



# CP2 CENTER NEWS

Newsletter of the California Pavement Preservation Center

No. 45

March 2018

## WRAPP Workshop Delivers

By Roger Smith, CP2 Center

Over 250 pavement practitioners turned out for the annual Western Region Association for Pavement Preservation (WRAPP) Workshop, held February 6-7 in Concord, CA. President **Sallie Houston**, VSS, welcomed the group and



cited the continued importance of pavement maintenance and preservation, especially at a time when funding for pavement work will be increasing. Originally the California Chip Seal Association, WRAPP has grown to over 30 members and is playing a lead role advancing pavement preservation concepts and technologies. They also provide training for the new national certification program and participate in various Caltrans committees.

The Workshop also featured display tables by numerous industry vendors providing the latest information on products and equipment for pavement preservation.

For additional information on the Workshop and the presentations go to: [www.wrapp.org](http://www.wrapp.org)

### SB1 Funding For Roads

On that topic, the primary buzz at the Workshop was the new SB1 'gas tax' revenue now starting to reach agencies. A Keynote Speaker was **Jim Frazier** Chair of the California Assembly Transportation Committee. In citing the major funding increases, he noted that local agencies' funding for street & roads will double, and that \$2 billion in projects have already been approved. But the referendum effort to repeal the Bill is gaining steam, and will likely be a November ballot measure.

SB1 details, noting that the funding must go for transportation projects and can't go to the General Fund. A new Inspector General has been added to the Department of Transportation to oversee the proper use of these funds. For more information on CSAC activities contact Kiana at: [Kvalentine@counties.org](mailto:Kvalentine@counties.org). For a listing of proposed projects and other on SB1 info, go to: [www.rebuildingca.gov/](http://www.rebuildingca.gov/)

As a primer for the anticipated SB1 funding, **Edric Kwan** of the Town of Moraga outlined their success with promoting and implementing sales tax measures for roads. They strive to make Moraga residents aware of how the funds are used to increase their pavement condition in terms of a measurable PCI increase. Important tips for making the public aware of the spending include education programs, via public media, social media, lawn signs, and even T-shirts. They have made their dollars go further by sometimes partnering with the neighboring cities of Orinda and Lafayette on pavement contracts. For more information go to: [www.moraga.ca.us](http://www.moraga.ca.us)

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Figure 1. Assemblyman Jim Frazier and Sallie Houston, WRAPP President

**Kiana Valentine** with the California State Association of Counties (CSAC) provided additional perspective on the

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### Contract Efficiencies for Lower Bids

**Jason Lampley** of ISS outlined practices for contracts and 'engineer's estimates' that can lead to lower bids on pavement surface treatments. Here's a few of his suggestions:

- Time your work for the 'shoulder seasons' (Spring & Fall).
- Pool your work with neighboring cities.
- Group project streets by neighborhood/locale.
- Purchase economy-scale quantities, expressly where specialty materials are involved.
- Use the 'or equivalent' clause to give contractor some options.
- Hot chip seals can allow longer work shifts and even night work.
- Take advantage of flexible equipment & crews (e.g., same slurry machines can put down different types in same contract) For more information contact Jason at: [jason.lampley@gcinc.com](mailto:jason.lampley@gcinc.com)

### P<sup>2</sup> Promotion and Multi-layer Treatments

**Scott Dmytrow** of Telfer Pavement Technologies presented his insight on promoting the concept and value of pavement preservation using the example of the newer 'multilayer' surfacings. Such systems might include placing a double chip seal followed by a microsurfacing, or a 3-layer approach involving a microsurfacing, followed by a chip seal with a final slurry seal 'cape'. These multilayer treatments can often be more cost-effective than a typical 'mill & fill' rehabilitation. It was noted that there's usually a cure period of several days between these layers. For more information contact: [scott.dmytrow@telferpavements.com](mailto:scott.dmytrow@telferpavements.com)

### QC on Emulsion Projects

One breakout session involved **Bob Staugaard** of APART discussing the important tests that should be run on emulsion. Agency quality assurance (QA) testing should include: emulsion viscosity, percent asphalt residue, penetration, and a test to determine the presence of polymer (e.g. torsional recovery). Samples should be obtained in wide-mouth plastic containers (half



**Figure 2. Sieve Analysis Testing**

gallon is best) and tested as soon as possible – usually within a few days of sampling. Samples shouldn't be left in the back of a truck! For more information contact **Bob Staugaard** at: [bobs@apartshafter.com](mailto:bobs@apartshafter.com)

### National Efforts On Pavement Preservation

Advances in pavement preservation on the national level were outlined by various speakers including **John Coplanz** on Rocky Mountain West Pavement Preservation Partnership (RMWPPP), **Eric Reimschuessel** of International Slurry Surfacing Association (ISSA) and **Dr. Gary Hicks** on the AASHTO Emulsion Task Force, which is developing national specifications on asphalt emulsions, in terms of the PG grading system, and national specifications for surface treatments.

### Education and Pavement Preservation

The inclusion of pavement preservation concepts in higher education was discussed by a panel of representatives from universities in the region, including CSU-Chico, CSU-Long Beach, U.C. Davis and the University of Nevada, Reno, which now offers 10 courses in pavement technology. **Dr. Ding Cheng** of CSU, Chico, reminded the group of the CP<sup>2</sup> Center's online database - a valuable clearinghouse for documenting pavement preservation projects. Anyone is free to access this website at: [www.cp2info.org/Center](http://www.cp2info.org/Center)

### WRAPP Awards

WRAPP's "Lifetime Achievement Awards" were given to **Erik Updyke**, soon to be retiring after 36 years with the Los Angeles County DPW, and to **Jack VanKirk** of Basic Resources. Jack will retire in June after almost 40 years in the pavement world.



**Figure 3. Jack VanKirk (l.) and Erik Updyke with Their WRAPP Awards**

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WRAPP's 2017 "Contractor Quality Awards" went to the following projects:

- City of Santa Maria and ISS for their Type 2 slurry seal program with over 250,000sy.
- Caltrans District 9 (Bishop) and American Pavement Systems for their double chipseal - 3/8" asphalt rubber chipseal followed by a 1/4" PME chipseal.
- City of Oakland and Telfer Pavement Technologies for the bonded wearing course (BWC) program.

The new President of WRAPP for 2018 will be **Jim Ryan** of Alon Asphalt.

The 2019 WRAPP Workshop will be held February 7 & 8 in San Diego at the Mission Valley DoubleTree Conference Center. For more information on the WRAPP Workshop,

including the various presentations, go to: [www.wrapp.org](http://www.wrapp.org)



Figure 4. Jim Ryan, 2018 President, takes the WRAPP gavel from Sallie Houston



## Caltrans Rubberized Chip Seal Performance Review

By Lerosé Lane and DingXin Cheng, CP<sup>2</sup> Center

As technologies advance with new asphalt binder materials, Caltrans is anxious to compare the performance of seal coats (aka. chip seals) including asphalt rubber (AR) binders. Caltrans has previously used terminal-blended rubberized asphalt binder (CRR18MB) in hot mix asphalt (HMA), but some local agencies have also used these binders in seal coats. To explore their potential use in chip seals, Caltrans has included CRR18MB as part of their chip seal study for comparison with field-blended asphalt rubber (Type I and Type II). The Type II asphalt rubber binder has been used extensively by Caltrans since the 1980's.

### Construction

Caltrans constructed the first terminal-blended rubber modified binder (MB) chip seal pilot project in District 2, Tehama County, on State Route (SR) 36 in a low mountain region in 2013. Another pilot project, in District 2, Shasta County, on SR 44, in a high mountain region, was constructed, near Mount Lassen in 2014. The projects are now



Figure 1. Typical AR Chip Seal Construction

three and four years old, and valuable information can be obtained by studying their performance with regard to total cracking of the pavement surface. During the fall of 2017,

Table 1. Summary of Two Rubbersized Chip Seal Projects

	SR 36	SR 44
<b>Base Binder Grade</b>	Lunday-Thagard PG 64-10	Paramount Petroleum PG 64-16
<b>Asphalt Rubber Blending</b>	Knife River's facility in Marysville (Type II*) with and without WMA	*VSSI, Inc., (Type I and II) with and without WMA
<b>WMA Additive for AR</b>	Sasobit GTRM 850 by Sasol Wax North America	SonneWarmix® CA by Sonneborn
<b>CRR18MB with and without WMA</b>	Paramount Petroleum	Paramount Petroleum
<b>CRR18MB with and without WMA</b>	Sasobit	Sasobit
<b>Climate Region</b>	Semi-Mountainous	High Mountain
<b>Initial Pavement Condition</b>	Good	Good
<b>Seal Coat Completion Date</b>	September 7, 2013	September 5, 2014

