INTRODUCTION

Due to the nature of construction, it is common for longitudinal joints in asphalt pavements to have low density and high permeability. This condition causes the pavement to be more susceptible to air and water penetration, thus enhancing a pavement’s waterproofing abilities and decreasing its susceptibility to oxidation and moisture induced damage. A fog seal is defined as:

“A light spray application of dilute asphalt emulsion used primarily to seal an existing asphalt surface to reduce raveling and enrich dry and weathered surfaces.”

(1) The success of an initial fog seal treatment project led the Indiana Department of Transportation (INDOT) in 2012 to begin requiring longitudinal joints to be fog sealed with a 2-ft wide band centered along the construction joint. However, no data have been collected to quantitatively support the observation that the lives of longitudinal joints have been improved.

OBJECTIVES

The objectives of this project were to:
1. Determine if applying fog seals to the longitudinal joints of new asphalt surface mixtures improves the performance of the joints
2. Determine the preferred type of fog seal material for use in sealing the longitudinal joints
3. Determine if the fog seals need to be reapplied and if so, at what intervals

RESULTS

After the first aging round, the permeability of all three groups increased and the permeability of the untreated samples was higher than of the treated samples. The permeability of all three groups after the second aging round was comparable to those after the first aging round. This indicates that there is a plateau in the effects of aging on permeability.

The ANOVA indicated that both the treatment type and asphalt condition were statistically significant and that the interaction between the two independent variables was not significant. The low p-values indicate a statistically significant difference between the two fog seal types. The only statistically significant differences in asphalt condition were between the samples after treatment with the samples after both aging rounds.

CONCLUSIONS & RECOMMENDATIONS

1. The presence of fog seals can improve the performance of longitudinal joints with respect to permeability. In this research, the fog seal treatments reduced the asphalt permeability and kept permeability testing was then repeated.

2. Fog seal application is easy, does not delay construction, and requires less labor and heavy equipment than other construction techniques. Consequently, many types of joint sealants/adhesives have been used with the intent of preventing air and water entrance and preserving joint integrity. INDOT currently uses undiluted tack emulsions, SS-1h and AE-NT, for longitudinal fog seals at a rate of 0.13L/m² (0.03 gal/yd²). The fog seals were applied evenly with a foam brush and allowed to sit at room temperature for a minimum of 24 hours to allow the emulsion to fully break. Permeability testing was then repeated.

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<table>
<thead>
<tr>
<th>Treatment</th>
<th>Air Void (%)</th>
<th>Permeability Coefficient, k (cm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS-1h</td>
<td>7.0%</td>
<td>1.59E-04</td>
</tr>
<tr>
<td>AE-NT</td>
<td>7.0%</td>
<td>1.57E-04</td>
</tr>
<tr>
<td>No Treatment</td>
<td>7.0%</td>
<td>1.57E-04</td>
</tr>
</tbody>
</table>

The permeability of asphalt mixtures increases as the air void content increases. Studies have shown that asphalt mixtures become permeable at critical air void contents of approximately 8 percent. At this level, air and water can penetrate the mixture and cause deformation and moisture damage. Due to the difficult nature of longitudinal joint construction, joints often have greater than 10 percent air voids thus making them permeable to air and moisture.

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## EXPERIMENTAL METHODOLOGY

Using a PG 64 asphalt mixture meeting INDOT mix design requirements for a 9.5mm ESAL Category 3 mixture design, (15) laboratory permeability specimens were prepared with air void contents of 7 ± 1 percent, which is typical of longitudinal joints. The initial permeability of each sample was determined in general accordance with FM 5-950 Florida Test Method for Measurement of Water Permeability of Compacted Asphalt Paving Mixtures. The (15) samples were then divided into three groups of five such that each group had similar average air void content and permeability with as similar standard deviations as possible.

## FoG Seal Application

### PERMEABILITY TESTING

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