EVALUATION OF MANUFACTURED SAND FROM FRANK W. WHITCOMB CONSTRUCTION CORP. FOR USE IN BITUMINOUS CONCRETE

Report 83-4
March 1983

REPORTING ON WORK PLAN 83-B-14

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

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Date: May 6, 1983

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ABSTRACT

Manufactured sand submitted by Frank W. Whitcomb Construction Corporation was tested for compliance with Section 700 Aggregates, Subsection 704.13 Fine Aggregate for Bituminous Concrete.

A modified Marshall test was run using 100% of the manufactured sand as the fine aggregate portion of the mix.

Results of this evaluation indicate that the product meets all requirements of subsection 704.13.

Results of the modified Marshall Series indicate that bituminous mixture meeting Agency mix criteria can be produced using 100% of this manufactured sand as the fine aggregate portion of the mix produced.

INTRODUCTION

This report is an evaluation resulting from a request to determine the possible use of a new fine aggregate in the production of bituminous concrete.

The request was submitted with an unofficial sample of the material by Frank W. Whitcomb Construction Corporation, Box 429, Bellows Falls, Vermont. 05101.

There was no official notification submitted stating what the material actually was, what source it originated from, or how it was manufactured.

Unofficially, it was stated that the material was a manufactured sand produced from quarried stone from Frank W. Whitcomb Construction Corporation's quarry in Winooski, Vermont. The material was manufactured by Rexnord Inc., Process Machinery Division in Milwaukee, Wisconsin. 53201. The parent material was transported there and the manufactured sand was produced with a Gyrodisc crusher.

This report documents the testing and results performed on the material that was submitted and mix that was produced with it.

PROCEDURES

The following tests were run on the material to determine its compliance with Vermont Standard Specifications, Subsection 704.13:

a. Three gradations.

b. Soundness of aggregate by use of sodium sulfate, T-104.

An acid insolubility test was run to determine if the material was a carbonate.

Specific gravities were run on the material.

Samples of 3/8" crushed stone were obtained from the same quarry source but crushed from a different location in the quarry. This material was used to run a Marshall series.

The 3/8" stone was tested for gradation, acid insolubility, and specific gravity.

An aggregate combination was designed to meet the Agency Specification gradation requirements. A 50% manufactured sand and 50% 3/8" stone blend was the combination arrived at.

A Marshall series was run on the aggregate blend. The asphalt contents used were 6.0, 6.5, and 7.0 percent. The bitumen used was an 85/100 penetration graded asphalt cement from B. P. Oil, Montreal, Quebec, Canada.

RESULTS

The gradation results of the sand are as follows:

Sieve Size	% Passing Sample #1	% Passing Sample #2	% Passing Sample #3	% Passing Average
No. 4	100	100	100	100
No. 8	95	95	95	95
No. 16	65	62	62	63
No. 30	41	37	37	38
No. 50	26	23	23	24
No. 100	15	13	13	14
No. 200	5	5	5	5

The results of the soundness of aggregate by use of sodium sulfate was 6% loss. The maximum allowed is 8%.

The acid insolubility of the sand was 98% indicating a non-carbonate material.

The Bulk Specific Gravity of the sand was 2.605.

The gradation of the 3/8" stone was as follows:

Sieve Size	% Passing	Vt. Specification Requirements % Passing
1/2"	100	100
3/8"	99	90 - 100
No. 4	29	-
No. 8	1	0 - 10

The acid insolubility of the 3/8" stone was 24% indicating a carbonate material.

The Bulk Specific Gravity of the 3/8" stone was 2.739.

The 50 - 50 blend combination of the manufactured sand and 3/8" stone produced the following gradation:

Sieve Size	% Passing	Vt. Specification Limits % Passing - Type IV Mix
1/2"	100	100
3/8"	99	95-100
No. 4	65	62-80
No. 8	48	39-60
No. 16	32	24-45
No. 30	19	14-35
No. 50	12	6-24
No. 200	3	0-5

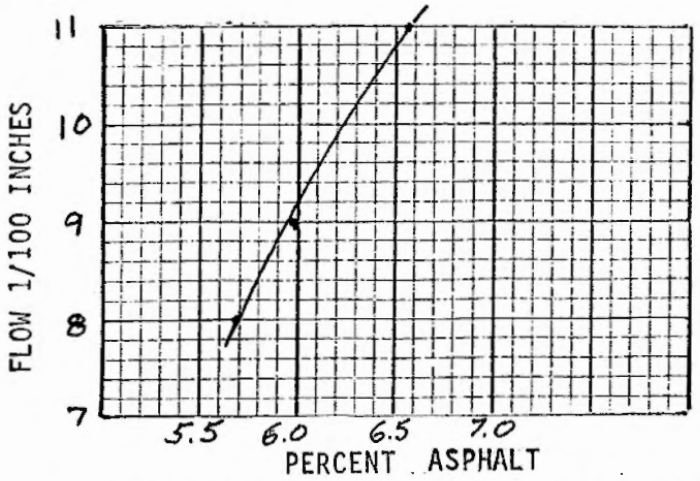
The Marshall series was run with the above gradation and an asphalt cement with a penetration of 94 and an absolute viscosity of 1350 poises at 140°F. The results of the Marshall series indicate that a Type IV mix made with the above combination with 6.3% asphalt cement will produce the following properties: (50 blow Marshalls)

