USE OF ASPHALT RUBBER

By

Carl Jacobson

MODERATOR CHELLGREN: Mr. Jacobson is a native of Arizona who received his degree in Civil Engineering from the University of Arizona.

Carl has been very active in the AGC and has held the position of President of the Arizona Chapter as well as a National Director. He is currently a National Director of TRIP and has numerous other affiliations.

Carl is President of the Asphalt Rubber Producers Group and also President of Crafco, Inc. He is going to lend us some of his expertise on the use of asphalt rubber.

SPEAKER JACOBSON: Thank you very much. I'd like to tell you a little bit about the history of asphalt rubber. First of all, rubberized asphalt has been around a long time and most of you have come in contact with it. This is the addition of neoprenes, the addition of latexes, and other types of rubber in small amounts.

To differentiate from rubberized asphalt, the program that was started in Phoenix, Arizona, has a significant amount of reclaimed ground tire rubber mixed with asphalt. So we call it an asphalt rubber rather than a rubberized asphalt.

Asphalt rubber has some significant properties that will help in retarding cracking in overlays on portland cement concrete. And that is the first topic that I want to talk about.

The portland cement concrete (pcc) pavements that have been around, and when we started the interstate system were designed to last for 25 years, are quickly coming to the end of their life cycle. The repair and rehabilitation of these pavements are extremely costly. We in the Asphalt Rubber Producers Group think we have a solution to this problem that is inexpensive as compared to grinding. The cost of our system in relationship to grinding and grooving is roughly one-third the cost.

The manufacture of asphalt rubber is generally done on the job site, where approximately between 20 and 25 percent by weight of rubber is added to the asphalt and blended through special blenders. These blenders mix the asphalt and the rubber together and put them into either a mixing or an application tank. The rubber is delivered and packed in 60-pound packages and then added to the blender with the asphalt.

There's three alternatives to overlaying pcc with Hot Mix Asphalt and eliminating or alleviating the stress.

In Phoenix, the asphalt rubber program, when it started about 18 years ago, started out as a chip seal where the asphalt rubber was applied in
the aggregate in regular fashion. It was called a stress-relieving membrane, stress-absorbing membrane, because it absorbed the stress and eliminated a lot of the reflective cracking.

In the overlay of pcc, we have what we call a stress-absorbing membrane inner (SAMI) layer, which is nothing more than a chip seal of rubberized asphalt overlaid with something else. We have three alternatives to pcc.

One is the regular SAMI or inner layer with a one-inch HMA overlay. The second, if the pcc pavement is very irregular, is an open-graded leveling course followed by a membrane, then the HMA overlay. And the third method is by placing a SAMI layer with a finishing course that has asphalt rubber as a binder.

The regular SAMI construction is your membrane with the overlay. The three-layer system is a system that seems to work very well on pcc -- is an open-graded leveling course with a rubber asphalt membrane and a one-inch HMA overlayer.

In a test conducted by the University of California, first a computer model was developed and then actual tests were taken on pavement test sections to show the stress over a crack when it is overlaid with and without an inner layer.

The stress-absorbing characteristics of the asphalt rubber reduce the crack stress by as much as 50 percent. There will be some more charts that you can see later on.

First, before anything else is done, the joint preparation must be taken care of on the pcc. There are many methods. We recommend that an asphalt rubber be used in a joint sealing operation. But some better results in some of the colder climates have surfaced with the use of a fabric overlaying on the cracks to further reduce the tip stress. This is a method of squeegeeing to level the cracks. Then the stress-absorbing membrane is applied through a distributor truck that is specifically prepared for shooting a very viscous material.

After the chip sealing operation, then the overlay proceeds with normal equipment. This particular photo is of a road that was overlaid with a control section, it had a membrane on part of the section and without a membrane on the other section. This is at Donner Pass in California.

In the foreground is the asphalt rubber membrane system of the inner layer and in the background is the control section. There's a significant amount of cracking in the control section and little, if any, cracking in the section with the asphalt rubber membrane.

