



CP² CENTER NEWS

Newsletter of the California Pavement Preservation Center

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Interview with Steve Takigawa, Director, Caltrans

By Ding Cheng, CP² Center



Steve Takigawa,
Deputy
Director of
Caltrans

Steve Takigawa is the Deputy Director of the Maintenance and Operations Program for the California Department of Transportation (Caltrans).

Mr. Takigawa is responsible for the day-to-day operations of the Division of Traffic Operations, Division of Maintenance, Division of Equipment, and the Americans with Disabilities Act Infrastructure Program, overseeing a statewide operating budget of \$2 billion and 8,500 employees. During his Caltrans career, Mr. Takigawa has spearheaded many transportation innovations in California. His strong leadership on innovation and management has helped Caltrans become a leader in providing cost effective, high performance, long lasting and sustainable pavement. The following are his answers to some questions that were asked by the Center.

1. *Can you provide an update on Caltrans pavement preservation efforts for both concrete and asphalt pavements?*

A. Caltrans has several innovative pavement preservation strategies for concrete and asphalt pavements that help reduce traffic delays and congestion during construction.

Using precast concrete pavement helps us get in and get out of construction faster. It is another tool to use along with rapid strength concrete slab replacements. We are partnering with the California Pavement Preservation Center to evaluate rapid strength concrete performance. Initial studies should be completed by the end of this year, and future evaluations are being planned. We are looking at the effectiveness of the Next Generation Concrete Surface (NGCS) to reduce tire/pavement noise by grooving and grinding the concrete. Caltrans is considering lithium silicate surface hardening products to extend the service life of concrete

pavement at higher elevations to prevent tire chains wear. For sustainability, an authorized materials list will allow alternative materials to be recycled and reused on concrete projects, and new guidelines and a standard plan were developed for concrete spall repairs.

By the end of 2014, a new concrete pavement guide, which does not replace the MTAG, will be published for new concrete pavement, pavement preservation, and rehabilitation activities. In addition,

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polyester concrete is being used for dowel bar retrofit backfill material to ensure long term performance. The CP² Center was involved with its development.

For asphalt pavements, there have been three long life asphalt pavement projects in Northern California on Interstate 5, with 35 lane miles. We continue to support warm mix technologies in preservation, both in mixes and in hot applied chip seals. Another goal is to increase our crumb rubber usage. Currently, we are at 23 percent of total usage and are seeking strategies to increase that percentage in the next construction season. We are also reviewing, with the help of the California Pavement Preservation Center, three seal coat pilot projects using different types of rubberized asphalt binders.

There is a new smoothness specification to improve the ride, reduce noise and fuel consumption and to increase the pavement service life.

2. *What is the funding outlook for both pavement preservation and the SHOPP program for the next few years? Are there new sources of funding that the department is exploring?*

A. The California State Transportation Agency (CalSTA) and Caltrans participated in the California Transportation Infrastructure Priorities (CTIP) working group for pavement preservation and “fix it first” initiative. This effort resulted in an additional \$337 million in the Governor’s Budget for this year, of which \$237 million is for the State Highway System to address deficient pavement, bridges and culverts. Caltrans currently has \$234 million available annually for pavement preservation and \$823 million for State Highway Operation and Protection Program (SHOPP) capital improvements, which adds up to more than a billion dollars a year.

Pavement has to compete for funds with bridges, congestion, and other projects. As with most agencies, we need a more



stable transportation funding source.

3. *Can you discuss the changes that are being made within Caltrans as a result of the departmental review conducted last year? What are the most significant changes that are being implemented in addition to the need to modernize and to be held accountable?*

A. The recent review helped to set the goals for Caltrans’ 2014–18 Strategic Management Plan, which includes input from external partners such as the Self Help Counties Coalition. This Strategic Management Plan provides an ongoing program review for new and improved business processes. Some of the changes include implementing an asset management approach to the infrastructure, zero based budgeting, and providing efficiency in the organization that leverages our limited SHOPP resources with local agency widening or pavement rehabilitation projects. In addition, Caltrans has started

publishing a plain-language report on its performance, The Mile Marker, which provides for more transparency to our partners and helps us do a better job of communicating our priorities along with our accomplishments.

4. *What are some of the major activities underway in the maintenance division, such as:*

a. *The status of the new pavement management system and how it will be used to help optimized resources*

A. Caltrans staff have used PaveM to analyze the 2014 SHOPP programmed projects and to provide a statewide priority of projects along with district pavement priorities. These priorities are based on the pavement condition, facility type, climate, average daily traffic and average daily truck traffic, and a benefit calculation is provided for each project location. Additional analysis will use pavement treatment models and decision trees to create future projects that improve the health of pavement. For MAP–21, freight movement will also be *Continued, next page*

considered.

Major accomplishments include:

- Statewide prioritization of 2014 SHOPP programmed projects and HM-1 projects.
- Updated GIS maps to display maintenance and rehabilitation projects and pavement condition.
- Reports that show project history over time by post mile and route.

The next steps are to update and refine the pavement treatment models to optimize pavement performance. PaveM will create new benefit models that provide performance dashboards to optimize the health of the pavement network and pavement smoothness and to help reduce greenhouse gas emissions. Other refinements will include:

- Updated performance models for both asphalt and concrete pavements.
- Optimized pavement inventory using benefit calculations and time.
- Decision trees that address how long pavement treatments really last.
- Collaboration with Caltrans' asset management team to include future performance metrics.

b. The performance measures that Caltrans plans to use in preparation for MAP-21

A. Caltrans will use the asset management approach where other assets' performance measures are addressed within rehabilitation projects. Among our priorities are major truck corridors and annual average daily truck traffic, as well as focus on complete streets and how pavement can enhance the alternative transportation modes for bicyclists and pedestrians. In addition, there are studies underway to determine the metric track of greenhouse gas emission



reductions.

c. Preservation treatments that are increasing in use because of performance, cost savings and or sustainability issues

A. Caltrans is using cold in place recycling (CIR) as sustainable pavement for the traveling public. Allocations for CIR projects have increased from \$18 million last year to \$45 million currently, as a result of a one time increase of \$27 million from early loan repayment funds.

We are looking at ways to increase the amount of crumb rubber in our asphalt pavement to increase the use of scrap tires in asphalt pavement and reduce the number of tires that go in landfill.

We are looking at specifications to increase the amount of reclaimed asphalt concrete and recycled asphalt shingles in hot mix asphalt (HMA).

Superpave adoption in the state is a result of positive partnering between industry and Caltrans, with the goal of a quality product that has an increased service life and minimal negative impacts on the environment and the traveling public. Specifications to transition from Hveem mix design to Superpave are underway. The new Section 39 specification will emphasize contractor quality control from HMA mix design to final completion acceptance by Caltrans. This specification will allow Caltrans to consider environmental conditions and traffic patterns when specifying the mix design. In addition, by using quality control assurance, the quality of materials and production will be maintained throughout the construction process.

