EVALUATION OF ASPHALT MIXES MADE FROM RECLAIMED CONCRETE AGGREGATES

Final Report
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by

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DISCLAIMER

ABSTRACT

Three comparable hot mixed asphalt paving mixes were produced using two different aggregates produced from reclaimed portland cement concrete paving and one from a crushed limestone aggregate. These were subjected both dry and soaked to indirect tensile tests to determine the wet strength retention. One mix made from reclaimed concrete demonstrated a slightly better strength retention than the limestone mix and the other less. Satisfactory asphalt paving mixes can be produced from reclaimed concrete pavements but the increased asphalt demand (about 1%) negates part of the potential savings.

INTRODUCTION

With the increased emphasis on using recycled materials in highway construction because of ecological and energy concerns we have seen the use of broken P.C.C. pavements as an aggregate in asphalt mixes. We are concerned about the quality of these aggregates, particularly their wet strength ratio, a property not regularly checked by Iowa in asphalt mix design.

Although P.C.C. pavement has been removed on a number of projects throughout the state, only two stockpiles of material that had been crushed to a gradation suitable for asphalt mixes were located.

SCOPE

This study examines the wet strength of hot mixed asphalt mixes using aggregates produced from reclaimed portland cement concrete pavements. Absorption, abrasion resistance and durability of the individual aggregate were not addressed in this study.

PROCEDURES

A. Materials

Reclaimed concrete pavement from I-35

Story County (AAT3-901)

Reclaimed concrete pavement from E. 14th St., Des Moines

Polk County (AAT4-896)

Cr. limestone - Ames Mine, Story Co. AAT5-6

Sand from Bellevue Sand and Gravel AAT5-1

AC-10, AB4-173

B. Mixes

1. Story Co. I-35

60% AAT3-901

40% AAT5-1

4.75%, 5.75%, 6.75% AB4-173

2. Polk Co. East 14th St.

60% AAT4-896

40% AAT5-1

4.75%, 5.75%, 6.75% AB4-173

3. All Virgin Aggregate

60% AAT5-6

40% AAT5-1

4.75%, 5.57%, 6.75% AB4-173

Samples of AAT3-901, AAT4-896 and AAT5-6 were built up to the same gradation.

C. Final Mix Gradation

Sieve No.	% Passing
1"	100
3/4"	98
1/2"	81
3/8"	70
No. 4	60
8	50
16	42
30	30
50	11
100	6.3
200	5.4

D. Mix Controls

Trial mixes from each combination of aggregates were tested to determine the optimum asphalt content. For each mix an asphalt content was selected that yielded laboratory voids of 4% with the standard 50 blow Marshall density procedure.

E. Test Specimens

Six cylinders were molded from each mix (3 to be tested dry and 3 to be tested after soaking) with the following asphalt contents:

Mix	% AC
1. (Polk)	5.95
2. (Story)	6.45
3. (Virgin)	5.10

F. Tests

Indirect tensile strength tests were conducted on half of the cylinders without soaking and half after soaking to determine the wet strength retention.

RESULTS

Table 1 shows the indirect tensile strengths of mixes with and without soaking and the percent of strength retained. Each strength value indicated is the average of 3 cylinders.

Table 1

Mix No.	Indirect Tensile Strength PSI (dry)	Indirect Tensile Strength PSI (soaked)	Retained Strength %
1	94.8	93.7	95.2
2	121.9	98.5	80.8
3	106.5	100.7	94.6

DISCUSSION AND CONCLUSIONS

The wet strength retention of these two mixes indicates these aggregates should be satisfactory for asphalt mixes. This may not be true for all reclaimed concrete aggregates. It is more likely they will be rejected because of absorption, abrasion or durability tests.

Some concrete pavements have been removed because of the D-cracking characteristics of their coarse aggregate. This should not be as great a problem in an asphalt pavement because of the waterproofing from the asphalt film, the reduced particle size and the resilience of the asphaltic mix.

It should be noted that the asphalt demand for the mixes made from reclaimed concrete was about 1% higher than the limestone mix. At $200 per ton for AC, this increases the mix cost about $2 per ton. In a mix containing 60% crushed concrete, the net cost of the crushed concrete would have to be $3.33 per ton less than crushed limestone to offset the cost of the additional asphalt.

Aggregates produced from recycled portland cement concrete pavements should be checked for durability, gradation and absorption as would virgin aggregates. The past performance of aggregates from the original source (if known) should also be considered.

Projects located long distances from good sources of coarse aggregate, such as in northwestern Iowa, are the best candidates for using reclaimed concrete aggregates.