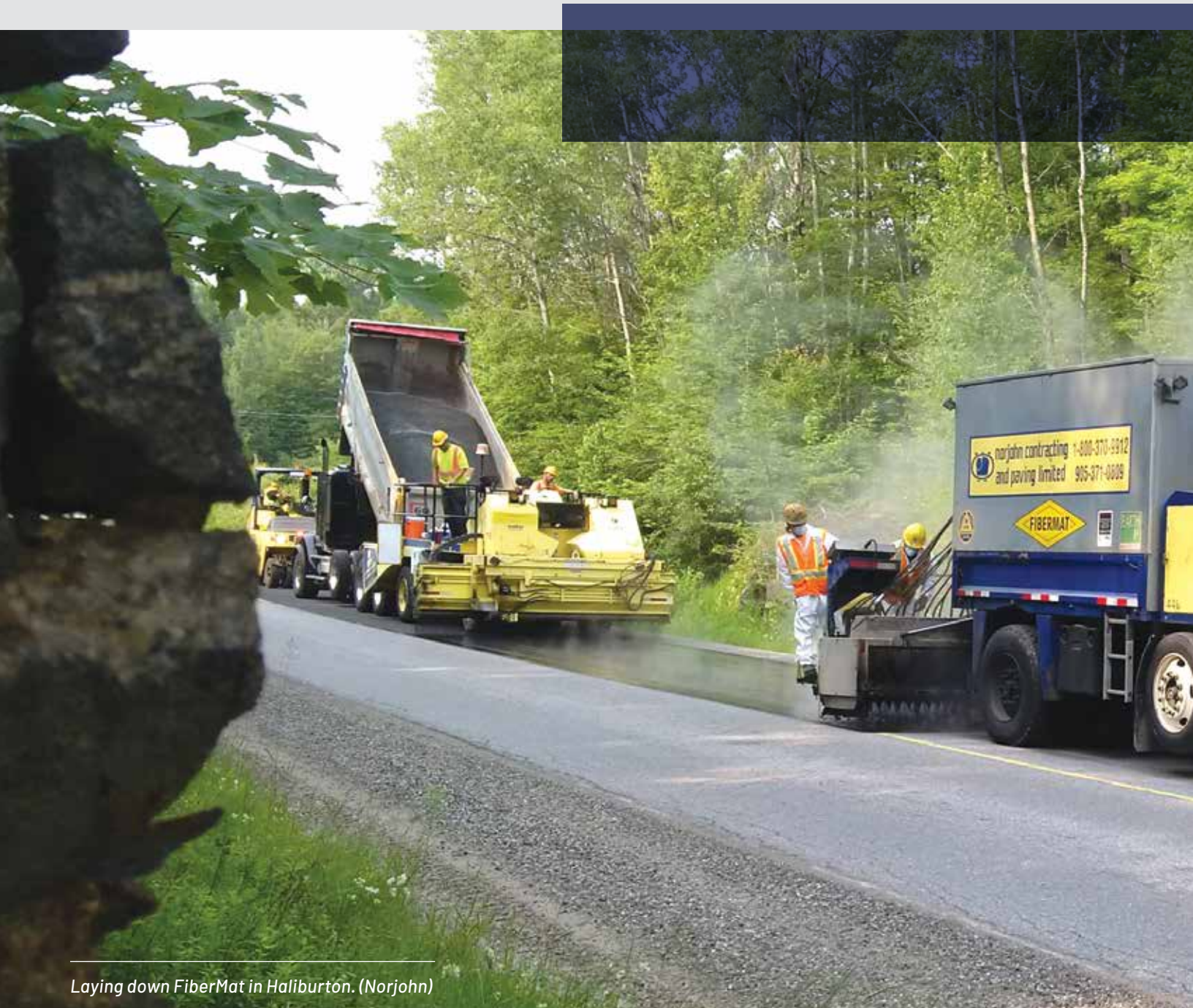
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ALBERTA

PAVEMENT PRESERVATION DELIVERS TANGIBLE RESULTS

by James Careless



Laying down FiberMat in Haliburton. (Norjohn)

To extend pavement life span and slow down deterioration, agencies in Ontario are adopting a pavement preservation approach to optimize roadway quality.



"Pavement preservation is a modern road management technique that employs timely investments of preservation methods to preserve or enhance pavement performance and extend the service life of the asset," explains Bill Wilson, Asset Management & Engineering Specialist with the County of Perth's Public Works Department.

By adopting pavement preservation, agencies are able to smooth out their expenditures over time. "Rather than having multiple major capital reconstruction or rehabilitation projects land in the same budget year, asset life can be extended through preservation to provide budget consistency while achieving service level expectations," Wilson says. "As budgets tighten, we need to extend the service life of our road assets in a way which makes financial sense and allows us to continue to provide a safe, smooth and uninterrupted level of service to our road users."

There are a wide range of pavement preservation techniques available to Ontario agencies. Crack sealing is a popular option for agencies faced with asphalt deterioration issues. By filling cracks in the asphalt surface layer as soon as they occur, water can be prevented from seeping into the pavement's lower levels and causing serious damage to the entire structure over time.

"This is obviously a tried-and-true method used to extend the life cycle of a paved road asset, and one that we budget for annually," says Wilson. "In our climate, I believe this is one of the more cost-effective ways to reduce freeze-thaw damage and improve ride quality."

Infrared heating is another effective solution to surface cracks. "It involves heating the area surrounding the crack using an infrared heater which enables us to 100 per cent recycle the asphalt in place," says Alex Laros, Supervisor of Roads for the City of Cambridge. "A rejuvenating agent is then introduced to the mix to add back the oils it has naturally lost. Next, a fine asphalt mix that is rich in asphalt cement is used to fill the voids and damaged areas. The reworked area is then compacted leaving a patch that is well bonded to material below and has four hot, watertight joints around the repair, thus creating a longer lasting repair." The whole process only takes 20 minutes from start to finish.

McAsphalt Industries has developed its own wide crack sealer. "MACSEAL M.A.R.S. is a hot-applied sealant comprised of a blend of specially engineered polymer-modified binder, fibers, and a carefully selected aggregate fraction. It's Canadian-made for the Canadian climate," says Dr. Sina Varamini, Research and Development Manager at McAsphalt. »



MACSEAL M.A.R.S, a hot-applied sealant, repairs wide cracks. (McAsphalt)

The product is heated at the job site using an agitator-equipped mobile kettle. The MACSEAL M.A.R.S. is then poured directly onto the crack. No finishing work is required because this product is self-levelling.

"Unlike traditional crack sealants that are mainly liquid, MACSEAL M.A.R.S. contains engineered binder and selected aggregate fraction to provide the structure and skeleton that you need to fill and stabilize wide cracks," says Dr. Varamini. "This provides the strength for the sealant to endure over five to seven years without cracking."