\*SR 36 did not use asphalt rubber (Type I)

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**Test Section Layout**

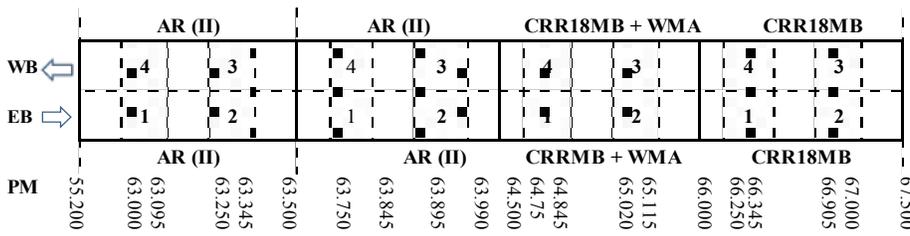
Both projects include multiple test sections, and within each test section, four Performance Evaluation Sections (PESs) were constructed, with post miles, for performance monitoring. Most of the PESs were 500 feet long, and are shown in Figure 2a, and Figure 2b. For the two projects, the condition of each PES section was evaluated by the CP<sup>2</sup> Center prior to the chip seal applications, and again in the fall of 2017. SR 44 lost 5 test sections due to either bleeding or rock loss. These sections were considered 'out of service', and not evaluated.

**Test Section Applications**

Application details for the various seal coat test sections are shown in Tables 2 – 7.

**Table 2. Summary of Two Rubbersized Chip Seal Projects**

Asphalt Rupper (Type II)	SR 36	SR 44
Binder Application Target Rates	0.58 gal/yd <sup>2</sup>	0.55 to 0.65 gal/yd <sup>2</sup>
Application Temperatures	400°F	Varied to a high of 410°F



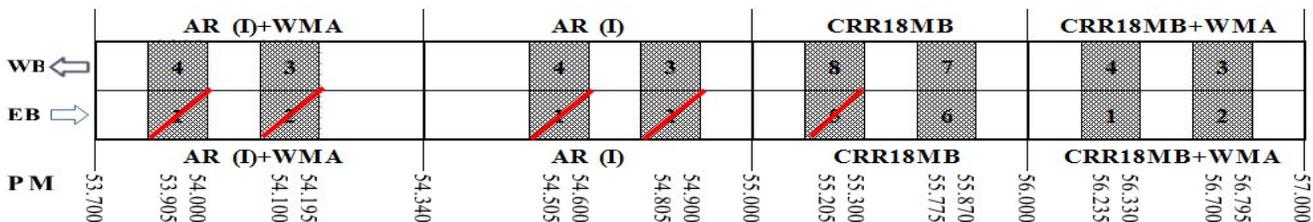
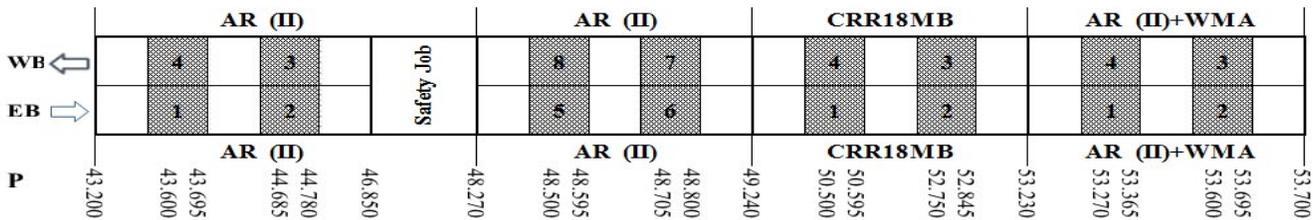
■ X Performance Evaluation Section (NOT TO SCALE)

- AR (II) = Asphalt rubber Type II
- AR (II)+WMA = Asphalt rubber Type II with WMA additives
- CRR18MB = Crumb rubber R18 modified binder
- CRR18MB+WMA = Crumb rubber R18 modified binder with WMA additives

**Figure 2a. Layout of the SR 36 Chip Seal Test Sections (2017)**

**Asphalt Rubber (Type II) Test Sections**

Figure 3 and Figure 4 on the following pages show the comparative cracking results for AR (Type II). For SR 44, the total cracking was 22 percent of the original cracking. For SR 36, the total cracking was 15 percent of the original cracking, which is 7 percent less than for SR 44. The AR (Type II) chip seal is performing well in both climate regions for retarding cracking.



■ X Performance Evaluation Section (NOT TO SCALE)

■ / Performance Evaluation Section out of Service (NOT TO BE EVALUATED)

- AR (II) = Asphalt rubber Type II
- AR (II)+WMA = Asphalt rubber Type II with WMA additives
- AR (I) = Asphalt rubber Type I
- AR (I)+WMA = Asphalt rubber Type I with WMA additives
- CRR18MB = Crumb rubber R18 modified binder
- CRR18MB+WMA = Crumb rubber R18 modified binder with WMA additives

**Figure 2b. Layout of the SR 44 Chip Seal Test Sections (2017)**

### AR (Type II) PES 1-8, SR 44

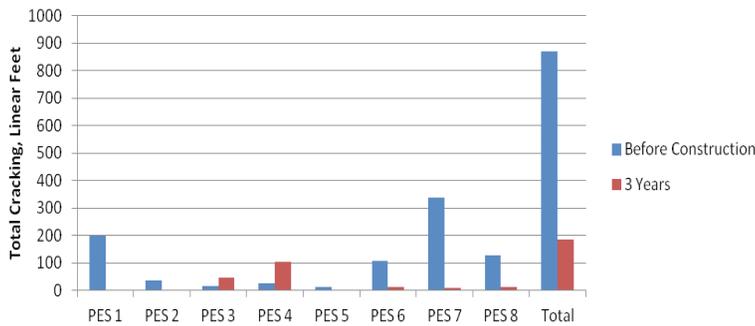


Figure 3. Comparative Cracking Results for AR (Type II) PES 1-8 (SR 44)

### AR (Type II) SR 36

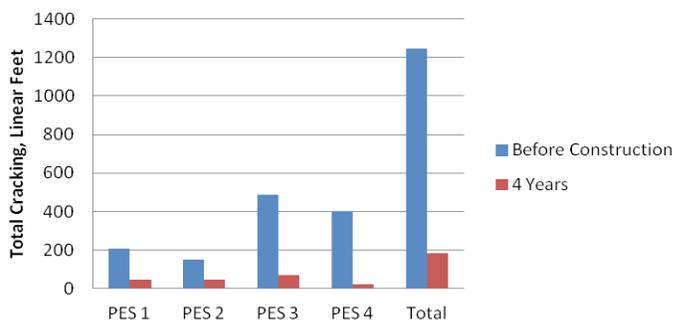


Figure 4. Comparative Cracking Results for AR (Type II) PES 1-4 (SR 36)

### Asphalt Rubber (Type II) with WMA Test Sections

Table 3. Summary of Two Rubbersized Chip Seal Projects

Asphalt Rubber (Type II)	SR 36	SR 44
Binder Application Target Rates	0.58 gal/ yd <sup>2</sup>	0.58 gal/yd <sup>2</sup>
Application Temperatures	350°F	375°F
Construction Dates	9/4/2013	8/27/2014
Warm Mix Additive	Sasobit	SonneWarmix® CA

Figure 5 and Figure 6 show the comparative cracking results for AR (Type II) with WMA. For SR 44, the total cracking was 93 percent of the original cracking. For SR 36, the total cracking was 30 percent of the original cracking, which is 63 percent less than for SR 44. The AR (Type II) with WMA chip seal is performing much better in the low mountain region for retarding cracking. These results should be verified with

more than four test sections, since it is more likely that WMA would be specified in a high mountain region such as SR 44.

