MATES

MICHIGAN DEPARTMENT OF TRANSPORTATION

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BIRDWATCHERS AND ASPHALT PAVERS UNITE!

The environmental movement that became prominent during the 'radical 1960s' was looked upon by many as consisting largely of people wearing love-beads and singing folk songs. A series of national traumatic events, however, brought much of mainstream America into environmental-friendly recycling programs. One such event was the Arab oil embargo in the 1970s when the price of petroleum products skyrocketed. Together with the gasoline prices we all grumbled about, the cost of asphalt cement, a material derived directly from petroleum went into the stratosphere.

When these shocking inflationary movements occurred, even hard-nosed businessmen began searching for ways to recycle costly petroleum products. One product that appeared to lend itself easily to re-use was asphalt concrete. We knew that, for the most part, aggregates in pavement didn't change over the years. Further, research had shown that asphalt cement in a dense mat didn't change to a great degree either. Why, then, couldn't the old pavement just be picked up, reheated to melt the asphalt, and re-used? For one thing, the asphalt cement had probably hardened to some degree and would harden more when reheated. Well then, why not rejuvenate it; perhaps by blending-in a softer asphalt? What about processing the old mix through an asphalt mixing plant? If we apply flame directly to the asphalt-coated mixture, the common practice, black smoke belches forth, violating clean air standards. Couldn't we solve that problem by modifying the processing procedures? It was worth a try. Thus, MDOT and the asphalt paving industry set forth, dragging along the skeptics both within the Department and in the industry.

The bituminous hot-mix recycling program in Michigan began in 1977. Drier-drum mixer asphalt plants were just beginning to take their place in the hot-mix industry and recycling of hot mixes was listed as a major technological advantage of the drier-drum mixer (bituminous plants are discussed in MATES Issue No. 6). Michigan's first hot-mix asphalt pavement recycling project was set up on M 52 in Ingham County. The contractor had obtained a stockpile of reclaimed asphalt pavement (RAP) from a previous project and was eager to get involved in the new hot-mix recycling technology. The necessary materials samples were gathered for the Testing Laboratory to develop and evaluate a mix design, the mix design information was taken to the plant site, and the experiment was initiated. The ratio of RAP to new material was varied from 50 to 100 percent and the amounts of new asphalt cement and aggregate were proportioned accordingly. This experiment was a great success; a lot of questions were answered and some new questions arose, but most importantly the new hot-mix recycling technology was born. Further, that length of recycled M 52 pavement, constructed 12 years ago, continues to serve well today.

The next few years were spent developing this new technology for the entire hot-mix industry. This involved adapting the technology to accommodate batch type hot-mix asphalt plants to the hot-mix recycling process, and required many mechanical and procedural changes. Although batch type plants could successfully produce recycled mixtures, it became obvious that the drier-drum mixer type plants held a distinct advantage. This was a contributing factor to the rapid changeover from batch type plants to the drier-drum mixer plants by the hot-mix industry in the past few years.

There were about 10 experimental hot-mix recycling projects scheduled from 1977 through 1984. These projects were all successfully completed and, through them, hot-mix recycling technology evolved into a two-method program.

The first method, the one most often used, allows the contractor to gather RAP from any available source and use it, after some processing, to produce recycled bituminous **base** or **leveling course** mixtures. This method, commonly called 'permissive recycling,' has grown rapidly in the last five years or so, to the point that approximately 40 to 50 percent of the total bituminous mixture procured for Departmental projects contains RAP.

The second, or alternate method of hot-mix recycling is included in a project's pavement design. On certain trunkline rehabilitation projects it is advantageous to either partially or completely remove an existing bituminous pavement. The pavement on these designated projects is tested and evaluated for recycling potential during the project's design phase. Whenever possible, the existing pavement will be utilized to its maximum potential which includes producing recycled bituminous **top course** mixture for the project from which the RAP came.

One further advancement in the hot-mix recycling program involves the limited use of 'permissive' RAP to produce bituminous top course mixture. At present, this method is authorized by Special Provision only. This method allows a contractor to process 'permissive' RAP to a rigid and narrow set of standards to produce a proprietary product which will meet all the specification requirements for bituminous top course mixtures. The standards for permissive RAP to be used in top course mixtures are even more restrictive than for virgin aggregate. Results from our first trial project are very encouraging.

The advantages of hot-mix recycling are many and are both general and specific in nature. The value of RAP for recycling purposes has changed a waste product disposal problem for contractors to a situation where most recycling contractors will pay from three to five dollars per ton for RAP delivered to the plant site.

Some of the general advantages to the public are:

Economics - Recycled mixtures generally cost two to five dollars per ton less than mixtures using all new materials.

Conservation - Recycled bituminous mixtures conserve energy, petroleum, gravel, and sand in substantial amounts. Exact values are difficult to measure but, in an average construction season, a conservative estimate would yield a savings of 40,000 tons of asphalt cement and 1.2 million tons of new aggregate.

Environmental - The recycling of bituminous mixtures saves large amounts of our mineral resources from being mined. It is also saving our landfills from filling up with used pavement.

The advantages, however, go beyond these important ones. In most cases, where the mixture design properties

are measured, mixtures containing RAP equal or exceed the properties of the same mix without RAP. The majority of contractors who recycle on a routine basis will use up to 15 percent RAP in all their commercial mixtures to take advantage of the savings and to enjoy the mixture-enhancement characteristics. One factor that is very difficult to predict is the dollars saved in asphalt cement. Many contractors feel that RAP on the ground is like money in the bank. When the price of crude oil increases, as it did in the mid-seventies, the value of the RAP goes up proportionally.