Initial field trials were conducted in 2016 at different General Aviation Airports (GAA) across Ontario where cracks on

runways and taxiways were sealed. After multiple winters and aggressive plowing, all the repairs were found to be in good condition. Since then, MACSEAL M.A.R.S has been successfully applied at more GAAs across Ontario including the Chatham-Kent Municipal Airport in 2018, Goderich and Earlton-Timiskaming Airports in 2019, and Brantford Airport in 2020. Results show that MACSEAL M.A.R.S provides a robust and cost-effective solution to keep runways and taxiways from further deterioration until rehabilitation is necessary.

Using the same concept, MACSEAL M.A.R.S has also been applied throughout different municipalities since 2016 to repair wide cracks on municipal roads where traditional

crack sealants are no longer effective and the owner does not have funding to perform conventional repairs and rehabilitation. These sections have been in place anywhere from a few months to more than three years in cities including the City of Hamilton, City of Cambridge, Niagara-on-the-Lake, and City of Brantford.

The City of Cambridge has been using MACSEAL M.A.R.S. to preserve its pavement in addition to milling down damaged areas and refilling them with HMA. "Cambridge is looking for new methods and technologies to aid in pavement preservation," Laros says. "We started to use polyolefin fibres in our asphalt when we are doing partial depth resurfacing to help prolong the life of the road surface. We apply another durable water proof coating 'Liquid Road' to our chip seal roads to help lessen water penetration and prolong chip seal roads."

Norjohn Contracting offers several products to support pavement preservation including Ultra-Thin Bonded Wearing Course, Scrub Seal and FiberMat. Ultra-Thin Bonded Wearing Course is placed on asphalt surfaces using a specialized spray paver. The process begins with a heavy application of a polymer-modified asphalt emulsion onto the roadway, followed by the paving screed. A smooth drum roller helps seat the aggregate into the heavy bond coat to provide a smooth riding surface. The entire lift is approximately 15 mm thick and does not require compaction.

According to the company, Ultra-Thin Bonded Wearing Course requires minimal preparation, seals the existing pavement, and restores ride and skid resistance. Once the materials have been placed, the road can be reopened to regular traffic within 15 minutes.

Scrub Seal works much like applying a chip seal treatment to a roadway. The difference lies in the array of differently-angled broom heads dragged behind the application truck.

The brooms scrub the asphalt emulsion into cracks and gaps in the roadway, as well as providing a protective seal over the entire treated surface. A specially formulated emulsion is used to rejuvenate the existing asphalt cement, restoring some of its flexibility.

FiberMat is a stress absorbing membrane interlayer (SAMI). It is not typically left exposed to traffic and is usually placed on an existing or milled surface before a standard overlay or cover aggregate application. FiberMat combats reflective cracking by laying down a layer of polymer-modified asphalt emulsion onto the roadway, followed by a layer of chopped fiberglass strands. Next, a second »

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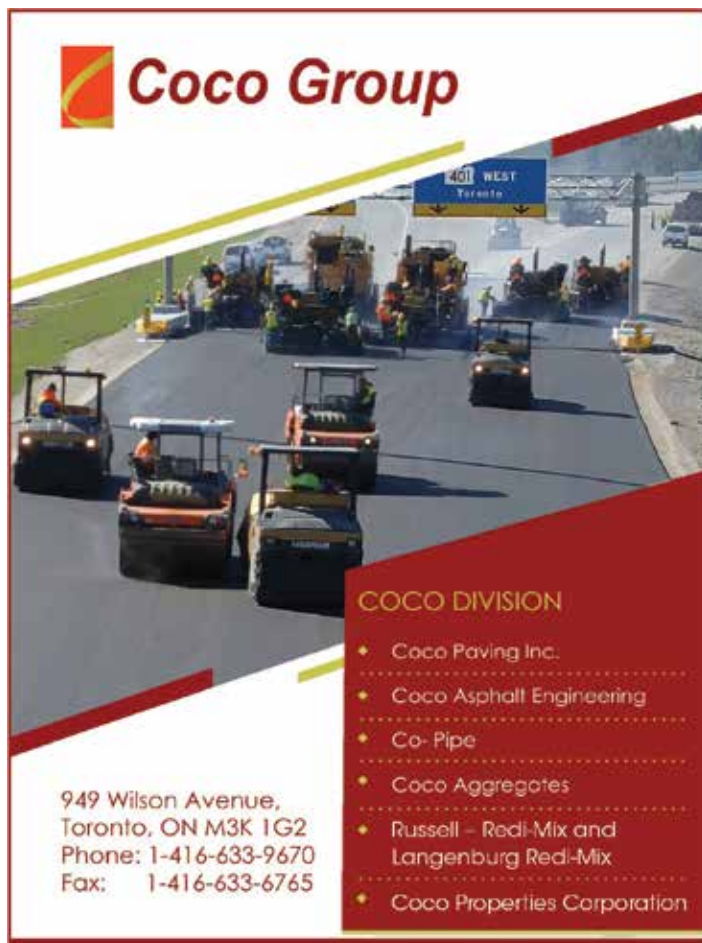
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coat of emulsion is applied on top of the strands to seal them in place and bond with a cover aggregate to protect the membrane. The fiberglass strands sandwiched between the two layers of asphalt emulsion provide significant tensile strength and load transference within the road surface to delay reflective cracking.

"We have completed a number of projects throughout Ontario – from small volume rural roads to 400 series highways – that have been effectively preserved through the application of FiberMat," says Derek Nunn, Norjohn Contracting's Assistant General Manager.

Whatever pavement preservation techniques being employed, Ontario agencies are achieving tangible results in extending roadway life span and spreading repair or replacement costs over time.

"Aside from the immediate benefits to the road users such as lesser construction impact, shortened construction periods, and the ability to generally maintain traffic flow, the results of pavement preservation go far beyond the actual site work," says Wilson. "I have seen road sections that were seemingly on their way to requiring full reconstruction/rehabilitation within years of assessment still performing eight to ten years later by using the appropriate preservation techniques." ■