### AR (Type II) + WMA, SR 44

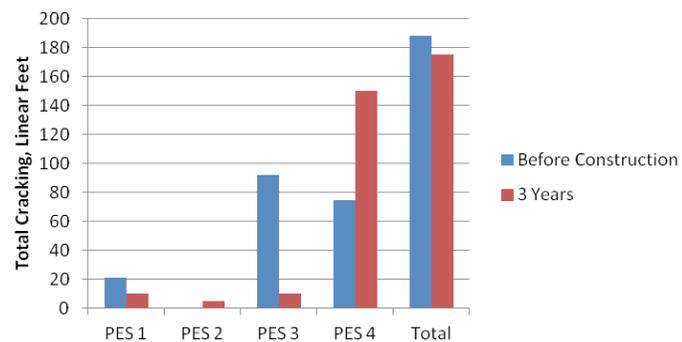


Figure 5. Comparative Cracking Results for AR (Type II) + WMA PES 1-4 (SR 44)

### AR (Type II) + WMA, SR 36

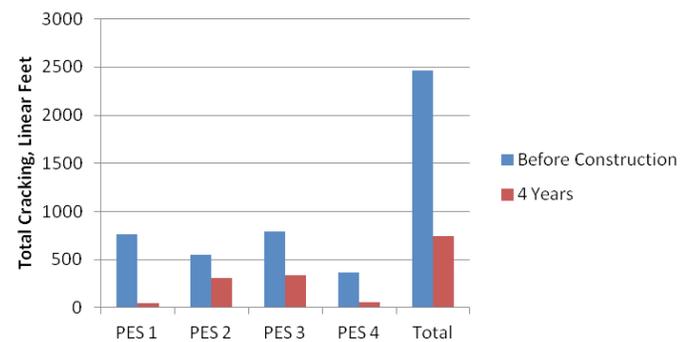


Figure 6. Comparative Cracking Results for AR (Type II) + WMA PES 1-4 (SR 36)

### Asphalt Rubber (Type I) Test Sections

Table 4. Asphalt Rubber (Type I) Construction Details

Asphalt Rubber (Type I)	SR 44
Binder Application Target Rates	0.56 gal/yd <sup>2</sup>
Application Temperatures	403°F

Figure 7 on the following page shows the total cracking results for AR (Type I) for PES 3 and PES 4. SR 36 did not have AR (Type I), so the results shown are for SR 44 only. The results are further limited to PES 3 and PES 4 since PES 1 and PES 2 were paved over due to concerns from Maintenance due to rock loss and bleeding. This product exhibited poor performance for these limited results, with a 190 percent increase in cracking when compared to the prior to construction cracking. *Continued, next page*

## AR (Type I) SR 44

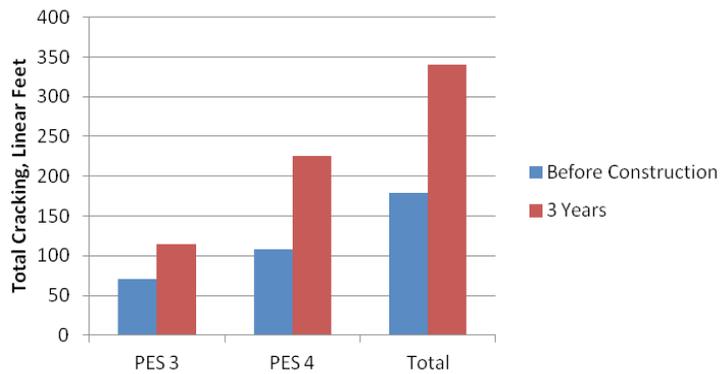


Figure 7. Comparative Cracking Results for AR (I) - (SR 44)

## Asphalt Rubber (Type I) with WMA Test Sections

Table 5. Asphalt Rubber (Type I) with WMA Construction Details

Asphalt Rubber (Type I) with WMA	SR 44
Binder Application Target Rates	0.58 gal/yd <sup>2</sup>
Application Temperatures	375°F
Construction Dates	8/27/2014
Warm Mix Additive	SonneWarmix® CA

Figure 8 show the total cracking results for AR (Type I) with WMA for PES 3 and PES 4. For asphalt rubber (Type I) with WMA, the results are also limited to PES 3 and PES 4 since PES 1 and PES 2 were paved over due to concerns from Maintenance due to rock loss and/or bleeding. This product exhibited poor performance for these limited results, with a 418 percent increase in cracking compared to the prior to construction cracking.

## AR (Type I) + WMA SR 44

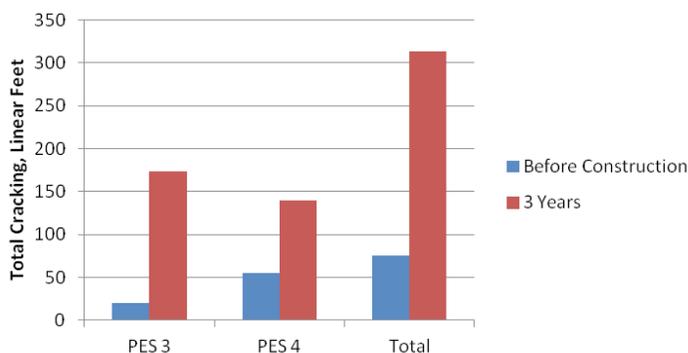


Figure 8. Comparative Cracking Results for AR (Type I) + WMA (SR 44)

## CRR18MB Test Section Applications

Table 6. CRR18MB Test Section Applications

CRR18MB	SR 36	SR 44
Binder Application Target Rates	0.45 gal/yd <sup>2</sup> (Trial rates of 0.40 to 0.50 gal/yd <sup>2</sup> )	0.45 to 0.47 gal/yd <sup>2</sup>
Application Temperatures	350 to 375°F	375°F

Figure 9 and Figure 10 show the comparative cracking results for CRR18MB. For SR 44, the total cracking was 486 percent of the original cracking excluding PES 5 which had been paved over. For SR 36, the total cracking was 11.4 percent of the original cracking, which is 475 percent less than for SR 44. The CRR18MB chip seal is performing much better in the low mountain region for retarding cracking. However, several of the SR44 test sections showed low cracking after 3 years. The difference was that PES 2, PES 3, and PES 4 received a double chip seal due to damage after winter suspension. With the double chip seal on PES 2 and PES 3, there was no cracking after 3 years on SR 44. However, overall, CRR18MB did not perform well in the high mountain region.

## CRR18MB SR 44

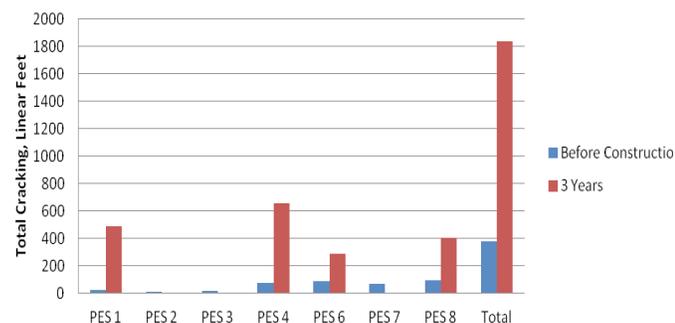


Figure 9. CRR18MB Performance (SR 44)

## CRR18MB SR 36

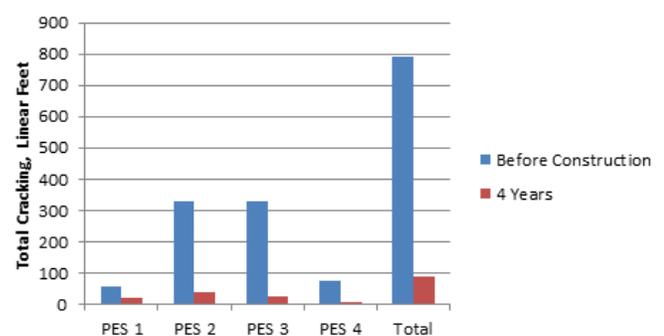


Figure 10. CRR18MB Performance (SR 36)

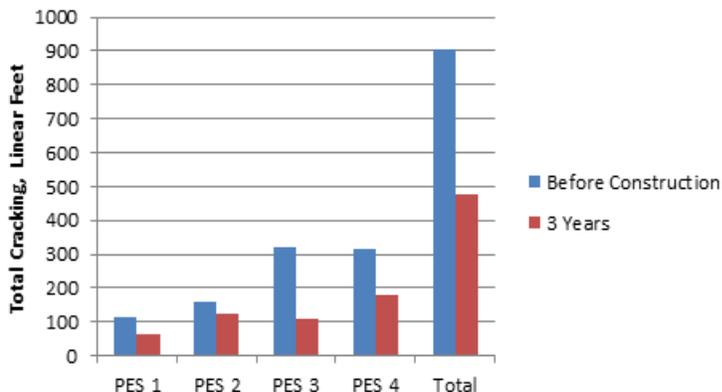
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**Table 7. CRR18MB with WMA Construction Details**

CRR18MB	SR 36	SR 44
<b>Binder Application Target Rates</b>	0.45 gal/yd <sup>2</sup> (Trial rates of 0.40 to 0.50 gal/ yd <sup>2</sup> )	0.45 to 0.47 gal/ yd <sup>2</sup>
<b>Application Temperatures</b>	330 to 350°F	355°F
<b>Warm Mix Additive (WMA)</b>	Sasobit GTRM 850	Sasobit GTRM 850

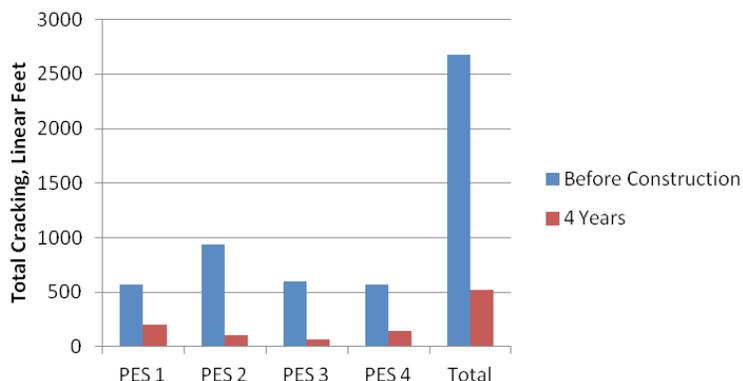
Figure 11 and Figure 12 show the comparative cracking results for CRR18MB. For SR 44, the total cracking was 53 percent of the original cracking. For SR 36, the total cracking was 19.4 percent of the original cracking, which is 33.6 percent less than for SR 44. The CRR18MB with WMA chip seal is performing better in the low mountain region for retarding cracking. However, overall, CRR18MB with WMA performed better in the high mountain region for retarding cracking, except for AR (Type II).

