Form R-396 (1/1/87)

Standard Title Page -- Report on State Project

Report No.	Report Date	No. Pages	Type Report: Final	Project No. : 9619
VTRC 89-R6	Aug. 1988	24	Period Covered: Aug. 1987 - Aug. 1988	Contract No.:

Title and Subtitle

Final Report - Field Management of Asphalt Concrete Mixes

Author(s)

C. S. Hughes

Performing Organization Name and Address

Virginia Transportation Research Council
Box 3817, University Station
Charlottesville, Virginia 22903-0817

Sponsoring Agencies' Names and Addresses

Va. Dept. of Transportation
1221 E. Broad Street
Richmond, Virginia 23219

University of Virginia
Charlottesville
Virginia 22903

Key Words

Marshall properties
Performance related specificatio
OC Curves
Pay factor

Supplementary Notes

Abstract

Marshall properties were determined on mixes from three different contractors each producing a 1/2-in and a 3/4-in top-sized aggregate mix. From these data, statistical analyses were made to determine differences among contractors and between mix types. The data were analyzed to develop tolerances that could be used in a performance related specification. A suggested specification including risk factors, OC curve, and pay factor schedule are included.

FINAL REPORT

(Corrected Version)

FIELD MANAGEMENT OF ASPHALT CONCRETE MIXES

by

C. S. Hughes
Senior Research Scientist

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

Virginia Transportation Research Council
(A Cooperative Organization Sponsored Jointly by the
Virginia Department of Transportation
and the University of Virginia)

Charlottesville, Virginia

August 1988
VTRC 89-R6

BITUMINOUS RESEARCH ADVISORY COMMITTEE

W. L. HAYDEN, Chairman, Assistant District Engineer, VDOT

J. D. BARKLEY II, Resident Engineer, VDOT

A. D. BARNHART, District Materials Engineer, VDOT

P. F. CECCHINI, District Engineer, VDOT

J. L. CORLEY, District Engineer, VDOT

G. W. F. CURTIS, District Materials Engineer, VDOT

W. R. DAVIDSON, District Engineer, VDOT

B. J. DAVIS, Area Engineer, FHWA

C. E. ECHOLS, Asst. Prof. of Civil Engineering, U. Va.

R. L. FINK, Assistant Maintenance Engineer, VDOT

C. S. HUGHES III, Senior Research Scientist, VTRC

S. J. LONG, Management Services Division, VDOT

J. T. LOVE, Materials Engineer, Materials Division, VDOT

J. G. G. MCGEEE, Assistant Construction Engineer, VDOT

T. W. NEAL, JR., Chemistry Lab. Supvr., Materials Div., VDOT

R. D. WALKER, Prof. of Civil Engineering, VPI & SU

FINAL REPORT

(Corrected Version)

FIELD MANAGEMENT OF ASPHALT CONCRETE MIXES

by

C. S. Hughes
Senior Research Scientist

INTRODUCTION

Although the Marshall Design Procedure is empirical, it is used by more than half of the state DOT's for asphalt concrete mix design. The mix design procedures defined in ASTM and AASHTO provide a set of criteria that can readily be met. The criteria for mix design are used to determine an optimum asphalt content for a specific aggregate gradation. However, once the mix design has been determined in the laboratory, the criteria established for mix design are not applicable to plant mix production. Normal variability in aggregate and asphalt content in a mix produced in an asphalt plant provides a mix that has different variances than those obtained at the design stage.

At present, most quality assurance procedures used at asphalt plants consist only of gradation and asphalt content tests. It is likely that the use of Marshall properties would allow the prediction of some performance behaviors better than gradation, and in fact, changes in Marshall properties may be indicators of gradation change. Properties such as voids in the mineral aggregate (VMA), voids total mix (VTM), and voids filled with asphalt (VFA) determined during mix production may provide more useful information than determinations of gradation do in the quality assurance process.

PURPOSE AND SCOPE

Before meaningful performance related specifications can be written for volumetric properties obtained from Marshall-compacted specimens, typical variances for these properties must be obtained from plant-mixed materials. From these variances, tolerances can be established based on statistical analyses. This study analyzed the variances and suggested tolerance limits and a pilot specification.

This study was limited to the determination of Marshall properties in plant-produced materials. The scope did not extend to construction properties such as density and smoothness. In a thoroughly developed specification, these properties should be included.

DATA COLLECTION

In order to collect sufficient data to be useful in developing tolerances, several variables had to be included. Although other studies have indicated little or no differences between mixes produced by batch and drum mix plants, both types of plants were used in this study. Concomitant with the inclusion of plant type was the size of asphalt labs, two being relatively large and one smaller. Another variable analyzed was mix type. Two Virginia mixes, S-5 (1/2-in top-sized aggregate) and S-10 (3/4-in top-sized aggregate), were tested at each plant. An additional variable was whether or not the samples had been allowed to cool and then had been reheated prior to compacting and testing.

