CP² Center News

Newsletter of the California Pavement Preservation Center

No. 33 March 2015

California Chip Seal Association (CCSA) Workshop - Another Big Success By Roger Smith, CP² Center

The annual Pavement Preservation Workshop put on by the California Chip Seal Association (CCSA) has become the 'don't miss it' event for people in the world of asphalt pavement maintenance. Over 250 people flocked to the big CCSA event at the Pacific Palms Hotel in the City of Industry on February 4 and 5, 2015, to get the latest info on pavement maintenance technologies, such as crack sealing, chip seals, slurry seals, and multi-layer systems, as well as updates on funding and asphalt safety. The event also included numerous vendor displays and a heavy equipment 'show & tell' outside. More information from this event can be found on the CCSA website at: *www.chipseal.org*

New CCSA President, Katrina Lynch (MWV) with outgoing President, Scott Dmytrow (Telfer)

The outgoing 2014 President, Scott Dmytrow of Telfer Highway Technologies, welcomed the group, reviewed the last year's events and introduced the 2015 President, Katrina Lynch of MWV / Evotherm.

CCSA put together a full agenda of 15 speakers on pavement maintenance practices. Here's an overview of the topics covered:

Funding State Assemblyman Eric Linder (Corona) discussed the latest options being considered for increasing the funds available for transportation, including maintenance on our "overburdened and under-funded roads". Ideas being considered include raising the per gallon gas tax, raising the vehicle license fee, imposing a user fee based on vehicle miles traveled (VMT) and even a repeal of Proposition 13 to enable agencies to deal with their problems on a local basis. Already on the table is proposed legislation (AB-4), which would stop gas tax money from going into the General Fund instead of to transportation, and also ensure that truck fees go for roads, not debt pay down. Other legislative solutions are also emerging.

Asphalt Safety Barry Gundersen of Gundersen Consulting came all the way from New Zealand to provide an excellent overview of some of the potential dangers of mishandling asphalt products. Since the asphalt products we use every day are petroleum based, they have the potential for fire and even explosion and serious burning. The most likely hazards would involve:

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- Water Boil-Over (from water contaminating hot asphalt)
- Fire – (from heating products above their flash point or using them in spray form)
- Auto Ignition (from the presence of small amounts of residual products like kerosene)

Since most first responders and even ER doctors aren't familiar with burns from asphalt products, it's important for workers to know they should not to try to remove asphalt stuck to the skin, but rather try to cool immediately with water and use a solvent after it's cooled.

Crack Sealing Carol Dennis of Maxwell Products provided an overview of the ASTM tests for crack sealing products and some guidelines for proper installation of sealants. She stressed the importance of preparation such as cleaning and drying the crack and the added life from proper overbanding with squeegee strike-off. Where movement (e.g. thermal) at the crack is expected, routing of the crack should be considered.

Slurry Seals and Microsurfacing Todd Vargason of Ergon Asphalt and Emulsions presented an overview of slurry seals and microsurfacing. He cited these treatments as being ideal for pavement with PCI of at least 80. Latex modified emulsion binder can increase durability and provide a "tougher" surface. If the pavement is rutted, only microsurfacing (not slurry) should be considered due to its higher stability and the fact that it can be placed thicker to fill the ruts. Microsurfacing should also be the first choice in cooler climates or for night work, since these materials involve a "chemical break" rather than relying strictly on air temperature and evaporation of the water. Laydown machines can be either truck-mounted type or the "continuous" type, which involve a longer 'train' if equipment fed by haul trucks. These trains may not be appropriate for many neighborhood streets. Asphalt emulsions used in the slurry process are usually CQS-1h, or when latex additives are used, PM-CQS-1h. Microsurfacing treatments usually involve the addition of portland cement and aluminum sulfate as a set retarder.
Lance Allan of Pacific Emulsions / Roy Allan Slurry Seal overviewed inspection practices including equipment calibration, material sampling & testing and field observations. He advised testing for a "clear water break" by simply using paper towels or a bare hand as an indicator of when traffic can be allowed on the fresh slurry. The ISSA Inspection Manual was cited as a good reference for inspection practices.
Sally Houston of VSS International provided a live demonstration of the effects of various additives like cement and aluminum sulfate on the slurry mix behavior.

American Asphalt's new slurry truck on display at CCSA workshop

Chip Seals George Bradley of George Bradley Consulting presented an update on chip seals and how they fit into the overall pavement management plan. The low cost and effective sealing offered by chip seals make them an excellent pavement preservation treatment for use while a pavement still in good condition. Chip seal inspection tips were offered by Shawn Rizzuto of Caltrans District 11 (San Diego) who sees chip seals as "his most cost effective maintenance treatment". Because of field problems he has seen, he advocates checking the variability of the spray bar using CT 339, and also verifying the chip application rate. He also sees promise in the development of variable rate spray bars that vary the binder application rate across the width of the lane.

Multi-layer Treatments Perhaps the latest approach to using the various surface treatments is to combine two or more of them into a "multi-layer" treatment. Jason Lampley of Intermountain Slurry Seals (ISS) Inc. provided an overview of these strategies, including:

- Chip directly over paving fabric
- Double chip seals
- Rubberized chip seal with an HMA Overlay (aka. SAMI)
- Cape seal (slurry seal over a chip seal)
- 3-layer systems (microsurfacing + chip seal + slurry seal)

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Roseville's Pavement Preservation Strategies Toolbox Jerry Dankbar from the City of Roseville provided an insightful overview of their approach to pavement preservation.

Jerry posed the common question, 'With everything that you have in your preservation toolbox for surface treatments, how do you know what process is the best, most cost-effective treatment for each road?'

Roseville starts with their pavement management systems (PMS) to look at what roads the system is telling them to resurface, by their PCI or PQI numbers. But just because the PMS states what the road needs, it may not be correct, and field verification must be done.