**CRR18MB + WMA SR 44**



**Figure 11. CRR18MB + WMA Performance (SR 44)**

**CRR18MB + WMA SR 36**



**Figure 12. CRR18MB + WMA Performance (SR 36)**

Field Performance of Both Pilot Projects

For the SR 36 pilot project, all of the products appeared to have good performance with retarding total cracking. CRR18MB had the best crack retardance with 11 percent total cracking, when compared to the pre-construction total cracking. AR (Type II) was a close second with only 4 percent more total cracking for a total cracking of 15 percent.

It is clear from these pilot projects that performance, for controlling total cracking, is more difficult to obtain in the high mountain regions with most binder materials. The warm mix additives with the AR (Type I) and AR (Type II) both had more total cracking than the same products without WMA. However for SR 44, the CRR18MB with WMA outperformed the CRR18MB binder for the high mountain region. See Table 8 for comparison results of total cracking between SR 44 and SR 36.

**Table 8. CRR18MB with WMA Construction Details**

Seal Coat Binder	SR 44 Percent Cracking* High Mountain Region (3 Years)	SR 36 Percent Cracking* Low Mountain Region (4 Years)	Difference in Percent Cracking Between SR 44 and SR 36
AR (Type II)	22	15	7
AR (Type II) + WMA	93	30	63
AR (Type I)	190	--	--
AR (Type I) + WMA	418	--	--
CRR18MB	486	11	475
CRR18MB + WMA	53	19.4	33.6

\*Percent cracking is the measured total cracking (linear feet) with the seal coat after 3 or 4 years of performance compared to the pre-construction total cracking.

Construction Reports

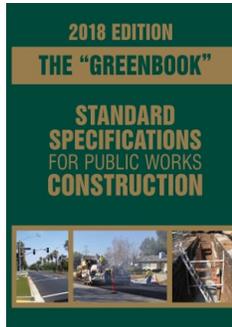
The CP<sup>2</sup> Center will continue to provide technical support for future evaluations of these and other projects for Caltrans.

For more information contact **Lerose Lane** at: [leroselane@gmail.com](mailto:leroselane@gmail.com) or **Ding Cheng** at: [dxcheng@csuchico.edu](mailto:dxcheng@csuchico.edu).



## The 2018 Greenbook is Out

The 2018 Edition of the Standard Specifications for Public Works Construction ("Greenbook") is now available for purchase. The Greenbook is a copyrighted publication published and distributed by BNi Building News [www.bnibooks.com](http://www.bnibooks.com). Notable additions and updates include specifications for polymer modified emulsion, microsurfacing,



By Erik Updyke, Los Angeles County performance graded tire rubber modified asphalt concrete, and polymer modified asphalt concrete.

The Greenbook Committee web site is [www.greenbookspecs.org](http://www.greenbookspecs.org). A complete meeting schedule of the Committee and various subcommittees and task forces is posted. Attendance is welcomed and available via [Go To Meeting](#).



## Cold-in-Place Recycling With Foamed Asphalt

By Dennis McElroy - Graniterock

With climate change a hot topic all over the world, it's not surprising new technologies for pavement rehabilitation have taken off throughout California.

The Golden State, a global leader in environmental stewardship, has embraced Cold-in-Place Recycling (CIR) as a greener, more economical method for restoring our beat up asphalt pavements. CIR can be performed using asphalt emulsion (CIR-AE) or foamed asphalt (CIR-FA).

State transportation leaders agree, foamed asphalt CIR has great potential, when used appropriately. Recently, industry and Caltrans worked together and developed a provisional specification (NSSP 30-6) for this technology.

"Recycling is something we definitely want to do, so we are testing the foamed asphalt process to see how it works," said Sri Balasubramanian, former head of the Caltrans Office of Asphalt Pavements. "We will evaluate this process over time, project by project, and determine its quality and whether it has the strength and durability to work for our needs."

Cold-in-Place recycling using foamed asphalt (CIR-FA) reuses the existing asphalt pavement to create a highly durable pavement layer, which becomes a key component of the pavement structure before final surfacing. As shown in Figure 1, it involves grinding up the top 3 to 6 inches of the existing asphalt surface and

mixing the pulverized pavement with foamed 'PG' asphalt binder and Type II Portland cement, then placing it back down with a conventional paver. It is then capped with a layer of new hot mix asphalt (HMA).

Other surface treatments, such as microsurfacing, thin bonded wearing course, chip seals, cape seals or slurry seals can be installed over

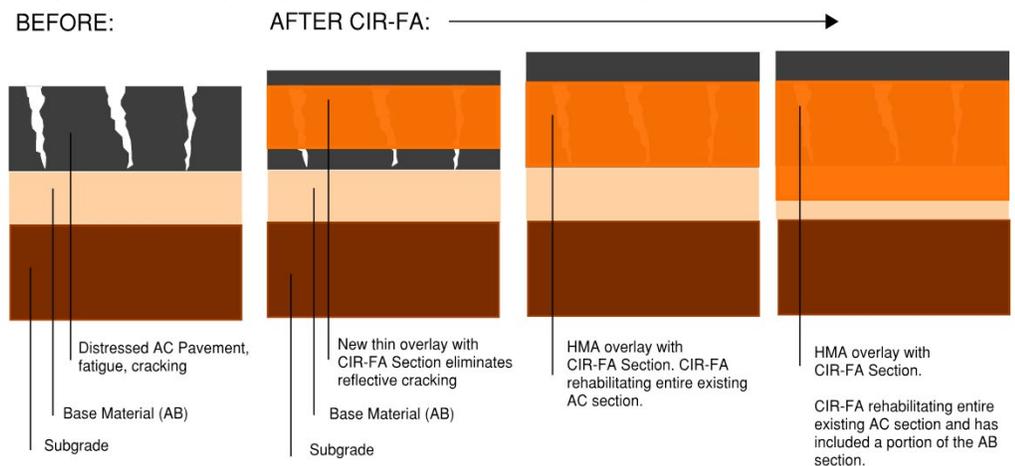


Figure 1. Some options for CIR-FA CIR mixes.

Since these thin maintenance treatments provide very little structural contribution to the overall pavement section, it is recommended that these types of treatments only be applied on roadways with low traffic volume roadways.

