International Journal of Advance Research in Science and Engineering
Volume No.07, Issue No.10, October 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

Modified Pavement Construction, Testing and Performance Resin Modified Pavement Demonstration

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ABSTRACT

Resin Modified Pavement (RMP) is a composite paving material consisting of a thin layer (2 inches) of open graded hot mix asphalt (HMA) whose internal air voids (approximately 30% voids) are filled with a latex rubber-modified portland cement grout. The objective of this project was to construct test sections composed of three different types of pavement; RMP, 3 inch thick ultra-thin whitetopping and Superpsve performance graded 82-22 polymer modified HMA pavement. This project was constructed at two signalized intersections on US 72 in Corinth, Missisippi in july of 2012 and will be monitored for a period of five years. Using the information gained from these test sections, the Mississippi DOT will be able to develop a "paving strategy" for heavily trafficked intersections within our highway network based on both economics and performance.

Key Words: *Resin Modified Pavement, Ultra-Thin White topping, Polymer Modified Hot Mix Asphalt, rutting*

I.INTRODUCTION

US 72 in Corinth, Mississippi is a moderately trafficked route located in the extreme north-east corner of Mississippi and utilized by traffic traveling between Memphis, Tennessee and Huntsville, Alabama. Within the limits of the research project location, US 72 is a 5-lane facility, with 2- 12' wide thru lanes in both the eastern and western directions and a 12' wide turning lane between the thru lanes. The existing pavement is 12.5" of full depth hot mix asphalt. The 1.5" thick surface course was placed during a 1992 overlay and the remainder of the pavement was constructed in 1976. Both current and projected traffic data are shown in Appendix A. Preconstruction measurements were taken to quantify the condition of the existing pavement at each section in the outside thru lane and can be found in Appendix B. These measurements include existing rut measurements, friction data, "California style" profilograph Profile Index (PI) and International Roughness Index (IRI). But measurements were taken manually by placing a metal straight edge on the pavement and measuring the depth from the straight edge to the pavement surface in the wheel paths. Measurements were taken to the nearest 1/16" and were taken on 25' intervals.

All friction data was gathered using the department's high speed friction testing system designed to meet all of the requirements of ASTM E274-90 "Standard Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire" and utilized a ribbed tire for friction data collection.

All PI data was gathered utilizing a computerized "California Type" profilograph with a 2' low pass third order butterworth filter. PI data is presented with a 0.2" Blanking Band and with a "Zero" Blanking Band. Preconstruction IRI data was collected using the department's ARRB Transport Research Walking Profiler.

II.OBJECTIVE

1. To assess the structural evaluation of flexible pavement for the strength of the pavement by deflection measurement using Benkelman beam
2. To measure the field density of the road using sand pouring cylinder

   To measure the roughness of the pavement surface using Bump integrator/ Merlin

3. To examine the pavement condition of the road (cracks, raveling, potholes, rutting, corrugation edge break etc) by carrying out visual inspection of road surface
4. To measure the resistance offered by the pavement surface against skidding of vehicles using portable skid resistance tester
5. To measure the pavement macro texture for the geometrical deposition of
6. individual aggregates. Texture depth using sand patch method
7. To study the gradation of the laid road.
8. To carry out different tests on recovered bitumen.

Need

1. Improved consistency
2. Reduced temperature susceptibility
3. Improved
4. Improved resistance to in-service aging
5. stiffness and cohesion
6. Improved flexibility, resilience and toughness
7. Improved binder aggregate adhesion

Benefits

RMP provides many of the more attractive benefits associated with both AC and PCC. It offers the ease of construction, the jointless surface, and the cost competitiveness of an AC material. It has the fuel, abrasion, and wear resistance of a PCC. RMP has successfully demonstrated resistance to permanent deformation damage from heavy, high-pressure tire loads. It has also proven its capability in carrying tracked vehicle traffic by resisting the abrasive action of the turning tracks (Ahlrich and Anderton 1991b). The RMP material is well-suited for practically any environment, as evidenced by its international history in regions ranging from the Scandinavian countries to the deserts of Saudi Arabia (Jean Lefebvre Enterprise 1990).

III.LITRETAURE RIVEW

Each test section was monitored over a five year period (April 2001- April 2006). Data collected included skid resistance, rut depth, IRI, and pavement distress surveys. Pavement distresses were identified using the LTPP distress identification manual and the following distresses were identified during this project:

Transverse Cracking
Longitudinal Cracking
Patching
Rutting

Once identified and measured, total deduct points were calculated using curves previously developed for MDOT. It should be noted that distresses for each of the test sections were normalized to a 500 foot section length for analysis due to the fact that MDOT's deduct curves are based on a 500 foot section length.

