Rocky Mountain Pavement Preservation Partnership

Meeting Minutes

Albuquerque Marriott Hotel
Albuquerque, New Mexico
October 28-30, 2008

Tuesday, October 28, 2008

The meeting began at 1:05 p.m. with the Moderator, **Mr. Steve Olson**, of the Colorado Department of Transportation, welcoming the participants to the first official meeting of the Rocky Mountain Pavement Preservation Partnership (RMPPP). **Mr. Olson** thanked the speakers and attendees (Attachment A) for their participation.

Mr. Olson then announced several agenda changes and ran through a list of housekeeping items. He expressed special thanks to **Ms. Patte Hahn** and **Mr. Larry Galehouse** of the National Center for Pavement Preservation (NCPP) for their efforts in organizing the meeting.

Mr. Olson asked the delegates to review the Partnership's draft By Laws in preparation for discussion and adoption planned for later in the meeting. He also asked the presenters to leave copies of their presentations with **Ms. Hahn** for posting on the Partnership's web site. **Mr. Olson** also urged the attendees to visit the exhibits and booths set up in the adjacent room.

Finally, **Mr. Olson** asked for a round of self introductions in which the attendees stated their affiliations and job titles.

Welcome
Mr. Robert Ortez, **Deputy Secretary for Operations, New Mexico Department of Transportation (NM DOT)**, welcomed the group to New Mexico and remarked on the good weather. He also explained that he was standing in for his agency's Secretary and would yield to her if she arrived in time. The NM DOT had a 5-year plan and had been practicing pavement preservation seriously for the last 4 to 5 years. **Mr. Ortez** declared that one of his agency's biggest problems was a shortage of funding - the available funds were adequate for only about 30% of needs.

Once again, **Mr. Ortez** welcomed the attendees, wished them a productive meeting, and offered to answer any questions.

Mr. J. Don Martinez, **Division Administrator, Federal Highway Administration, New Mexico Division**, welcomed the group to New Mexico and thanked the Partnership for inviting him to speak. He emphasized New Mexico as a safe place – no earthquakes, floods, etc. However, the state was short of dollars, so he urged the delegates to "spend it up!!"

On a more serious note, **Mr. Martinez** observed that today was a good time to discuss preservation, particularly as the Highway Trust Fund's receipts were down. The highway system was vital because it kept the economy moving. Pavement preservation makes good pavements last longer. We cannot afford to let our pavements deteriorate. Even with more revenues, funding would be inadequate so pavement preservation is essential. **Mr. Martinez** reiterated his welcome and wished the Partnership success.

"Managing Your Pavements – Working Together", Butch Wlaschin, Office of Asset Management, Federal Highway Administration, Washington, D.C.
After thanking the attendees, **Mr. Jim Sorenson**, **Ms. Patte Hahn**, and **Mr. Larry Galehouse**, **Mr. Wlaschin** said that it was essential to look beyond just pavement preservation – the problems begin far earlier. He then suggested using the following alternative approach.

First, we need to adopt a whole life approach right from the beginning, i.e., in planning. Traditionally, pavements have been provided using a sequence of semi-related steps. Instead, there needs to be a close collaboration between planning, design, construction, and maintenance from the outset. Today, there is a great lack of collaboration with the result that pavements fail prematurely, e.g., why do they need to be reconstructed before 50 years? The problem is also compounded by the fact that we are trying to get by using different materials, because in many cases, the good materials have already been used up. In this area, we need to be far more innovative.

Mr. Wlaschin then broke down the life of a typical pavement in terms of which agency entities had responsibility:

Planning, design, construction	20% of life
Operations, maintenance, preservation, rehabilitation	60% of life
Reconstruction	15% of life
Disposal, salvage	5% of life.

Communication and collaboration are essential. We must break down the organizational silos such as materials, design, maintenance, etc. In fact, a design narrative outlining exactly what is intended for the pavement is essential. We cannot simply "walk away" from the pavement – we must be out there in less than 8 to 10 years doing planned preservation. Throughout a pavement's life cycle, it is necessary to perform the right action at the right time.

Mr. Wlaschin emphasized that Pavement Preservation Partnerships (PPPs) have an essential role to play in bridging the gap between what is happening now and what could happen. For example, when was the last time pavement designers talked seriously about preservation? Feedback is vital. What is the performance of a given pavement, treatment, QC / QA, etc? Where is the feedback?

In conclusion, **Mr. Wlaschin** outlined the Partnership's proper role:

- Know the business from planning to disposal and products, services, and options,
- Know the participants,
- Be the advocate,
- Be the spokesman, and
- Be the educator.

Pavement management differs from and transcends pavement management systems (PMSs) and pavement preservation.

Welcome
Rhonda Faught, Cabinet Secretary, New Mexico Department of Transportation (NM DOT), Albuquerque, NM.

Ms. Faught also welcomed the delegates to New Mexico and gave special thanks to **Messrs. Wlashin** and **Sorenson** of the FHWA, and **Mr. Robert Young** of the NM DOT.

With respect to pavements and preservation, **Ms. Faught** asked whether we use the same language to communicate with different audiences and she wondered what message people are actually hearing. We are all in the business of "selling" pavement, but who would want to buy pavement that would not last? **Ms. Faught** recalled that only a few years ago, New Mexico was just trying to hold its system together. Her agency had changed from using thick overlays (fewer miles) to thin overlays (more miles). She then asked rhetorically, "Why treat a pavement in good condition?"

New Mexico was the first state to implement a long term (20-year) warranty. The Governor and Legislature had preferred new construction and believed that any extra revenues should be used for that purpose. However, **Ms. Faught's** agency believed that existing revenues should be used to preserve the system.

Ms. Faught then observed that Western DOTs tended to be run by people who came up through the ranks, while in Eastern DOTs, there is a tendency to recruit outsiders, many of whom lack a transportation background and need to be educated. **Ms. Faught** also praised **Mr. Ortiz** for his efforts and success in getting the universities involved with pavement preservation. We need to grow the Highway Trust Fund and we need to demonstrate that we are preserving pavements – the public expects no less.

"FHWA Initiatives", James Sorenson, Office of Asset Management, Federal Highway Administration, Washington, D.C.

Mr. Sorenson apologized in advance for having to leave immediately after his presentation, saying he needed to be in Reno, NV the following morning for the first Southwest Bridge Preservation Workshop.

Mr. Sorenson reported that during the previous week, the AASHTO Board of Directors had approved the addition of bridges to the Transportation System Preservation - Technical Services Program (TSP·2), thereby making it a combined program for pavement and bridge preservation with a voluntary contribution of $20K/year/state.

Mr. Sorenson also mentioned that the FHWA Divisions had been working with the states and had established a national website for standard (and draft) specifications and standard plans. The website should benefit contractors and suppliers by reducing the amount of duplication. Specifications from South Africa and New Zealand are also being included.

Asking how we are going to get to the next stage with preservation, **Mr. Sorenson** cited the "little red book[1]" and strongly promoted the concept of Remaining Service Life (RSL).

With reference to what is on the horizon, **Mr. Sorenson** reported the following items:

- The Administration has drafted their version of a 6-year highway bill valued at approximately $245B.
- Last week, AASHTO drafted their version of a 6-year highway bill valued at approximately $545B.
- Both bills highly recommend the adoption of effective management systems.
- Both bills recognize the need for workforce development in response to widespread employee turnovers.
- Research and Development (R&D) is very important for preservation.
- A Preservation Roadmap featuring 57 pavement and bridge projects has been approved by AASHTO's Board of Directors. The Roadmap is available on the TSP·2 website.
- An Emulsions Task Force has just been created under the Pavement Preservation Expert Task Group (ETG).
- Designers need to understand how pavement preservation tries to slow deterioration from the top down.

Mr. Sorenson mentioned that **Mr. Olson** had done a lot of preparatory work for this meeting and he urged the delegates to carefully consider the Board of Directors election scheduled for the following day. Both agencies and industry must become actively involved. In this regard, **Mr. Sorenson** cited the "virtual" teams he uses to co-opt people to accomplish tasks. For example, Mr. **Steve Mueller** helps **Mr. Sorenson** with the Pavement Preservation Partnerships (PPPs). **Mr. Chris Newman** assists in the areas of maintenance and workforce development. **Mr. Joseph Gregory** assists in pavement preservation, recycling, and the ETG.

[1] "***A Quick Check of Your Highway Network Health***", by Larry Galehouse, Director National Center for Pavement Preservation, and Jim Sorenson, Team Leader, FHWA Office of Asset Management.

In the area of education, **Mr. Sorenson** mentioned the wide variety of courses available through the FHWA's National Highway Institute (NHI). For example, a free web-based basic pavement course is being developed for the Northwest Pavement Management Association (NWPMA). Details are available on the Washington State Department of Transportation (WSDOT) website[2].