Foamed asphalt is produced by injecting small amounts of air and water into standard performance grade asphalt binder, such as PG 64-10, at high pressure, which results in the binder foaming and expanding to approximately 20 times its original volume. The foamed asphalt is then delivered into the single drum mixing chamber via injectors located on top of the drum housing and mixed into the pulverized aggregate. Material sizing is achieved by the down-cutting milling head, the condition of the existing asphalt pavement, and the forward

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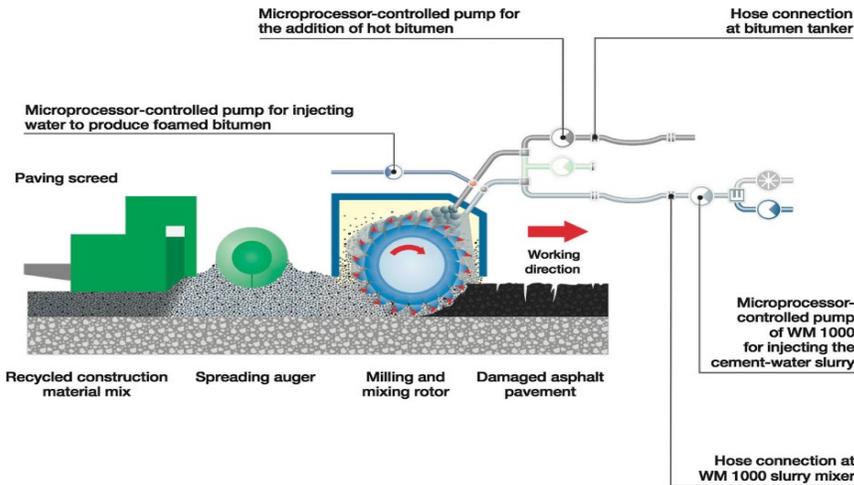


Figure 2. CIR-FA Process

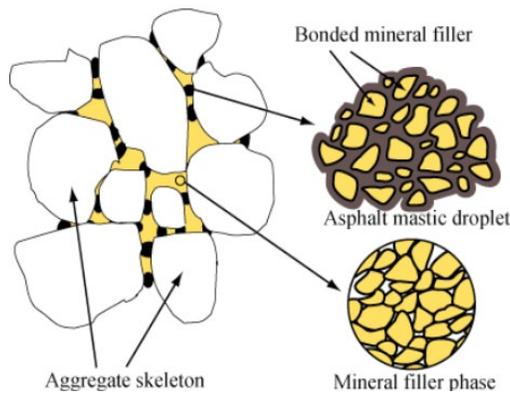


Figure 3. Foamed Asphalt

speed of the recycling unit (Figure 2).

The CIR-FA layer creates structural value, which allows the final surface layer thickness to be reduced. The thinner HMA surfacing results in lower material costs and eliminates the trucking of new material to the project.

CIR-FA can be performed with a single recycling unit as shown in Figure 4, which consists of an asphalt binder tanker truck feeding a Wirtgen 3800 CR recycling machine, followed by standard paving equipment. Larger multi-unit recycling 'trains'

can be used to grind, crush if necessary, and mix the grindings on site. Utilizing the single unit recycler in urban environments will increase productivity and safety throughout the project site.

The recycling technology that Wirtgen provides has allowed this recycling method to grow in

urban areas because of the machine's easy maneuverability. So not only has CIR-FA been used on heavily traveled roadways such as Monterey Highway in San Jose, but also on arterial, collector, and residential roadways throughout California with great success. The recognized benefits of CIR can be summarized as follows:

- Saves 20% - 40% of your road maintenance budget.
- Cuts greenhouse gas emissions by 52%.
- Reduces truck traffic by 90%, saving costs and creating a safer working environment.
- "Zero waste" approach to pavement rehabilitation.
- Faster Construction times compared to traditional remove-and-replace methods.

The City of San Jose Public Works Department, responsible for 6,000 lane miles, has incorporated CIR as part of its pavement maintenance program for the past six years.

"Cold recycling in-situ fulfills exacting quality requirements, is extremely economical, environmentally-friendly, and has the least impact on the public," said Frank Farshidi Ph.D., P.E., a project manager for the city of San Jose. "The main reason we like CIR is because it minimizes the traffic impact and the number of trucks coming in and out of the project site, and we don't have to close the road. The residents really like that. "

Along with Caltrans, San Jose has created its own CIR specification to use on a project-by-



Figure 4. Single Unit Recycler – Wirtgen 3800 (Hellyer Ave, Santa Clara County 2017)

project basis. Their Monterey Road Project in 2011, which involved 2-inches of rubberized HMA (RHMA) over 4-inches of CIR-FA, saved over \$500,000, or about \$118,000 per lane-mile, over traditional HMA methods. The project also saved over 1,400 truck trips and 10,000 tons of material.

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Figure 5. Monterey Road Before



Figure 6. CIR-FA operation on Monterey Road in 2011

An increasing number of public works agencies, including the cities of San Jose, Hayward, Santa Cruz and San Francisco, and also Santa Clara, Monterey, Marin and Contra Costa counties have caught on to the process and repeatedly use it to address their pavement maintenance backlogs.

With this new Caltrans NSSP 30-6 for CIR-FA,



Figure 7. CIR-FA surface during curing phase, before final RHMA surfacing - 2011



Figure 8. Monterey Road condition - 2016

even more local public works agencies are expected to choose CIR-FA for their road maintenance projects.

For more information contact: **Dennis McElroy** at: [dmcelroy@graniterock.com](mailto:dmcelroy@graniterock.com)



## Maltene Rejuvenators For Aged Pavements

By Jim Brownridge – Tricor Refining

The saying is true that asphalt pavements start out black and Portland concrete pavements start out white, but both turn gray in the long run. Asphalt pavements lose essential components as they age, turning black to gray, while concrete just darkens. The characteristics of an aged pavement are cracking, brittleness, loss of aggregate and oxidation, which together compromise service life and pavement condition index (PCI).

When asphalt binder is exposed to oxygen and the sun's ultraviolet rays, over time they begin to oxidize. The changes that occur to asphalt binders are primarily due to the chemical composition of asphalt, leaving binders stiffer, less ductile. The aging process reduces the ratio of oily maltenes in the binder, leaving a greater ratio of stiffer asphaltenes. These changes over time result in a hardened, more brittle asphalt

binder. A key to understanding how maltene-based 'rejuvenator' emulsions work is knowledge of what maltenes and asphaltenes are. What's left after the refining and distillation of crude oil are the heavy resins at the bottom of the crude barrel, or asphalt. Asphalt is sold and supplied based on the basis of 'PG' grading specifications. In our industry, we can also emulsify asphalt with water to make various products that can be sprayed onto pavements to coat and protect them (e.g., fog or chip seals), or blended with aggregates and placed as slurry and micro seals.

Asphalt binder will have heavy, black materials in it, called asphaltenes, and light oils and resins called maltenes. The maltene-based rejuvenator is a blend of four maltene fractions with no black color to them, because they do not contain asphalt. Unlike

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asphalt emulsions, that protect and add binder to the surface, the maltene emulsion rejuvenator penetrates into the surface and combines with the weathered and oxidized asphalt binder holding the aggregate. It softens it, or changes its viscosity, and adds durability.

Petroleum or maltene-based rejuvenators aren't the only product being sold as rejuvenators. Recently, some proprietary recycling agents

replace the natural petroleum oils and resins missing from the asphalt binder. They provide workability by softening the asphalt, but there's no improvement in durability because they can't add back the missing maltene fractions.

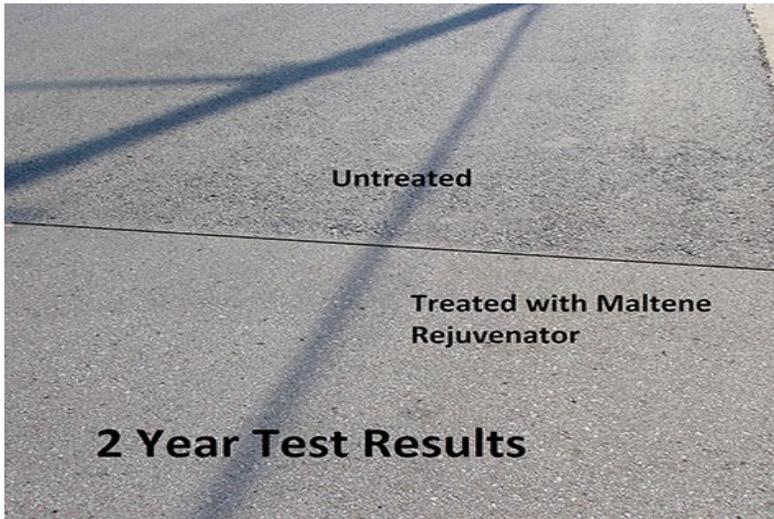
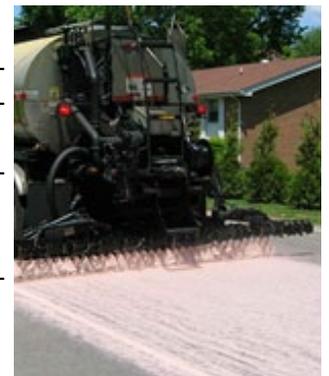
In agency pavement preservation programs asphalt emulsion-based rejuvenators should have a place alongside established treatments such as chip seals and slurry surfacings, experience shows. But generally, pavement management programs don't include asphalt rejuvenators as options within their software.

Travis County, Texas, has used maltene-based Reclamite rejuvenator successfully for years, according to **Don Ward**, P.E., former director of road maintenance. Ward did extensive research 14 years ago and traveled to a number of states to look at products applied.

"I was taken aback by how the product worked," Ward said. "A county in Florida had 15 years of documentation and was able to demonstrate how millions of dollars had been saved preserving pavements with a maltene-based rejuvenator."