Roseville uses slurry seals (rubber and fiber modified, type I-II-III), cape seals (all types), HMA overlays (thin, thick, rubber), and total road reconstruction (FDR including cold foam, and completely rebuild from bottom up).

Assessing traffic counts and loadings is important. Are there buses now using this residential road as a pass through to other streets or to pick up passengers? Is this street a truck route for your city? Was the road built to accommodate the projected loading? They also consider the updated ADA rules/regulations that need to be complied with that affect the choice of surface treatment.

Roseville finds that slurry seals are much more cost effective than cape seals and HMA overlays, and that preventative maintenance is much more cost effective than reactive maintenance. Their customers definitely notice the difference.

Their overall goal is to resurface the street every 7 to 10 years, and try to place slurry seals in the first 10 years. Of course, they always strive to place 'the right treatment at the right time on the right pavement'.

RAP Use In Pavement Preservation

Reclaimed asphalt pavement (RAP) is used in almost all hot mix asphalt today. So why not make use of it in maintenance treatments as well. Doug Ford of Pavement Recycling Systems offered a view of how it's being done in chip seals and slurry seals. For chip seals, chips made of RAP can perform very well, even though they will not usually meet the specification for cleanness value (75 minimum). But because the fine dust from the milling is actually asphalt dust, it does not compromise the bond of the chip. RAP chips have been used by San Bernardino County, Los Angeles County and Caltrans District 8 (San Bernardino).

RAP has also been used successfully in slurry seal mixes. Although not advisable for Type I slurry due to its higher dust content, it works well in Type II slurry, and the required emulsion content will be slightly lower than for conventional slurry mixes. Many agencies in southern California are using RAP slurry seals, usually with 3% polymer (latex) additive in the emulsion. Rubber-tired rolling of the slurry is also helpful in many situations.

NCAT Test Track Update The National Center for Asphalt Technology (NCAT) in Auburn Alabama is now using its famous oval test track for testing maintenance treatments. Heavily loaded, multi-axle "truck trains" run continuously on this oval track to provide accelerated loading and quicker answers about what works and what doesn't Dr. Buzz Powell provided an interesting glimpse at how the track works and the future plans for testing the effectiveness of treatments such as crack sealing methods, microsurfacing, multi-layer treatments and thin overlays. They are developing the concept of "life extension benefit curves" as a basis for comparing various maintenance treatments. They are trying to get more participation and support for this effort from western states DOT's such as Caltrans. For more information go to: *www.pavetrack.com*

Aerial photo of NCAT pavement test track

Funding Needs Assessment By now we're all aware that California's road agencies are 'crying poor' when it comes to funding for the many road improvements they need. The reality of the situation was brought to light by Kiana Buss of the California State Association of Counties (CSAC). In addition to the well used fact that California will need about $7.3 billion per year over the

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next 10 years to preserve our roads, she presented some figures that really hit home regarding how little we spend on gas taxes compared to our other personal habits, shown below:

Cable TV.....	$1,032 / yr.
Cell Phones.....	852
Coffee Habit.....	780
Gas Tax (State & Fed.).....	368

With various forms of legislation being proposed, there will no doubt be help coming and it will likely involve a combination of strategies, including a gas tax increase, indexing of the gas tax to CPI, returning truck fees to the transportation fund and possibly even a fee on vehicle miles traveled (VMT). Local sales tax initiatives will also continue to play a key role. Currently 15 counties have enacted these dedicated sales tax initiatives.

For more information go to: *http://www.savecaliforniastreets.org/read-the-report/*

CCSA Awards

A big part of the annual CCSA Workshop is the presentation of awards for outstanding pavement maintenance projects. Here's this year's award winners:

- Contra Costa County / American Pavement Solutions
  (Cape Seal with Rubber in Discovery Bay)
- San Diego County / VSS International
  (Slurry Seals on 60 road segments)
- City of Escondido / All American Asphalt
  (Scrub seal on alligator cracked pavement)
- City of Corona / All American Asphalt
  (Rubber-Polymer Modified Slurry (RPMS))
- Caltrans District 4 (San Francisco) / Telfer Highway Technologies
  (Thin Bonded Wearing Course on Hwy 37)

Copies of all the presentations from the workshop will be available on the CCSA website at: *www.chipseal.org*

ASPHALT PAVEMENT NEWS

High Friction Surface Treatment (HFST) Gains Popularity in California

By Roger Smith, CP^2 Center

Although conventional chip seals are considered primarily a surface treatment for pavement preservation benefits, their rocky texture can also provide a side benefit of improving pavement friction or "skid resistance" as pavement engineers like to call it. Of course, chip seals are high production treatments ideally suited for big projects on open roadways, such as arterial streets, county roads or state highways. But what if you only want to treat a short 'spot' location where there's a history of wet condition skid-related accidents, perhaps a particular curve on a higher speed roadways or an area approaching a stop sign or traffic signal? At such spot locations with a history of wet condition related accidents, higher surface friction can bring down the number of these incidents. Considering the mobilization and placement efforts required, a chip seal operation probably wouldn't be the best strategy for spot applications.

For these spot applications, a product known as High Friction Surface Treatment (HFST) has been used in many states and is now being used around California. This specialized surfacing is a chip seal of sorts, involving fine, angular, highly polish-resistant aggregate spread onto a layer of multi-part resin binder at air temperatures above 55°F. A single truck applies both the resin binder and the aggregate.

HFST application truck

Current Caltrans Specifications (NSSP 37-6) require the aggregate to be calcined bauxite aggregate, relatively small and single sized (95% passing No.6, 5% passing No.16 sieves) and spread at a rate of 18 lb/sq yd (retained).

