

USE OF LOCAL SANDS ON EASTERN SHORE

by

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(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

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INTRODUCTION

In October 1959, an investigation of methods of improving Eastern Shore sands for use in bituminous mixes was undertaken by the author, then an engineer trainee assigned to the Research Council for that purpose. The primary objective of the investigation was to maximize the amount of local materials that could be used in bituminous mixtures while maintaining adequate mix characteristics. The local sands had not been used previously because of their uniform size; i.e., most of the materials are of the -#10, +#80 gradation. Laboratory experiments were conducted to investigate the feasibility of using fillers and hard grade asphalts to enhance the characteristics of mixtures incorporating the local sands.

In May 1960, the "Preliminary Report on Materials to Stabilize Eastern Shore Sand for Use in Bituminous Concrete"⁽¹⁾ concluded that, although a great difference was found in the properties of mixes made from various local materials on the Eastern Shore, even the poorest graded could be used with the addition of fly ash and 50/60 penetration asphalt in lieu of the normal 85/100 penetration grade.

In the summer of 1960, two special summer undergraduate trainees extended the experiments to include the use of portland cement⁽²⁾ and asbestos and fly ash.⁽³⁾ They concluded that the addition of portland cement could improve some, but not all, sands satisfactorily, and that asbestos, fly ash, and a hard grade asphalt improved the quality of the mixes.

The reports on these experiments led J. H. Dillard to conclude⁽⁴⁾ that the laboratory results were sufficiently positive to warrant a field installation.

The field installation in the form of an overlay was made in July 1961 on Route 617 in Northampton County.⁽⁵⁾ The present report discusses the performance of the installation over the 16-year period before a surface treatment was applied. The timing of the report also coincides with the initiation of a project to develop a procedure for designing emulsion mixes which could provide an added incentive for using the local sands.

FIELD INSTALLATION

Of the 10 mixes used, local sand comprised at least 88% of the aggregate. The fly ash content varied up to 8.7% and the asbestos content up to 2.7%. A 60/70 penetration asphalt was used in the mixes on three test sections. A schematic of the test sections is shown in Figure 1.

As described in the installation report and shown in Figure 2, the existing paved surface was approximately 1 in. thick and badly cracked. In some spots the edge had disintegrated almost completely, as shown in Figure 3.

In general, the construction proceeded in the normal manner. The test sections were not designed to determine the specific influences of the two types of filler on the Marshall properties of the mixes, but to find the most economical mix that would (1) provide adequate stability and durability, and (2) present no problems in paving. The general approach used was to begin with the most stable mix and proceed to mixes of anticipated lower stabilities and also lower cost. The mix on one section included only sand and asphalt; no filler. At the time of the installation, the necessary information on the adequacy of the initial stability and the ease of placing the mix was gained. The information on durability was determined over the life of the resurfacing and is reported here.

The three most stable mixes all contained both fly ash and asbestos fillers, and an asphalt content of 8.5% or greater. These three mixes also had the highest Marshall densities. The 100% sand mix had the lowest stability and density.

From these results it was concluded that sand mixes should be considered as alternatives to the conventional mixes on the Eastern Shore on all except the most heavily travelled roads.

This recommendation was never carried through on a large scale for several reasons. One concerned the limited number and the locations of the bituminous hot mix plants in the area.