We have purchased eight new inertial profilers for Caltrans to help with our Quality Assurance Program regarding pavement smoothness. Having smooth pavement will help reduce greenhouse gas emissions, reduce fuel usage, reduce annual vehicle maintenance costs, and give motorists a comfortable ride.

As mentioned previously, we are monitoring three long life pavement projects using hot mix asphalt.

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5. Can you tell us what the feedback has been for your new magazine, "The Mile Marker", which can be found at: http://www.dot.ca.gov/ctjournal/2014-1/TheMileMarker_Jan2014.pdf.

A. The Mile Marker has been well received by internal and external stakeholders. About sixty media outlets, including major networks such as NBC, CBS, ABC, and NPR, cited The Mile Marker in their top stories relating to congestion and pavement health of the State Highway

System.

6. Can you tell us if Caltrans is going to provide its employees any training on pavement preservation?

A. At this time, Caltrans' Pavement Program is updating the pavement Maintenance Technical Advisory Guide (MTAG) and implementing hands on training for field maintenance, including on the job training for both asphalt and concrete pavement issues, best practices, and pavement preservation strategies. 



FiberMat Successfully Applied in Arizona

By Jon Layne, Sully-Miller Contracting Co.

In June of 2013, Sully-Miller Contracting Co., a subcontractor to Sunland Asphalt, performed over 135,000 square yards of FiberMat Type A to Mohave County Department of Public Works.



Figure 1. Lipan Blvd. before FiberMat Treatment (May 2013)

FiberMat is a 100% recyclable, crack-inhibiting membrane that delivers a matrix of fiber-glass strands embedded between two layers of a polymer-modified emulsion all in one pro-

cess. There are two types of FiberMat- Type A which is used as a surface wearing course and Type B as an interlayer.

Contrary to popular belief, FiberMat is not a new process. It has been extensively researched and utilized for over 20 years throughout the Colas Group. Executive Summaries from both Penn State and Texas Transportation Institute are available. In addition, the National Center of Asphalt Technology is currently testing the performance of both types of FiberMat with results expected in 2015. To date, there are 18 FiberMat machines throughout North America since its arrival in the US in 2003. However, the process was new to Jed Noble, Engineering Manager of Civil Infrastructure, and his team at the Mohave County Department of Public Works.

As a result, FiberMat was applied to 3 different types of low volume/low PCI roads for Mohave County in Fort Mohave, Arizona:

- One mile of Joy Lane had extensive crack sealing performed prior to application of FiberMat.
- One mile of Lipan Blvd. had extreme alligator cracking throughout the pavement with no crack-sealing whatsoever. This road was actually a good candidate for rehabilitation/reconstruction.
- A 14 lane-mile section of Boundary Cone Road had various pavement conditions that included potholes filled with cold mix and crack seal performed on the edge of the roadway.



Figure 2. Lipan Blvd. One year after FiberMat (May 2014)

Sunland Asphalt, the licensed distributor of FiberMat in AZ, was Prime Contractor on the project and provided all equipment and materials as Sully-Miller operated the FiberMat machine only. As a value-added Quality Control/Quality Assurance service, Sully-Miller filmed the roads prior to

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Figure 3.
Sunland
Asphalt and
Sully-Miller
performing
FiberMat on
Pierce Ferry
Road.

construction, during, and after construction using HD video cameras integrated with GPS capabilities- the only contractor in the US currently using this technology. The roads were again filmed one year later to virtually show interested agencies the effectiveness of FiberMat without having to travel directly to the project. All of the videos were also shared with Mohave County for their own use.

Extreme climates played a role during the construction process with temperatures exceeding 113 °F as well as wind gusts in excess of 35mph making it difficult on all parties. However, the project was completed in only 4 working days. Annual temperatures for the project range from as high as 122 °F to as low as 21 °F.

Mohave County's Public Works Director, Steven Latoski noted:

"Mohave County recognizes FiberMat as an innovative yet proven pavement surface rehabilitation treatment, which the County selected through a "smart" request for proposals process toward developing a qualified products listing of pavement treatment products supporting the County's Capital Pavement Preservation Program and engineered to deliver cost efficient pavement surface rehabilitation. Mohave County is confident FiberMat, through its tensile strength and flexibility qualities, will sustain pavement surface layer condition and smooth riding surface through a prolonged service life versus comparable treatments in its class."

As a result of FiberMat's performance in 2013, Mohave County invited Sunland Asphalt and Sully-Miller in 2014 to perform a 7-mile section on Pierce Ferry Road- the only access route to the Grand Canyon Skywalk.

Sully-Miller will continue to film these roads on an annual basis to prove its effectiveness to interested state and local agencies in Arizona, Nevada, and California. To view the before and one-year-after videos, visit Sully-Miller's YouTube Channel at <https://www.youtube.com/user/SullyMiller2010>.



Is Green Asphalt Repair Even Possible, Or Is It Just a Paver's Fantasy? By W.R. Bill Bailey, Lakeside Industries

No place in the nation has a higher forest density than the Pacific Northwest. So it stands to reason that there are more forest roads than anyplace in the nation. Maintaining those roads comes with a special responsibility. Certainly, budget is always an issue, but the bar is set even higher when it comes to the environment. Whether a local and county agency or forest and parks departments, reducing the environmental impact of maintaining asphalt roads is a must. And that's happening in the Northwest with the help of Lakeside Industries and EZ Street Bioblends cold asphalt.

With traditional cold mix asphalt products, there are distinct environmental and safety challenges, and they begin with one key ingredient: diesel fuel. Typically patching materials contain up to 30% #2 diesel as a diluent to keep the asphalt mixture from setting up too quickly. In the wet climate and rain, the excess often leaches into the water table when

thrown into a pothole. Contractors have also been fined for allowing diesel to be used on truck beds and paving equipment.

Adding diesel keeps the cold patching product workable. Using it to repair a road creates an obvious case of introducing a pollutant into the environment. Manufacturing it creates air pollution and a substantial carbon footprint and is a waste of good fuel material so direly needed today. Moreover, traditional cold mix asphalt products become hard and unworkable in the cold weather of the Northwest. A work crew repairing an asphalt road will typically use a hot box or a propane torch for heating the material to a workable state. The problem is acute: diesel's flashpoint is typically 148 °F, therefore using an open flame is a liability and the risk of overheating the product is high. Overheating makes traditional cold mix asphalt hard and brittle, which leads to early failures.

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Lakeside Industries has become one of the Northwest's largest asphalt paving contractors, serving Washington, Oregon and Idaho. They do so with a level of community engagement, environmental awareness and commitment to quality that is the hallmark of a legacy brand. They've won hundreds of awards for their performance—including numerous commendations for their commitment to the environment.



products, EZ Street Bioblends gives off no VOC fumes.