The resin binder is spread via an automated continuous application vehicle at a rate of 0.32 gal/sq yd and must have a maximum cure time of 3 hours or less. The calcined bauxite aggregate must be applied by the same automated vehicle that applies the resin binder. Typically the contractor is required

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to place a HFST trial section, duplicating actual placement process, the size of trial section is usually 20' long by 12' wide. The trial section must meet the dynamic friction requirement of 0.75 at 60 km/h when tested under ASTM E1911-09a. The automatic aggregate spreader must be capable of applying up to a continuous 12-foot wide surface. The HFST must be closed to traffic during the cure period, and

HFST aggregate application

excess aggregate is removed by sweeping before the treated lane is opened to traffic. Caltrans applications have primarily involved entrance and exit ramp locations to improve skid resistance, but they've also used it on certain horizontal curves like the ones on Highway 101 near Crescent City, and Highway 20 near Nevada City. According to Robert Peterson of Caltrans HQ Division of Local Assistance, HFST used to date has been generally successful.

"We've used HFST on over 30 locations statewide, and have another 100 sites planned. It's worked very well for us." said Peterson. "However, an early trial on State Route 20 in the Sierra Nevada snow country did not withstand the action of tire chains and snow plows, so applications in those harsher winter climates will be limited. The main and very important distinction between HFST and all the other pavement strategies is that HFST is a pavement treatment to reduce collisions, whereas all others strategies are for pavement preservation - not necessarily to reduce collisions at spot locations."

HFST texture

Sri Holikatti with the Caltrans Office of Asphalt Pavement indicated that a study done last year for Caltrans by Fugro Consultants of Sacramento, tested dynamic friction (via ASTM E1911-09a) at four field sites. The study revealed significantly higher friction measurement for HFST surfaces compared to adjacent control surfaces. Friction values on HFST surfaces ranged from 0.74 to 0.93 compared to 0.33 to 0.55 for control sections.

Placer County recently let a contract for spot application of HFST at 26 locations around the

HFST on an off-ramp

County - some on curves and some approaching controlled intersections. The County's Landy Darrow coordinated these installations done by contract with Interstate Road Management (IRM), a division of DBi Services.

According to Richard Baker of DBi, "After being awarded a local (HSIP) grant for safety improvements, the County - following Caltrans lead - specified high friction surfacing treatment (HFST). The process, which is used extensively throughout the U.S., was pioneered in California some years ago. Nationally, results from user agencies are showing up to a 74% reduction in fatalities and serious injuries where the process is installed."

Other California agencies that have used HFST's include Nevada County, Napa County, Tulare County, San Joaquin County, Orange County and the City of Modesto.

Geosynthetics in Asphalt Pavements

By Ray Myers, Asphalt Fabric Interlayer Association (AFIA)

Geosynthectics began being perfected for the construction industry in the late 1960's. Recall when synthetic clothing hit the market (e.g. polyester suits). The resin manufacturers knew there would be industrial applications for these products, so they began manufacturing the synthetic strands into engineering products.

There are several ways to get those strands into a usable form. The most familiar are the fabrics with strands in a random pattern, classified as nonwoven, with the most familiar brand being Petromat. The second method is by weaving the strands. This group is called woven geosynthetics.

For pavement applications, geosynthetics are manufactured for use both IN the asphalt layer and BELOW, in the subgrade. The most important point that should be taken away from this article is that geosynthetics (IN or BELOW) can improve the performance of pavement. Section 88 of the Caltrans Standard Specifications addresses these geosynthetic materials. The term *geotextiles* and *geogrids* are used for geosynthetics BELOW the paving section.

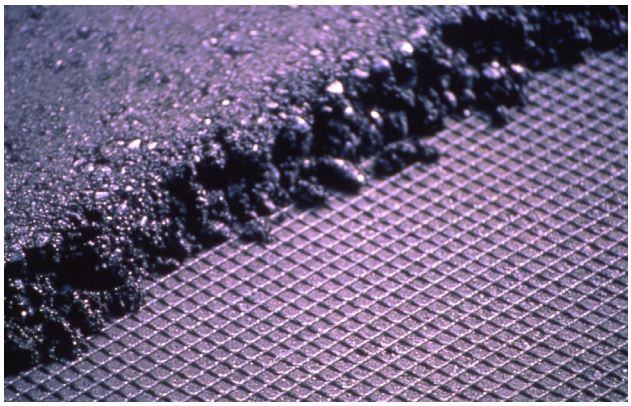
We will first explore the geosynthetics used IN the HMA (or WMA) pavement layers or in chip seal-over-fabric treatments, also known as geosynthetic reinforced chip seals (GRCS). The products used IN the pavement section are all classified as *interlayers*, and include the following:

Paving Fabric A nonwoven geosynthetic weighing a minimum of 4.1 oz. per square yard, which, when embedded in a field applied, hot asphalt cement tack coat (e.g. PG 70-10), becomes an asphalt-saturated waterproofing membrane under HMA (or WMA) or GRCS.

Paving fabric interlayer

Paving Mat Similar to Paving Fabric above, but a wet-formed, nonwoven hybrid of fiberglass and polyester fibers constructed to a nominal 4.0 oz/yd^2 weight. These mats are dimensionally stable, and engineered for use as a higher-modulus interlayer, when applied with an asphalt tack coat under HMA (or WMA) layers, or as part of a GRCS.

Paving Grids Strong, high modulus (50 kN, 100 kN and 100X200 kN), non-waterproofing, open mesh grid interlayers installed onto an existing pavement using a pressure sensitive adhesive on the grid - or a lightweight carrier fabric attached with a light tack coat - to reinforce an HMA (or WMA) overlay.



Paving grid interlayer

Paving Geocomposite Grids High modulus grids [50kN, 100kN and 100X200kN] laminated to a paving fabric. When embedded in a field-applied asphalt tack coat (e.g. PG 70-10) it becomes an asphalt saturated waterproofing membrane interlayer that also reinforces an HMA or WMA overlay.