Mr. Sorenson also emphasized the necessity to integrate pavement preservation into PMSs. Many of the old PMSs, which were based on pavements failing, have now been replaced.

"AASHTO TSP·2 Program and the NCPP", Larry Galehouse, Director, National Center for Pavement Preservation, Michigan State University

Mr. Galehouse began by describing the TSP·2 concept. He said that although the audience clearly were strong supporters of pavement preservation, it was still necessary to struggle to obtain the necessary preservation resources. Today, roadway products are more expensive, but pavement preservation can help substantially and the sooner it is applied the better. He then went on to describe the acronym TSP·2 which had its genesis at the Pavements Task Force meeting held in conjunction with the AASHTO Subcommittee on Maintenance in Duluth, MN on 14 July 2003. Due to the inflexible nature of traditional pooled funds, AASHTO chose to develop the TSP·2 approach as a more flexible method of promoting and supporting the preservation concept. Its objective is to implement pavement preservation best practices.

TSP·2 has three phases:

I Pavement Preservation Technical Services Program.
- Help Desk
- Website
- Speakers Bureau
- Technical Exchange

II Regional Pavement Preservation Partnerships, e.g., Northeast, Midwestern, Southeast, Rocky Mountains, and Western.
- Promotion of sound practices by sharing information.
- All members are invited to share information.

III Bridge Preservation Technical Services Program and Partnerships (Approved by AASHTO's Standing Committee on Highways (SCOH) on 18 October 2008).
- Help Desk
- Website
- Technical Exchange

Mr. Galehouse explained that we were now at Phase III. On October 18, 2008, AASHTO's SCOH approved the integration of bridges into the program, and on October 20, 2008, the AASHTO Board of Directors gave its approval. He then displayed a map showing potential Bridge Preservation Partnerships and explained that it was essential to regard all of our infrastructure components as valuable assets. **Mr. Galehouse** also showed a listing of the members of the TSP·2 Oversight Panel and the Mission and Vision Statements for TSP·2. (The major elements of the TSP·2 Strategic Plan are displayed on the TSP·2's website at

[2] http://www.wsdot.wa.gov/TA/T2Center/T2Bulletin/2001Spring/6-NWPMA.pdf

http://www.tsp2.org). In order to improve the practice of all preservation, **Mr. Galehouse** said that continual training would be needed.

Mr. Galehouse then proceeded to discuss the FHWA Pavement Preservation Technical Appraisal Project, giving the following highlights:

- There is a new sense of urgency and attitudes are improving toward pavement preservation.
- 62% of states have little or no pavement preservation integration with their pavement management systems (PMSs).
- There is significant resistance (51% political) to pavement preservation. Elected officials pose the greatest barrier. Industry (HMA contractors) also provides resistance, mainly on the east coast.
- The most significant obstacles are funding (69% of the states) and agency resistance through entrenched managements.
- Popular preservation treatments (based on 33 state DOTs) include:
  - HMA overlays (97% of states)
  - Chip seals (86% of states)
  - Micro-surfacing (77% of states).
- Chip seals present the greatest potential for success (Minnesota had a 5-month old chip seal that was mistaken by the hot mix industry for a HMA overlay and nearly given a paving award).
- Chip seals also present the greatest potential for failure.
- "Worst first" is used to prioritize projects by 63% of states.
- Formal performance tracking is almost universally ignored.
- States report that a typical 20-year designed reconstructed or rehabilitated asphalt pavement (with proper design parameters and left untreated) lasts from 8 to 14 years.
- Difficulty finding quality contractors was reported in 64% of states.

Mr. Galehouse then presented the following interim findings:

- There is a recognized need for pavement preservation,
- Many agencies are in the early stages of a preservation program,
- Agencies have had poor experiences with many treatments,
- There is a limited contractor base,
- There is a limited suite of treatments in agency "toolboxes",
- There is a great need for training and certification,
- There is a lack preservation program funding,
- There is high internal resistance to change,
- Public education/awareness need to be expanded,
- Better tracking and PMS integration are needed,
- Greater FHWA Division support is needed, and
- States need to get beyond the "Worst First" project selection paradigm.

Finally, **Mr. Galehouse** described the Polymer Modified Emulsions Technology Deployment Study being conducted for the FHWA Central Federal Lands Highway Division and the FHWA Office of Asset Management. The NCPP was under contract to develop a best practice guide and model specifications. Currently, there are no national standards to help guide pavement

practitioners on the use of Polymer Modified Emulsions (PME). **Mr. Galehouse** listed the following issues:

- Emulsion physical & chemical properties do not always correlate with performance,
- High distillation temperatures can alter physical properties of asphalt emulsion residue, including polymer structure,
- New testing methods may delay shipping and application of emulsions, and
- Superpave PG specifications do not address failure mechanisms of emulsion applications.

The study's two goals are:

1. Develop performance-related specifications for polymer modified:
   - Chip Seals,
   - Slurry Systems (including micro-surfacing), and
   - Cape Seals.
2. Create a framework for performance- based asphalt emulsion specifications that address problematic issues:
   - New Residue Recovery Method
   - New Tests to Measure Polymer Modification
   - Longer Time Necessary for Testing
   - Specifications that Reflect Actual Field Performance.

In summary, **Mr. Galehouse** said that we have answered where we need to use polymers in binders – now we need to answer the same question for emulsions.

- Break -

Public Relations Roundtable, Larry Galehouse, Moderator

Mr. Galehouse began by lamenting the fact that DOTs do not do a good job in telling their stories to the general public. He then invited the roundtable participants to present their observations and views from their particular perspectives.

Public Relations within Agencies

Alaska – Alaska still practices "worst first", but the agency is getting started on preservation. The planners are strong supporters of preservation.

Idaho – The Idaho Transportation Department (ITD) has a chemistry laboratory within which they feature tours for school children and legislators. Idaho's materials laboratory tries to let the agency's employees know what they do.

Mr. Galehouse – Employees need to have the correct answer for when they are challenged by the public.

New Mexico – Hot mix asphalt (HMA) costs $160K per mile versus $40K per mile for chip seal. The agency conducts public meetings before the start of each chip seal season. Employees have a reasonably good understanding of why preservation is necessary.

Utah LTAP – **Mr. Bolling** has demonstrated to local agencies why pavement preservation is needed and what it can do for them. There is a great need to educate professors and instructors in educational establishments.

Oregon – The agency has had a "quasi" preservation program for many years and it realizes that resurfacing is necessary. They fail to do a good job in educating the public on the need for thin treatments on good roads. While there is good support from the Maintenance and Construction Engineers, there is also a need to extend preservation treatments to higher volume roads, e.g., Interstate Highways.

Navaho Nation – The agency is not yet paving as they are still upgrading dirt roads to gravel. They expect to be upgrading to asphalt soon, but as yet, there is no program.

Arizona – Pavement preservation originated with the maintenance forces and even lower level employees understand and support the concept. The challenge lies with upper level employees. Arizona has been successful with pavement preservation because front line supervisors attended meetings and seminars and returned to their jobs with new ideas.

Oregon – Oregon has been resurfacing for a number of years and the program was implemented through design. However, the big barrier lies in educating the design staff – they want to <u>design</u> and are less interested in preservation.

Colorado – The agency is in the early stages with public relations (PR). They are educating their upper managers. The Chief Engineer is in a key position and staff have laid out the benefits of preservation and performed cost analyses. First, gain higher level support and then work down through the organization. Engineers want to build "monuments" – they are not promoted for their preservation achievements.

Utah – **Mr. Tim Rose** reported that Utah had had a pavement preservation program and little design is needed. The major impediment is lack of resources. Politically, they are forced into "worst first" as budgets tighten. The Transportation Commission understands the need for preservation, but the Legislature needs to be educated. Utah has been doing pavement preservation for 10 to 12 years. **Mr. Rose** recommended a book by Dale E. Peterson, titled *"Good Roads Cost Less: Pavement Rehabilitation Needs, Benefits, and Costs in Utah"*.

Public Relations outside Agencies

Mr. Peter Montenegro, BASF Corporation reported the results of a survey his company had undertaken in 2007. The survey revealed that pavement preservation had not been a subject of PR in most companies and that public agency employees were not in a position to do PR. **Mr. Montenegro** said that BASF was now promoting pavement preservation in trade magazines. (They also promote their products, but their emphasis is on pavement preservation best practices.)

Mr. Galehouse recommended that if a DOT has experienced an extraordinary job, they should publicize it and get the word out.

New Mexico – Agencies need to put their best foot forward in pavement preservation. Many of the questions are addressed at the district level. Recently, after New Mexico had won some awards for excellence, the agency got the word out and gained some public understanding. New Mexico also uses university students to collect pavement information – the agency has a good program and has obtained favorable publicity.

Mr. Galehouse recommended the TSP·2 Bulletin Board – do not be afraid to post articles.