Bioblends is also thicker, which is better. On a Brookfield viscometer, diesel fuel blends of bitumen often measures around 300 centipoise. The bio-oil blends of bitumen in Bioblends measures between 800 and 900. In the simplest terms, we're talking the viscosity of whole

Teaming up to produce EZ Street Bioblends asphalt was a "no-brainer" for Lakeside. EZ Street asphalt is recognized as a leading cold product. Quick and efficient, EZ Street's guarantee of permanent pothole repairs and utility cuts make it a favorite among both work



crews and the people who sign the checks in the Northwest.

Bioblends offers the same EZ Street value and

benefits in a green product. Bioblends is formulated with an advanced bio-oil substitute (reclaimed vegetable oils) for diesel. Lakeside produces Bioblends in their plants for use across the Northwest. The gains are tremendous including: a smaller carbon footprint, no petroleum-derived diluent being introduced into the environment, and the product's work-



ability in cold weather is much better than traditional cold mix asphalt products. But if a road

crew wants to use a hot box or a propane torch, no problem. The flashpoint for the bio-diesel product is 365 °F. The risk of starting a fire is greatly reduced and unlike diesel

milk vs. the viscosity of honey. Higher viscosity yields better asphalt oil film thickness, and thicker films of the same bitumen wears better. EZ Street Bioblends asphalt lasts longer with nearly a decade of actual use by British Columbia and Alberta and no complaints.

Heated or cold, it can be placed by hand, grader, paving machine or Layton (pull) box. Clackamas, Multnomah, Lane, Deschutes and many other Counties in Oregon blade or machine repair with our material. The product comes in 50 lb. bags, Supersacks or in bulk, whatever suits your needs. The product is compacted just like hot mix asphalt.

As mentioned, Bioblends can be used warm or cold. However, it can also be put into a hot box or heated with a propane torch. Warming the product helps dry out the hole into which it's placed. Warming also yields easier compaction, which is critical to proper repairs. And if any warmed product is left over, it lets the user do something no other product can:



EZ Street Bioblends asphalt can be reheated and used later. Decades of listening to and learning from the "old guys" paid off.

EZ Street Bioblends asphalt and Lakeside Industries: working together in the Northwest and now available in California, to keep America moving forward with a "going green" that actually performs better than the old method.



CCSA hosts 4th Annual Pavement Preservation SoCal Roundtable

By Jon Layne, Sully-Miller Contracting Co.

On June 19th, 2014, the CCSA hosted their 4th Annual Pavement Preservation Roundtable at the Hotel Fullerton in Southern California. This no-cost event to agencies included presentations from industry experts about aggregate gradation changes, the manufacturing process of emulsions, Hot Applied Binders, and funding in regards to pavement preservation. Industry sponsors of the SoCal Roundtable were able to give a brief description about their company and the services they offer.

Approximately 35 people were in attendance from both industry and local agencies. Some of the agencies included: San Bernardino County, Los Angeles County, Riverside County, City of Laguna Hills, and Santa Barbara County. At the end of the presentations, a peer

interaction period allowed agencies and industry to not only share their best practices but also discuss issues the pavement preservation industry can address. This forum also gave agencies the opportunity to discuss the decision making process for certain preservation treatments on their roads and what can be done to deliver the best value for the taxpayers.

If you haven't attended one of these local roundtable events, the CCSA encourages you to attend next years' event. In the meantime, agencies can visit the CCSA or the CP2 website for resources in regards to pavement preservation. Be sure to also watch your email inbox for an invitation to the CCSA's 2015 Workshop to be held at the Industry Hills Expo Center in Southern California in February.



Buried Treasure Concrete Pavement Preservation: The Treasure

Map By Kristin Dispenza, Constructive Communication

The Buried Treasure approach to concrete pavement preservation (CPP) got its name because it reclaims assets that have been previously hidden below grade. It is a pavement preservation strategy that uncovers and renews aged portland cement concrete pavement (PCCP) which has been overlaid with asphalt due to non-structural issues such as poor ride quality and excess tire/pavement noise. The method has been gaining popularity due in part to paving materials' price escalation as well as the need to minimize unnecessary traffic disruptions for today's motorists.

Because it is imperative to determine an underlying pavement's viability before a project can be planned and executed, the advancement of Buried Treasure CPP has been predicated on the availability of modern non-destructive testing tools. Ground penetrating radar, for example, can be useful in determining whether existing concrete pavements under an asphalt overlay are experiencing void problems. Alternatively, if concrete core samples are taken as part of the project scope, the core hole can be used as a pathway for a Dynamic Cone Penetrometer to be used to measure the stiffness of the sub-base material. Another option for determining the strength of underlying

pavement is to compare falling weight deflectometer values from before and after placement of the asphalt overlay, if that data has been collected.



The time may be right for Buried Treasure CPP on many of today's road repairs – but what engineering and jobsite processes are currently in place? How is the work performed? In short, is there a 'treasure map' to follow when pursuing this pavement preservation option.

There are a number of documented projects that can provide insight into best practices for Buried Treasure CPP. Two highlighted in this article include the New Jersey Department of Transportation's (NJDOT) 2009 Buried Treasure project on Highway 21 and the Minnesota Department of Transportation's (MnDOT) 2012 Buried Treasure CPP project performed on a heavily trafficked section of I-94 between Minneapolis and St. Cloud, Minn.

New Jersey's Highway 21 Project

The project area for Highway 21 – an urban freeway in Newark, N.J. – was 5.9 miles long and consisted partly of elevated roadway using curbs and gutters for storm water drainage and partly of rural interstate design with paved shoulders and open

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ditch drainage. The existing concrete pavement was constructed in three phases. In 1931, 1.4 miles of roadway were constructed. Phase Two, which covered 3.5 miles, took place from 1958–1961 and used a long panel design with stainless steel dowels on a 73 foot joint spacing. Mesh was purposely placed in the top one-third of the pavement depth to help control top down cracking from shrinkage of the concrete. The final phase, a 1.0 mile stretch, was completed in 1970. This pavement is 9 inches thick and was placed on a 12 inch aggregate base.

By the early 1990s, this stretch of Highway 21 was experiencing a large number of wet weather accidents and had less than desirable skid numbers. To address the problem, a micro-surfacing treatment was applied in 1993. Delamination of this treatment led to a second micro-surfacing treatment in 2001, which also suffered from delamination, partially due to the condition of the underlying pavement. By 2008, major repairs were deemed necessary. In addition to using pre-cast panels for full depth repair on some areas and performing partial depth patching on other areas, the New Jersey DOT decided to try an innovative CPP approach: removing the asphalt overlay and diamond grinding the underlying concrete pavement.