Geocomposite Strip Membrane A "peel & stick" paving fabric strip, 12" to 36" wide, saturated with asphalt at the factory and precoated with rubberized asphalt to bond the membrane to the existing pavement under a HMA or WMA overlay. These strip membranes are intended to waterproof localized areas like large linear cracks or paving joints. Bus stop areas are also an application for this product.

The second major group of geosynthetics are those used BELOW the pavement structural section on the subgrade material or sometimes within thicker aggregate base layers. These can be nonwoven or woven fabrics, or grids. The term *geotextiles* and

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geogrids are used for geosynthetics used below the paving section.

These below-pavement geosynthetics have strength in at least two directions most commonly, and are therefore biaxial. When used in walls or embankments the primary strength is in only one direction, and these are called uniaxial. Below-pavement geosynthetics can perform two primary functions:

- Separation. The optimum load bearing capacity of a base aggregate or subgrade soil is determined in part by the amount of fines present. Native soils of low bearing capacity are typically high in fines. To increase the load bearing capacity of the section below the pavement section, a much more competent base aggregate (i.e., low in fines - such as 5% or less) is normally placed over the native material. However, when a heavy axle load passes over a pavement section in which the supporting aggregate/soils are saturated, the section is compressed and the water is forced up towards the surface. That water carries fines with it, which contaminate the more competent base aggregate. Separating geosynthetics placed above the native soil and below the more competent base aggregate will allow the water to pass through, but not the fines.
- Stabilization. When vertical wheel loads bear down on the pavement, the load is transferred to the supporting aggregate base layers. If the aggregate can spread laterally, it will not support the load. A geosynthetic stabilizes the aggregate and does not allow it to spread - like a rack holding billiard balls together. Be it a grid, or a woven or nonwoven geosynthetic, these engineered products can restrict the aggregate from spreading and thus support the load.

Geosynthetics can also provide reinforcement, a third possible function. However, the products only develop their highest strength after being stretched or elongated. Even though the elongation is very small horizontally it may be sufficient to allow the pavement to rut vertically to an unacceptable amount.

In summation, there are several ways geosynthetics can enhance the pavement system in which they're placed. Used in the right application, they almost always extend pavement life and reduce long term maintenance, and prove cost effective.

For more detailed information email *info@aia-us.org* or call Ray Myers, AFIA at 916-933-9140.

PCC PAVEMENT NEWS

Results of Caltrans' Shrinkage Study for Rapid Strength Concrete

By Doran Glauz, Caltrans, Ding Cheng, and Lerose Lane, CP^2 Center

Background

Concrete shrinks causing stress that leads to cracking. If there is more shrinkage, it follows that there will be more cracking. As a result, the Caltrans standard specifications limit the maximum permissible shrinkage in concrete used for pavement. Shrinkage is measured for 28 days after 7 days of moist curing.

Caltrans uses full-depth slab replacement as a maintenance strategy on concrete roadways. Slab replacement is typically done using rapid strength concrete (RSC), which can gain strength sufficient for traffic in as little as 1-1/2 hours. A fundamental question arises: Is it appropriate to measure shrinkage in concrete that gains strength in 1-1/2 hours in the same way that shrinkage is measured in concrete that gains strength in 10 days or more? Another way to look at the question is to wonder if there is a change in the property of RSC in the first 7 days that influences the amount of measured shrinkage or if there is significant unmeasured shrinkage in the first 7 days.

This study compared the measured shrinkage of RSC using the current Caltrans specified protocol for the initial measurement and initiation of drying to having the initial measurement and initiation of drying at the age intended for opening the RSC pavement to traffic. Shrinkage was measured in different RSC mixes using various materials that comply with two traffic opening criteria. The criteria were (1) to achieve 400 psi of flexural strength in 4-hours, and (2) to achieve 550 psi of flexural strength in 3-days.

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Scope

This study included two strength/age criteria for each of the 3 different cement/admixture combinations for a total of 6 mix designs (Table 1). Exact mix proportions were determined by trial batching. The 400 psi (4-hours) and the 550 psi (3-day) mix designs each had three combinations. The combinations were: (1) TXI Type III cement with WR Grace admixtures, (2) TXI Type III cement with BASF admixtures, and (3) calcium sulfoaluminate (CSA) cement from CTS cement manufacturing with BASF admixtures.

Table 1. Rapid Strength Concrete Mix Design Combinations

Strength Requirement	Cement		
	TXI Type III	TXI Type III	* CTS CSA
400 PSI in 4 Hours	BASF Admixtures	WR Grace Admixtures	BASF Admixtures
550 PSI in 3 Days	BASF Admixtures	WR Grace Admixtures	BASF Admixtures

* CTS CSA mix design can use either WR Grace or BASF admixtures

This study was done on a fast track schedule. Each mix design was evaluated for shrinkage using the initial measurement of a prism at standard 7 days, and at the age intended for opening the slab replacement pavement to traffic as indicated by the strength requirement in Table 1.

It was difficult to determine the proper water to cement ratios to meet the strength requirement within 50 psi. Many trial batches were required for each combination of materials to zero-in the proper proportions. The mixes had to have a higher water to cement ratio than what the manufacturers had recommended because the intention was to achieve a certain strength at a certain time rather than to simply exceed the strength at that time.

Figure 1. Trial batch RSC materials (w/o admixtures)

Figure 2. Trial batch at CSU, Chico lab by Brennen Urbanek, CP^{2}Center

Figure 1 shows materials for a trial batch, while Figure 2 shows a trial batch being made. The admixtures' dosages had to be carefully adjusted so that the mix didn't harden while mixing. This could require a retarder, and then an accelerator to be added for final mixing just prior to the mix being placed into the molds for the 4 hour, 400 psi mix. The Center's staff developed an Excel program based on the recorded loading to calculate the theoretical flexural strength.