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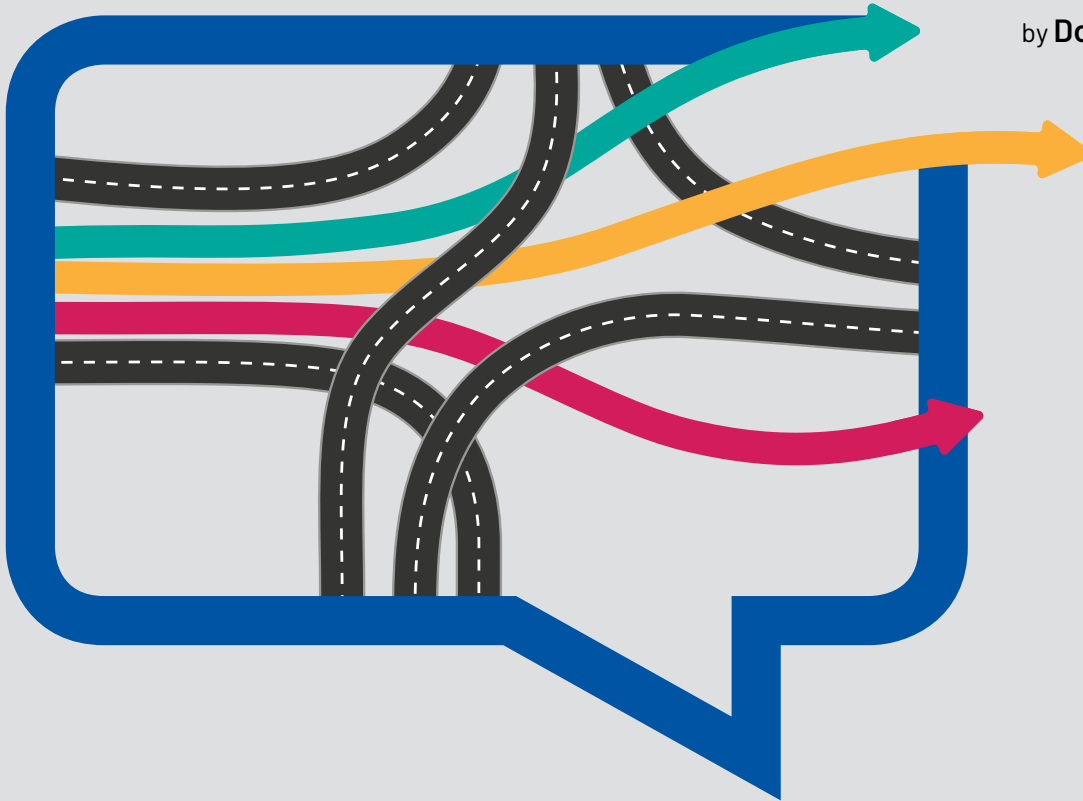
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ONTARIO ASPHALT EXPERT TASK GROUP

FIRED-UP and READY TO GO!

by Dobra Ambaiowei



Lao Tzu notes, “*The journey of a thousand miles begins with one step.*” In support of the quest for quality asphalt roads, the Ontario Asphalt Pavement Council (OAPC) has taken yet another step towards the objective of excellence in asphalt pavements.

If you remember, the Quality of Asphalt Pavement Task Force was formed in late 2014 to assess asphalt concerns and propose workable solutions that were scientifically sound and practical. The work of this task force culminated in December 2016 with the publication of bulletins regarding those top concerns which are available on the OAPC [website](#).

Building on the foundations laid by the Task Force, and more importantly, seeking more efficient ways to discuss technical matters relating to the challenges, research and improvements to asphalt cement technology and asphalt mixture/pavement performance in Ontario, the idea of an Asphalt Technical Symposium (ATS) was born – credits to my senior industry colleagues and mentors, Pavel Kriz and Vince Aurilio.

The ATS is a platform sponsored by OAPC to encourage and improve communication and collaboration between stakeholders in Ontario’s asphalt industry with the following core objectives:

1. Provide a platform for unbiased technical discussion and sharing;
2. Educate each other on the specific elements of technology necessary to achieve high performing asphalt pavement including materials, design and construction practices;
3. Respectfully share different points of view and visions to improve asphalt pavement quality; and
4. Identify and develop a list of technical topics and agree on next steps to adequately address them.

We have now successfully held two symposiums in June 2019 and 2020, and are looking forward to the next in 2021 and beyond. We hope that all who have attended the ATS found it informative and worthwhile, and enjoyed the technical »

presentations and discussions. Presentations from the symposium are available on OAPC's [website](#) under Publications.

ONTARIO ASPHALT EXPERT TASK GROUP

A key aspect of the discussions at the symposiums highlighted the need for an Ontario Asphalt Expert Task Group (OAETG) to satisfy the specific mandates below:

- a) To brainstorm asphalt-related and emerging issues, particularly on subjects of *Recovery for Acceptance and Mix Performance Acceptance*;
- b) To proactively identify potential improvements to mixture and binder performance specifications and testing methods pertaining to Ontario-specific climatic and traffic conditions;
- c) To act as an advisory group to recommend and/or perform asphalt research interests and needs; and
- d) To contribute to content development and organization of the Asphalt Technical Symposium (ATS).

After several meetings and consultations, the activities of the OAETG are moving forward. Membership comprises of volunteer representatives that includes experts from the asphalt industry (contractors, producers, refiners, suppliers), government (municipal and/or provincial), academia, associations (OAPC, Asphalt Institute), and special interest groups. Progress related to the work of the OAETG will be captured in the report of OAPC's HMA Technical Working Group. Independent experts may be invited to attend OAETG meetings to participate in the review or discussion of specific research or implementation technology issues. The role of these independent experts will be to provide specialized expertise related to specific projects as a supplement to that of the OAETG.

The current make-up of the OAETG is summarized in the table. On behalf of OAPC, I wish to extend our thanks and appreciation to the volunteer members and look forward to welcoming more volunteers, especially from our municipal counterparts and contractor/producer members. ■

ONTARIO ASPHALT EXPERT TASK GROUP (OAETG)

Name	Affiliation	Membership Distribution
Chris Campbell	Imperial Oil	ATS Co-Chair, Industry - Refiner
Doubra Ambaiowei	ORBA/OAPC	ATS Co-Chair/Staff Liaison, OAPC
Sina Varamini	McAsphalt Industries Ltd.	OAETG Chair, Industry - Supplier
Pejoohan Tavassoti	University of Waterloo	OAETG Vice-Chair, Academia
Amma Wakefield	Asphalt Institute	OAETG Secretary, Association
Yashar Alamdary	Coco Asphalt Engineering (A Division of Coco Paving Inc.)	Industry - Supplier
Mneina Amin	OGRA/MEA	Government - Municipal
Mike Aurilio	Yellowline Asphalt Products Ltd.	Industry - Supplier
Hussain Bahia	University of Winsconsin-Madison	Academia
Scott Crowley	Aecon Materials Engineering – AME	Industry - Contractor
Aicha Ghezal	City of Ottawa	Government - Municipal
Daniel Grant	Imperial Oil	Industry - Refiner
Mehran Farashah Kafi	University of Waterloo	Academia
Ahmad Khan	Queens University	Academia
Fernando Magisano	Canadian Asphalt Industries Inc.	Industry - Supplier
Chanaka Nawarathna	Queens University	Academia
Salehi Saeid	University of Waterloo	Academia
Trevor Tinney	Town of Innisfil	Government - Municipal
David Youkhana	-	Special Interest Group

Dulay mixes SUCCESS at McAsphalt



Ron Dulay

It's been a challenging year for everyone, and running a lab with pandemic protocols is no exception. But during the busy construction season, testing is crucial and work has to continue. "We obviously can't do our work from home, so we've made adjustments to the way we do things so we can continue with our work. It's been a challenge at times, but I think we've managed it very well," says Ron Dulay, Lab Supervisor at McAsphalt Industries Limited.