Due to the potential for slab cracking, slab stabilization was included in the contract. The underlying soils were primarily unstabilized silts and sands and were therefore susceptible to washouts under the transverse concrete joints. Polyurethane grout was chosen for the slab stabilization work that was done at each joint along the 9.8 miles of roadway, totaling 400 joints in the northbound lane and 300 in the southbound lane.

Jobsite Judgment Calls and Lessons Learned

The shallow placement of the steel reinforcing mesh in the original pavement had been a concern for project engineers from the outset of the job. In order to minimize contact with the steel mesh, the asphalt milling and removal operations had to be performed within tight tolerances in order to leave as much of the protective concrete cover as possible.

The diamond grinding contractor, Interstate

Improvement, Inc. of Fairbault, Minn., requested that the asphalt milling contractor leave a thin layer of asphalt on the concrete surface. This remaining asphalt would be removed later by the diamond grinding equipment minimizing section removal and possible contact with the steel mesh.

Ride quality data collected at the completion of the project exhibited a big improvement over the pre-grind ride profile. In December 2007, the pavement had an average IRI of 160.94 inches per mile. After diamond grinding was completed on the underlying pavement, the final IRI was an average of 112.00 inches per mile – an improvement of 30%.

The bid price for the removal of the micro-surfacing overlay was \$784,245 for 266,750 square-yards at a unit price of \$2.94 per square yard. The bid price for the diamond grinding was \$1,963,280 for 266,720 square-yards at a unit price of \$7.63 per square yard. With the ever increasing cost escalation of paving materials, the value of the asphalt millings should be considered in the overall cost of a Buried Treasure CPP project. Using the bid tabs on the Highway 21 project, it was determined that a one inch micro surfacing overlay generated approximately 0.05 tons of RAP per square-yard. The value of the RAP can be taken into account at the time of bids.

The concrete pavement on Highway 21 is yet another example that an urban freeway with curb and gutter drainage can be rehabilitated with concrete pavement preservation techniques at a competitive cost in an environmentally friendly manner.

Minnesota's I-94 Project

In 1974, the Minnesota Department of Transportation (MnDOT) completed construction on a new section of I-94. It consisted of 65 miles of 24-foot wide, nine-inch thick concrete pavement with 27-foot panels using skewed doweled contraction joints. By early 2013, traffic had reached capacity at 28,500 vehicles per day with about 13 percent of vehicles being trucks. With such heavy use, the ride quality of the surface had begun to suffer due to the original designer's choice of load transfer devices, which were one-inch black steel dowels with no epoxy coating (common practice today calls for 1.5-inch diameter dowels with a thick epoxy coating).

Rusted dowels and the lack of load transfer led to joint faulting. The initial *Continued, next page*

repair method utilizing micro-surfacing did not provide the desired longevity due to the fact that the structural problems associated with the underlying pavement were never addressed. The micro-surfacing that had been applied in 2006 was removed and the Buried Treasure CPP strategy was undertaken. Full depth repair was performed on all transverse joints and on cracked slabs, followed by diamond grinding. This strategy was determined to meet the required 20 year design life required by MnDOT engineers.

Using Buried Treasure CPP, even with the cost of removing every transverse joint, allowed the overall project cost to be far less than it would have been with other treatment options available. Interstate Improvement Inc. was awarded the contract in the amount of \$8,422,705 for the 11.2 miles of concrete rehab and diamond grinding. With the cost at \$752,027 per mile for the total project, the concrete items were only \$537,134 per mile. The cost of the full depth repairs was \$420,089 per mile.

The two projects discussed above highlight some of the challenges as well of the benefits of the Buried Treasure CPP process. According to Jake Steinberg, President of the International Grooving & Grinding Association (IGGA), "the Buried Treasure CPP strategy is a perfect fit for these times of limited transportation funding and increased environmental awareness. It is an economical, long lasting

and sustainable process that brings new life to these structurally sound concrete pavement sections that have been covered up by an asphalt band-aid. The projects on Minnesota's I-94 and Highway 21 in Newark, N.J. are a testament to this cost effective repair method."

Buried Treasure CPP is:

- Long lasting
- Better for the environment
- Simple (It can be completed in off-peak hours with short and mobile lane closures.)
- Supportive of the local economy
- Readily available
- Fast to advertise, bid, let and complete
- Flexible (PCCP can be rehabbed using CPP up to three times with little loss of structural or load carrying capacity. Furthermore, applying CPP in one lane doesn't require application in an adjacent lane.)
- Cost effective
- Quiet
- Safe
- Fuel efficient (Rigid concrete surfaces exert less rolling resistance than flexible surfaces.)
- Smooth
- Proven



Preservation of Concrete Pavement Using a Lithium Densifier and Shotblasting By Liam Cumberpatch and Dominique Pittenger, University of Oklahoma

A primary purpose of current and previous pavement preservation projects in Oklahoma is to explore an innovative surface treatment for preserving concrete pavements: a modified silicon reactive lithium densifier (surface hardener) applied over shotblasting (DOS). The term "densify" refers to the chemical reaction that occurs between the lithium silicate hardening agent and the concrete pavement surface that creates a denser, harder surface texture compared to untreated concrete. Shotblasting is used to enhance the penetration of the densifier. In highway application, DOS can enhance rut and wear resistance. However, it is underutilized by state highway agencies due to its relatively recent emergence as a pavement preservation

treatment and a perceived adverse impact on skid resistance on high-speed roads. Treatment evaluation presented herein shows results of laboratory and field tests that offer a comparative analysis of aggregate characteristics and skid resistance performance of the DOS treatment. A cost comparison of three pavement preservation treatment options (PPTs) for preserving concrete pavements is also included.

Oklahoma, along with twenty-one other states, has mostly soft aggregate, which compromises the performance of concrete pavements. The objective of the current laboratory study is to evaluate densifier-treated limestone aggregate characteristics that relate to highway performance in terms of abrasion resistance, skid resistance and aggregate

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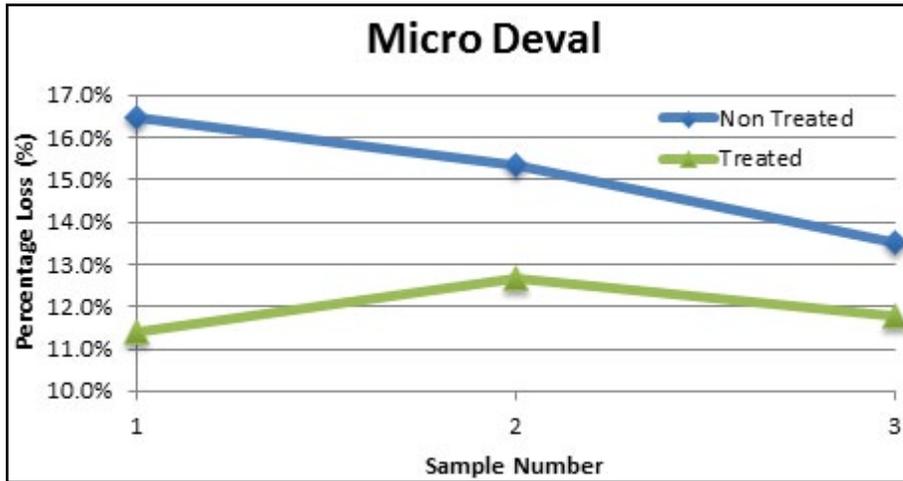