Initially, trial batches were made and only strength specimens were fabricated, under AASHTO R39, to determine the correct proportions to achieve the target strength. The strength was calculated as the average of 4 specimens tested under AASHTO T97 (Figure 3). After proportions were determined, three prisms and one beam were fabricated in a batch for shrinkage testing. The beam was used to verify the strength of the batch.

Standard shrinkage tests were performed as described in Section 90 of the Caltrans Standard Specifications, as well as with modifications for curing time and testing intervals.

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Figure 3. Flexible strength testing on RSC beam sample

The shrinkage samples were placed in an environmental chamber (Figure 4) for the dry conditioning. Shrinkage measurements were taken through 28 days drying. The temperature was set at 73°F with a relative humidity of 50%. The shrinkage of the samples was measured with a length comparator, shown in Figure 5.

Figure 4. Concrete environmental chamber for drying concrete samples

Findings

Major findings based on the shrinkage study:

- For the 4-hour (400psi) mix designs, the measured 28-day shrinkage is significantly higher, about a factor of 2, when the initial measurement is taken at 4 hours as compared to when the initial measurement is taken at 7 days. Most of the difference in shrinkage happens in the first day after the initial measurement. Therefore, in the first 24 hours significant shrinkage occurs that is not normally captured under typical laboratory measurement methods.
- For the 3-day (550 psi) mix designs, the measured 28-day shrinkage is somewhat higher when the initial measurement is taken at 3 days as compared to when the initial measurement is taken at 7 days. The difference in shrinkage seems to happen before 7 days drying. Therefore, measurable shrinkage occurs during the fourth through seventh day after mixing, though not nearly as much as in the first 24 hours.
- Based on the test results, CSA cement had less shrinkage for both the 4-hour and the 3-day mix designs when compared to Type III cement no matter when the initial measurement was taken.
- To achieve the strength vs. time criteria without overshooting, a higher water to cement ratio was used than what was recommended by the cement manufacturers.

Figure 5. Shrinkage measurement on a prism sample by using a length comparator, which measures specimen length change

The findings from this study revealed some fundamental characteristics of RSC used in highways that were suspected, but not known. By improving the understanding of the relationship between shrinkage vs. time for RSC, Caltrans can improve their specifications for this product.

Acknowledgements

The CP^2 Center appreciates the following supporters of this study:

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BASF—Greg Guecia
WR Grace—Joe Terrill
A & A Concrete—Aggregate from Knife River's Orland plant
Knife River, Inc.—Aggregate from Knife River's Orland plant
Capital Engineering Laboratories—Barry Lotz

Note: The findings of this article supersedes the previous CP^{2}C article, Caltrans Initiated a Shrinkage Study on RSC, in the December 2014 CP^{2}C newsletter. More details about the study will be posted on the Center's website, once it is finalized.

Launching of the World's Largest Concrete Pavement Preservation Field Experiment

By Kim Willoughby and Jeff Uhlmeyer, Washington State DOT

The largest portland cement concrete (PCC) pavement preservation field experiment will soon kick off. The study, a national "pooled fund" experiment (TPF-5(291)) is currently a combined effort among seven states with the Washington State DOT as the lead state. Figure 1 indicates a map of the states where the SPS-2 experiments were constructed, with the smiley faces designating the seven states that have contributed to the pooled fund effort.

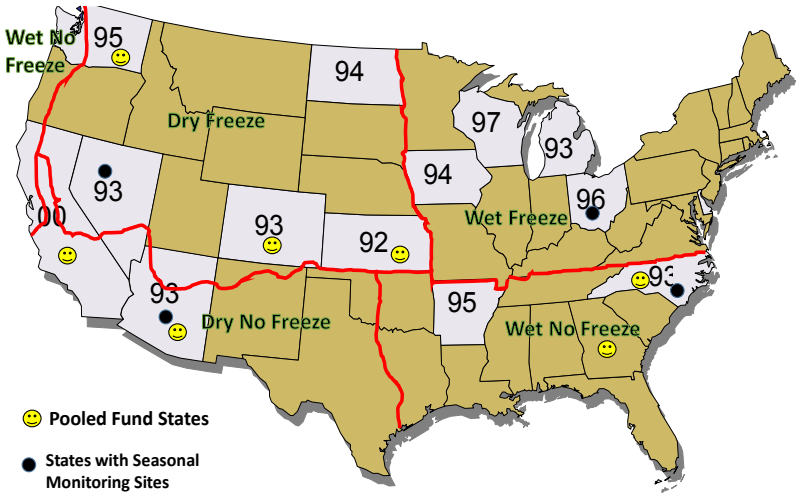

Figure 1. SPS-2 test sections and pooled fund state locations

The pooled fund study will 'piggy back' on the existing long term pavement performance (LTPP) SPS-2 experiment , "Strategic Study of Structural Factors for Rigid Pavements". This is the most comprehensive ongoing PCC pavement research effort undertaken since the AASHTO Road Test. Fourteen states constructed SPS-2 projects, beginning in 1992, and they range in age between 14 and 22 years. Eleven of the original 14 experiments are still in service.

Due to the age of the existing SPS-2 projects, it is now time to develop a second experiment, based upon the first, which determines the most effective concrete preservation strategies for extending the service lives of these pavements. It is paramount that as these pavements begin to deteriorate, the proper intervention time and prevention strategy be determined and implemented. With such an approach, the cost effectiveness of the various strategies can be determined.

The pooled fund study is a two phase effort, with the first phase intended to provide an assessment of the existing SPS-2 experiment in terms of surviving test sections, condition of existing sections, and what is possible to study and accomplish. The second phase will propose a preservation experiment for the SPS-2 projects and supplemental sections - identifying the preservation treatments, evaluation intervals, and potential benefits. Using the previously developed information, the effort will identify any additional needed test sections, additional testing and data collection efforts.