After 28 years in the business, Ron is known for his dedication to the asphalt industry and excellent work in the lab. In April, he was promoted to lab supervisor at McAsphalt in the middle of the pandemic lockdown. He says it's been a learning experience but he's enjoying the process and is happy to be working with a great team. "I feel so lucky to have such a good relationship with the people I work with. The job is important, but it's the people who really matter," he says. "Michael Esenwa has also been very helpful in teaching and guiding me in this new role."

"I have been Ron's manager for more than 10 years now and I know his capabilities first hand. He's such a likable guy who is extremely hard working and professional," says Michael Esenwa, Design & Engineering Services Manager at McAsphalt.

Ron's lab career began after graduation from Centennial College in 1991 when he was hired by JEGEL, starting at the bottom and working his way up. "I essentially started by cleaning the equipment used in testing, listening and learning as I went along. One day a technician was on holiday and they needed someone to do the emulsion testing, so I did it and that was the beginning. In my seven years there, I was thrown into everything and learned a lot," says Dulay.

In 1998, he was hired to work on asphalt testing in the lab at McAsphalt where Keith Davidson was in charge. Dulay counts himself as extremely fortunate to have learned from one of asphalt's greats. "Keith was such an important teacher and mentor for me, and a really great guy. I learned so much about mix designs from him. It was very busy lab and there weren't too many of us, so I was exposed to all kinds of testing from cold and hot mix to warm mix asphalt and foam," says Dulay.

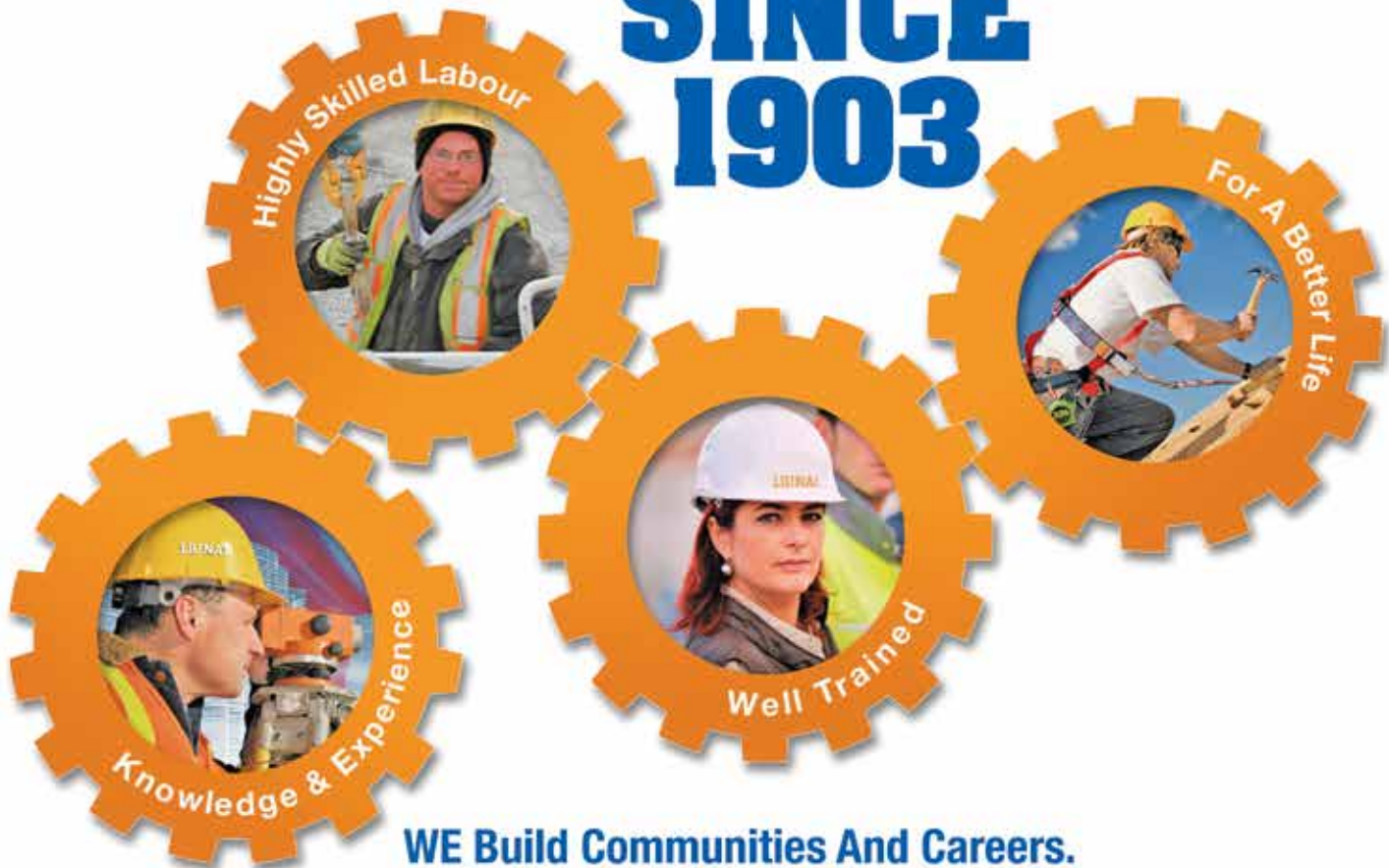
Ron's work has continued to focus on getting mix designs right particularly with the changes in asphalt cement specifications in recent years which require multiple trials to fine tune the mix whether it is hot, warm or cold mix, or cold-in-place recycling. Ron also follows through to oversee the QC testing to make sure the mix behaves in the field the way it was designed in the lab.

"Ron has excellent technical skills and is one of the most dependable people I've ever met," says Esenwa. "He's also really good at translating numbers into reality. When there's a problem, most of the time he solves it before bringing it to the engineers."

After 22 years with McAsphalt, Ron is still excited about the work and learning everything he can. "I never expected to be in the asphalt industry, but I'm happy we've stuck together. I love my job and I'm still having fun which is important. And most of all I enjoy the people I work with. It's really the people that make the difference," Dulay adds. ■

Lara Henry is a communication specialist and editor of ASPHALTopics.