Figure 1. Micro Deval results for densifier-treated and non-treated aggregate.

polishing. Micro Deval (AASHTO T-327) provides insight regarding the ability of the densifier application to harden limestone aggregate. The testing process is used to simulate polish-wear forces on the aggregate. Figure 1 shows some Micro Deval results, which reveal that the aggregate samples with directly-applied lithium silicate densifier (triangle designation) had less percentage weight loss than the non-treated samples (diamond designation). Good friction performance has been correlated with aggregates that exhibit Micro Deval weight loss values of 12% or less. Therefore, the results indicate that the treated aggregate is harder and more abrasion resistant and would facilitate good pavement surface friction and better performance than the non-treated aggregate.

After being subjected to Micro Deval, the limestone particles were characterized using an aggregate imaging system (AIMS) to determine retained angularity, a characteristic that relates to desirable field performance. The results show that applying the densifier directly to the aggregate also enhances the aggregate's ability to retain angularity. In general, a higher angularity index (4,000+) indicates a more angular particle, while a value lower than 2100 indicates a rounded particle. Figure 2 shows the angularity values from the limestone particle testing, represented on the x-axis, for the

(a) pre-Micro Deval particles (baseline, dashed line), (b) densifier-treated particles, post Micro Deval (solid line), and (c) non-treated particles, post Micro Deval (hashed line). While the non-treated limestone became more rounded under polishing forces, the densifier-treated aggregate trended more closely with the aggregate that received no polishing force at all, indicating that the chemical application does indeed enhance aggregate abrasion resistance, and by extension, skid resistance.

Three field trials were constructed on concrete pavement and then evaluated over an approximate three-year period:

1. DOS
2. shotblasting only, and
3. diamond grinding only.

The DOS section had a densifier applied to the surface after shotblasting. The shotblasting process included a single directional shot pattern and 4-foot wide head. The third section consisted of traditional diamond grinding.

The research methodology consisted of collecting performance data for each section and conducting life cycle cost analysis (LCCA) and the American Society for Testing and Materials, International ASTM E274 - Standard Test Method for Skid Resistance of Paved Surfaces

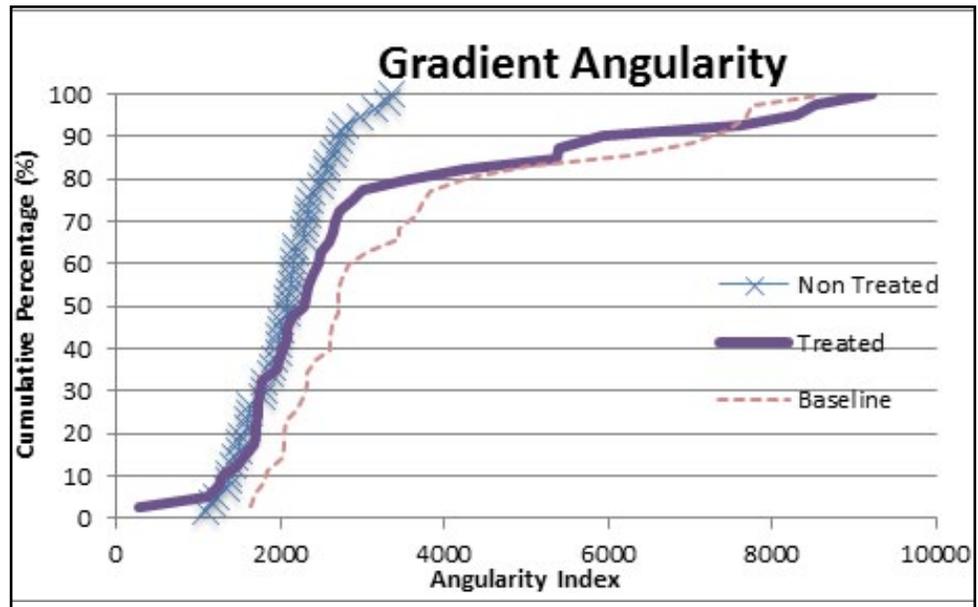


Figure 2. AIMS results: gradient angularity for densifier-treated and non-treated samples

Using a Full-Scale Tire is commonly used to determine microtexture and was used in this research to evaluate skid resistance (treatment performance). The initial measurements were taken immediately after construction for the establishment of baseline

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measure, then monthly thereafter for the duration of the testing period. One of the study's objectives in tracking DOS skid number change over time was to directly address the potential safety issue associated with applying a chemical treatment to the concrete pavement. Figure 3 shows the skid values over time, with the first data point representing the baseline value. Using a failure criterion of 25, the DOS treatment has performed at acceptable skid levels and has exhibited no discernible surface friction deterioration. Furthermore, the results for all three treatments are comparable and have remained relatively constant over the testing period. More observation time is required to determine if there will be a difference in long-term performance.

The LCCA revealed that the DOS treatment is a cost effective option when compared to the other two treatments when the service life input values are 3 years for shotblasting, 7 years for DOS and 8 years for diamond grinding. DOS service life was estimated since long term performance data does not exist for this new technology. However, even for the traditional treatments, performance data is limited. For