Although initially targeted as only a 3-year effort, it is desired that this project will begin the long term preservation experiment. The FHWA LTPP program currently evaluates these sections and will continue to do so as long as they remain part of the national experiment.

ABOUT THE ORIGINAL LTPP SPS-2 PROGRAM

The LTPP program, which began in 1987, was initially designed as a comprehensive 20-year study of in-service pavements. This effort resulted in the development of a series of rigorous long term field experiments monitoring more than 2,400 asphalt and concrete pavement test sections across the U.S. and Canada. The LTPP program consists of two approaches: General Pavement Studies (GPS) and Specific Pavement Studies (SPS).

The GPS efforts used existing roadway sections of various ages, designs, and climates selected through a controlled experimental design to determine the effects of specific features on performance. Since this experiment used existing roadway sections, it was expected to provide research results in the short term.

The SPS experiment consisted of nine experiments designated as SPS-1 through SPS-9 that address the effects of structural factors, maintenance treatments, rehabilitation alternatives, environmental effects, and HMA mixture type on pavement performance. The SPS approach required construction of standard test sections which enabled testing of the original materials and monitoring and documenting the construction procedures. This approach also

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enabled a cradle-to-grave analysis of the projects providing a more rigorous experiment. Most of the SPS experiments were designed as long-term experiments.

The SPS-2 experiment represents the most comprehensive PCC research since the AASHO Road Test. The experiment includes permanent weigh-in-motion instrumentation which allows reliable traffic and loading data collection. Comprehensive material testing has occurred since the original construction. Rigorous performance monitoring has also occurred since original construction. The specifications required to construct the 168 SPS-2 projects were consistent across the states to ensure quality construction and to reduce variability.

The SPS-2 experiment for PCC pavement was designed to evaluate the relative influence and long term effectiveness of five design features and three site factors.

The five design factors are indicated as follows:

- Concrete Thickness (8 in and 11 in)
- Base Type (Lean Concrete, Dense Graded aggregate, Permeable Asphalt Treated)
- Concrete Flexural Strength (550 psi and 900 psi at 14 days)
- Lane Width (12 ft and 14 ft)
- Drainage (with and without edge drains)

The three site factors considered in the experimental design are:

- Climate—Temperature and Freeze/No Freeze
- Climate—Precipitation
- Subgrade—Fine Grained and Coarse Grained Soils

By creating a new pavement preservation experiment as an extension of the existing LTPP SPS-2 experiment, a more comprehensive and effective experiment can be put in place, with cradle-to-grave monitoring and evaluation.

Web-based PCC Training Available By Steve Healow, FHWA

Training modules, under the general heading "Concrete Pavement Construction", are available through the American Concrete Pavement Association (ACPA) website. The training modules include multimedia presentations by recognized experts and commentary by pavement construction professionals.

Module Title	Hours	Continuing Education Credits
Best Practices for Handling Aggregate for Concrete Paving	3.5	3.5
Best Practices for Constructing Smooth Concrete Pavements	4.5	4.5
Proper Use of Stringless Slipform Paving Technology	1.5	1.5

Interested parties should sign on to the ACPA web page *http://acpa.scholarlab.com* and register using coupon code: Pavement1.

GENERAL NEWS

Joint Training and Certification Program To Move Forward

By Roger Smith, CP^2 Center

Caltrans is moving forward with Joint Training and Certification Program (JTCP) for field material testers working on Caltrans projects. Joe Peterson former Chief for the Office of Roadway Materials and Testing Services of Caltrans has been assigned as the Project Manager for this big effort. Joe will work for approximately one year in this role and will outreach to Caltrans Construction, Districts, local agencies and various industry trade groups including CalAPA, CALCIMA, AGC, RPA, SCPA, SCCA, and CCTIA, outlining the program and inviting participation.

The JTCP will ultimately offer training and certification for both Caltrans and Industry technicians in the testing of soil, aggregates, hot mix asphalt (HMA) and Portland cement concrete (PCC) with the objective of:

- Providing highly skilled, knowledgeable materials sampling and testing technicians
- Promoting uniformity and consistency in testing
- Providing quality improvement

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- Creating a harmonious working atmosphere between public and private employees based upon trust, open communication, and equality of certification

The Caltrans Independent Assurance (IA) program requires that each laboratory and all testers performing work on the State highway system be certified.

Laboratory certification insures that equipment is maintained and has current calibration, and that testers hold certifications for test methods they will be performing. Caltrans tester certification requires testers to provide proof of training, take a written test and perform the test in the presence of IA representative. Currently there is no provision for the joint training and certification of both Caltrans and Industry technicians.

High-Tech Vans To Evaluate California Highways

Reprinted with permission from the "California Asphalt Insider," an official publication of the California Asphalt Pavement Association (CalAPA)

In 1895, three men that made up the newly formed California Highway Commission climbed aboard a horse-drawn wagon and crisscrossed the state's vast reaches to map out what would eventually become California's master plan for freeways and highways.

Years later, as paved roads replaced wagon trails, state engineers and maintenance personnel conducted "windshield" surveys to monitor the condition of pavements and identify those that needed attention.

This month will mark the beginning of a new frontier of sorts as Caltrans begins collecting precise information on every crack and bump on the state highway system, including exact GPS coordinates, for use in prioritizing scarce pavement maintenance resources.

The department recently awarded an $8 million contract to a Tulsa, OK, firm to measure the depth and width of every pavement distress in the 15,000-mile freeway and highway system, and link those measurements with precise Global Positioning System (GPS) coordinates.

The company, Pathways Services Inc., uses sensors and computers mounted on and inside specially-equipped vans, and the data is funneled into special software that collects and displays the information. The $1 million vans take digital photographs of the entire road surface and right-of-way in high-definition, as well as use lasers to collect measurements of every crack and rut in the pavement surface.