Colorado – Educate the media. Require contractors to issue PR flyers. If a project is planned for a particular area, have the contractor issue an educational PR flyer explaining the project and what the public can expect.

Mr. Bolling – Have contractors help out with publicity.

Mr. Galehouse – Talk about revenues and costs because this is what people really understand. Why undertake preservation projects in the first place? It is all about saving money, i.e., taxes. This is how we get their attention. Pavement preservation eliminates long construction closures and saves time and money.

Utah – How do you get legislators to think beyond their terms?

Mr. Galehouse – Each DOT needs a champion. Use the TSP·2 Bulletin Board to get the message out.

By Laws Discussion and Partnership Information, Steve Olson, Moderator

Mr. Olson moderated a discussion of the draft By Laws at which several suggestions were made. No final decisions were reached.

- Adjournment for the Day -

Wednesday, October 29, 2008

Report - "FHWA Polymer-Modified Emulsion Program", Chris Lubbers, BASF Corporation

Mr. Lubbers reported on the FHWA Polymer-Modified Emulsion Program, sponsored by the FHWA and administered by the NCPP. The study seeks to generate a model specification for polymer-modified emulsions (PMEs) that can be tested in field projects by the Central Federal Lands Highway Division.

Mr. Lubbers then displayed the following draft ("straw man") PME specification components:

- Low temperature recovery method with high tensile testing,
- Intermediate temperature with low tensile testing, and
- Performance testing for:

- Chip seal
- Polymer-modified slurry
- Micro-surfacing.

Projects using the new specifications have been planned (or implemented) as follows:

Project	Date	System(s)
Arches National Park, UT	September, 2008	Chip Seal - CRS-2P (SBR) Micro-surfacing (NRL, Ralumac)
Dinosaur National Monument, UT/CO	September, 2008	Chip seal - PASS - CRS-2P (Latex)
Death Valley National Park , CA	November, 2008	Chip seal (SBR, SBS?)
Crater Lake National Park , OR	Spring, 2009	Chip seal (TBD)

Mr. Lubbers then proceeded to his main presentation.

Presentation - "Emulsion 101", Chris Lubbers, BASF Corporation
Mr. Lubbers began his presentation by discussing asphalt emulsions - formulations, components, and other ingredients and talked about component distribution. He then described Polymers as being derived from "**Poly**" = many + Mono**mers** = small molecules and listed the major latex polymer types:

- SBR Latex
- Natural Rubber Latex
- Ground Tire Rubber - GTR (REAS[3]).

Mr. Lubbers then proceeded to discuss visco-elastic behavior and said that polymers help improve high temperature behavior and flexibility at low temperatures. In some respects, micro-surfacing (polymer + asphalt (hard)) behaves in a manner similar to latex foam (latex + air (soft)).

Finally, **Mr. Lubbers** described the benefits of using polymers in various treatments:

- Chip seals
  - Early and long term chip retention
  - High temperature strength
  - Low temperature flexibility
- Slurry seal and micro-surfacing
  - Improved mix cohesion
  - Reduction in abrasion loss of aggregate
  - Resistance to deformation.

Presentation - "SBS Supply Outlook", Henry Romagosa, ICL Performance Products
Mr. Romagosa began by saying that unfortunately, raw materials needed to manufacture polymers were in short supply, and the production of Ethylene was a particular problem.

[3] REAS = **R**ubberized **E**mulsion **A**ggregate **S**lurry

Butadiene is one by-product of ethylene, but while oil prices remain high, producers find the production of other by-products to be more profitable.

Mr. Romagosa summarized the problem as follows:

> Ethylene is made by a steam cracking process which can accept as input, either gases such as ethane, butane, or propane, or liquid petroleum such as gas oil or naphtha. While ethylene, propylene, or benzene can be produced from either gas or liquid, other products such as butadiene can only be produced from liquid petroleum. As the relative prices of the inputs vary, producers move back and forward between gas and liquid inputs and the supply of butadiene becomes unstable.

Mr. Romagosa suggested the following list of modifiers as possible alternatives to SBS polymers during the supply shortage:

- Styrene Butadiene Latex,
- Reacted Ethylene Terpolymer (Elvaloy),
- Ethyl Vinyl Acetate (EVA),
- Ground Tire Rubber (GTR),
- Hybrid Binders, and
- Polyphosphoric Acid (PPA).

"Panel Discussion"
Henry Romagosa, ICL Performance Products
Chris Lubbers, BASF Corporation
Steve Mueller, Pavements and Materials Engineer, FHWA

The Panel Discussion began with **Mr. Romagosa** addressing the polymer shortage.

Mr. Romagosa believed that the polymer supply in 2009 would be adequate, although the price would be high.

Mr. Lubbers felt that the supply of SBS would be partially dependent on what happens to the tire industry – if tire production is down, there will be more SBS available.

Mr. Mueller introduced himself and declared that the session was highly chemically oriented. He felt we needed to pay more attention to materials. Agencies should use their PMSs to monitor performance. Although polymers are beneficial, we need to do a better job in documenting performance. SBS does improve pavement quality, particularly with respect to rutting and low temperature cracking. We also need more data and monitoring on emulsions – we already have a lot of data on HMA. **Mr. Mueller** cautioned the audience not to revert to neat asphalt – polymers are really necessary to get improved performance and reverting to neat asphalt would be a mistake. We should also look at other non-SBS modifiers. As a last resort, **Mr. Mueller** recommended considering concrete which may require re-bidding projects. Concrete has good engineering qualities, is economical, and is environmentally friendly.

Mr. Lubbers observed that high asphalt and HMA prices are forcing more states to undertake more pavement preservation treatments.

Mr. Mueller mentioned that the U.S. has 4 million miles of public roads, of which two thirds are paved. Of this total, 77% are owned and operated by local agencies, 20% by states, and 3% by federal agencies. Most roads at local levels may not need polymer-modified emulsions because of their low traffic volumes.

Mr. Romagosa speculated that polymer prices would remain high.

Mr. Mueller responded to a question on the feasibility of price indexing for emulsions by saying that many states already have indexing for steel and other materials and that indexing for emulsions was an interesting idea. If indexing were to be instituted for emulsions, price adjustments should also be required when prices fall.

A suggestion was made that perhaps doing nothing would not be such a bad idea. The PG system allows you to estimate a consequence of a decision. For example, if going from a polymer to a neat asphalt decreases reliability from 99.999% to 92%, this may be acceptable. However, if such an action reduced the reliability to 60%, this may not be acceptable.

"State Agency Presentations"- Angela Parsons, Alaska DOT&PF, Moderator

Ms. Parsons opened the session by suggesting that state presentations include information on:

- Goals of their preservation programs
  - Paved lane-miles
  - Budgets
  - Preservation treatments
    - Treatment types
    - Successful treatments
    - Problems with treatments
    - New treatments
- Barriers encountered.

Ms. Parsons then invited the states to present their reports.

New Mexico – Ernest Archuleta, New Mexico Department of Transportation
Mr. Archuleta began his presentation by describing his agency's distribution of lane-miles among its 6 districts. Over the last 10 years, NMDOT has seen a 12% increase of 3,200 lane miles bring the statewide total to 30,446 lane-miles.

While his agency had seen about a 41% increase in budget over the last 10 years, **Mr. Archuleta** said that increase had been very slow and gradual. From 1999 to 2007, New Mexico's budget was mostly flat with only minor increases every couple of years. However, in 2008, the New Mexico Legislature had appropriated an 18% budget increase. In 2008, the Department had received a one-time appropriation of $42 million from the General Fund to fund the maintenance program.

Mr. Archuleta declared that New Mexico had serious funding deficiencies as shown by the following:

NMDOT Overall Needs $16.7B

- 20 year projection
- Based on HERS-ST Model, 2005

Gap in Funding per Year

• Routine Maintenance	$ 21.8M / year
• Pavement Preservation	$ 54.2M / year
• GRIP[4] I	$445M / year
• GRIP II	$ 87M / year
• Rail Runner Operations	$ 18M / year
• Unfunded Capital Improvements	$386M / year for 20 years
• Bridge Deficiencies	$ 43.3M / year for 5 years
• Bridge Replacement	$ 25.3M / year
• Bridge Maintenance	$ 12.6M / year

An unfortunate consequence of the widening funding gap has been a shift toward more reactive (versus proactive) maintenance.

Since 2003, the number of lane-miles of chip seal per year has been steadily falling as the cost per lane-mile for chip seal has been increasing. In fact, **Mr. Archuleta** stated that lane-mile costs for other treatments had also increased, some dramatically, and he presented the following table as an illustration.