Three contractors participated in the study:

(1) APAC-Virginia - Chesterfield, (2) B&S Contracting, Inc. - Staunton, and (3) Mega Contractors - Rockville. It was intended that each contractor make 22 sets of Marshall specimens for each mix type while still hot and allow duplicate samples to cool before reheating and compacting. This was accomplished for all but one mix for one contractor. B&S made only 20 sets of the S-10 mix. These samples were obtained and tested over a two-month period.

The properties tested were: Asphalt content, VTM, VMA, VFA, Marshall stability and flow, gradation, and filler/asphalt ratio. Some contractors also included bulk and Rice specific gravity data. Only the data for asphalt content, volumetric properties, and Marshall stability and flow were analyzed.

ANALYSES

Averages and standard deviations were obtained for each mix type for hot and reheated samples from each contractor. The data were derived from samples taken at the stratified random rate, based on time, of 4 for the first day and 2 for each day thereafter. The data supplied by each contractor are contained in Appendix A.

Hot Versus Reheated Samples

The t test for difference between two means was used to determine whether a significant difference existed between the averages of hot and reheated samples, and the results are shown in Table 1. Asphalt Content had only one occurrence in which the average hot sample was significantly different than the average reheated sample at the level of significance of .01. The average stability values were significantly higher for the reheated samples compared to the averages obtained from hot samples on three of the six tests. This indicates that with the exception of stability, the other Marshall properties produce comparable results whether tested hot or reheated. The negative t values for VTM indicate that the averages of hot samples for all mixes but one were lower than the averages of reheated samples although none were statistically significantly lower.

Table 1

Marshall Data
t Test Results: Hot and Reheated Samples (t = .01)

Plant	Mix	D.F.	A.C.	VTM	VMA	VFA	Stab	Flow
B&S	S-5	42	-0.18	-0.45	-0.52	0.48	-2.06	0.00
B&S	S-10	38	-0.28	-1.08	-1.28	0.77	-3.06*	-0.96
APAC	S-5	42	1.99	-1.82	-0.36	2.15	-4.52*	-1.78
APAC	S-10	42	4.15*	-0.98	0.41	1.69	-4.59*	-0.51
Mega	S-5	42	0.00	-1.54	0.00	1.90	-0.92	-1.46
Mega	S-10	42	0.66	0.00	0.00	0.09	0.09	1.01

*Designates significant difference
$t_{.01,\,38} = 2.712$
$t_{.01,\,42} = 2.700$

The F ratio was used to determined if significant differences were found in the variances of the hot and reheated samples. Table 2 shows the F ratio values. Three significant differences were found between the variances of hot and reheated samples and all three were associated with the S-5 mixes. It was the author's opinion that with only three out of 36 F tests significant, the standard deviations can be pooled for the hot and reheated samples.

Table 2

F Ratios: Hot vs. Reheated (*F* = .01)

S-5

Plant	A.C.	VTM	VMA	VFA	Stab	Flow
B&S	1.481	1.234	1.206	1.327	1.984	1.134
APAC	2.692	1.405	3.399*	1.266	4.263*	1.165
Mega	1.267	1.852	4.779*	1.980	1.477	1.531

S-10

Plant	A.C.	VTM	VMA	VFA	Stab	Flow
B&S	1.459	1.200	1.056	1.082	1.162	1.866
APAC	1.563	1.000	1.284	1.458	2.050	2.235
Mega	1.538	1.035	1.080	1.051	1.609	1.129

F .01, 19, 19 = 3.03
F .01, 21, 21 = 2.86

Contractors

Since each contractor used a different job mix formula, and the target values were different for each, it would have been meaningless to compare averages between contractors. However, it was reasonable to assume that the variances from contractor to contractor would be comparable. Thus, the *F* ratio was used to determine whether significant differences existed in the variances between contractors.

Table 3 shows the *F* ratios by contractor and mix type. There are 10 occurrences of a significant difference. Mega is involved in 8 of the 10 differences. This raises the question as to whether the results from a drum-mix plant tend to be more variable than those of the batch plants. This would be a possible consequence of having no internal screening system. Close examination of Table 4, which is a summary of the averages and standard deviations of Marshall results, shows that for the standard deviations in all but one case of a significant difference, Mega has a lower standard deviation than the other contractors. Thus, if any inference is to be drawn from the differences in variability, it must be that in this case, the properties of mixes produced in the drum plant are less variable than those produced in the batch plants.