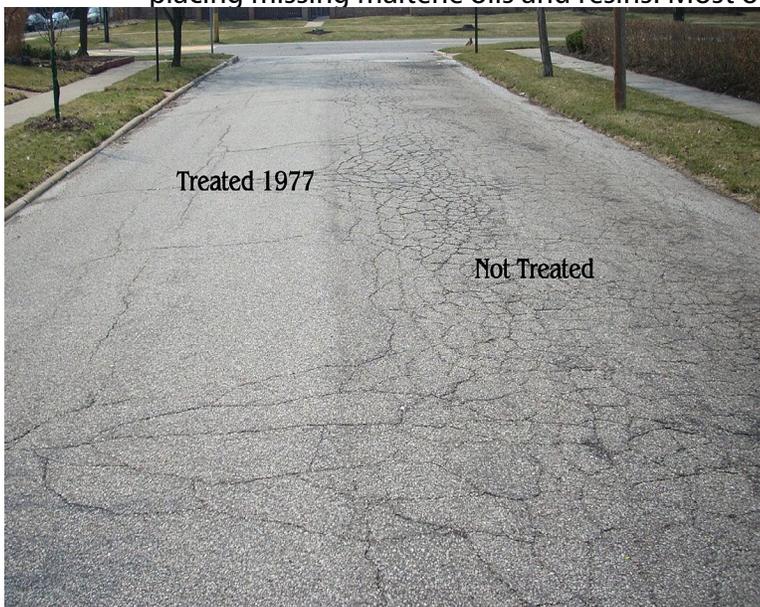
Also, in Visalia, Calif., **Norm Goldstrom**, Public Works Manager, has successfully used maltene-based rejuvenators in their pavement preservation program since 1990. The goal is to maintain the high PCI's, shown by its pavement management system program, with a lower cost treatment, extending pavement life four to five years. Penetration and viscosity testing of asphalt binders utilizing Caltrans test methods and DSR testing showed substantial improvement leading to reduced stiffness of the binder and retarding the aging process. Visalia's use of rejuvenators has been so successful that it received the 2015 Project of the Year Award from

the Western Region Association for Pavement Preservation (WRAPP). For more information contact **Jim Brownridge** with Tricor Refining at: [jimb@tricorrefining.com](mailto:jimb@tricorrefining.com)



*Figure 1. Treated Pavement Shows Less Aggregate Loss Compared to Untreated Section*

made from bio-based oils have also been marketed and sold as rejuvenating agents. A true rejuvenator changes what's underneath, by replacing missing maltene oils and resins. Most of



*Figure 2. 2009 photo shows performance of 1977 rejuvenator in Cleveland, Ohio*

the bio-based materials involve corn, vegetable, or rapeseed, with diluents derived from agricultural sources. These type of products will penetrate the asphalt binder to soften it, but cannot



# Pervious Concrete for Stormwater Design

By David Liguori, Bay Area Pervious Concrete

Civil engineers have their hands full these days when it comes to stormwater design. No longer can they simply slope everything to a drain and send it off to the city system. In many cases, cities are now restricting, or even completely eliminating, the volume of stormwater runoff from a property.

In an attempt to make this work designers tend to throw everything but the kitchen sink (think multiple BMP's) at the problem in order to satisfy the new regulations. These designs tend to be complex and costly, while often still producing stormwater runoff. But it does not have to be that way.

Pervious concrete stormwater management systems, when designed according to the principle known as Large Area Thin Infiltration Systems (LATIS), are considerably more effective and

less costly than other BMP's or hybrid systems. More than just a way to reduce stormwater runoff, pervious concrete pavement greatly simplifies stormwater management by completely eliminating stormwater run-off, even in slow-draining Type D clay soils during the

largest storm events. LATIS however, represents a 180-degree departure from conventional stormwater modeling and design and requires a major re-think.

In conventional designs, water is typically moved, by drainage infrastructure, from where it falls to an area with a smaller footprint. In order to make this trade-off, the depth and volume of water in the smaller area is increased considerably. While natural environments have a considerable capacity to absorb rainwater, stormwater "run-on" will quickly overwhelm the soil's absorption capacity.

By comparison, when rain falls on a permeable pavement, there is no transporting or moving of the water, it simply stays where it falls. If it rains two inches, then the system has two inches of water evenly spread out over the pavement area. Quickly making its way through the pavement and into an open-graded rock



Figure 2. Pervious Concrete (with coloring)

layer below, the rainwater either infiltrates immediately into the soil or, in the case of soils with very low infiltrations rates, is stored temporarily while it slowly soaks in. This rock layer "buffer zone" results in a highly effective and completely passive stormwater mitigation system - with the ability to capture and infiltrate most storm events with no additional infrastructure.

Many such 'infrastructure-less' systems have been designed and installed and are providing outstanding performance. Having closely monitored these systems during the records rains of the 2017 California winter, we can report that not one of them ever reached capacity or produced outflow. In addition to the performance benefits, the greatly simplified design will likely lower project costs compared to other BMP's and hybrid approaches.

As for lessons learned, we've come to understand that using pervious concrete as a drain or filter for runoff from adjacent pavement or landscape areas, is not a good practice. Although a common design, it dramatically increases the need for maintenance and reduces performance because stormwater 'run-on' directed onto pervious concrete brings with it fines and sediment that quickly build up within the pore spaces, negatively impacting performance. On the other hand, when these pavements are designed as stand-alone systems, and only receive the rainwater that falls on them, they perform at extremely high levels for long periods of time with little or no maintenance.

In regard to the pavement itself, modern concrete mix designs, equipment, and installation techniques have evolved considerably over the past decade and brought pervious concrete to a level of durability and consistency needed to tackle the biggest challenges. *Continued, next page*

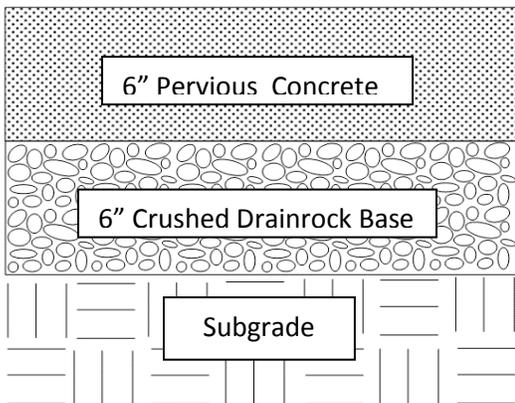


Figure 1. Typical Section (parking lot)

The original generation of pervious concrete mix designs utilized very low water-cement ratios (0.25-0.28) that were excessively demanding to work with and, due to the lack of moisture, they typically achieved very low hydration and thereby lower strength levels. Modern mixes, however, are able to achieve much higher water-cement ratios, particularly through the use of superabsorbent polymer (SAP) additives, providing a dramatic increase in both workability and performance. These mixes are discharged from the truck faster and placed in



Figure 3. Pouring pervious concrete over drainrock base

less time with less effort, providing a welcome increase in productivity.

Using your pavement as your stormwater management system is a relatively new concept, and it can be a big step for many designers. Without the proper knowledge and education, one can easily spend more money than they should to produce a system that underperforms it's potential.

For more information go to: [www.bayareaperviousconcrete.com](http://www.bayareaperviousconcrete.com)



## Case Studies on Concrete Repair Best Practices

By FHWA's "EDC News"

Materials quality, equipment, and construction methods used in pavement preservation improved significantly in the past 20 years, leading to longer lasting preservation treatments. Various publications document design procedures and materials for concrete preventive maintenance, but less information was available on construction best practices. To address this, the Missouri Department of

Transportation (MoDOT) published a [report](#) consolidating case studies from several States for six concrete pavement restoration techniques. MoDOT also published a technical brief for each case study: [cross-stitching](#), [dowel bar retrofit](#), [diamond grinding](#), [full depth repair](#), [partial depth repair](#), and [slab stabilization](#). For information, contact Jason Dietz of the FHWA Resource Center at [jason.dietz@dot.gov](mailto:jason.dietz@dot.gov).