Pavement Preservation Treatments	Lane-Mile Cost 5 Years Ago	Present Lane-Mile Cost	Percent Increase
Fog Sealing	$1,045	$1,156	11%
Crack Sealing	$3,600	$14,600	306%
Chip Sealing	$4,852	$8,205	65%
Open Graded Friction Course (OGFC) Overlay	$10,920	$32,160	195%
2" Hot Mix Overlay	$34,027	$80,960	138%
Heater Scarification & Overlay (Cutler)	$9,504	$64,125	575%
Micro-surfacing	$37,500	$58,560	56%
Cold Mill / Inlay	$175,000	$359,000	105%
Cold In-Situ Recycle Overlay	$200,000	$350,000	75%
Rehabilitation	$500,000	$750,000	50%
Reconstruction	$1,125,000	$1,835,000	63%

Mr. Archuleta then mentioned that crude oil prices had dropped 57% since July 2008 from $140 / barrel to $60.53 / barrel, but that in June 2008, New Mexico's asphalt price per ton had

[4] GRIP = **G**overnor **R**ichardson's **I**nvestment **P**rogram.

increased by $500 to $750, which was having a serious effect on the Department's pavement programs.

Mr. Archuleta then presented the following conclusions:
New Mexico's transportation needs far outweigh the available funding,
Federal revenue streams are decreasing, with more pressure for States to fill the gap,
New Mexico's current funding level will not sustain the state's future transportation needs, and
More transportation funding options are needed.

Colorado – Steve Olson and Mindy Crane, Colorado Department of Transportation
Mr. Olson began his presentation by giving an overview of Colorado's geographical characteristics and describing his agency's roadway network of 23,000 lane-miles. Last year (2007), Colorado's network condition was 59% good / fair; 41% poor. This year (2008), the condition had slipped to 53% good / fair; 47% poor. Colorado restricts its pavement preservation treatments to roadways with at least 5 years of remaining service life (RSL).

Mr. Olson mentioned that his agency's Surface Treatment Program (STP) annual budget ranged from $100M to $150M. The Maintenance Surface Budget was approximately $50 million per year, mostly reactive. Pavement preservation is only 5% of surface treatment budget.

Mr. Olson explained that Colorado was a tough environment for highways and pavements failed for a variety of reasons, including:

Load
- Heavy Trucks
- Bus Traffic
- Chains
- Plows

Water
- Infiltration
- Freeze-Thaw

Materials
Construction

Freeze / thaw cracking was particularly prevalent in Colorado and **Mr. Olson** showed several examples of this type of distress.

In its Pavement Preservation Program, Colorado uses minor rehabilitation, preventive treatments, and corrective maintenance. The emphasis is on preventive maintenance:
- Applying the right treatment on the right pavement at the right time,
- Keeping good and fair roads in good and fair condition (RSLs > 6 years), and
- Working on public relations – the Department has an image problem when applying preservation treatments on roadways that appear to be in good condition.

Mr. Olson then showed several examples of good candidates for preventive maintenance.

Of particular interest was CDOT's Policy Memo 18, implemented in 2004. The policy requires each Region to spend at least 5% of its Surface Treatment Program budget on pavement preventive maintenance. The policy appears to indicate agency Leadership support for the preventive maintenance philosophy.

In formulating its preservation strategies, CDOT relied on tried and true methods such as crack sealing and chip seals, and also on additional methods such as:

- Brazier Mix,
- Sand Seal,
- Slurry Seal,
- Nova Chip,
- Armor Cote,
- Cape Seal,
- Micro-surfacing,
- Thin overlays,
- Concrete crack / joint sealing,
- Slab replacement,
- Diamond grinding, and
- Ultra-Thin White-topping

Mr. Olson also explained that Colorado had had considerable success with chip seals and had used them on I-70.

Despite this success, **Mr. Olson** told his audience that Colorado's pavement preservation efforts still faced barriers such as:

- Inadequate funding.
- Moving away from worst first policy - top to bottom. The current baseline condition inhibits shift from worst first (22% RSL = Poor 0, 41% RSL <=5).
- Integration of PM activities into all steps of a pavement's life cycle.
- A public perception that CDOT has good roads. CDOT's maintenance does a good job of keeping things together on the surface.

Finally, **Mr. Olson** cited CDOT's recent completion of major projects in large metropolitan areas (TREX, COSMIX).

Oregon – John Coplantz, Oregon Department of Transportation
Mr. Coplantz began his presentation by showing Crater Lake, Oregon's only National Park. He then gave an overview of Oregon's Pavement Plan (2008 – 2009) presented as a tableau similar to that shown in the publication, ***"A Quick Check of Your Highway Network Health[5]"***. The tableau showed that the proposed program would restore 11,955 lane-mile-years of life to the system, which loses 18,150 lane-mile-years each year. Thus the program is deficient by 6,195 lane-mile-years (34%) and the network will continue to lose ground.

[5] ***"A Quick Check of Your Highway Network Health"***, by Larry Galehouse, Director, National Center for Pavement Preservation and Jim Sorenson, Team Leader, FHWA Office of Asset Management.

Mr. Coplantz then described Oregon's preservation toolbox:

Asphalt Surfaces

- Chip seals (ADTs up to 5,000),
- Fog seals (over chip seal or on old open graded friction course (OGFC)),
- Crack sealing (a little),
- 2" hot mix asphaltic concrete (HMAC) and emulsified asphaltic concrete (EAC) overlay, and
- Thin HMAC patching (rut filling, blade patching, plug patching).

Concrete Surfaces

- Full depth patching & spall repair, and
- 2" HMAC overlay ("sacrificial" layer - studded tire rutting).

Next, **Mr. Coplantz** described some of Oregon's successes and problems:

Successes

- Most preservation has been on low volume roads (ADT<2,500), and
- 20% of low volume road mileage has been improved from "poor" to "fair-or-better" in last 10 years with chip seals and thin overlays.

Problems

- All of the treatments can be problematic if not constructed correctly, and
- Recycled projects placed years ago now have widespread stripping problems.

As it expands its pavement preservation efforts, Oregon has several treatments of interest and associated questions:

Asphalt Surfaces

- Chip seals – Can Oregon place them on high ADT roads? Interstates?
- Cold recycling – How can Oregon avoid past problems?
- When installing 1.5" overlays, how can Oregon ensure quality when much of the paving is done during cool nights or in circumstances requiring long hauls?
- Is there enough market for micro-surfacing in Oregon? How would micro-surfacing perform with studded tires?

Concrete Surfaces

- Is Oregon creating long term problems by diamond grinding reinforced concrete pavements?

Finally, **Mr. Coplantz** described some of the barriers faced by his agency's pavement preservation program:

Climate

- Short seasons,
- Cool placement temperatures, and
- Winter maintenance.

Traffic

- Getting traffic through work zones,
- Delay corridors, and
- Night work.

Agency

- Policy and Standards Issues – With the STIP and 3R design process, Oregon has at least 4 years between project selection and construction, which makes timing a thin overlay very uncertain at best,
- Other needs such as safety, bike / pedestrian trails, drainage, operations, etc. tend to experience "scope creep" charged against the paving program's resources,
- Design by Committee involves too many disciplines for simple preservation projects, and
- No accountability system exists for achieving "X" pavement condition or "Y" miles of preservation.

Other

- Dedicated funding, material availability, and public support.

Alaska – Angela Parsons, Alaska Department of Transportation and Public Facilities
Ms. Parsons began by putting Alaska into perspective – she showed a typical map of the USA on which Alaska is tucked into a corner as though an afterthought. She then showed a second map of the USA on which Alaska was superimposed at the same scale. At 591,000 square miles, Alaska is as wide as the lower 48 states and larger than Texas, California, and Montana combined.

Ms. Parsons then presented a summary of her state's pavement preservation activities:

- The Statewide Maintenance and Operations (M&O) Engineer manages a capital program of $50 million / year allocated to the 3 Regions for pavement preservation and other preventative maintenance.
  Regional Allocations:

- **Northern** ($24M)
  - Crack sealing, chip seals, high floats $10M
  - Mill / overlay $13M

- **Central** ($24M)
  - Repairs: Mill / overlay, pre-level / overlay, patching $17M
  - Preventative treatments, but only about $1M crack sealing $3M
  - No chip seals

- **Southeast** ($2M)
  - Chip seals (no crack sealing) $1M

Alaska, with its small population, relies heavily on Federal funding and **Ms. Parsons** wondered whether the state was past the point of preservation. She said the Pavement Preservation Program faced serious challenges and listed the following conditions as real problems:

- Poor conditions with a large backlog of reconstruction,
- Cost escalations,
- Lack of flexibility, and
- Needs that have outpaced funding

Other problems included:

- Remaining service life (RSL). Statewide, RSLs ranged from a low of 4 years for the National Highway System (NHS) in the Central Region to a high of 10 years for the non-NHS in the Northern Region.
- Permafrost which causes unstable embankments.
- Surface wear and rutting in the Central Region.
- High International Roughness Index (IRI) problems.
- Problems caused by the use of studded tires.
- Capacity problems in the Central Region.
- Statewide life cycle (2008-2030) needs of $7.4B, which when added to the backlog of $750M, produce total needs of $8.2B for the planning period.