A pavement condition rating (PCR) was calculated using both IRI and distress ratings.

All long term roughness and rutting data was collected using an International Cybernetics Corporation full size profiler model MDR 4086L3.

The following is a summary of the long term data for each test section. Ultra-Thin Whitetopping

Long term data for the Ultra-Thin Whitetopping test section is given in Table C10 of Appendix C.

Skid resistance performance was good for the Ultra-Thin Whitetopping test section, with no average values falling below 40. A value of 35 or better is desired on all MDOT maintained roads.

Collection of the rut values for the Ultra-Thin Whitetopping produced some minimal average rut values. It was determined however that these values were due to the lasers of the profiler reading the joints cut into the pavement and not due to actual rutting of the pavement.

Test sections for the Ultra-Thin Whitetopping, as noted in the previous chapter, began in less than satisfactory condition with initial IRI values above 4. Those values were significantly higher than those of the other test sections. IRI values this high are normally associated with older pavements in need of repair, not new construction. A review of the data shows that the condition of the pavement continued to deteriorate over the life of the project.

The substantially high IRI values were most likely what produced the low pavement condition rating (PCR) values. Initial PCR values for the inside and outside lane were 65.9 and 54.6 respectively. MDOT suggests that four lane pavements with a PCR value

IV.ACKNOWLEDGMENTS

The study reported herein was conducted by the Mississippi Department of Transportation (MDOT) under the sponsorship of the Federal Highway Administration, Mississippi Division Office. This work was accomplished during the period March 2001 through June 2002 under the supervision of Ms. Joy F. Portera, State Research Engineer followed by Mr. Randy L. Battey, State Research Engineer. This report was prepared by Mr. Randy L. Battey of the MDOT Research Division.

The author wishes to express his appreciation to the many people whose efforts contributed to the success of this study. Acknowledgment is made to Messrs. John W. Avent, Johnny L. Hart, Alan D. Hatch, Chester M. Drake and Sammie D. Evans who assisted with the construction documentation and data collection. Appreciation is expressed to the personnel of MDOT District One, including but not limited to, Messrs. Paul Swindoll, Neal Peach, Keith Swain, Barry Boyd, Johnnie Bennett, Robert Parks and Leon Burns who were most supportive and instrumental in the construction of this project. Additional acknowledgment is made to the personnel of APAC Corinth operations, including but not limited to Messrs.

Mike Tucker, Mike Bogue, Donnie Dees, Keith Kelly and to Mr. Mark Ishee of Ergon Inc. The contributions of Dr. Randy Ahlrich, Gary Anderton and Ibrahim Murr should be recognized, for without their experience and assistance this project would not have been possible.

During the period of this study, the Executive Director of MDOT was Mr. Hugh Long followed by Mr. Larry “Butch” Brown. The Deputy Executive Director / Chief Engineer was Mr. James Kopf.

V.CONCLUSION

Using construction, performance, and cost data from these test sections; a head to head comparison of each paving method can be made in order to assist the Mississippi Department of Transportation in developing a paving strategy for highly trafficked intersections. For the comparison, each paving method will be ranked in several categories. The best paving option for each category will be given a value of 1, the next best will be given a 2, and the least desirable option will be given a 3. Once all categories are ranked, the pavement options will be totaled with the lowest total being ranked the best option.
The comparison above shows the PG 82-22 to be the best option. That result is supported by the information gathered throughout this study.

One issue affecting the PG 82-22 was rutting near the end of the study. This is an issue with all asphalt pavements; however improvements continue to be made in Superpave mix designs to alleviate rutting. Also, the PG 82-22 section was constructed at about one third of the cost of the other test sections, meaning the Ultra-Thin Whitetopping and the Resin Modified test sections would need to have three times the service life to account for the difference in cost. That was certainly not the case with the Ultra-Thin Whitetopping as it was removed and replaced in 2007 due to excessive failures.

The Resin Modified pavement sections held up throughout the study, however the complexity and attention to detail in construction needed for this pavement to perform successfully makes it a less appealing option.

This was evident because even in the controlled environment provided by this study, construction problems occurred with the capping of grout before it fully penetrated the mat. After reviewing all available data for this study, the cost, performance, and ease of construction makes the PG 82-22 the most reasonable choice for paving of MDOT’s highly trafficked intersections.

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