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TECHNICALLY SPEAKING

Mike Aurilio

The basics of PMAC

There are a number of ways to improve the performance of a pavement, but a popular way is to add polymers such as SBS (styrene-butadiene-styrene) to the asphalt cement to produce polymer modified asphalt cement (PMAC). It's generally well known that SBS improves the rutting resistance of the asphalt, but there's a lot more to it than that. There is some evidence that SBS can reduce the aging of the asphalt cement and improve the coating of the aggregate, but the biggest benefit comes from turning the asphalt cement into a more elastomeric material.

SBS is an elastomer, which means it is a rubbery polymer. The addition of SBS to asphalt cement makes it a rubberier material which improves the strain tolerance and gives the pavement a better ability to recover from an applied load. You can think of the pavement having more of a stretchy, spring-like response rather than a brittle, glassy response under certain conditions (i.e. low temperature and high frequency loading). SBS also has a much lower glass transition temperature than asphalt cement which ensures the rubbery behaviour is present at cold temperatures. This change in the way the pavement responds to loading increases the general cracking resistance.

The performance of SBS-modified asphalt can be impacted by the compatibility between SBS and asphalt cement. Good compatibility is required to ensure swelling of the SBS chains

and good dispersion of the polymer which are necessary for maximizing the rutting and cracking performance. Swelling and good dispersion ensure that a polymer network is created through the entirety of the asphalt cement matrix which increases the stiffness and rubbery nature. The compatibility is influenced by:

- Asphalt cement chemistry;
- SBS structure; and
- Cross-linking agents.

The asphalt cement chemistry and SBS structure influence how the different fractions of each material interact when they are added together. Certain asphalt cements can be more compatible with SBS than others simply because they come from different crude sources. A cross-linking agent greatly improves the thermal stability of the blend by creating permanent bonds between the SBS chains. Without a cross-linker, the blend can be prone to phase separation under long term, high temperature storage. The cross-linker can also improve the stiffness and elastomeric qualities of the PMAC which will help with performance. Evaluating the storage stability is one way to understand compatibility and the effectiveness of a cross-linking agent. You can see in Figure 1¹ on the next page how the same amount of SBS can be dispersed in different asphalt cements depending on the compatibility. »

¹ Planche, Elwardany, Adams, Rovani, Boysen, "Compatibility in Asphalt — A Moving Target with Sources, Modifications and Aging", TRB Annual Meeting, January 13, 2020

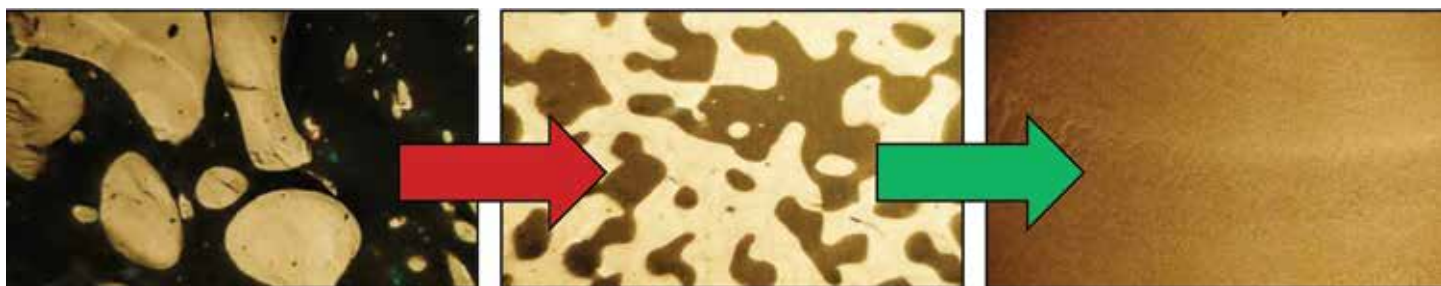


Figure 1. Fluorescence microscopy images of different asphalts containing the same amount of SBS showing increasing compatibility from left to right. Images taken on the micrometer scale.

The concentration of SBS used also influences the performance of the pavement. Generally, increasing the amount of SBS used will lead to better performance if you have good compatibility. At low concentrations (0 to 2 per cent), there is not enough polymer in the asphalt cement to induce a significant elastomeric response. At moderate concentrations (2 to 4 per cent), which could be considered typical for Ontario pavements, the stiffness increases and the asphalt cement becomes noticeably elastomeric. In the 0 to 4 per cent SBS range, the SBS is typically dispersed through the asphalt, but as the concentration goes above 4 per cent, a phase inversion begins.

The 4 to 6 per cent SBS range can suffer from issues with instability as a result of polymer and asphalt rich regions. However, when the concentration increases to 6 to 8 per cent, the phase inversion completes, and the asphalt cement is stable again with very good performance (referred to as Highly Modified Asphalt or HiMA). The addition of 6 to 8 per cent SBS can be quite expensive though and could be reserved for specific applications. The 2 to 4 per cent range ensures an improvement in performance and can be relatively cost effective. It should also be noted that the specific values of the ranges are highly dependent on the compatibility and use of a cross-linking agent.

TIPS FOR EVALUATING PERFORMANCE

Evaluating SBS-modified asphalt cement can be tricky. The PGAC system was originally designed around evaluating unmodified asphalt and as a result does not properly characterize the increase in performance observed in the field. The traditional PGAC tests such as the Dynamic Shear Rheometer (high and intermediate temperature grade) and the Bending Beam Rheometer (low temperature grade) operate with

low strain and assume the behaviour is linear (response is proportional to the input). The addition of SBS means that the behaviour is no longer linear and these tests can mischaracterize the change in performance.

AASHTO M 332 uses the Multiple Stress Creep Recovery (MSCR) test which applies a much larger strain and has proven to be a better way to evaluate the rutting characteristics and the elastomeric nature of PMAC. This strain is more indicative of strains observed in the pavement. The percent recovery portion of the test also gives a good estimate of the SBS concentration. As the SBS concentration increases, the strain tolerance increases, and the cracking resistance generally improves. In this way, an increase in the percent recovery can be indicative of better cracking resistance even though the test is designed to evaluate rutting resistance. The elastomeric behaviour will be present at all temperatures. You can see in Figure 2 below that there is a linear relationship between SBS and the percent recovery. All three asphalt cements here show a similar relationship.