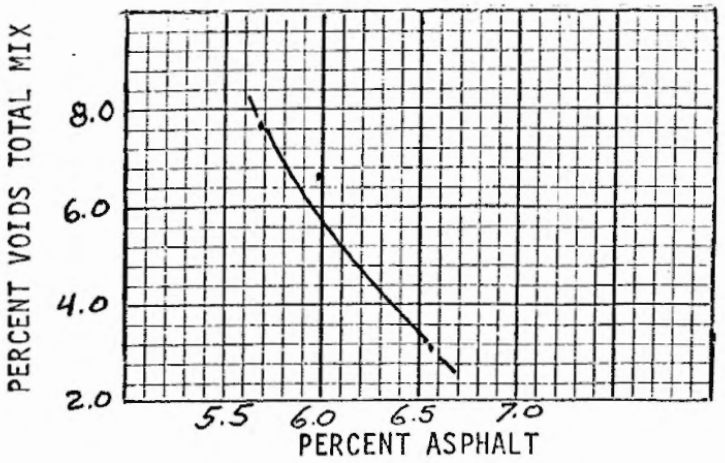
Mix Properties	Vermont Specification		Asphalt Institute (MS-2) Marshall Design Criteria
	Present	Proposed	
% Air Voids - 4.0	2-5	3-5	3 - 5
Stability - 1470 lbs.	None	1000 Minimum	500 Minimum
% VMA - 17	None	16 Minimum	16 Minimum
Flow - 9 (.01 in.)	None	8-20	8 - 18

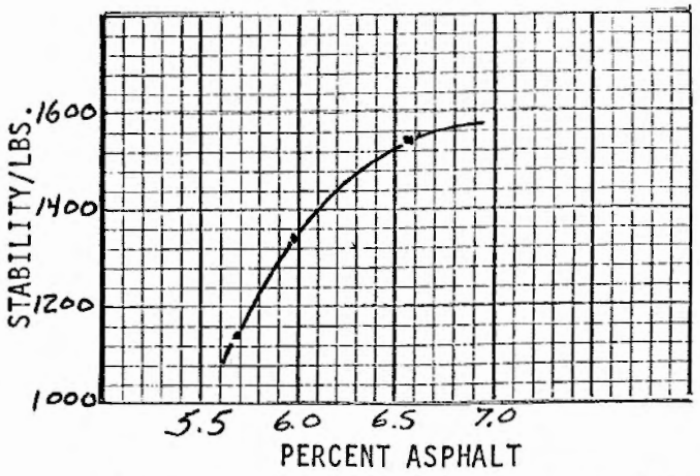
Following are the test property curves developed from the Marshall Series:

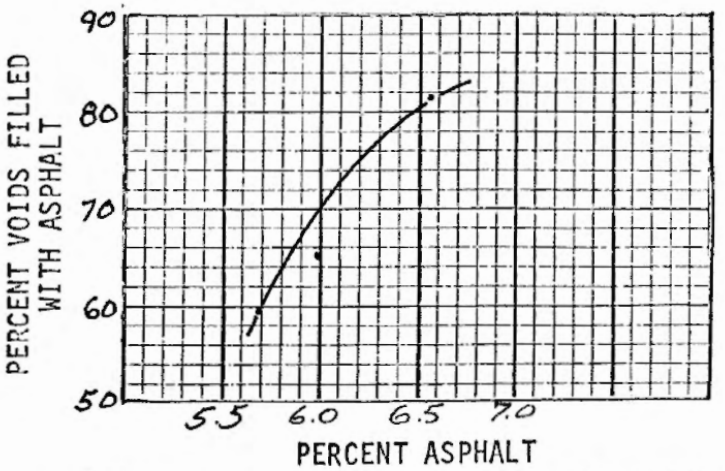
VERMONT AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION
BITUMINOUS CONCRETE SUB-DIVISION
MARSHALL TEST PROPERTY CURVES