Despite these problems, **Ms. Parsons** cited the Southeast region for its success with chip seals which may have been due to:

- Less extreme temperatures and weather conditions,
- Stable embankments,
- Less studded tire wear and traffic congestion,
- Longer construction window, and
- The Southeast Region may be best candidate area for fog seals.

Finally, **Ms. Parsons** said that Alaska was particularly interested in:

- Developing a system for identifying / prioritizing good candidates, documenting and monitoring pavement preservation activities and results – map and web based,
- Supporting in-house communication and collaboration,
- Developing strong public relations (PR) support for pavement preservation and moving away from "worst-first",
- Collaborating with the University of Alaska for pavement preservation research and receiving advice for successful partnership, and
- Developing the concept and implementation of warranties.

- Lunch -

Arizona – Bill Hurguy, Arizona Department of Transportation
Mr. Hurguy described Arizona's state highway system as consisting of approximately 30,000 lane-miles with a rehabilitation budget of $115M and a pavement preservation budget of $8M.

Prior to FY 2005, all pavement preservation treatments used district budget funds, which as **Mr. Hurguy** explained, created a perverse incentive for districts to neglect pavement preservation and wait for rehabilitation funding. In 2002, the Department began considering a separate pavement preservation budget. In FY 2005, the agency created a $5M pavement preservation budget as part of a 5-year program. In FY 2007, a Preventive Surface Treatment Engineer was added and the program began to develop. In FY 2009, Arizona expects to apply pavement preservation treatments on approximately 2,000 lane-miles (7%).

The pavement preservation toolbox contains:

- Fog seals,
- Slurry seals,
- Sand seals,

- Cinder seals,
- Chip seals,
- Micro-surfacing,
- Crack sealing,
- Thin (< 1") overlays, and
- Diamond Grinding.

Of all the pavement preservation treatments, chip seals had been the most successful and the most problematic.

Mr. Hurguy also told his audience that the greatest barriers to fully implementing Arizona's pavement preservation program were inadequate budgets and lack of a consistent commitment from the agency's leadership.

Budget limitations were partly due to the funding of preventive surface treatments exclusively from scarce state funding. The Department believed that it could conserve resources by not having to conform to the stricter requirements imposed on Federal aid projects and also by administering the work through maintenance rather than construction.

Mr. Hurguy also observed that his Department's top administration kept changing and the program's success was more the result of commitment at middle and lower management levels. As evidence of successes, **Mr. Hurguy** pointed to slowly increasing budgets and the development of a training program. Finally, he observed that Arizona would never have enough funding to rehabilitate itself out of the deterioration problem – preservation was its only hope.

Arizona – Globe District - "Training", Joel Miller, Arizona Department of Transportation
Mr. Miller began by describing the "Who", "When", "Why", and "What" of Arizona's training program:

- **Who** – Maintenance engineers, superintendents, supervisors, lead technicians.
- **When** - Every District in 10 months and for new employees and promotion candidates.
- **Why** – Close to the system. Front line employees need to be familiar with the system and be able to take ownership.
- **What** – Develop the program, manage limited resources, and applications.

Mr. Miller then described the highlights of the PASER System used in his agency and showed a typical PASER Rating Form. With respect to the use of the PASER Manual, he made the following points:

- Why reinvent the wheel? It is useful to be able to compare candidate pavements with photographs taken on Arizona's system and it is possible to upgrade the photographs to reflect actual conditions.
- The Manual provides a good starting perspective.
- Distresses are clearly outlined.
- There is a consistent evaluation across the system.

As the Rating Forms are generated, they are first sent to the district offices and then to the Statewide Office.

Finally, **Mr. Miller** made the following motivation points:

- There is a need for Champions! (Front Line, Middle Managers, Top),
- Recognize and reward efforts,
- It is important to remember that pavement preservation is a long term planning solution with short and mid-term applications, and
- Pavement preservation augments the Rehabilitation and Construction Program.

Idaho – Mike Santi, Idaho Transportation Department

Mr. Santi began his presentation by stating that Idaho's roadway public[6] transportation system was comprised of more than 70,000 centerline-miles of road and about 4,000 bridges. The state highway system consisted of 11,948 lane-miles, of which about 6% was PCC pavement.

Idaho's recommended program for the period FY 2009 to FY 2013 consisted of:

- Pavement Preservation $184M (1,460 lane-miles)
- Pavement Restoration $197M (409 lane-miles)
- Expansion $194M (171 lane-miles)
- New Construction $761M (Bonding)

Mr. Santi then displayed a table showing all of Idaho's preventive maintenance treatments (for asphalt pavements), reasons for use, traffic volumes, average life expectancy, and average cost per lane-mile. The agency's principal preventive maintenance treatments were:

- Crack Sealing,
- Fog Seal,
- Slurry Seal,
- Micro-Surfacing,
- Chip Seal,
- Quick Setting Chip Seal,
- Double Chip Seal,
- Plant Mix Seal (SSP-412), and
- Thin Hot Mix Overlay.

Mr. Santi then displayed a similar table for concrete pavements, of which the principal preventive maintenance treatments were crack and joint sealing, sub-sealing, and diamond grinding.

Mr. Santi mentioned that paradoxically, chip seals were Idaho's most successful and most problematic preservation treatment. They were successful because they were cost-effective and used low technology, but they were problematic because they were dusty, produced loose chips which damaged vehicles, were noisy, and resulted in a rough texture. Despite these problems,

[6] Federal, state, and local roads.

Idaho applies chip seals on Interstate highways with traffic volumes in the range 15,000 to 20,000 ADT.

Mr. Santi saw inadequate funding and lack of education as barriers in his state.

Utah – Tim Rose, Utah Department of Transportation

Mr. Rose began his presentation by describing his agency's pavement system health. In the period between 2000 and 2007, 90% of Utah's Interstate miles were in fair or better condition, compared with 70% and 50% for Arterials and Collectors respectively. Similarly, 90% of the Interstate miles had fair or better ride quality[7], compared with 90% and 75% for Arterials and Collectors respectively.

Utah's Composite Construction Cost Index (CCCI) had remained fairly stable[8] until 2004, when it increased sharply due to oil-related cost increases. **Mr. Rose** told his audience that Utah would need a fuel tax increase of 20 cents per gallon to fund its projected shortfall and that any new revenues would be used to expand capacity.

In the area of pavement management, Utah had established six Quality Improvement Teams (QITs) to address the following topics:

1. Current STIP recommendations,
2. Route Prioritization / Hierarchy,
3. Materials / Pavement Design,
4. Research and Innovation,
5. Construction / Maintenance, and
6. Targets / Pavement Condition Index.

The teams had made a number of significant recommendations, including:

- Revising the Scope on 7 of 27 STIP projects,
- Changing scopes to include Cold In-place Recycling (CIR), as well as different surface seal treatments,
- Continuing the planned treatments on the remaining projects (planned treatments were already the most cost effective),
- Forming a Pavement Management Strategy Team to write a new policy and tie all the recommendations together,
- Sending recommendations from 3 Sub-QIT Teams to the Strategy Team for review and discussion, and
- Asking the Strategy Team to recommend the most promising ideas for implementation.

Mr. Rose also mentioned that his agency had conducted an economic analysis that had established points of diminishing marginal returns for dollars spent over periods of 10, 15, and 18 years. Finally, he outlined highlights of his agency's future planning:

- To complete a new Pavement Management Policy,

[7] Based on IRI and dTIMS Ride Quality Index.
[8] Increasing at an annual rate of about 4.8% over a 30-year period.

- To present the policy to senior leadership and the Utah Transportation Commission for approval,
- To implement the policy, preferably on a short-term basis, and
- To continue promoting the need for more pavement preservation / rehabilitation resources.

Navajo Nation – Patricia White, Navajo Department of Transportation
Ms. White began her presentation by giving some background information about her agency, which was formed recently after accepting a transfer of roads from the Bureau of Indian Affairs (BIA). The Navajo DOT's highway network exists in Utah, New Mexico, and Arizona, with whose DOTs it has cooperative arrangements. In 2006, the Department began operations with just 13 employees. Today, it has 100 employees and expects to have over 300 within the next two years.

The agency has the following assets:

- 6,300 miles of dirt and gravel roads,
- 5 airports (2 in New Mexico and 3 in Arizona),
- 4 maintenance yards (2 in New Mexico and 2 in Arizona),
- 12 graders, and
- 7 water trucks.

Within the next 2 years, the DOT expects to purchase additional equipment, including a paver.

The agency derives its revenues from the BIA and from fuel excise taxes. It also expects to inherit 1,562 miles of paved roads. Although the agency can draw upon the BIA for technical assistance, it is still responsible for all maintenance.