The Double Edge Notched Tension (DENT) test and Extended Bending Beam Rheometer (ExBBR) test both operate in the

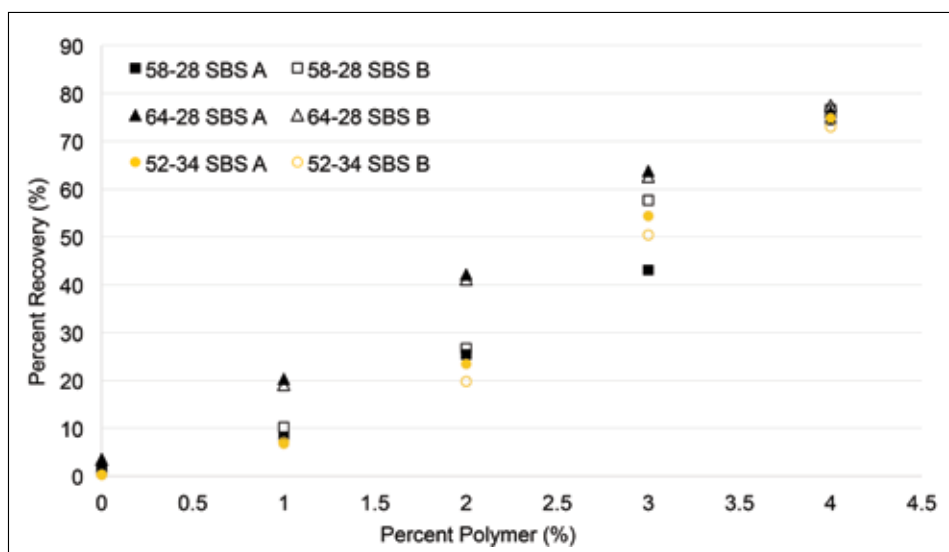


Figure 2. Relationship between SBS content and MSCR recovery.

low strain regime. The ExBBR still assumes the behaviour is linear despite the extended conditioning time. The test still applies force the same way as the regular BBR and, as a result, both are unable to characterize PMAC well. The DENT test is based on ductility and PMAC is no longer purely ductile in the same fashion as unmodified asphalt. This shift to an elastomeric behaviour is very difficult for the DENT test to characterize. Figure 3 shows us the relationship between Critical Crack Tip Opening Displacement (CTOD) from the DENT and the concentration of SBS. These low strain tests have been shown to be better evaluators of performance for unmodified asphalt but there are simpler options available. Large strain tests may be necessary to better evaluate cracking resistance in PMAC.

PMAC is clearly a great tool to have when it comes to improving the performance of pavements, but understanding the fundamentals of

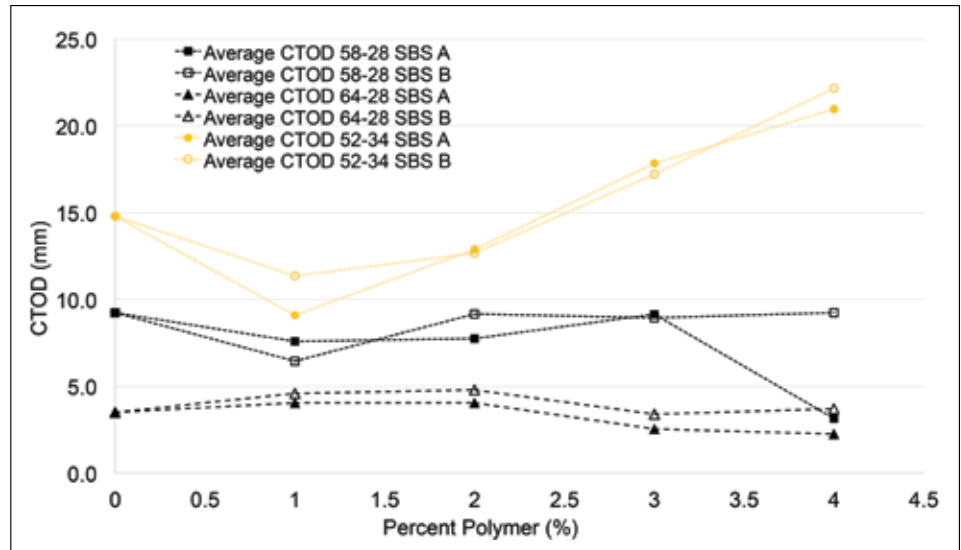


Figure 3. Relationship between DENT CTOD and SBS content.

what it does and how it works is important in understanding how to maximize performance. Compatibility between asphalt cement and the SBS is incredibly important, but so is the construction and the evaluation process. ■

Mike Aurilio is Senior QC and Product Development Co-ordinator at Yellowline Asphalt Products Ltd.

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ENVIRONMENTAL ESSENTIALS

Ryan Downing

Planning for safety during a pandemic

The senior leadership team of the Tomlinson Group of Companies was attending a strategic business review and conference in Las Vegas, Nevada, when COVID-19 changed everything in Canada on March 13, 2020.

After a weekend of conference calls, the company's leadership team put a series of different staging protocols and processes in place around such things as physical distancing, respiratory protection when two metres of distancing was not possible, face shields, equipment cleaning, questionnaires for all personnel arriving to a site or a Tomlinson facility, and guidelines for all employees on how to stay safe.

Communication was vital to the success of Tomlinson Group's speedy roll-out of protocols. One of the first

things the company did was to quickly set up a section on the home web page to communicate how to best protect against the virus. Daily emails were sent with the relevant information to all employees. The safety team at Tomlinson Group published its COVID-19 recommendations and practices to the website where they could be accessed and downloaded, and continues to do so. Binders with all the safety information were distributed to each project site across Ontario to ensure compliance.

Early on, the Tomlinson Group established its COVID-19 task force, which is represented by approximately 50 people from different divisions within the company who met daily to discuss issues. Our mission was clear: keep working, but work safely. Everyone embraced the mission. In fact, we



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probably had more of the COVID-19 safety measures implemented before they were up on the public health website. To see everybody rely on each other during this time was amazing. From the leadership of the company to the guys in the field, everybody was working as one team.

The leadership at Tomlinson Group also believes in giving back to the communities it serves through these trying times. As the company was working on its COVID-19 preparations in March, it took stock of its safety supplies. Michael Mohr, our Central Stores Supervisor, had a surplus of PPE and we made the decision to donate almost 30,000 N95 respirator masks to local hospitals across eastern Ontario to help support front-line workers during the pandemic.

When we reached out to the hospital directors and offered them the masks, I was shocked at how desperate the situation was. Hospital directors were brought to tears in many cases when we offered them the N95 respirators. We couldn't deliver them fast enough. Even though we were worried that we would run out of masks for ourselves, it was a really easy choice to make, since keeping people safe has been our priority throughout this entire crisis.

Now that the initial peak of the pandemic appears to have passed, the focus of the Tomlinson Group is preparing for the second wave that seems to have begun. To plan for this, the HR team has developed a flow chart with precise communication directed to managers and employees that clearly lays out the steps to be taken in the event of a positive case of COVID-19 within the company.

The flow chart was put to the test when a positive test result came back from the field in July. After operating for the better part of four months during the height of the pandemic, this was the first positive test result for an employee at the company. We had everything in place to handle a positive case so that it wouldn't spread and we could keep it isolated. Because we were prepared for just this situation, our crew was kept safe; they were able to get back to work after isolating and there was no delay to any of our projects.