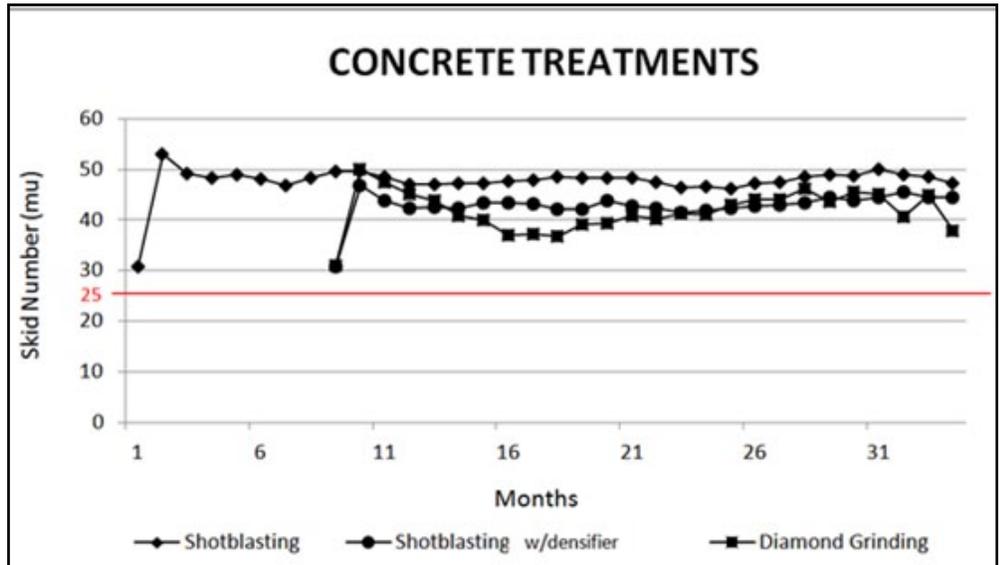


Figure 3. Microtexture-Based Performance of PPTs on Concrete Substrate

example, a 3-year service life is generally assumed for shotblasting. However, this study's field trial data shows that the treatment will probably satisfactorily perform for a period of longer than 3 years. Using performance-based service life input values instead of assumed values can change the rank order of the LCCA output, as it did in this case. This demonstrates the need for more long term performance data for PPTs and shows the benefit of using actual performance data in analyses.

These studies demonstrate that DOS efficacy and cost effectiveness can be comparable to traditional treatments found in the pavement preservation toolbox. Additionally, it showed that the process can be used on a high-speed highway without compromising safety. DOS can offer a technically viable option for preserving concrete pavements.

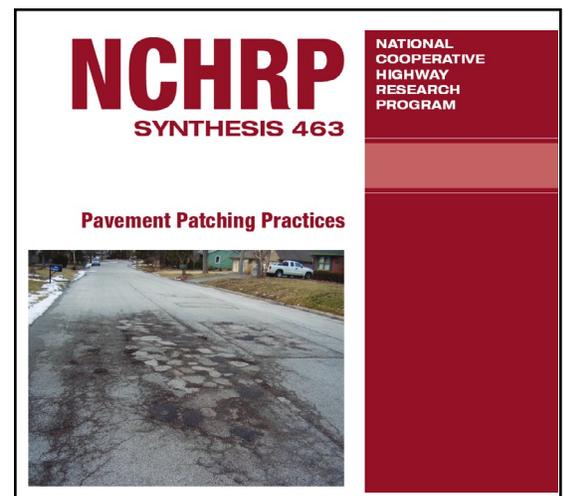
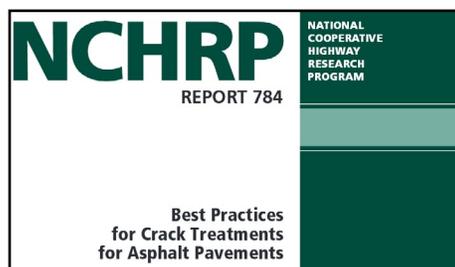


NCHRP Releases New Reports on Best Practices

Two reports have been issued recently dealing with best practices for patching and Crack Sealing. The reports include:

- NCHRP Synthesis 463 on Pavement Patching
- NCHRP report 784 on Crack Sealing

These reports can be found at the Center website: <http://www.csuchico.edu/cp2c/library/index.shtml>.



FHWA Update By Steve Healow, FHWA, CA Division



There is good news and bad news regarding the Highway Trust Fund (HTF). The good news is the fund is expected to remain solvent through May 2015 as congress passed and the president signed the Highway Transportation and

Funding Act of 2014 on August 8th. The Act transferred \$10.8 billion into the HTF and extended MAP-21 programs through May 2015. The bad news is there's still no long-term sustainable revenue solution for the HTF, nor is there a long-term surface transportation reauthorization bill on the horizon. Over the past decade Caltrans has obligated approximately \$3 billion annually from the HTF.

The Every Day Counts, Part 3 (EDC3) initiative kicked off in August and will run through 2016. The purpose of EDC3 is to accelerate project development and delivery while improving mobility and construction quality. Eleven innovative strategies in design, contracting and construction practices have been selected. See the strategies and/or apply for a grant at <http://www.fhwa.dot.gov/accelerating/edc3.cfm>.

The reader may recall the Strategic Highway Research Program (SHRP) authorized by congress in 1991.

Apparently congress is still fond of research and technology development because a follow-up program, SHRP2, is authorized in Section 52003 of MAP-21, where in the secretary of transportation is directed to consult with AASHTO and TRB to develop and deploy innovative and cost effective pavement strategies and paving materials to improve performance and extend service life. There is also emphasis on enhancing non-destructive inspection (NDI) technologies. An overview of 119 SHRP2 activities in 37 states can be found at <http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/OverviewMaterial.aspx>.

Section 1203 of MAP-21 is entitled "National Goals and Performance Management Measures".

That section directs the secretary of transportation to circulate a draft regulation which proposes and defines national measures for the condition of pavements and bridges on the National Highway System (NHS). The proposed rule will direct the state DOTs



to consult with metropolitan planning organizations (MPOs) as necessary to ensure consistent target values are established for the NHS. MPOs are now included in this conversation because section 1104 of MAP-21 expanded the NHS in California to include 7,000 miles of local principal arterials. The proposed rule will be published in early October, followed by a 90-day comment period. After public comments are considered the final rule will be published.

If your city or county would like to use highway trust fund dollars in your projects and programs consider visiting 'Federal Aid Essentials for Local Public Agencies' at <http://www.fhwa.dot.gov/federal-aid-essentials/catmod.cfm?id=107>. There you'll find instructions on a variety of topics including environmental analysis, finance, right-of-way, project development, construction and contract administration. There are also video explanations of hot topics like Buy America and Americans with Disabilities Act (ADA).



Speaking of ADA did you know seven local agencies in California have already signed settlement agreements with the U.S. Department of Justice? Read them at <http://www.ada.gov/civicac.htm#CA>.

Have you heard of the Transportation Curriculum Coordination Council (TCCC)? In cooperation with AASHTO the TCCC is committed to developing web-based training resources which are comprehensive and timely. Focus is on cost effective pavement preservation strategies. See a list of courses at <http://www.tccc.gov/webcourse.aspx>. Note the only cost is your time.



FP² Update By James S. Moulthrop, P.E., Executive Director, FP² Inc.

The President has signed the extension of MAP-21 until May, 2015 with funding that will allow the FHWA to reimburse DOTs from the Highway Trust Fund (HTF). Good news on one front that projects will continue to proceed as planned and bad news that there is only a short term extension, not the kind that allows agencies to plan for future revenue, and contractors and equipment manufacturers to expend capital expenditures for future expansion. We will continue to be involved with Congress to encourage the development and passage of a long term transportation bill that properly funds the HTF.