Ms. White said that she was being trained in pavement preservation and expects to establish a pavement management system (PMS) in conjunction with a network database and maintenance plan.

- Break -

Presentation - "Pavement Preservation: Getting Ahead of the Curve for Locals", Doyt Bolling, Director, Utah Local Technical Assistance Program (LTAP)
Mr. Bolling began by outlining the following discussion points which formed the structure of his presentation:

- Pavement Management Process
- Pavement Preservation Concepts
- Remaining Service Life Approach
- Demonstration of the Utah LTAP Transportation Asset Management Software (TAMS) System

The pavement management process may be summarized by the following steps:

- Collecting / updating the inventory,

- Assessing conditions,
- Setting performance objectives (Standards)
- Evaluating assets,
- Analyzing alternative strategies,
- Allocating resources,
- Implementing projects,
- Measuring performance, and
- Collecting feedback and making adjustments.

Mr. Bolling then explained the pavement preservation concept and showed the audience curves showing pavement condition as a function of time and traffic, after which he presented a framework for selecting treatments based on pavement serviceability indices (PSIs).

Next, **Mr. Bolling** explained the concept of Remaining Service Life (RSL) and showed the relationship between Pavement Condition Index and RSL.

Then, **Mr. Bolling** introduced his audience to the Utah LTAP's TAMS Pavement Management System (PMS) with the following properties:

- PMS Process
- GIS-Based
- Uses RSL Approach
- Combines Network and Project Level Information
- Subjective Ride Evaluation
- Visual Condition Surveys
- Individual Pavement Performance Curves
- Pavement Preservation Focus.

Mr. Bolling then used the TAMS to illustrate the analysis of local agency networks and used photographs of pavements in various stages of deterioration to demonstrate what various RSLs looked like. **Mr. Bolling's** examples illustrated pavements needing routine maintenance, preventive maintenance, rehabilitation / structural improvement, and reconstruction. Finally, he showed RSL distributions for Utah's State Highway Network, Tooele County's roads, and Heber City's Street Network, while emphasizing the versatility of his software.

In conclusion, **Mr. Bolling** showed a gravel road performance curve.

Presentation - "Asphaltic Concrete Pavements – A Pavement Preservation Process", Vern Thompson, Crafco Corporation

Mr. Thompson began his presentation by presenting an overview and objective. First, comes a pavement evaluation and the decision to seal working cracks (> 3mm) and fill non-working cracks (< 3mm). Next, pavement high / low temperature extremes are determined, a product is selected, and the proper equipment is used to apply the sealant / fill product. **Mr. Thompson** justified crack treatments by stating that they

- Prevent water intrusion into subbase,
- Prevent the intrusion of incompressibles,

- Improves ride quality smoothness,
- Slow down pavement deterioration, and
- Are cost effective.

In justifying crack treatments, **Mr. Thompson** cited **FHWA Report No. FHWA-RD-99-147**, ***"Materials and Procedures for Sealing and Filling Cracks in Asphalt-Surfaced Pavements - Manual of Practice"*** The FHWA-RD-99-147 states on Page 1, "With proper and timely application, crack sealing and filling can extend pavement life past the point where the cost-benefit [sic] of added pavement life exceeds the cost of conducting the operation." He then quoted **Mr. Jim Sorenson** of the FHWA, ***"Preservation teaches us to fix it before it breaks. This philosophy when applied extends the service life and saves dollars."***

In discussing what crack to treat, **Mr. Thompson** reminded his audience not to forget the edge joint, through which water often infiltrates. He then proceeded to discuss various crack types and techniques such as routing and sealing, and also distinguished between cohesive failure (unsuitable sealant) and adhesive failure (poor crack preparation). **Mr. Thompson** mentioned that the use of rubberized (polymer-modified) asphalt sealants in routed working cracks gave 5 - 9 years of performance versus 2.5 - 5 years of performance in un-routed working cracks.

Mr. Thompson then went on to discuss various types of equipment such as applicators and rollers, and concluded his presentation by summarizing the steps in applying crack treatments and reiterating his earlier justification for treating cracks.

Presentation - "Chip Seal best Practices", John O'Doherty, National Center for Pavement Preservation (NCPP)

Mr. O'Doherty began his presentation by three reference documents to the audience:

1. NCHRP Synthesis 342, "Chip Seal Best Practices", Transportation Research Board, Washington, D.C., 2005
2. "Maintenance Technical Advisory Guide (MTAG)", California Department of Transportation, Sacramento, CA, 2003
3. "Analysis of New Zealand Chip Seal Design & Construction Practices", Gransberg, Douglas D., et al.

He then described chip seals as the "Work Horse of Pavement Preservation", defining Pavement Preservation as *"... a program employing a network level, long-term strategy that enhances function pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety, and meet motorist expectations"*.

Chip seals tend to be more popular overseas where the philosophy and technology are quite different from those found in North America.

Mr. O'Doherty then reviewed the advantages and disadvantages of chip seals:

Advantages	Disadvantages
• Cost-effective treatments • Good durability	• Cure time • Flying chips

• Ease of construction • Improved skid resistance	• Noise considerations • Weather considerations • Performance

Next, **Mr. O'Doherty** compared chip seal technology as practiced in North America with overseas practices. For example, whereas in North America, chip seals are used in response to distress and to prevent water infiltration, in overseas practice, they are used to improve low skid numbers and to serve as a wearing surface. It was also interesting to compare the different ways chip seal technology evolved as illustrated in the following table.

Characteristic	North America	Overseas
Philosophy	Art	Science
Agency Realm	Maintenance	Construction
Forces	In-House	Contractor
Design	Recipe	Engineering Principles
Risk	Agency	Contractor
Pavements	Variable	Textured (Sand Circle)
Surface Hardness	No	Yes
Outcome	Uncertain	Predictable

In overseas applications, chip seal service lives were considerably higher than those achieved in North America[9].

Next, **Mr. O'Doherty** discussed different approaches to chip seal design and then proceeded to illustrate various types of chip seals such as Single Chip Seal, Double Chip Seal, Racked-in Seal, Cape Seal, Inverted Seal, Sandwich Seal (Dry Matting), and Geotextile-Reinforced Seal.

Mr. O'Doherty then discussed chip seal materials, including aggregates and binders. Aggregate performance was optimized when the aggregate had the following properties.

- Single sized (if possible) (generally 3/8" for single chip seals and ½" and ¼" respectively for the first and second applications of double chip seals),
- Minimum fines (<2% passing the #200 sieve),
- Clean,
- Free of clay,
- Cubical (limited flat particles),
- Crushed faces,
- Abrasion < 30%,
- Binder-compatible,
- Damp for emulsions, and
- Dry for hot binders.

Next came a discussion of chip seal equipment, including a water re-texturizing machine for preparing the pavement, ultra-high pressure water cutters, distributor spray bars, distributor rate

[9] Average chip seal service life in the United States was 5.76 years, in Canada 5.33 years, and in Australia, New Zealand, UK, and South Africa, it was 9.60 years.

control computers, self-propelled aggregate spreaders, low drop aggregate spreaders, aggregate pre-coating loaders, rollers, and brooms.

Of interest were the following best equipment practices:

- Computerized distributors for greater control,
- Matching chip seal equipment with distributor (speed of operation),
- Variable nozzles to reduce binder in wheel paths,
- Plastic broom bristles to reduce aggregate dislodgement,
- Water re-texturing machines to remove irregularities, bleeding, and
- Use of vibratory pneumatic rollers.

In overseas practice, it is also customary to avoid the use of excess aggregate, so much so that the specifications contain penalty provisions for the use of excess aggregate. The Montana field-sweeping test (Maintenance Chip Seal Manual 2000) curtails the bias to spread excess aggregate created by paying for it by the ton. Montana requires that the amount of excess chips be less than 10% of the design rate and adjusts the pay quantities based on the sweeping test results. This may also reduce the potential for windshield damage claims.

Mr. O'Doherty then discussed chip seal contracting, including the use of warranties, the contract risk continuum, and the following best contracting practices.

- Let chip seal contracts to allow early season construction,
- Allow enough time for curing of pre-construction preparation,
- Make jobs large enough to attract bidders, and
- Restrict warranties to jobs where contractors have sufficient control.

Finally, **Mr. O'Doherty** discussed qualitative and quantitative performance measures, and summarized areas needing further research.

Presentation - "Chip Seal best Practices and New Ideas", Wade Miller, Western Emulsions, Inc.

Mr. Miller began by briefly outlining his presentation:

- Understanding the 'concept' of chip sealing,
- Providing some suggested best practices,
- Cost and economically efficient alternative practices, and
- Merely being "in spec" is inadequate.

He then proceeded to define a chip seal as *"...a surface treatment in which the pavement is sprayed with asphalt (generally emulsified) and then immediately covered with aggregate and rolled"*.