This is a diagram of the three-layer system. Arizona State University and Arizona DOT came up with some computer models and some test sections to show what is happening to the crack over and under the overlay system or the membrane.

As you take a moving vehicle into the crack, you see a very high stress in the asphalt concrete without the membrane and a reduced stress by as much as 80 percent in the surface course above the membrane. So you are
absorbing a lot of the crack stress to eliminate or retard the cracking in the overlay system.

If you were to translate that into thickness, the stress in a one-and-a-half inch overlay above a rubber membrane is more effective in retarding cracking than a seven-inch overlay of HMA without the membrane.

There was a section put down about eight years ago on the Durango Curve in Phoenix, Arizona, by the DOT. This is the surface conditions before application of the membrane.

What was done here, a 5/8 inch leveling course followed by a stress-absorbing membrane inner layer and then a 5/8 inch finishing course, open-graded mix, was placed on pcc pavement. At the end of a 3-year study, there was no reflective cracking in this section. At the end of 6 years, you can see some of the cracking starting to reflect through on the pcc pavement.

As a result of this test section, this last year more sections -- this is the end of that one particular test section -- they have overlaid an additional four miles of freeway both ways with the system, and this is the way it looks today.

The riding and the noise reduction is tremendous -- the riding has improved.

Also in 1972, the City of Phoenix had this particular pcc pavement. They went in with a different system. They put an open-graded mix with only three percent asphalt in it and flushed the asphalt rubber into the system. This was in 1972. This is the way it looks today.

It is a low-volume city street. When it was first started it was about 2,000 ADT; today it's -- because of rerouting of some of the streets, it has very low volume.

Incidentally, the freeway in Phoenix that we showed previously had a daily traffic of a hundred thousand vehicles. This is Madison Street in Phoenix.

One significant property of asphalt rubber that has surfaced in the City of Phoenix's 15-year report on the use of asphalt rubber was the characteristic of retarding the aging. This happens to be Sky Harbor Municipal Airport, some of the taxiways that were overlaid. This is the main runway. In 1972, I believe it was, they overlaid or rebuilt the south runway. They also did some taxiways.

They put an asphalt rubber chip seal over the top of the main runway and left the taxiways in the same condition. But the construction was identical with the exception of the asphalt rubber chip seal over the main runway.

They took tests in both the main runway and the taxiway on about a three-year interval. But this is a chart of the aging characteristics of the asphalt in the main runway and also in the taxiway.
The blue line is the aging of the taxiway; the red line is the main runway. As you can see, very little deterioration in the asphalt in the mix in the main runway. Now, you see a flat area in the blue curve. And the results showed this but there was very little documentation to find out. An investigation showed that there were two projects where Reclamite was put on the taxiway in that period of time which retarded the aging characteristics of the asphalt, which was an interesting concept.

The advantages of asphalt rubber -- this slide happens to come from the presentation that was presented at TRB by the engineer for the City of Phoenix, and these are his conclusions. I say it retards reflecting cracking; he says it stops it -- waterproofs the structure, stabilizes the unit, stops spalling asphalt at potholes and larger cracks, eliminates maintenance, renovates existing HMA, prevents crack reflection, prevents spalling at pothole edges, provides a truly flexible surface, eliminates need for maintenance for at least a full eight years, and adds to the life of the pavement by as much as two times, and some tests show that it is three to five times longer.

Also, another use of asphalt rubber is as a binder in a surface course. There are some changes that have to be done to the design of the pavement medium or coarse side on the gradation, keep the Number 30 below 25 percent, make lab mix at a higher temperature, 350 degrees mixture temperature, 20 percent more binder, delete the antistrip and increase Marshall flow.

From the plant standpoint, there's some special piping, because you don't use the same tank for storage of your asphalt as you would with asphalt rubber. You have to mix it at 50 degrees higher temperatures than you normally would. You do not use pneumatic rollers. You do not use vibratory on the breakdown. And you have a contingency of mortar sand because sometimes the mix might be a little sticky and you may need this for finishing.

It can be put through a regular HMA facility or a drum dryer. It looks a little different when it goes through the laydown machine. As you can see here, it has a little different texture. But other than that, it acts very similar to your normal HMA paving mixture.

