

UTC Project Information

Project Title	Development of an Acceptance Test for Chip Seal Projects
University	Michigan State University
Principal Investigator	M. Emin Kutay, Ph.D., P.E.
PI Contact Information	Associate Professor Department of Civil and Environmental Engineering 3546 Engineering Building, East Lansing, MI 48824 Tel: (517) 353-9297, kutay@egr.msu.edu
Funding Source(s) and Amounts Provided (by each agency or organization)	\$120,000 MDOT \$50,000 MSU
Total Project Cost	\$170,000
Agency ID or Contract Number	DTRT13-G-UTC44
Start and End Dates	October 1, 2014 to December 31, 2016

Brief Description of Research Project

Chip seal is a preventive maintenance method performed by many DOTs, county road departments and cities. In this method, the deteriorated pavement surface is covered by asphalt binder and uniformly graded aggregates. Typically, asphalt emulsion (sometimes cutback asphalt) is sprayed on the surface and aggregates are embedded into the emulsion. After compaction and curing of the emulsion, loose aggregates are removed by sweeping (via rotary power brooms). The primary role of the asphalt binder is to serve as a waterproof membrane that protects the pavement surface from sun, oxidation and moisture infiltration. The role of the aggregates is to act like a ‘bridge’ so that sufficient skid resistance is provided. In general, chip seal is applied on roadways with low to moderate traffic. Also, the condition of the existing pavement should be suitable for application of chip seal. Chip seal is not applied to heavily distressed and rough pavements. Pavements with low to moderate raveling, transverse cracking, block cracking and smooth surfaces with low skid resistance are optimal for chip seal applications.

One of the most important parameters of a chip seal design is the binder aggregate embedment depth. Transportation agencies typically specify an embedment depth on a percentage basis. The embedment depth is typically

defined as the height of the asphalt binder divided by the average height of the aggregates. Specifications require the embedment depth to be assessed after construction and initial curing of the chip seal emulsion. Cold weather states generally require a 60-70% chip embedment depth while warm weather states require a 50-60% embedment depth at the time of initial acceptance. If percent embedment is too high, then ‘bleeding’ problem may be experienced, typically along the wheelpath. Conversely, insufficient embedment depth may lead to insufficient bonding between the cover aggregates and the binder, leading to aggregate loss. Other factors contributing to problems like bleeding and aggregate loss include the aggregate aspect ratio, angularity, softness/stiffness of the substrate etc.

Considering the wide variety of the pavement surface conditions as well as aggregate shape characteristics, and new asphalt binders (e.g., polymer modified), it is very important to be able to measure the percent embedment of aggregates in the field. While the original chip seal design is based on a given percent embedment, an objective method to quantify and confirm percent embedment after placement does not exist. Currently, evaluation of the appropriateness of the aggregate embedment is heavily based on the experience of the field inspectors. An objective field test is needed to support a more uniform method of acceptance for a chip seal treatment. Therefore, the objective of this research project is to develop an objective test method to measure the percent aggregate embedment in chip seal projects. This test method can be used as the basis for an acceptance specification by the roadway agencies. It can also be used to validate/refine chip seal design procedures in the future.

Describe Implementation of Research Outcomes (or why not implemented)

N/A

Place Any Photos Here

Impacts/Benefits of Implementation (actual, not anticipated)

The successful completion of this research project will establish the procedures and draft standard test method for the acceptance test for chip seal treatments.

Web Links

<www.chpp.egr.msu.edu>

- Reports
- Project website