Another concern for the company going forward is to ensure that its employees are well aware of what to expect living in a COVID world for the foreseeable future, such as what happens when their children go back to school and come in contact with the virus. By talking about it now, the Tomlinson Group hopes that, if there is an emergency situation, everyone will be on the same page and know what to do.

We are very proud at how we have stayed at the forefront of health and safety planning over these past months. Safety is a CORE value for the company and being proactive about these kinds of scenarios will make a huge difference throughout the coming winter. The pandemic isn't over and we will do our very best to keep our workers safe. ■

**Ryan Downing is Vice President, Operations Support
for R.W. Tomlinson Limited.**

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INDUSTRY NEWS



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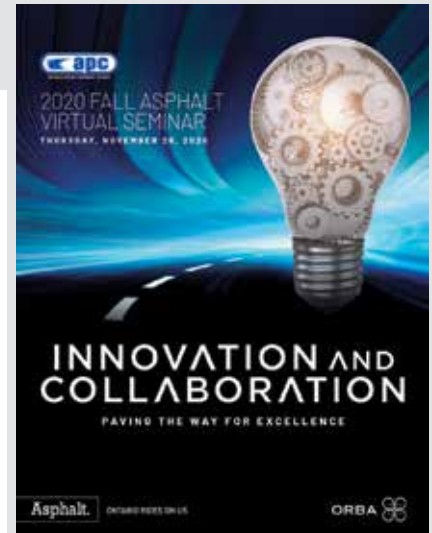
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THE 4th ANNUAL MUNICIPAL PAVING AWARD

Nominations are open for OGRA's 4th Annual Municipal Paving Award. The purpose of the award is to promote and recognize the successful collaboration between municipalities and HMA producers for excellence and innovation in paving projects in Ontario. Finalists will be announced via email in late January, and the Municipal Paving Project of the Year Award will be announced at the 2021 OGRA Conference. The deadline for submissions is December 18, 2020. For details, see the [News & Events](#) page on OAPC's website.

JEFFREY KALINOVICH, FLEMING COLLEGE The Ontario Asphalt Pavement Council Roads Scholarship Award for Academic Achievement

Plans for graduation and award ceremonies and celebrations have been curtailed due to the COVID-19 pandemic. However, the OAPC Roads Scholarship program continues to award \$1,000 scholarships to students who demonstrate exemplary leadership within their respective programs and who express an interest in the asphalt paving industry. In his own words:

"As a married father of three, my career change has been quite a ride, with no regrets. I've had a wide array of tasks on the job from engine and transmission replacement and reseals, to preventative maintenance services and plenty in between. I can thank the faculty at Fleming College's Frost campus for providing a strong foundation to build a successful career on, and get a good start in a shop with valuable mentorship. A national dealership no less – Brandt Tractor! As anyone in the industry can attest to, training and tools cost plenty of money. My most recent air tool purchase after receiving this award was the Snap-On PTR72 air ratchet. It's more powerful, faster, and quieter, and a welcome improvement over my old, tired, hand-me-down version. The Ontario Asphalt Pavement Council Roads Scholarship Award for Academic Achievement has helped in a big way, from buying needed tools to taking care of some of the student loan. So thank you very much! Your assistance has made a difference." Jeffrey Kalinovich, Heavy Equipment Techniques Program, Fleming College

Please go to the [News & Events](#) page on OAPC's website for a full list of scholarship recipients featured in the Roads Scholarship Spotlight.



HELP BUILD THE FUTURE OF THE ASPHALT INDUSTRY – OAPC STUDENT RESUME PORTAL

Encourage, engage, employ! Do you know a high school, college, or university student thinking about joining the asphalt and road building industry? **Encourage** them to post their resume to the OAPC Student Resume Portal. ORBA members can **engage** with the portal to view submitted resumes from construction and technology students. **Employ** students and help them develop the skills to grow in the industry and build the future of the asphalt industry. Please go OAPC's website under [Careers](#) to access the resume portal.

OAPC PUBLISHES THE LAST THREE OF THE TOP 10 LIST – WAYS TO GET MORE DURABLE HMA PAVEMENTS FACT SHEETS

The *Top 10 List* fact sheet series is now complete with the publishing of fact sheets #3 *Specify a Finer Gradation for your Mix Type*, #4 *Don't Overheat the Mix* and #10 *Use RAP Responsibly*.

Go to OAPC's website under [Publications & Education/Factsheets](#) to download the fact sheets.



ORBA WEBINARS AVAILABLE ON WEBINAR ARCHIVE LIBRARY

ORBA's complimentary October webinar series covered hard-hitting issues featuring diversity and inclusion in the workplace, resources for employee mental health, and the responsible use of RAP. If you missed it, the following webinars are now available in ORBA's Webinar Archive Library:

- **Welcoming Diversity and Inclusion in our Workforce** – A three-part series presented by Bronwyn Weaver, president of Q4 Impact, and her team. **Thank you to webinar sponsors Kiewit Corporation and Yellowline Asphalt Products Ltd.**  
- **TOOLS IN YOUR TOOLBOX: Strategies for Building Mental Health in the Construction Industry** presented by Nancy Watt, president of Nancy Watt Communications.
- **Top 10 List of Ways to Get More Durable HMA Pavements – The Responsible Use of RAP** presented by Doubra Ambaiowei, ORBA Technical Director.

Go to <https://orba.org/orba-webinars/> for full details.

OAPC PUBLISHES UPDATED HOT MIX ASPHALT SAFETY DATA SHEET

Revisions to the Hot Mix Asphalt Safety Data Sheet (SDS) are complete. The new SDS conforms to the 16 section recommendations of the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS). It is intended to serve as a guide for industry and membership, with resources drawn from OSHA, NAPA, and the International Agency for Research on Cancer (IARC). Go to OAPC's website under [Publications & Education/OAPC Publications](#) to access the document.



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For 94 years, ORBA has brought together industry leaders and stakeholders to exchange ideas, discuss the challenges that lie ahead and find solutions. ORBA will continue to bring together the road building industry and the greater stakeholder community at its 2021 Virtual Summit. Stay tuned for details coming soon.



OAPC AND ORBA PARTICIPATE IN 2020 AMO VIRTUAL TRADE SHOW

From August 17 to 19, 2020, ORBA and OAPC participated in AMO's Virtual Conference and Trade Show. The 2020 AMO trade show connected 1,500 participants, 46 exhibitors and 22 sponsors. For the first time since its inception, the conference was held virtually. ORBA and OAPC shared the new experience by jointly hosting an exhibitor booth and were grateful for the opportunity to connect with Ontario municipalities and their stakeholders. A special thank you to the 170 booth visitors who browsed and collected ORBA and OAPC swag. We hope to be back, in person, at AMO next year.