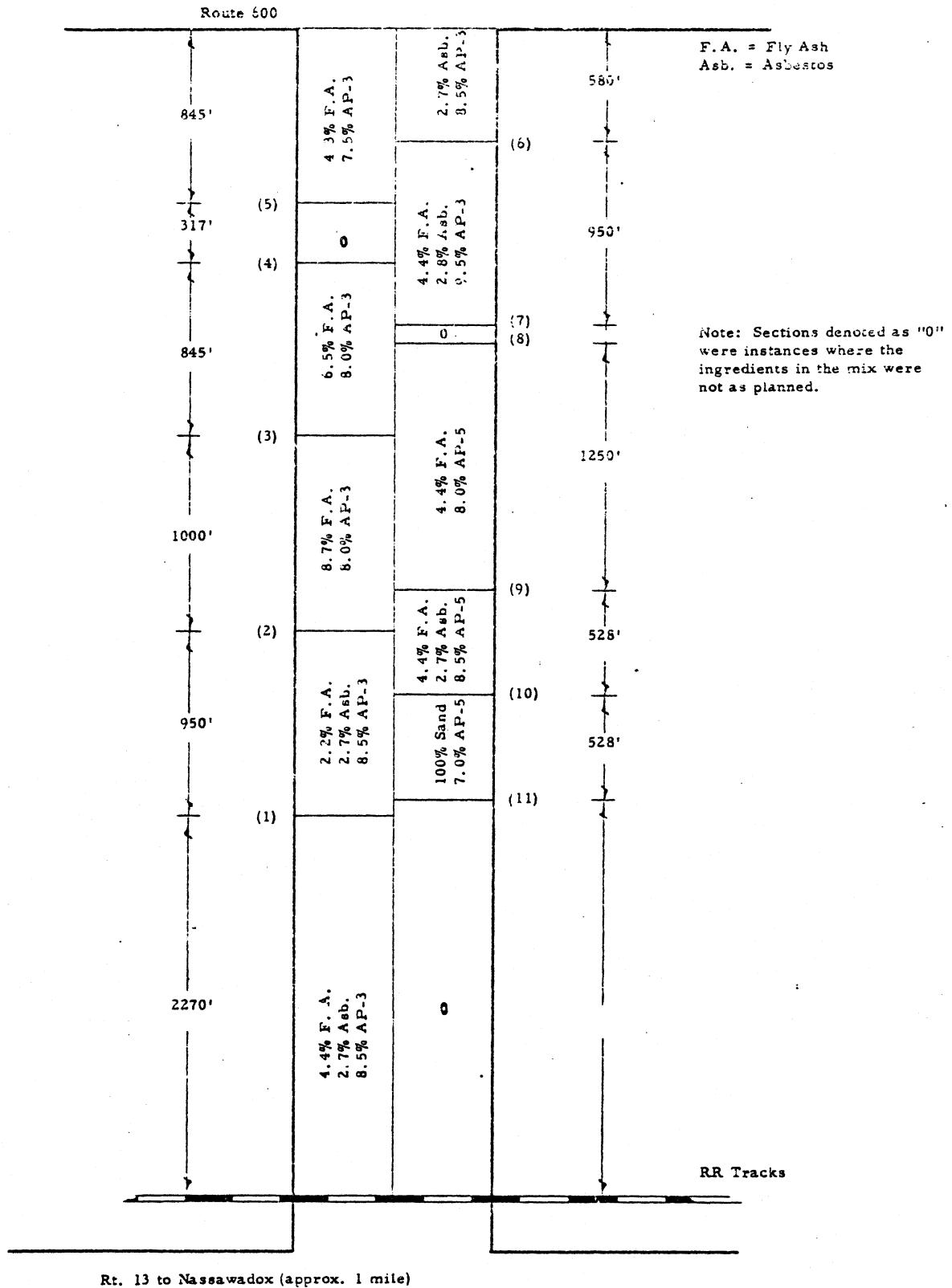


Figure 1. Location of experimental sections on Route 617.

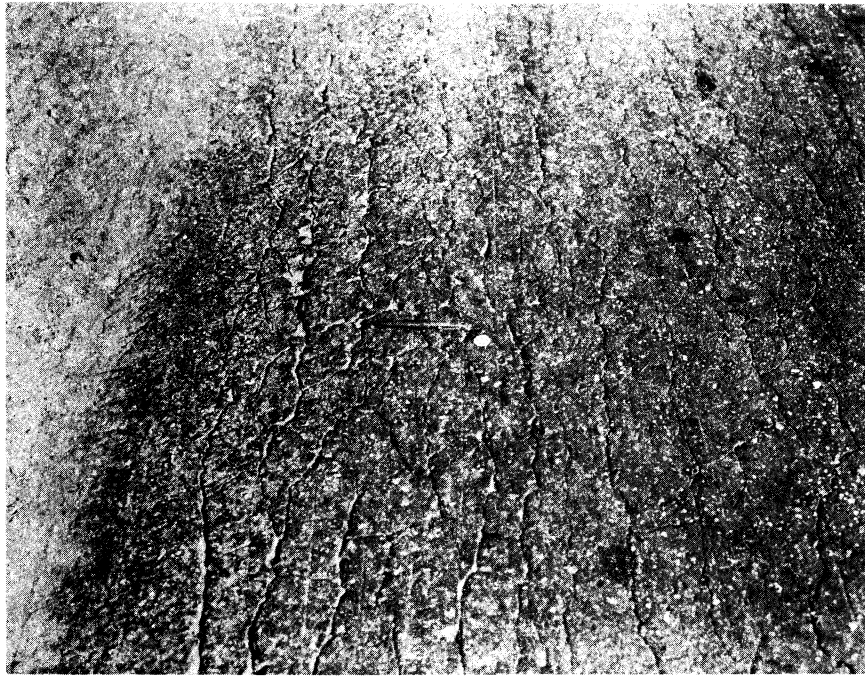


Figure 2. Existing paved surface badly cracked.



Figure 3. Disintegration of pavement edge.

PERFORMANCE

In August 1977, after the field installation had been in service for 16 years, a performance survey was made of all sections. At that time, the road was scheduled for resurfacing.

Although longitudinal and transverse cracking were noted on each section, several sections were in relatively good shape after 16 years. For instance, the section overlaid with the mix which included 4.4% fly ash, 2.7% asbestos, and 8.5% 85/100 penetration asphalt had only 1.1 transverse cracks per 100 ft. and only 75 ft. of longitudinal cracking over its 2,270-ft. length. While this was the least cracked section, the sections overlaid with four other mixes exhibited only slightly more cracking. The sections with the least cracking were those which had had the highest initial stabilities and densities. Conversely, the most badly cracked section was the one resurfaced with the 100% sand mix, which initially had had the lowest stability and density.

Since asbestos is no longer allowed as an additive, attention was given to the fly ash sections. Surfaces with 8.7%, 6.5%, and 4.3% fly ash performed very well and thus indicate that the addition of fly ash alone can produce an acceptable mix.

VALUE OF RESULTS

The value of these results are primarily twofold. First, they show that the Eastern Shore sands can provide durable, economic asphalt mixes when a small amount of imported filler material is added. Secondly, they indicate that with the increased use of asphalt emulsions it is probable that the sands would perform well in a cold mix. In order to investigate this probability, Eastern Shore sand will be one of the aggregates used in the emulsion design project now being initiated at the Council. (6)

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