The hot-mix recycling program really has arrived. Most contractors with permanent plant locations are now establishing RAP piles and are recycling on a daily basis. The availability of RAP is really not sufficient to meet the demands or desires of the industry. As the Department strives to maintain a safe and superior highway system, the continued utilization of the hot-mix recycling technology will continue to play a major role in the bituminous hot-mix paving program.

-Ted Hanlon

TECHADVISORIES

The brief information items that follow here are intended to aid MDOT technologists by advising or clarifying, for them, current technical developments, changes or other activities that may affect their technical duties or responsibilities.

GREETINGS FROM THE NEW DIVISION ENGINEER

Although I have only been Division Engineer of Materials and Technology for a few weeks, I feel compelled to extend a word of greeting to our **MATES** readers. I am both thrilled and challenged by the opportunity to head-up this vital and technically diverse Division.

My short-term goal is to visit each of the Department's nine District offices as well as with representatives from the various contracting industries to solicit comments and feedback on the Materials and Technology Division's operation and role within the Department of Transportation. My viewpoint is that this Division is in 'partnership' with the nine Districts, the other Central Office Divisions, and the contracting industries to supply a service to the public of the State of Michigan. This service is to plan, build, and maintain a transportation system that best meets the needs of both the travelling public and commercial interests, within the confines of available funds.

Within this partnership we each have our unique roles and responsibilities to perform. It is my objective to clearly delineate the role and responsibilities of this Division concerning the partnership and to maximize our efforts in fulfilling all that is expected of us. I also hope to stimulate and promote open and honest commication between this Division and all the other partners as mentioned above. I believe that this is the only way we can work together, the Michigan Department of Transportation and the construction and roadbuilding related industries, to provide the level of quality service that the public expects. If any readers have comments relating to this, or anything else you would like to discuss, feel free to call me at (517) 322-1085.

Happy New Year to you all and I am looking forward to meeting and working with you.

— James D. Culp

MDOT RESEARCH PUBLICATIONS

PCC Pavement Joint Restoration and Rehabilitation - Final Report, Research Report No. R-1298, by J. E. Simonsen and A. W. Price. This is the final report on a project designed to develop a joint repair detail that could be opened to traffic within eight hours and function properly for a 10-year period. After developmental work by Research Laboratory personnel, a contract was let for 2700 lane repairs, 2100 of which were step-cut tied joints, and the remaining 600 were of the loose fitting dowel type. In the step-cut tied joints, seven tie bars were grouted into holes drilled in the face of the existing slab at each end of the repair. Prior to this a 1/4-in. step was sawed at each end to the slab's mid-depth to provide load transfer. The remaining repairs consisted of using 10 loose fitting dowels (1-5/16-in. diameter dowels inserted in 1-3/8-in. diameter holes). In the seven years since construction, nearly 70 percent of the tied joints failed either due to insufficient epoxy, or improperly proportioned epoxy in the holes. Performance of the loose fitting dowels (on I 94, I 75, US 23, and I 75BL in Pontiac) indicate that 98 percent of the joints have vertical offsets of less than 3/16 in. and for the remaining 2 percent the offset is 1/4 in. or less. The performance of loose fitting dowelled joints depends on good base support, properly sized dowel holes, exact matching of the new concrete surface to the elevation of the existing pavement surface, and good durability and abrasion characteristics of the aggregate used in the concrete pavement to be repaired. It is concluded that, when properly constructed, loose fitting dowelled joints will provide several years of service without excessive faulting.

Field Evaluation of Experimental Fabrics to Prevent Reflective Cracking in Bituminous Resurfacing - Final Report, Research Report No. R-1300 by V. T. Barnhart. This study involved the installation in 1982 of six different types of commercially available fabric strips as reinforcement over conventionally repaired joints and cracks on a section of concrete pavement (I 94BL in the City of Kalamazoo) being prepared for asphalt resurfacing. The purpose of the project was to compare the performance of fabric-treated and untreated repaired joints and cracks in the overlay. Annual surveys were performed through 1986, and cores taken to assess the condition of the fabrics. While there is some evidence that the fabrics will perform as a crack reducing or retarding material, none of these met the manufacturer's claim that they will greatly reduce or completely prevent reflective cracking. The evidence available to date, coupled with the cost of fabric treatment, suggest that further use of fabrics for the specific purpose of crack reduction is not warranted.

PERSONNEL NOTES

The Materials and Technology Division is pleased to welcome a number of new members to its ranks. Two Engineering Technicians have joined the Structural Services Unit of the Testing Laboratory, **Joe Anderson** and **Tom Miller. Don Hadd** is a new Engineering Technician in the Geotechnical and Geoenvironmental Section, Soils and Foundations Unit. **Pat Pingel** has joined the staff as a share-time Typist Clerk, taking over half of **Lori Wieber**'s duties. **Kendra Rang,** who has worked for us as a seasonal employee in past years, is now a permanent Engineering Technician for the Bituminous Services Unit of the Testing Laboratory. And, **Ken Thorp**, formerly of the Design Division, has been named Assistant Specifications Engineer in the Specifications Section. We know that each of these new members of the Division can be counted upon to contribute to our part of the total transportation picture.

This document is disseminated as an element of MDOT's technical transfer program. It is intended primarily as a means for timely transfer of technical information to those MDOT technologists engaged in transportation design, construction, maintenance, operation, and program development. Suggestions or questions from district or central office technologists concerning MATES subjects are invited and should be directed to M&T's Technology Transfer Unit.

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