THE LAST WORD

Don Wilson

Time to reflect

Thirty-nine years with Dufferin Aggregates. How rare and cool is that to spend your entire working career with one company. You don't see that too often anymore. I am somewhat of a traditional guy and had planned to retire at the end of 2021 at the age of 65, but an early retirement opportunity presented itself and I was all in to make that change now.

In September 1981, after graduating from Ryerson with a Civil Structural Engineering degree, I was hired by Dufferin Aggregates as a sales and marketing representative. My new boss was Mike O'Connor (OHMPA past president, 1980, and executive director, 1997-2012). Mike proved to be a great sales and marketing mentor for me. My scope of work with Dufferin was to manage the sales and operations of the Etobicoke asphalt plant where we catered to third party small paving contractors. Mike's first marching orders for me were to climb on board the OHMPA train and join a few committees. He knew this would be an invaluable experience for me in starting my career.

I worked my way up the ladder until it was my turn to take on the president's role in 1988. I am the youngest president to have served OHMPA at age 32. The most important issue during my term was dealing with the Ministry of Transportation on End Result Specifications. It was indicative of how OHMPA as an organization was becoming the key industry representative on a broad range of issues. Rob Bradford (OHMPA executive director, 1990) and I also knew that OHMPA had to segue to a full time operation and delivered a five year plan to define just what sort of an association we needed.

My key sales responsibility at Dufferin over my entire career was selling aggregates to the asphalt producers segment. I never realized at the time how fortunate I was to be dealing with the people and companies that were the pioneers in building quality roads in Ontario. I was so privileged to meet and have long time relationships with industry icons like Mark Gazzola, Vern Gazzola, Joe Boccia, Cosimo Crupi, Bill Graham, Ashton Martin and Don Budd to mention a few.

There were a few notable achievements I am quite proud of over my career. We developed a very strong asphalt segment that continues today. I was also responsible for developing and introducing a product that is patented in the industry called HPB (High Performance Bedding). Jim Bartley (consultant) and I take great pride in that accomplishment.

And then there is my Dufferin Aggregates family. There are too many people over the years to recognize in this article, but I will mention a few. I was pretty green when I started and was mentored by Jim DiMarco and Ken Howard. Terry Waites, a brilliant marketer, was influential to me for many years. These gentlemen knew that relationship building was the key to being successful in sales. I took that advice to heart my entire career with my clients. Our sales team at Dufferin is tight and, in my opinion, the most talented in the industry. Our leadership group headed by Dan O'Hara, Jim Petrella, Jeff Benedict and Kate Lyons will continue to lead the way.

What lies ahead for me in the future? Lots! My wife, Angela, who is well known in the construction industry, is retiring at the end of this year. We plan to travel in Europe and play golf in Palm Springs once the COVID situation is in check. I am starting to take piano lessons, and will continue to play beer league hockey and critique and pray for my Toronto Maple Leafs to win the Stanley Cup again.

The industry is changing. Consolidation over the last several years has been apparent. COVID issues hopefully will be behind us soon and the industry will flourish under a new norm. The new generation of sales reps is so computer literate. My only advice to them is to be careful not to fall short on relationship building with their clients. ■

Don Wilson has recently retired from his role as Sales and Marketing Representative for Dufferin Aggregates.

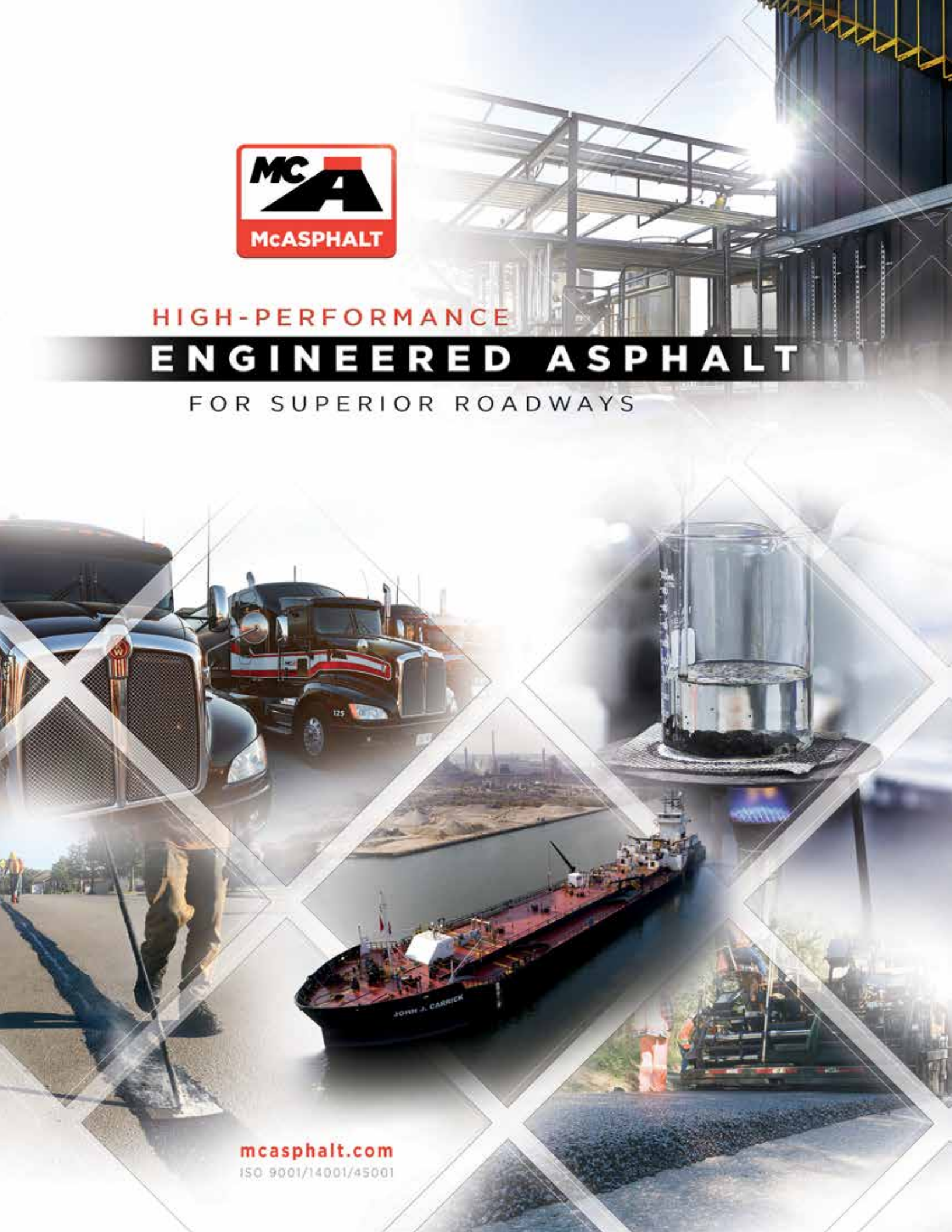


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