## Useful Websites

By Roger Smith, CP<sup>2</sup> Center



Here's a list of useful online resources for pavement maintenance and preservation:

- Caltrans "Maintenance Tech. Advisory Guide" (MTAG): [http://www.dot.ca.gov/hq/maint/MTA\\_GuideVolume1Flexible.html](http://www.dot.ca.gov/hq/maint/MTA_GuideVolume1Flexible.html)
- California Pavement Preservation Center, Chico (CP<sup>2</sup>C): [www.cp2info.org/center](http://www.cp2info.org/center)
- Western Region Association for Pavement Preservation (WRAPP): <http://wrapp.org>
- California Asphalt Pavement Association (CalAPA): <http://calapa.net/>
- Caltrans Standard Specifications: [http://www.dot.ca.gov/hq/esc/oe/construction\\_contract\\_standards/std\\_specs/2015\\_StdSpecs/2015\\_StdSpecs.pdf](http://www.dot.ca.gov/hq/esc/oe/construction_contract_standards/std_specs/2015_StdSpecs/2015_StdSpecs.pdf)
- Asphalt Reclaiming & Recycling Association (ARRA): [www.arra.org](http://www.arra.org)
- Asphalt Interlayer Association (AIA):

- [www.aia-us.org](http://www.aia-us.org)
- Metropolitan Transportation Commission (MTC): <https://mtc.ca.gov/our-work/invest-protect/investment-strategies-commitments/fix-it-first/local-streets-and-roads-1>
- U.C. Berkeley Tech Transfer (classes): [www.techtransfer.berkeley.edu](http://www.techtransfer.berkeley.edu)
- Asphalt Institute (AI): [www.asphaltinstitute.org](http://www.asphaltinstitute.org)
- National Asphalt Pavement Association (NAPA): [www.hotmix.org](http://www.hotmix.org)
- Foundation For Pavement Preservation (FP<sup>2</sup>): [www.fp2.org](http://www.fp2.org)
- International Slurry Surfacing Association (ISSA): [www.slurry.org](http://www.slurry.org)
- Asphalt Sealcoat Manufacturers Association (ASMA): [www.sealcoatmfg.org](http://www.sealcoatmfg.org)



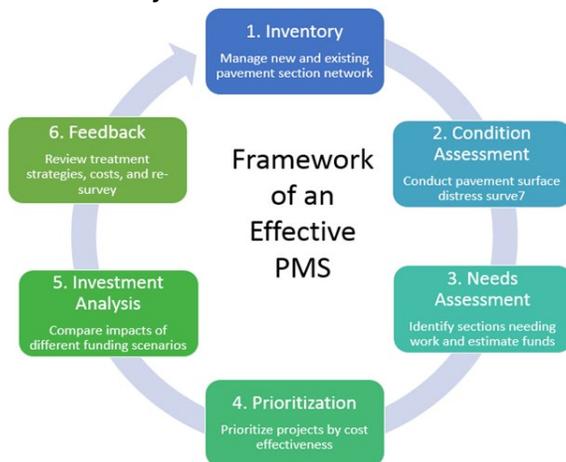
# Get Your Pavement Management House in Order

By Sui Tan, Metropolitan Transportation Commission (MTC)

With the passage of Senate Bill 1, local agencies will be receiving about \$1.5 billion per year for the next 10 years for road maintenance. For most agencies, this is probably the largest source of dedicated funding available. It is paramount to show California voters that these monies will be put to good use for road repair. However, when it comes to road repair, should it be business as usual? Are you going to pave the worst roads first? Or are you going to fix the good roads so that they last longer?

It is my hope to instill some 'best management practices' when it comes to pavement management. It doesn't matter whether you are just about to implement a new pavement management system (PMS) or managing an existing system, every step is designed to improve cost-efficiency, and promote infrastructure sustainability.

Figure 1. Framework of an Effective PMS



I hope the following six steps will help improve customer satisfaction and deliver accountability and transparency to the motoring public, while also minimizing life-cycle costs for managing and maintaining pavement assets.

## Step 1 – Inventory

- Identify the minimum data requirements for network-level decisions.
- Data collection is costly; collect only what is needed.
- Consider PMS software that is easy to use and maintain.

## Step 2 – Condition Assessment

- Commit to condition assessment at regular intervals – i.e. arterial and collector at a 2-year interval while residential and local road at a 4-year interval.
- For network-level planning, assessment by representative sampling is the most cost-effective way.

- Set up a data quality management plan.

## Step 3 – Needs Assessment

- The PMS decision tree must be able to support preventive maintenance, minor and major rehabilitation, and reconstruction.
- Decision trees should promote pavement preservation.

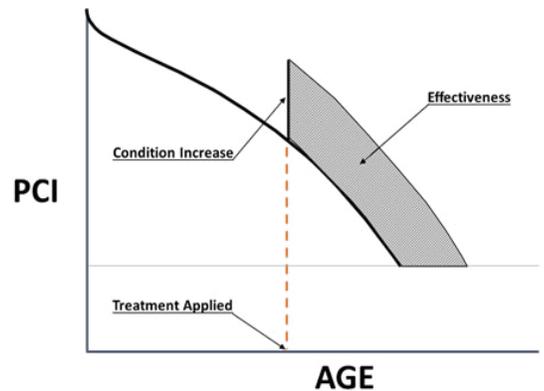


Figure 2. PCI vs AGE Comparison

## Step 4 – Prioritization

- Prioritization is a process to maximize benefits and minimize costs.
- Select a PMS that has a strong emphasis on preventive maintenance for pavement preservation.
- Avoid a PMS that relies on ranking that is based on fixing the 'worst-first'. Instead, focus on a cost-effectiveness approach.

## Step 5 – Investment Analysis

- You don't need an MBA to run investment analysis.
- Look for PMS software that provides easy to run, yet robust analysis.
- Time savings in conducting analysis can be refocused on educating decision makers.

## Step 6 – Feedback

- Underlying a PMS software is a work-in-progress database. Keep the database current.
- Verify that street segment inventory is accurate, such as functional class, surface type, length, width.
- Conduct pavement condition assessment regularly.
- Update the work history annually.
- Review your decision tree periodically.
- Update treatment unit costs annually.
- Reassess your data quality management plan periodically.

For more information on effective pavement management contact Sui Tan at: [stan@bayareametro.gov](mailto:stan@bayareametro.gov)



## FHWA Update

By Steve Healow, FHWA Sacramento

Infrastructure is finally the top issue between the white house and capitol hill. The white house forwarded their long-anticipated infrastructure investment plan to congress on Feb. 12. The 55-page plan can be viewed at: <https://www.whitehouse.gov/wp-content/uploads/2018/02/INFRASTRUCTURE-211.pdf>.



Members of Congress treated the White House plan as a conversation starter. In the House, the Transportation and Infrastructure committee is working on their own surface transportation bill, which they plan to roll out this summer. They promise to focus on an issue which isn't in the White House plan, i.e. fixing the Highway Trust Fund for the long term. Expect lively debate as our lawmakers consider new and old ideas to raise revenue, such as tolls on interstate, commercializing interstate rest areas and raising the gas tax.

Your attention is directed to the Missouri DOT Innovation Library, which includes references from the 'Every Day Counts (EDC)' Pavement Preservation Initiative, a series of Tech Briefs entitled "Concrete Repair Best Practices". The series includes Tech Briefs on dowel bar retrofit, diamond grinding, partial- and full-depth repair and slab stabilization. Coming soon - a series on asphalt pavement preservation, which will include chip seals, slurry seals, micro surfacing, and thin lift asphalt overlay construction quality assurance best practices. You can visit the MoDOT library at: <http://www.modot.org/services/or/byDate.htm>. More information re. the EDC-4 initiative is available at: [https://www.fhwa.dot.gov/innovation/everydaycounts/edc\\_4/pavement.cfm](https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/pavement.cfm)

Did you know the National Center for Pavement Preservation (NCP) web site includes a video library with over 400 videos and PDF presentations in a dozen categories including paving materials, recycling, sustainability, treatment selection and surface preparation? See the library directory at: [https://www.pavementpreservation.org/video\\_library/pavement/index.html](https://www.pavementpreservation.org/video_library/pavement/index.html)

If you're looking for some fundamental on-demand instruction under the general heading of asphalt emulsions, binders or mixtures, be sure to check the Asphalt Institute webinar series. Many are available at no cost. See the webinar series at: <http://www.asphaltinstitute.org/asphalt-institute-webinars/>

### References:

- <http://thehill.com/policy/transportation/infrastructure/370445-five-things-to-know-about-the-leaked-trump>
- <https://www.usnews.com/opinion/economic-intelligence/articles/2018-01-31/trumps-infrastructure-pledge-in-state-of-the-union-raises-many-questions>
- <https://www.trucks.com/2018/02/07/trucking-industry-wants-trump-infrastructure-plan/>
- <http://www.ttnews.com/articles/trump-unveil-outline-infrastructure-plan-feb-12>
- <http://thehill.com/policy/transportation/infrastructure/372812-senate-budget-deal-includes-20-billion-infrastructure>
- <http://www.star-telegram.com/news/traffic/your-commute/article199661654.html>
- <https://www.reuters.com/article/us-usa-trump-infrastructure/trump-asks-democrats-to-negotiate-on-infrastructure-plan-idUSKCN1FX31A>
- <https://us13.campaign-archive.com/?u=80dbe14272ec0b5e1a1bf5b4e&id=7a5d002730>
- <http://thehill.com/policy/transportation/infrastructure/373775-five-takeaways-from-trumps-infrastructure-proposal>
- <https://www.bloomberg.com/view/articles/2018-02-13/trump-s-hardest-construction-job>
- <http://thehill.com/policy/transportation/374056-gop-chairman-trump-infrastructure-bill-could-be-ready-closer-to-the>
- <https://news.transportation.org/Pages/021618trumpplans.aspx>
- <http://abcnews.go.com/Politics/white-house-plan-calls-15-trillion-investments-fix-story?id=53004281>
- <http://thehill.com/policy/transportation/373407-read-trumps-15t-infrastructure-plan>
- <https://news.transportation.org/Pages/021618congress.aspx>

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## New Caltrans JTCP Resource

Caltrans is moving technician certification from its Independent Assurance unit to the 'Joint Training and Certification Program (JTCP)' for certain test methods. JTCP is administered by California State University of Long Beach (CSULB). The last pilot session was held December 14 and December 15. Now the program is live for 2018. LASTRADA Partners has been providing classroom training for the pilots and will provide class room training for many of the 2018 session.