Mr. Miller explained that there were many reasons for using chip seals including:

- As a cost-effective surface treatment,
- To protect underlying pavement,
- To waterproof the pavement surface,
- To seal small cracks and imperfections,

- To provide a new wearing surface,
- To restore surface friction,
- To improve aesthetics and lane delineation,
- To extend service life, and
- To improve safety.

He then described and showed examples of various types of equipment used to install chip seals. Next, **Mr. Miller** described and showed examples of chip seals:

- Single Course Chip Seal (single pen)
- Double Course Chip Seals (double pen)
- Scrub Seals
- Cape Seals
- Racked-In (sand choke)
- Sandwich Seal
- New Construction

In any chip seal project, certain important factors need to be closely monitored because they play a vital role in determining the success of the application. They are:

- Road Selection / Road Preparation,
- Materials,
- Weather,
- Equipment,
- Construction Methods, and
- Traffic Control.

Mr. Miller stressed that in order to obtain a successful chip seal, it was important that the candidate roadway have a sound structural section and not be in need of repair. Any isolated dig-outs and / or crack sealing should be completed before the chip seal is applied, and the lead time will vary depending on the preparation method.

The addition of polymers to the emulsion can yield several benefits such as:

- Improved adhesion (less chip loss),
- Improved resistance to flow at high temperatures,
- Improved flexibility at low temperatures, and
- Longer service life.

Mr. Miller then covered some chip seal areas where issues could arise.

Emulsion Issues

- Lack of coverage uniformity (ridging or streaking) caused by improper height of the spray bar,
- Nozzle problems (clogged or misaligned), or
- Use of an emulsion with too high a viscosity.

Chip Issues

- Gradation varies daily or truck-to-truck,
- Chips not damp enough,

- Chips too damp,
- Application not modified to fit traffic pattern, and
- Chips irregular in size and / or dirty.

Weather Issues

- Too hot during the day (> 110°F atmospheric),
- Evenings too cool (<50°F ambient),
- Low pavement temperature in "shaded" areas, and
- Change in weather soon after chip seal is placed.

Presentation - "Innovative Technology - Fibermat", Nelson Wesenberg, COLAS – Midland Asphalt Materials, Inc

Mr. Wesenberg set the stage for his presentation by reviewing the evolution that is occurring in the management of highway systems. He contrasted the old approach with modern asset management and declared that today's highway managers are really making business decisions when it comes to investing public funds. Therefore, new and innovative thinking is required to stretch the limited dollars available. **Mr. Wesenberg** then described his company's Fibermat process and recommended it as a cost effective way to extend pavement life.

Fibermat was developed and used in the United Kingdom for over 20 years. It consists of glass fibers sandwiched between layers of emulsion. The asphalt emulsions are applied through a split spray bar and form waterproof membranes. The fiber glass strands, which are introduced between the spray bars, provide an ability to withstand stresses and give enhanced tensile properties.

Special emulsions are applied at a rate of 0.4 - 0.5 gallons per square yard. Fiber glass is cut in-situ and applied at a rate of 2-4 ounces per square yard. Various aggregate sizes are used, of which the most common are ¼" to ½".

Fibermat can be used as a skid-resistant wearing surface (SAM[10] Type A) or overlaid with a different wearing course such as HMA or Nova Chip (SAMI[11] Type B).

Mr. Wesenberg then described and showed examples of equipment used in the Fibermat process, including the chopping unit used to create the fibers from spools of fiber glass.

In conclusion, **Mr. Wesenberg** summarized his product's benefits to the customer and its performance.

Benefits include:

- Public Safety
  - Speed and efficiency of application
    - Initial construction speed and rapid opening, minimizing disruption to the public

[10] SAM = **S**tress **A**bsorbing **M**embrane
[11] SAMI = **S**tress **A**bsorbing **M**embrane **I**nterlayer

  - Improved surface friction characteristics
    - Safer driving conditions in good and bad weather
  - Waterproofed surface prevents damage to sub base
    - Extends ride quality
    - Maintains safe driving surface (retards pothole development)
  - Improves Customer relations
    - Reduces public complaints due to poor road conditions
- Cost Effectiveness
  - Speed and efficiency of application
    - Competitive labor costs
    - Speed of process reduces on-road crew and equipment costs
    - Reduces exposure to potential liability
  - Waterproof surface preventing damage to sub-base
    - Extends pavement life
    - Maintains ride quality longer
    - Maintains safe driving surface (slow pothole development)
  - Slows propagation of reflective cracks
    - Extends pavement life
    - Extends life of overlay surface treatment
    - Maintains waterproofing characteristics for longer life

Fibermat's performance includes:

- Increased tensile strength (+30%).
- Good fatigue performance (+30%).
- Pavement longevity verified by site monitoring.
- Ability to be used throughout the construction layers.
- Ability to be manufactured on-site and to size.
- Ability to be opened to traffic quickly.
- Waterproofing properties provided by the binder layer.
- Good surface on which to apply other asphalt layers.

- Adjournment for the Day -

Thursday, October 30, 2008

Presentation - "Micro-surfacing / Slurry Seals", Jim Cody, Holly Asphalt, Albuquerque, NM

Mr. Cody began his presentation by briefly recounting the history and development of micro-surfacing dating back to the German autobahns of the 1970s. He then gave the International Slurry Seal Association's (ISSA's) definition of micro-surfacing:

> *"A mixture of Cationic polymer modified asphalt emulsion, mineral aggregate, mineral filler, water and other additives properly proportioned, mixed and spread as a surface treatment. When applied the Micro Surface shall have a homogeneous appearance, fill cracks, adhere firmly to the surface and provide a weatherproof, high friction seal".*

According to **Mr. Cody**, the two primary uses of micro-surfacing are:

- Preservative - Any activity performed, or material utilized to preserve the existing condition and extend the useful life of a pavement, e.g., delaying oxidation.
- Corrective - Any activity performed, or material utilized to correct a faulted pavement to an acceptable condition, e.g., correcting rutting.

Mr. Cody then described the components of a micro-surfacing system:

- Emulsion (typically cationic, polymerized, e.g., CSS-1P),
- Additives,
- Water (potable),
- Fines, and
- Aggregates (generally ¼").

He singled out the aggregates as being the major and most critical component, affecting long-term performance.

Aggregate tests required for laboratory mix design include:

- Gradation,
- Hardness,
- Soundness,
- Sand Equivalent, and
- Methylene Blue.

Laboratory design involves an understanding of the intended environment (pavement description, condition, ADT, climate), the treatment's objective (life expectancy and texture requirements), and materials selection (aggregate, emulsion, mineral filler). The design steps are:

- Determination of the theoretical asphalt content,
- Determination of the theoretical water and filler contents,
- Running the compatibility cup test and the adhesion test,
- Physical testing of the trial mixes, and
- Delivery of the optimum design to contractor / buyer.

After showing various roadways needing preservation or corrective treatments, **Mr. Cody** described and showed a typical stockpile site and the equipment that would be used to install micro-surfacing treatments. He then discussed wearing courses and showed examples of various microsurfacing applications.

Mr. Cody then described and showed the application of a Cape Seal which consists of a polymer-modified asphalt emulsion chip seal followed by a micro-surface course or slurry seal.

Finally, **Mr. Cody** referred his audience to the following micro-surfacing brochures available from the International Slurry Surfacing Association[12] (ISSA):

- "Recommended Performance Guidelines for Micro-Surfacing A 143 (Revised 01/2001)", and

[12] International Slurry Surfacing Association, # 3 Church Circle PMB-250, Annapolis, Maryland 21401, Phone (410) 267-0023, www.slurry.org

- "Micro-Surfacing - Quality Control, A Guide to Quality Construction"

Business Meeting, Steve Olson, Facilitator

By Laws
Mr. Olson summarized the main sections of the draft By Laws, including the states included in the Partnership, membership in good standing, the amount of the voluntary contribution, and the probability that the contribution would eventually be required. He solicited, but received no comments or concerns from the membership.

The Steering Committee is to consist of 10 Directors (voting) and one Federal member (non-voting). Provision for an At-Large Director was removed.

In Article 5, the host agency is to provide an additional attendee to assist with logistics, note taking, etc.

In Appendix A, it was explained that the TSP·2 voluntary contribution also covers Partnership fees.

Appendix B clarified the staggering of terms which was designed to get through the first 3 years. Officers will cycle through the chairs. There will be 3 Officers and 7 other Directors. Each year, 3 Directors plus one Secretary / Treasurer will be replaced. The next meeting may not be for a year, so the Directors not chosen today should be chosen within the next 60 days (by 31 December 2008). All terms are to expire at the Annual Meeting.

Mr. Olson (NM DOT) moved to accept the By Laws, **Mr. Quint Davis (Simon Contractors)** seconded, and the motion was approved unanimously.

The meeting was then adjourned for a brief period to allow the state and industry delegates to caucus separately.