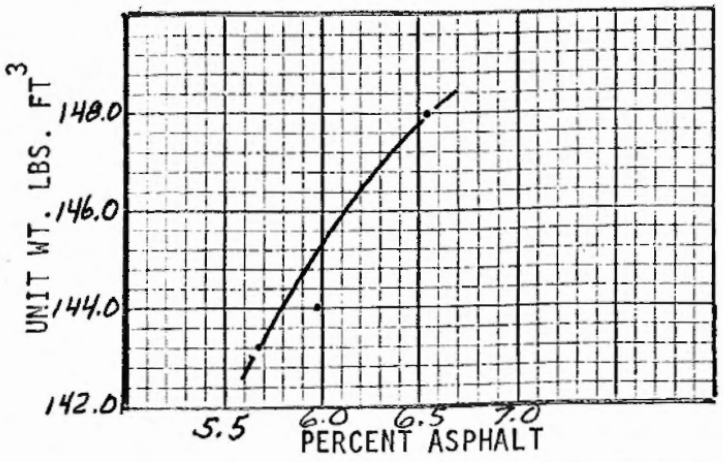
Project Name & No. POSSIBLE FUTURE USE Year 1983 Prepared By: E.L. CHAFFEE
Plant Location F.W. WHITCOMB - WILLISTON - MANUFACTURED SAND Date Prepared: 03-21-83
Item 406 Type Mix IV Design No. —

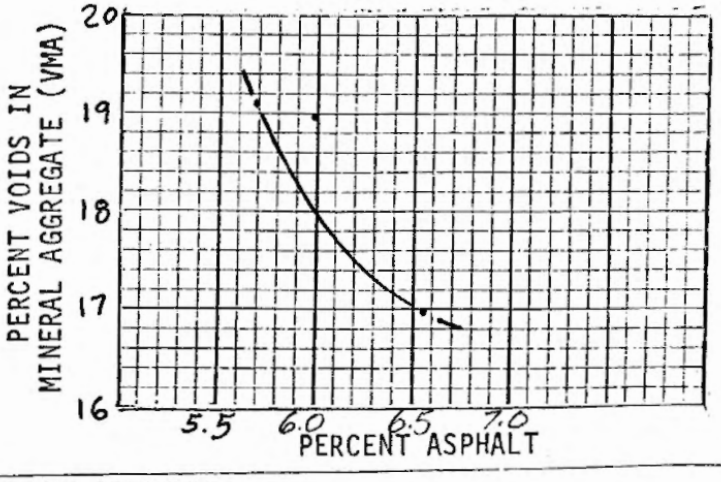












VALUES AT OPTIMUM ASPHALT

PROPERTY	STABILITY	UNIT WT. LBS.FT^3	% VOIDS TOTAL MIX	FLOW	VMA	% VOIDS FLD
ACTUAL	1470	147.0	4.0	9	17	77.0

TESTED BY: W. ROYCE DATE TESTED: 02-09-83 A/C DESIGN 6.3

EVALUATION OF RESULTS

The gradation results indicate that the manufactured sand can be combined with a coarse aggregate to produce a combination that will meet specification gradation requirements.

The material meets soundness of aggregate specification requirements.

The acid insolubility test is not a requirement but does indicate that the parent rock is non-carbonate and may be a quartzite. The 98% acid insoluble values obtained on the manufactured sand differs significantly from the 24% value obtained on the 3/8" stone. Such results indicate that the parent rock for the two materials came from different locations in the quarry.

CONCLUSIONS AND RECOMMENDATIONS

This evaluation indicates that bituminous mixtures meeting specification requirements can be produced using the manfactured sand that was submitted for evaluation.

This evaluation has not addressed the workability of the mix produced with this material. This could only be properly evaluated through actual field use.

It is recommended that Frank W. Whitcomb Construction Corporation, at their own risk, demonstrate through actual production and lay down, the characteristics of a mix made with this material.

TA 565 Rev. 4/79

Prepared By: E.L. Chaffee, Jr.
Date: 3/21/83
Sheet 1 of 1

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

RESEARCH INVESTIGATION

Work Plan No. 83-B-14

Subject Evaluation of Manufactured Sand From Frank W. Whitcomb Construction Corporation for Use in Bituminous Concrete

Investigation Requested By Frank W. Whitcomb Corp. Date December 13, 1982

Date Information Required A.S.A.P.

Purpose of Investigation Evaluation of a new fine aggregate to determine possible use in the production of Bituminous Concrete for the Vermont Agency of Transportation

Proposed Tests or Evaluation Procedure

1. Examine material for compliance to Vermont Standard Specifications Sub Section 704.13.
2. Design an aggregate combination using the sand and coarse aggregate from the same source meeting Agency Gradation Specifications.
3. Run a modified Marshall Design series for the designed aggregate combination.
4. Evaluate test results.
5. Write a report documenting the testing and results,obtained.

Proposal Discussed With C. Jerd Projected Manpower Requirements 20 man days

Investigation To Be Conducted By Bituminous Concrete Subdivision

Proposed Starting Date February 3, 1983 Estimated Completion Date April 1, 1983

Approval/Disapproval by Materials Engineer R.F. Nichols 3-24-83

Comments by Materials Engineer

Materials & Research Division
Agency of Transportation
Date Typed: March 23, 1983