To help understand the JTCP program and aid all the stakeholders in the transition to certification to JTCP, we have consolidated resources from Caltrans, CSULB and the California Asphalt Pavement Association into one web page.

By Dan Ridolphi, LASTRADA Partners

The LASTRADA Partners JTCP resource page includes:

- Description of JTCP program.
- Tests in each of four modules.
- Links to the CSULB and Caltrans JTCP page to find a schedule of training.
- CalAPA articles about the JTCP program.
- Caltrans one page informational flyer about JTCP.

[California Joint Training and Certification Page](#)

The JTCP is an important step in improving the quality of construction materials laboratory testing in California and we are proud to be part of the program. For more information go to: [http://bit.ly/Joint\\_Certification](http://bit.ly/Joint_Certification) or contact Dan Ridolfi at: [dan@lastradapartners.com](mailto:dan@lastradapartners.com) 

## New Website for P<sup>2</sup>

As Google has become more powerful, how do we make sure that the pavement preservation (P<sup>2</sup>) message is kept in the forefront? One way is a great website name and great content.

**Savemyroad.com** by Ergon Asphalt is just one example of that type of website. It's an interactive site that allows visitors several options.

A user can seek advice by inputting different types of pavement distress, traffic levels and road function, and the site will give you possible treatments. This approach was very much inspired by CP<sup>2</sup> Center's own website. The site also allows you to practice your pavement preservation knowledge and to do some preservation modeling options. So you can learn how to maximize your roadway network overall PCI while maximizing your budget - or you can show what happens if you use the 'worst first'

By Scott Metcalf, Ergon Asphalt & Emulsions

approach. Importantly, it helps to point out what happens when you don't practice 'preservation first'. The web site also hosts draft "Construction Guidelines", which can be used by an agency as a starting point to develop a specification.

Another important aspect of any successful website is that in today's marketplace it must be able to be used on an array of mobile devices, which **Savemyroads.com** allows. Worth noting is that FHWA is currently working on a new website - along with the PPRA (a joint industry effort between AEMA, ISSSA and ARRA) which, along with **savemyroad.com**, will give agencies easily accessible, accurate and updated information for pavement preservation.

For more information go to: [www.savemyroad.com](http://www.savemyroad.com) or contact **Scott Metcalf** at: [scott.metcalf@ergon.com](mailto:scott.metcalf@ergon.com) 

## Patrons Program Update

The CP<sup>2</sup> Center's Patrons Program gives our partners from industry and other pavement oriented groups a way to provide more general sustaining support for the Center, and to help direct and even participate in the Center's activities.

The Center was established in 2006 at CSU, Chico, to provide assistance with the development and use of appropriate pavement preservation strategies, and it celebrated its 10th anniversary in August, 2016. The Center was originally funded by Caltrans and continues to work closely with them, as well as other agen-

By Ding Cheng, CP<sup>2</sup> Center

cies. We maintain a very experienced staff of pavement experts and a state-of-the-art laboratory facility which continues to improve each year.

But the Center is funded only by its contracts with agencies such as Caltrans, Cal Recycle, Metropolitan Transportation Commission (MTC) and also some industry clients. In all cases, work under those contracts is narrowly defined, so that funding may only be used for specific contract tasks. The Center, therefore, has no contingency funding to sustain "overhead" activities, such as maintaining *Continued, next page*



lab equipment, preparing contract proposals, participation in events to promote pavement preservation, organizing meetings and conferences, and delivering training classes. This funding must come from non-contract sources such as our Patrons Program. Donation of used lab equipment is another way Patrons have supported the Center.

Co-Chairs for the Patrons group are currently **Scott Metcalf** (Ergon Asphalt and Emulsions) and **Rene Vercruyssen** (Knife River).

The next Patrons meeting will be April 27 - location to be determined.

For more information on joining or supporting our Patrons Program, please contact CP<sup>2</sup>C Director **Ding Cheng** [dxcheng@csuchico.edu](mailto:dxcheng@csuchico.edu) or **Scott Metcalf** [scott.metcalf@ergon.com](mailto:scott.metcalf@ergon.com) or **Rene Vercruyssen** [Rene.Vercruyssen@knife-river.com](mailto:Rene.Vercruyssen@knife-river.com). More information on the Patrons Program can also be found on the Center's website at [www.cp2info.org/Center](http://www.cp2info.org/Center).



## Mark Your Calendar: Coming Events

By Roger Smith, CP<sup>2</sup> Center

The CP<sup>2</sup> Center's **Patrons Meeting** will be held on April 27. Companies that are not already Patrons but have an interest in supporting the Center and knowing more about the Patrons program are encouraged to attend. For more information contact **Ding Cheng** at: [dxcheng@csuchico.edu](mailto:dxcheng@csuchico.edu)

The California Asphalt Pavement Association (CalAPA) will hold its "**Spring Conference and Equipment Expo**" April 25-26 at the DoubleTree Hotel in Ontario. The Conference will feature speakers from industry, government agencies and academia, as well as vendor displays – both indoor and outdoor. The popular "AP101" class will be offered the first morning of the Conference. For more information go to: [www.calapa.net](http://www.calapa.net)

Two of CalAPA's "**Asphalt Pavement 101**" classes will be offered this spring:

- April 24, 2018: San Diego, CA
- April 25, 2018: Ontario, CA

This half-day class offers an overview of the basics of asphalt pavement including materials and pavement construction. For more information go to: [www.calapa.net](http://www.calapa.net)

The Asphalt Institute will offer its "**Principles of Construction Quality Asphalt Pavements**" at two California locations:

- April 2, 2018: Fontana, CA
- April 5, 2018: San Jose, CA

For more information go to: <http://www.asphaltinstitute.org/construction-of-quality-hot-mix-asphalt-pavements-seminar/>

The Institute also offers several online webinars. Of particular interest in the field of pavement preservation is their free **Asphalt Emulsion Webinar Series**. For more information go to: <http://www.asphaltinstitute.org>

A **Contra Costa County Transportation Authority (CCTA)** 'Tech Series' event, featuring Larry Scofield from the American Concrete Pavement Association (ACPA) and John Harvey from UC Davis Pavement Research Center, will be held on Wednesday, April 4th from 11am to 1pm at CCTA in Walnut Creek. They will be discussing the latest concrete pavement technologies.

For RSVP information please contact **Stephanie Hu** at [stephanieh@ccta.net](mailto:stephanieh@ccta.net)



**Disclaimer:** Caltrans does not endorse any industry products or services, and the contents of newsletter articles reflect the views of the authors and do not necessarily reflect the official views or policies of Caltrans, the CP<sup>2</sup> Center, or the State of California.

Caltrans established the California Pavement Preservation (CP<sup>2</sup> Center) at CSU, Chico in July 2006, and fully funded the Center in January 2007. Dr. DingXin Cheng is the current Director of the Center. Mr. Hector Romero is the current contract manager of Caltrans.

The purpose of the Center is to provide pavement preservation support services to Caltrans and other public agencies, and to industry. Unique services include developing educational programs in pavement preservation, providing training and staff development opportunities, providing needed technical assistance to public agencies and industry, and managing/conducting research and outreach services, such as this newsletter.

CP<sup>2</sup> Center News is published quarterly by the CP<sup>2</sup> Center, Langdon Hall Suite 203, California State University, Chico, Chico, CA 95929-0603, Subscriptions by e-mail: contact [CP2C@csuchico.edu](mailto:CP2C@csuchico.edu) to add your name to the distribution list.