The preservation group study at NCAT continues and the 2012 research study will wind down this fall and a comprehensive report on the findings on the track and the off-site study on AL Lee County Road 159 will be presented at a meeting to be held in Auburn, AL on March 3-5, 2015. Preliminary discussions have taken place with NCAT to continue the monitoring the preservation sections on both facilities until they reach pre-treatment conditions. Discussions have also been held regarding the

next three year cycle at the track since additional states have indicated a desire to participate in the next preservation study. Additionally, preliminary discussions have been held between NCAT and AL DOT to place treatments on a state highway and also with MN Road to coordinate a study of similar preservation treatments at both facilities.

We continue to be engaged with the ADA issue as can be noted in the last two issues of the Preservation Journal. The CA Asphalt Pavement Association issued a Special Report entitled "Bumpy Road for Federal ADA Guidance on Pavement Maintenance" in July and the CA Chip Seal Association is currently surveying their membership to determine the effects of the DOJ/FHWA memo. We plan to gather as much data as possible on this impact of this issue so we can have a meaningful discussion with our FHWA contacts.

If you haven't already, plan now to attend the International Pavement Preservation and Recycling conference in Paris, France on February 23-25, 2015.

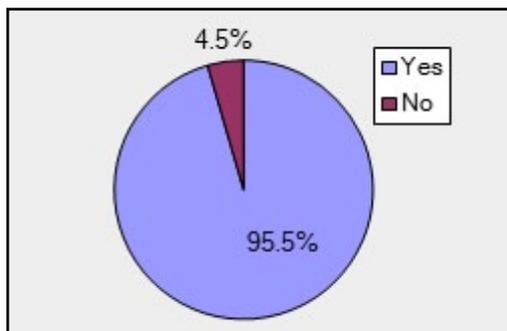


Survey on Newsletter of California Pavement Preservation Center

By Ding Cheng, CP² Center

The following is a brief summary of the survey results on the usefulness of the CP² Center newsletter. The survey was conducted between June 15 and 25, 2014. There were a total 247 people who responded to the survey. More than 95.5% of participants believe that the CP²C newsletter is useful and 97.2% of people would like to continue receive the Center's newsletter. The following shows the details of answers to each of the four questions.

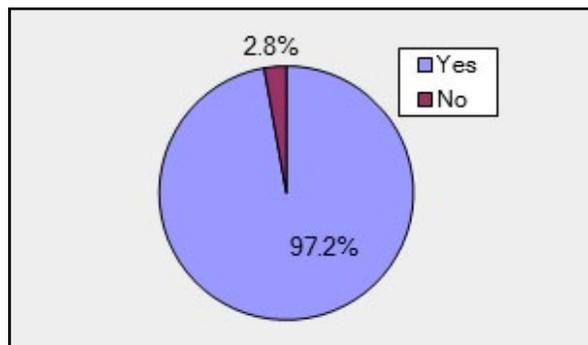
1. *Do you feel that the CP²C newsletter is useful to you?*



Responses: There were total of 247 participants who replied. 95.5% believe CP²C newsletter is useful while 4.5% believe it is not useful.

2. *Do you still want to receive the newsletter in the future?*

Responses: There were a total of 247 participants replied. 97.2% would like to receive CP²C newsletter in future while 2.8% wouldn't like to receive CP²C newsletter.



3. *Do you have any particular area(s) of interest that you want to see addressed in the newsletter?*

Response: There were 110 people who responded to the question with some good suggestions. See Table 1.

4. *What is your affiliation?*

Responses: There were a total of 247 participants who replied to the question.

32% were from state or federal agencies; 27% were local agencies, 22% were industry, 6% were academia, and 5% were internationals.

In summary, many readers are interested in asphalt/concrete preservation, new products and technologies, recycling, new pavement preservation treatments and its performance, ongoing research, and more.

Table 1.
Newsletter Survey Selected Responses

No	Selected Responses
1	Discuss the relative merits of the various treatments for pavement rehab and pavement preservation. For instance, keep giving info. About scrub seals, ARAM, micro surfacing, cape seals, CIPR, etc.
2	Caltrans Task Sub Group progress report including next meeting updates.
3	experience and work on preservation treatments, including case study examples
4	Pavement Preservation use of polymers
5	New or innovative technology
6	Better crack sealants and patch materials
7	I like the variety of topics covered
8	HMA study and new technology
9	tack application - spread rate and cleaning of surface - pick-up problems
10	Emerging technologies, treatment performance/success stories.
11	Preservation of alternative pavements surfaces such has chip seal. Also, it would be nice to see discussions on cost of pavement treatments to use with our PMS program.
12	Pavement preservation topics applicable to Cities with insufficient budgets for pavement maintenance and rehabilitation.
13	How to prolong the life of pavement.
14	Continue highlighting what preservation treatments are and are not working in California.
15	Pavement preservation. Also interested in new products or pavement treatments as well as updates on past product testing to determine the longevity of products and treatments applied in field tests.
16	Good case studies on the real life successes, failures & challenges encountered by agencies. I see some reoccurring practices by Contractors that create problems for agencies. If agencies readily shared project details that could avoid reoccurring problems and it would let Contractors know that their bad practices are being shared with other agencies.
17	"recycled materials (RAP/RAS)
18	non-intrusive pavement maintenance techniques
19	New pavement preservation treatments, preservation treatment performance

20	Technology and development, research findings, etc.
21	Performance assessment of existing pavement
22	pavement testing, evaluation, maintenance timing and strategy etc.
23	Yes, get more real life articles whether they are successful or not.
24	Latest technology trends and the latest on maintenance strategies.
25	pavement preservation , infrastructure funding.
26	Asphalt rubber and rubberized asphalt
27	more about preservation methods cir/fdr etc.
28	Micro surfacing options in lieu of overlays to stretch our maintenance dollars farther, if possible.
29	Sustainability, alternative cementite's materials, non-Portland cement usage.
30	Full depth reclamation of BST over aggregate base "pavement" structures.
31	Resurfacing and preventive maintenance, Dual Diagnosis
32	"An recurring article that will be featured in every issue, describing the ongoing research studies, and their updates.
33	Perhaps any forthcoming MAP-21 implementation-related info.
34	Keeping up on the new types of sealing and surface treatments available.
35	Use of RAP & RAS in HMA/WMA & Maintenance Treatments.
36	Rubberized Asphalts, Plus Grades of PG Binders, MEPDG, Binder & Emulsion Testing / Equipment Updates, Performance Testing & Requirements, Mix Design Requirements & Updates, Minimum Testing Requirements
37	Recycled Asphalt Pavement (RAP) used in Bituminous Surface Treatment (BST) and/or Slurry Seal construction.
38	sealcoats on residential roadways
39	Comparison of treatment life expectancy
40	I read the tips for inspectors and the survey results... both high interest areas.
41	Updates on the California PP working groups
42	Interviews, inspection keys, help desk, and more
43	Development of a help desk to answer questions from agencies"



2014 GeoHubei International Conference and Meetings in China

By Ding Cheng, CP² Center

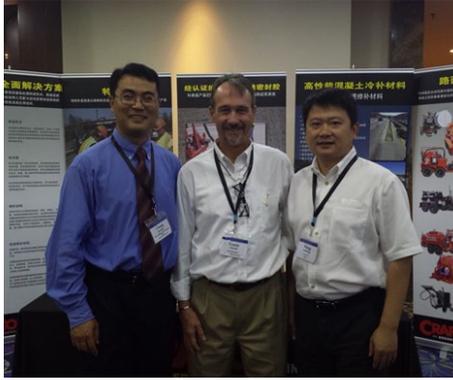


Figure 1. Ding Cheng with Charles Grady and Max Wang of Crafcoc, Inc.