Election
The following Directors were elected:

State Agencies
Lloyd Neeley, Utah DOT
Steve Olson, Colorado DOT
Angela Parsons, Alaska DOT
Robert Young, New Mexico DOT

Local Agencies
- *To be determined* -

At-Large
Alfred Myron, Bureau of Indian Affairs (BIA), Navajo, Division of Transportation

Federal

Steve Mueller, FHWA

Tribal Agencies
Patricia White, Navajo Nation DOT

Industry
Quint Davis, Simon Contractors
Mo Moabed, Holly Asphalt Company

Academia
Doyt Bolling, Utah LTAP

Chair (1 Year Term)
Steve Olson, Colorado DOT, the sole nominee, was elected unanimously.

Vice-Chair (1 Year Vice-Chair, 1 Year Chair, 1 Year Steering Committee)
Quint Davis, Simon Contractors, the sole nominee was elected unanimously.

Secretary / Treasurer
Angela Parsons, Alaska DOT, volunteered and was accepted unanimously.

Next Meeting
The next meeting will probably be in late March 2009, but the Steering Committee will make the final decision.

Brainstorming - "2008 – 2009 Initiatives", Steve Mueller, FHWA, Moderator
Mr. Mueller began by posing two important questions for consideration and discussion by the audience.

1. What items / projects should the Partnership support and move forward through the TSP·2?

Candidates could include:
- Research (PP Roadmap)?
- Training (On-line Courses)?
- Technology Implementation?
- Technology Deployment?

After some discussion, the following points emerged:
- Training is needed – staff turnover is unacceptably high
- Managers need to be trained to manage effectively
- New technology will require training
- Many preservation treatments are untried
- It is unnecessarily expensive for agencies to be continually "reinventing the wheel"
- States should share their experiences and information.

Mr. Mueller also reminded the audience that TSP·2 activities will need to be reported to the TSP·2 Oversight Panel, which will also present an annual report on the operation of the TSP·2 Program to AASHTO's Standing Committee on Highways (SCOH).

2. What barriers to pavement preservation does the Partnership need to break through?

Candidates could include:

- Funding?
- PMS / Pavement Preservation integration?
- Consistency of standards? (Three Midwestern states have 125 sealant specifications)
- Proprietary products?
- Adoption of a marketing plan – how to sell the preservation concept to the public?
- FHWA Division Offices?

Mr. Young mentioned that the New Mexico DOT had experienced problems in its dealings with the FHWA's New Mexico Division Office. With a particular project, after the DOT had done an assessment and made recommendations, the FHWA's New Mexico Division Office had applied pressure on the agency to change the recommendations. Following the I-35W bridge collapse in Minnesota, the New Mexico Division told the New Mexico DOT that their relationship would change from help and assistance to oversight.

Mr. Mueller suggested the establishment of 4 Task Forces as follows:

1. **Training**
   - **Goal:** Each agency / organization will have 10 staff members complete the free 6-hour NHI on-line training class.
   - **Goal:** Provide support for other training opportunities, e.g., Transportation Curriculum Coordination Council (TCCC), NHI, LTAP, Industry.
   - **Goal:** Identify states possessing continuing education requirements for Professional Engineers.

   Ms. Angela Parsons (AK DOT) moved for the creation of a Task Force for Training, **Mr. Wally Smith (Deery American)** seconded, and the motion was approved.

2. **Emulsions**

   Goal: Recommend necessary laboratory tests and equipment for state agencies and private laboratories involved in pavement preservation.

   Goal: Inventory the existing equipment currently in state laboratories.

   After some discussion, the delegates decided not to create a Task Force, but to schedule a presentation for the next meeting.

3. **PMS / Pavement Preservation Integration**

   Goal: Identify best practices and using the NHI 131104 course materials, create a check list.
   - "Preservation Optimization" - CO
   - "Point of Diminishing Returns Analysis" - UT

- Performance Measures.

Goal: Survey the Partnership's members to develop a baseline of the extent of integration.

Goal: Develop a Peer Exchange for 3-5 state agencies to advance PMS/PP Integration, and create a report for the RMPPP/TSP·2 on how well integration is being achieved.

Ms. Angela Parsons (AK DOT) moved for the creation of a Task Force for PMS / Pavement Preservation Integration, **Mr. Robert Young (NM DOT)** seconded, and the motion was approved.

4. **Communications and Marketing**

Goal: Evaluate existing communications and marketing efforts performed by member agencies.

Goal: Identify best practices.

Goal: Create a recommendation report for the RMPPP/TSP·2.

Goal: Identify and involve P.R. staff within member agencies.

The following points were made:

- There is a need to target upper managements and politicians.
- Agencies need greater funding flexibility.
- Statewide Transportation Improvement Programs (STIPs) should contain a Pavement Preservation Program category (15% ±).
- The FHWA should assist by giving more guidance to Division Offices to allow states to use Federal aid for pavement preservation.

Mr. Tim Rose (UT DOT) moved for the creation of a Task Force for Communications and Marketing, **Mr. Joel Miller (AZ DOT)** seconded, and the motion was approved.

Following these discussions, the following Task Force memberships were chosen.

Training
Robert McCoy, NM DOT **(Leader)**
Wally Smith, Deery American
Joel Miller, AZ DOT

PMS / Pavement Preservation Integration
Angela Parsons, AK DOT **(Leader)**
Patricia White, Navajo DOT
Lloyd Neeley, UT DOT

Communications and Marketing
Robert McCoy, NM DOT **(Leader)**
Steve Olson, CO DOT
Mindy Crane, CO DOT
Angela Parsons, AK DOT

Mr. Mueller concluded his presentation by reminding the audience that:

- The RMPPP is supported by the AASHTO Transportation System Preservation Technical Services Program (TSP·2)
- State Members need to support the TSP·2 through the AASHTO voluntary assessment process. Please be sure to work with your State Research Engineers to assure your membership!
- The State Match requirement has been waived for TSP·2 participation. (100% SP&R funding.)

Presentation - "Monitoring Pavement Preservation Treatments, Documenting Cost & Performance", Tim Rose, Utah Department of Transportation
Mr. Rose began by saying that the Utah DOT had originally developed a tracking system called a "Plan for Every Section" (PFES), whose main features included:

- Information updating by Region Pavement Management Engineers,
- Updates that included maintenance sections and route definitions,
- Construction history, and
- Ability to store time-based treatment schedules and pavement condition information by maintenance section.

The agency had decided to consolidate several functions and planned to acquire an Agile Assets Pavement Management System for their Operations Management System (OMS). The Department felt that the Agile PM Module would better fit their needs and would be able to replace the PFES.

Mr. Rose explained that Utah's Automated Pavement Distress Collection System collects the following information:

- Profile - IRI, Rutting & Concrete Faulting,
- Pavement Distress – Environmental & Wheel Path Cracking, Skin Patching, etc.,
- Photo Log / Road View Images.

The system uses crack detection software to process images and is able to make bi-weekly deliveries of high quality data, although several Internet access issues still needed to be resolved. The data are finally uploaded into Deighton dTIMS CT for analysis.

- Break -

Roundtable Discussion – Steve Mueller, FHWA, Moderator
Mr. Mueller began by referring the audience to **NCHRP 523 (2004), *"Optimal Timing of Pavement Preventive Maintenance Treatment Applications"***, saying that David Peshkin had been responsible for doing the underlying research under Project 14-14. The study concluded that we are not doing an adequate job in preserving our pavements. Part of the research resulted in the development of a methodology expressed in an Excel-based Visual Basic tool called "OPTime". The methodology is able to calculate:

- The benefit of applying a treatment,
- Different benefits for treatments applied at different times, and
- Costs of applying treatments.

Mr. Mueller declared that in preservation, we lack the vast accumulation of scientific knowledge that exists in the areas of asphalt and concrete pavement technologies.

Mr. Young believed that PMSs would be very helpful here. The forecasting tools contained in PMSs should be able to generate recommendations.

Mr. Mueller recounted that in the San Francisco Bay Area, municipalities devised a cooperative system known as BAMS (**B**ay **A**rea **M**anagement **S**ystem) to assist with project selection. Initially, there had been a 5% incentive to use BAMS - eventually all jurisdictions came to use the system.

Mr. Mueller recommended common design criteria and noted the fact that small jurisdictions sometimes have special problems. Politicians resist data consolidation - they prefer to have politics drive decisions. There is a tendency to develop region-wide monitoring systems, especially as toll roads proliferate.

Most PMSs deal with the type, severity, and extent of cracking.

Finally, there was a general discussion of PMSs, data collection, etc.

The meeting was adjourned at 11:41 a.m.

Attachment A

Attendee List
Rocky Mountain Pavement Preservation Partnership
October 28- 30, 2008

Last Name	First Name	Organization	E-mail Address
Anwar	P.	NM DOT	
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