It has been successfully used in direct overlays on pcc with very little reflective cracking.

That's some of the projects. This particular picture is another one that was taken at the Donner Pass in California where there was a test section put down and the asphalt rubber was used as a binder in the leveling course and also in the surface course and there has been no reflective cracking. Two years after this was put down there was 800 inches of snow in this particular area. Another picture of that same area.

The advantages of asphalt rubber in HMA: longer life, better temperature susceptibility, better adhesion, blacker pavement; you can use an open-graded mix in colder areas because of its flexibility, and it produces better surface drainage, reduces skidding, and has less noise.
In conclusion -- and if I have some time, I have more slides that I took out that I'd like to show you -- asphalt rubber can go hand in hand with improvements in our pavement technology and increasing the life of our roads.

I will move quickly -- I have slides to show some conditions where asphalt rubber has been used over pcc pavement in Texas and New England.

The first one is on Route 12 near Sterling, Massachusetts. This is the condition of the pavement prior to its use. Now this particular project, they used a 12-inch wide fabric over the cracks for crack preparation. After six years -- this is the chip sealing operation -- after six years there is absolutely no reflective cracking through the pcc pavement into the existing surface.

This is the surface as it is today 6 years after it was put down. Here is the control section. The same treatment was done only the asphalt rubber was omitted as a membrane. They did the same type of crack treatment as in the other section. As you can see, most of the cracks are reflecting through the control section.

Now, in Texas, I-45, this is the condition of the pavement when they put the rubber membrane directly on it. There you can see the cracks reflecting through the membrane just before the chips are put down. This is the condition of it today.

This was done in two phases -- they had a winter shutdown -- if you want to know why the difference in color.

As a result of these particular projects, the State of Texas will put down approximately 200 lane miles a year using asphalt rubber as the inner layer over pcc and over HMA pavement.

Thank you very much. Do we have time for any questions? If there are any questions, I will be glad to field them.

MEMBER: I have been to Sweden and examined the roads. I notice very few cracks. I wonder if you have information on that?

MR. JACOBSON: In Sweden I believe they are using the Plus-Ride system, which is an addition of rubber as an aggregate rather than as a binder.

MR. CRAWFORD: Campbell Crawford, NAPA staff. I have a couple of questions. First of all, one is really a clarification. You showed a slide which displayed a 50-degree higher temperature for asphalt rubber surface courses but in your presentation you said 50 percent. Which temperature is it?

MR. JACOBSON: I make mistakes, too. Fifty degrees higher than your normal mix temperature. In other words, if you are mixing at 325, you need 375.

MR. CRAWFORD: You also mentioned a computer program had been used in Phoenix, I guess it was, which showed a reduction, and you had a chart which you showed the reduction in the stress of up to 80 percent. And my question really is: Is this a computer program-devised simulation or
were there actual measurements which showed that reduction of up to 80 percent?

MR. JACOBSON: Originally it was a computer module that was devised to test it, but it was borne out by putting strain gauges in the mix and testing it on site also.
CONCURRENT WORKSHOP SESSION: ASPHALT ADDITIVES, Monday, January 20, 1986, 11:15 a.m. - 1:00 p.m.

PROGRAM CHAIRMAN: Will H. Shears, Jr., NAPA Chairman of the Board and President
J.H. Shears' Sons, Inc.
Hutchinson, Kansas

MODERATOR: Jon Chellgren, Executive Vice President
Pavex Corporation
Pompano Beach, Florida

SPEAKER: Carl Jacobson, President
Asphalt Rubber Producers Group
Tempe, Arizona

(A number of slides were used and referred to in this presentation; however, they were not available to us for publication)
Dear Mr. Carlson,

Enclosed are the session Proceedings from NAPA's 31st Annual Convention in Honolulu, Hawaii, that you had requested. They are based on transcriptions of recordings of the actual presentations and have been edited only for extraneous material.

We appreciate your interest very much.

Very truly yours,

George C. Coggin
Director of Communications