The 2014 GeoHubei International Conference was successfully held in Hubei, China from July 20 to 22, 2014. The conference was endorsed by a number of leading international professional organizations including ASCE, TRB, etc. About 200 people from around the world participated the conference, which provided a showcase for recent developments and advancements in design, construction, and safety inspection of transportation infrastructures. The keynote speakers included Dr. Mike Winter from TRL of the UK, Dr. John Crittenden from Georgia Tech of USA, Mr. Charles Grady of Crafcoc, Dr. Martin Mgangira from the Council for Scientific and Industrial Research (CSIR) of South Africa, and Dr. Changjie Xu from Zhejiang University of China. Dr. Winter gave a speech on Sustainable Infrastructure in the UK, Dr. Crittenden gave a speech on the Role of Geotechnology in Transforming Urban Areas for Sustainable Development. Mr. Grady presented Innovations in Concrete Pavement Technology – Recent Innovations and Research Findings from the USA, and Dr. Mgangira discussed Sustainable Approach to Infrastructure Rehabilitation and Construction. Dr. Xu presented Frontier Problems of Geotechnical Engineering in Transportation Engineering.

Dr. Ding Cheng attended the conference and gave two presentations. One dealt with Quality Assurance of Performance Data for

Pavement Management Systems and the other was on the Evaluation of Using Polyester Grout for Dowel Bar Retrofit. Figure 1 shows Dr. Cheng with Charles Grady and Max Wang of Crafcoc at the conference.

During Dr. Cheng's visit in China, he also attended meetings with several transportation institutions in China. After visiting Jiangsu Transportation Institute in Nanjing on July 24th, he met with several pavement preservation centers and key labs of China including Shandong Transportation Research Institute, Liaoning Transportation Research Institute, and Gansu Transportation Research Institute on July 25th. Figure 2 shows the people Dr. Cheng met in Shandong province. During the meeting, Dr. Cheng introduced the current pavement preservation practices in United States while others introduced the advancement of pavement preservation technologies used



Figure 2. Meeting in Shang Dong Province. From left to right: Shijie Ma, Hao Li, Yunquan Li, Lin Wang, Yu Jia, Ding Cheng, Xiaomin Li, Yueming Dong, Huiqin Zhang

in China including synchronized chip seals (shown in Figure 3), Novachip, Micro Surfacing, and more.

Dr. Cheng also visited the Research Institute of Highway Ministry on July 28th in Beijing, China. The pavement preservation techniques are significantly different in different parts of China. Overall, China is transitioning from building new roads to maintaining and preserving existing roads. Although pavement preservation still facing challenges, some provinces are quickly developing modern pavement preservation techniques and establishing cost effective pavement preservation programs.



Figure 3. Synchronized Chip Seal Application in China





Mark Your Calendar (Coming Events)

FHWA Intelligent Compaction Retrofit Kits Evaluation Open House in California (September 25, 2014 Sacramento, California)

There will be a rodeo the week of September 22, 2014 at the U.S. 50/Sylvan Valley Road interchange project to show case intelligent Compaction retrofit kits and intelligent compaction rollers. Interested persons can RSVP for the Thursday, 9/25/2014, open house at <http://fhwaic.splashthat.com/>.

Training Opportunities from Technology Transfers Program in November 2014 and January 2015 (Berkeley, California)

The Technology Transfer Program will provide professional trainings on pavement by Blair Barnhardt. To register, visit <https://registration.techtransfer.berkeley.edu/CourseStatus.awp?~142IDM251118> or <https://registration.techtransfer.berkeley.edu/CourseStatus.awp?~153IDM260106>.

Maintenance Superintendent's Association Training Conference & Equipment Show (October 1-2, 2014 Sacramento, California)

This event is a must see" for agency maintenance personnel. For more information go to <http://www.mainsupt.com/>.

Pacific Coast Conference on Asphalt Specifications Committee Meetings (October 7-8 Reno, Nevada)

Pavement representatives from six state DOT's and FHWA meet regularly as committees for asphalt binders and mixes, emulsions, and recycling. These committee meetings are open to anyone interested in contributing to the discussion of asphalt specifications. For more information go to: <http://www.pccas.org/>.

2014 Rocky Mountain West Pavement Preservation Partnership Annual Meeting (October 8-10, 2014 Phoenix, Arizona)

Many pavement professionals from State and Provincial Agencies, Contractors, Suppliers,

Academia, Local and Federal Government Officials will be at the regional forum to share and publicize information describing improvements in research, design, specifications, materials and construction practices, and the benefits of Pavement Preservation through education and application. For more information visit: <https://tsp2pavement.pavementpreservation.org/rocky-mountain-west-rmwppp/annual-meetings/2014-2/>.

International Symposium on Pavement LCA 2014 (October 14-16, 2014 Davis, California)

UC, Davis and UC, Berkeley, will be hosting this symposium focusing on the implementation of Life Cycle Assessment (LCA) for pavements at the network and project levels. Also, workshops and presentations addressing LCA for pavements will be given during event. For more information and the various MSA chapter meetings around California go to: <http://www.ucprc.ucdavis.edu/LCA2014/>.

California Asphalt Pavement Association Fall Asphalt Pavement Conference & Equipment Show (October 29-30 Sacramento, California)

This 2-day event will feature speakers on timely topics in the field of asphalt pavement technology. There will also be numerous vendor and equipment displays. For more information go to <http://calapa.net/>.

"Pavement Maintenance for Local Agencies" ITS class (IDM-04) via U.C. Berkeley, (December 3, 2014 Santa Rosa, California)

Previously done as an 'online' class, this special 1-day "live" class provides a solid working knowledge of the most common pavement maintenance and preservation practices. Basic principles, best field practices and safety issues are covered. An excellent primer for roadway maintenance personnel at all levels. For more information go to www.techtransfer.berkeley.edu.



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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