Florida Department of Transportation
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EFFECT OF ASPHALT CEMENT DEFICIENCY ON OPEN-GRADED FRICTION COURSES

PROBLEM STATEMENT

Asphalt concrete is the main paving material used today. It is also the most costly material used in the construction of flexible pavements. Long-term performance of hot-mix asphalt (HMA) pavements is contingent upon (1) good mix and thickness design, and (2) quality construction.

Raveling is a very common and visible form of asphaltic concrete degradation that decreases the effective life of open-graded friction courses (OGFC) . This, in turn, reduces their effectiveness for skid resistance and safety. One potential cause of premature raveling is asphalt deficit, which occurs when the asphalt cement content of an asphalt pavement is below design target.

The lack of empirical information dealing with the prediction of the reduced pavement life due to asphalt cement (AC) deficit makes it difficult to make accurate and uniform decisions regarding the acceptance or rejection of asphalt deficient pavement.

Currently, the Florida Department of Transportation (FDOT) uses a system where a pay factor is deducted from the contractor's fee to account for low AC contents. However, the actual impact, such as increased maintenance and user costs and accelerated deterioration, is never really assessed. Thus, the reduction in the life of the pavement is not quantified.

OBJECTIVES

Low AC content is a cause of raveling, which, consequently, should be predictable by correlating it to asphalt cement deficiency and also to the reduction of the useful life of the pavement.

The goal of this research is (1) to correlate the reduction of HMA pavement life to asphalt cement (AC%) deficit, and (2) to produce guidelines for decision-making on projects with deficient AC content. The project addresses the following open-graded friction course issues for FC-2 and FC-5, two types of friction course currently used in the state of Florida:

- How much (if any) AC content loss takes place as the friction course ages.
- How the following values correlate: AC content determined from the asphalt plant hot-mix samples versus in-place core samples.
- Whether the results of this study apply to FC-5 as well as FC-2 open-graded mixes.
- How in-place AC contents compare to design mix target values.
- How AC content deficiency relates to the expected life for FC-2 and FC-5 open-graded pavements.
- A study of current raveling related to the present acceptance practices.

FINDINGS AND CONCLUSIONS

The following is a summary of the conclusions drawn from the study:

1. There is a strong correlation between the occurrence of raveling and the decrease in AC content.
2. The percent AC deficiency in raveling projects is greater than that in non-raveling projects.
3. AC loss occurs over the life of the pavement.
4. Initial AC content deficiency can accelerate raveling and reduce the effective life of the pavement.
5. Raveling seems to occur in FC-2 pavements when the AC deficiency reaches approximately 16% of the target value, regardless of time.
6. The following equations relate %AC loss and time, when considering both NCAT and flowmeter measurements: ***% AC loss = .0103* Friction Course Age (days) + 1.342.***
   Annual % AC loss during the initial year of service life: *5.1%.*
7. Overall, the annual loss of asphalt cement is within the range of 5% and 6% during the initial year of service life.
8. FC-2 mixtures tend to have a lower percentage of fines.
9. For FC-2 mixtures, the occurrence of raveling is independent from the fine content.
10. The data used in this study is not sufficient to validate Sontowski's idea that a high fine content could yield to premature raveling.
11. For the projects used in this study, the percentage of excess fines does not seem to have an impact on the occurrence of raveling.
12. FC-5 with a high fine content in this study does not ravel during the first 1.5 years of its life.

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