The competitively bid contract, which required potential vendors to demonstrate their equipment in the field, calls for the entire statewide highway network to be surveyed twice, between January and August, including much of the National Highway System "off-system" network as well, department pavement managers say.

The data will ultimately be funneled into the department's new Pavement Management System, and will be the foundation for rating pavements and analyzing and selecting the best new projects for all pavements.

For more information on the company that will be conducting the pavement surveys and the technology that will be utilized, go to: *http://pathwayservices.com*

Hot-Applied Crack Sealing In Winter – Get Your Game On!

By Brian Price, Crafco, Inc.

Crack sealing is often thought of as a task best suited for warmer seasons and climates. While spring and fall are optimum times for crack sealing, winter may also be a good time as long as you follow a few important tips. Crack sealing can be performed in virtually any outside air temperature as long as the crack is dry and warmed to 40°F (4°C) which is easily done with a hot air lance. There are several states that routinely do crack sealing in the winter such as MT, NY and others.

Crack sealing in cool weather

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One advantage of sealing in the winter is that the cracks are already open and can more easily be sealed.

An important point for government agencies and contractors is that you can extend the pavement preservation construction season by crack sealing. When most types of preventive maintenance and preservation techniques can't be done because either they are emulsion (water)-based, the asphalt plant is closed, or the materials themselves will not cure appropriately, you can still install hot-applied crack sealants!

Longitudinal crack sealing

Best practices for winter crack sealing

Here are a few tips to follow when crack sealing in the winter:

1. Clean, dry cracks and proper temperature are the keys to effective crack sealing. Sealant manufacturers typically recommend pavement temperature exceeding 40°F (4.4°C). If pavement temperature is lower than 40°F, it may be warmed using a hot air lance. The hot air lance a) removes moisture, b) removes vegetation, c) removes clay, and d) warms pavement to ensure sealant adhesion. Some specifications, like the Montana Department of Transportation, allow crack sealing in roadway temperatures as low as 35°F (1.7°C).
2. Having a dry road is even more important than air or pavement temperature. Some crews usually wait at least a day after new snowfall to start sealing, after changing temperatures and traffic have had a chance to dry out the pavement. Be sure to inspect the cracks for ice or deicing chemicals/materials because they will negatively affect sealant adhesion and should be removed.
3. When using hot-applied sealant in the winter, the Federal Highway Administration suggests choosing a softer, more flexible sealant for working cracks. As the crack expands or contracts over time, a flexible sealant will be able to move with the crack whereas a harder sealant will become brittle and shatter. Consult your supplier for material recommendations.
4. Apply crack sealants at the upper-end of their recommended application temperature range. All hot-applied sealants have a recommended material temperature that is determined to achieve good adhesioIn cold weather, sealant may cool in the application hose or applicator and not reach the pavement at the proper temperature. Raising the temperature of the material while in the melter can aid in compensating for this temperature loss.
5. To ensure that their equipment is ready to work in the cold, some crews start their crack sealant machine and other equipment in the morning before heading out in the evening to seal. This gives the engine plenty of time to warm up and adapt to the environment. Also, storing the melter inside overnight allows the machine to retain more heat resulting in fast heating time in the morning. Some melters are equipped with an overnight heater, so plug them in overnight to improve heating time.
6. Striking off the sealant with a squeegee helps ensure none of the sealant escape from the crack. Sealing disks attached

Larger cracks require a special tool

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to the end of the application wand can achieve a similar result as striking off the sealant. The key is to keep the sealant narrow and tight to the pavement to minimize bumps and reduce damage from traffic and snow plows.

Sealant material being injected into cracks on highway

Best practices when it is too cold to crack seal

If it is too cold to crack seal today, spend your time preparing so that you can immediately get to work as the weather improves. Any breakdowns during the season have an expensive cost – in both time and revenue. To make the most of your time and investment, follow these tips:

1. Service your equipment per the manufacturer's maintenance schedule.
   a. Heat Transfer oil should be changed every 500 hours or once/year, whichever comes first.
   b. Replace or service items like: hydraulic oil; engine oil, filters and fluids.
   c. Service your burner – just like your home furnace these burners need regular service to maintain peak efficiency.
   d. Clean the inside of your sealant tank. The side walls, bottom and ceiling should be scraped to remove all sealant that has built up during the season. This build up slows heating and recovery time and eventually falls into the tank clogging your pump and wand tip.
   e. Check your pump output. Is it delivering the proper gallons per minute to make your operation efficient?
   f. Inspect your application hose and hose cover for cracks, holes and dry rot and replace for safety. If you have an electric hose that needs service, this is a great time to send it in.
   g. If you need assistance contact your equipment supplier.
2. Provide training in equipment operation and safety for your crew. Distributors or manufacturers often have programs setup to assist you.
3. Pre-order your crack sealing equipment, materials and tools so you have everything you need to get a fast start when the weather clears.
4. Attend industry trade shows and association meetings to keep abreast of the latest technologies and advancements in the industry.

For more information about crack sealing solutions contact your local distributor or contact Brian Price at: *Brian.Price@Crafco.com*

FHWA Update By Steve Healow, FHWA Sacramento

Good news: Your next surface transportation reauthorization was the subject of a February 11 hearing before the House Transportation and Infrastructure Committee. The hearing was convened by Chairman Bill Schuster and included opening testimony by Secretary of Transportation, Anthony Foxx. Secretary Foxx emphasized to lawmakers the need for pavement and bridge preservation, expansion of our existing infrastructure, and streamlining the permits and consultation processes for accelerating project and program delivery.

Foxx pointed out that the current continuing resolution expires in May and is the 32nd temporary extension since 2009. Secretary Foxx took this opportunity to introduce to lawmakers the "Grow America Act", a bill proposed by the White House which would authorize $487 billion over six-years, funded in part by new taxes on businesses.

No matter how you feel about surveys, the results of a recent **survey by the Rockefeller Foundation** indicate the public isn't aware of how they contribute to preservation of our

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transportation infrastructure.

- 66% of respondents agreed improving transportation infrastructure is important;
- 80% of respondents agreed federal funding for transportation infrastructure improvements would boost our economy;
- 64% of respondents said government spending on transportation infrastructure projects is inefficient; 32% said it is efficient.
- There is little public support for raising the federal gas tax to generate funding for transportation infrastructure improvement projects;
- The public isn't aware of how they contribute to the highway trust fund. Individuals generally don't know what amount they pay in gas taxes - most overestimate.
- The average household spends $46 per month in federal and state gas taxes, $160 for fuel and electricity, $161 for cell phone service and $124 for cable and internet services.

U.S. Secretary of Transportation Anthony Foxx recently unveiled **"Beyond Traffic"**, a survey of the current state of our surface transportation system and where we may be if trends continue. The quality of our nation's roads has fallen to #16 in the world. The average American spends five days per year stuck in traffic. The trucking industry loses $27 billion per year in wasted time and fuel due to congestion. "Beyond Traffic" is only 80 pages plus appendices and can be viewed at this URL. [*http://www.dot.gov/sites/dot.gov/files/docs/Draft_Beyond_Traffic_Framework.pdf*]

CP² CENTER NEWS

CP² Center Patrons Program Update

By R. G. Hicks, CP² Center

The annual Patrons Meeting and Open House will be held at the California Pavement Preservation Center on March 19. We are always seeking to expand our Patrons group. Here's some background information.

The California Pavement Preservation Center (CP²) Center was established in 2006 at CSU Chico to provide assistance with the development and use of appropriate pavement preservation strategies. The Center was originally funded by Caltrans and continues to work closely with them, as well as other agencies. We maintain a very experienced staff of pavement experts, and a state-of-the-art asphalt laboratory facility.

But the Center is funded only by contracts with agencies such as Caltrans and CalRecycle and other clients, and 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 lab equipment,
- preparing contract proposals,
- organizing meetings and conferences,
- participation in events to promote pavement preservation, and
- delivering training classes.

This funding must come from non-contract sources such as our Patrons Program.

Patron supporters of the CP² Center can benefit from:

- general promotion of pavement preservation concepts (e.g., via our newsletter)
- an increased market for pavement preservation products and services
- training programs in pavement preservation technology
- assistance with research, both lab and field
- availability of a credible "3rd party" for technical expertise
- participation in special meetings and conferences.

For more information on how to join and the benefits of joining, please contact Co-Chairs, Dr. Gary Hicks at *rghicks@csuchico.edu* and/or Dr. Hans Ho at *handsho@telfercompanies.com*. More information on the Patrons Program can also be found on the Center's website at *http://www.csuchico.edu/cp2c/*

COMING EVENTS

Mark Your Calendar (Coming Events)

CP² Center Patrons Meeting and Open House March 19 (Chico, CA)

The CP² Center is supported in part by Patrons, usually industry partners with an interest in pavement preservation. Various levels of Patron participation are available. The annual Patrons Meeting is an informative event and a chance to meet Center personnel and tour the Center's lab facilities. For more information contact Dr. Gary Hicks at: *rghicks40@outlook.com*

CalAPA Spring Asphalt Pavement Conference and Equipment Show April15-16 (Ontario, CA)

This popular event by the California Asphalt Pavement Association (CalAPA) will be packed with technical and practical information on asphalt pavement research, pavement design, placement, testing and acceptance, as well as funding projections and other issues of interest to pavement professionals.

The conference will also feature dozens of vendor booths, a reception and an outdoor equipment expo where the latest in construction equipment will be on display. Previous conferences have been attended by more than 200 construction industry professionals and local, state and federal public works officials. For more information go to: *http://events.r20.constantcontact.com/register/event?oeidk=a07eah3og49930da4d9&llr=bisj8dcab*

"Roadshow" Training Available

It's difficult to send your pavement maintenance crews away for training, so why not have the training brought to you. "The Asphalt Pavement Maintenance Roadshow" (IDM-05RS), offered through the Technology Transfer Program at U.C. Berkeley, is a 4-hour class geared to field crews and their supervisors and managers. This class will be delivered at your location, for your crews, by request. It focuses on asphalt materials, patching, crack sealing, preservation strategies, equipment and safety. For more information on this and other Roadshow classes go to: *www.techtransfer.berkeley.edu/roadshows*

Nevada Transportation Conference April 14-15 (Reno, NV)

This annual conference always provides plenty of interesting speakers and panel discussions offering insight on transportation issues in our neighboring state. In addition to pavement topics, this year's conference will include diverse topics from funding to fracking to drones. For more information go to: *www.rtcwashoe.com/ntc*

ICMPA 9th Conference May 18-25 (Washington, D.C.)

The International Conference On Managing Pavement Assets (ICMPA) will bring together pavement design and management engineers, companies specialized in providing pavement management services and data collection, researchers and specialists on asset/pavement management, general pavement/road engineers, planners dealing with the development of public works programs, and academics specializing in pavement design, analysis and management. See more at: *http://www.cpe.vt.edu/icmpa9/index.html#sthash.hOz8cn6T.dpuf*

This newsletter was produced in partnership with Caltrans. Caltrans established the California Pavement Preservation (CP² Center) CSU, Chico in July 2006, and fully funded the Center in January 2007. Dr. DingXin Cheng is the current Director of the Center.

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.

The Center works closely with the Pavement Preservation Task Group (PPTG), a statewide volunteer group consisting of members from Caltrans, Federal Highway Administration (FHWA), industry, various public agencies and academia to help promote cost-effective pavement preservation.

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