Table 3

F Ratios: Contractor (F = .01)

S-5

Plant	A.C.	VTM	VMA	VFA	Stab	Flow
B&S/APAC	1.194	2.574	1.865	1.547	4.024*	1.422
APAC/Mega	1.291	4.479*	1.623	3.329*	10.785*	1.870
Mega/B&S	1.081	11.528*	3.027*	5.150*	2.680	1.316

S-10

Plant	A.C.	VTM	VMA	VFA	Stab	Flow
B&S/APAC	1.826	1.675	1.169	1.476	8.052*	1.724
APAC/Mega	1.417	1.375	2.367	1.377	10.572*	3.880*
Mega/B&S	1.289	2.302	2.025	2.033	1.313	2.250

*Designates significant difference
$F_{.01, 21, 21} = 2.86$
$F_{.01, 19, 21} = 2.90$
$F_{.01, 21, 19} = 2.98$

Mix Type

As with contractors, averages were known to differ between properties for each mix type and thus the use of the *t* test would be meaningless. However, a test of the variances would show whether the standard deviations of the 1/2-in top-sized aggregate mix were significantly different from those of the 3/4-in top-sized aggregate mix from the same contractor. Table 5 shows that of 18 comparisons none showed a significant difference.

Table 4

Table of Averages and Standard Deviations
Summary of Marshall Results

Plant		A.C.	VTM	VMA	VFA	Stab	Flow
B&S	Hot	6.02	5.4	19.0	72.1	1764*	7.6
S-5	Reheated	6.03	5.6	19.2	71.3	1917	7.6
	Avg **	6.02	5.5	19.1	71.7	1841	7.6
	Std **	0.183	1.46	1.27	5.56	246.7	0.78
B&S	Hot	5.65	3.6	16.5*	78.1	2231*	9.1
S-10	Reheated	5.67	3.9	16.8	77.0	2402	9.4
	Avg **	5.66	3.8	16.6	77.5	2316	9.3
	Std **	0.227	0.88	0.74	4.52	176.8	0.99
APAC	Hot	5.51	4.3*	17.0	75.0*	2422*	9.3
S-5	Reheated	5.39	4.8	17.1	72.1	3096	9.8
	Avg **	5.45	4.5	17.0	73.5	2759	9.5
	Std **	0.200	0.91	0.93	4.47	494.9	0.93
APAC	Hot	4.98*	3.9	15.5	75.4	2662*	9.3
S-10	Reheated	4.77	4.1	15.4	73.5	3356	9.5
	Avg **	4.88	4.0	15.5	74.5	3009	9.4
	Std **	0.168	0.68	0.80	3.72	501.7	1.31
Mega	Hot	6.08	3.0	16.8	83.0*	2194	11.2
S-5	Reheated	6.08	3.2	16.8	81.6	2236	11.5
	Avg **	6.08	3.1	16.8	82.3	2215	11.3
	Std **	0.176	0.43	0.73	2.45	150.7	0.68
Mega	Hot	5.18	4.3	16.1	73.5	2270	10.7
S-10	Reheated	5.14	4.3	16.1	73.0	2266	10.5
	Avg **	5.16	4.3	16.1	73.3	2268	10.6
	Std **	0.200	0.58	0.52	3.17	154.3	0.66
	Std***	0.19	0.89	0.86	4.1	--	0.92

*Designates significance (α = .01)
**Average and standard deviation for hot and reheated samples
***Pooled standard deviation

Table 5

$\underline{F}$ Ratios: Mix Type ($\underline{F}$ = 0.01)

Plant	A.C.	VTM	VMA	VFA	Stab	Flow
B&S	1.539	2.753	2.945	1.513	1.947	1.611
APAC	1.417	1.791	1.351	1.444	1.028	1.954
Mega	1.291	1.819	1.971	1.674	1.048	1.062

*Designates significance
F .01, 21, 21 = 2.86
F .01, 19, 21 = 2.90
F .01, 21, 19 = 2.98

These data indicate that the standard deviations are not a function of mix type and thus can be pooled, and the same tolerances, based on the typical variability, can be applied to both mix types.

SPECIFICATION

Other than the tolerances to be used in the specification, the lot size, point of test, number of tests per lot, type of test, and the consequences of what to do with "out-of-spec" material must be decided upon. The following are suggested.

Lot Size

A day's production is a very logical lot size because of the cyclic nature of starting-up, producing, and shutting down. However, the use of a day's production for a lot size presents two problems. First, the same number of tests must be performed whether two hundred tons are produced in a day or two thousand tons. The other potential problems are equipment breakdowns, inclement weather, etc. If for some reason a plant shutdown occurs before the number of samples are obtained for specification compliance, the tolerances must be adjusted to keep the statistical risks constant.

For these reasons, a tonnage may be preferable to a day's production for lot size. It is suggested that 1,600 tons be used to define a lot.

Point of Test

The mix shall be sampled from the truck at the plant.

Tests Per Lot

It is suggested that four tests be taken in a stratified random manner from each lot.

Test

For the Marshall properties, it is suggested that the maximum theoretical specific gravity be based on ASTM D 2041, the Rice Method, and that the Rice test be run each time Marshall properties are determined.

The method of test used for the asphalt content in this study was the reflux extractor. One of the sources of variability in the determination of standard deviation is the test method. The tolerances based on the typical standard deviation can be used with other test methods, with the understanding that if the component of variance due to the other test method is larger than that of the reflux method, the tolerances will be tighter than intended and the producer's risk will be higher.

Tolerances

It is suggested that the tolerances be applied on a lot-by-lot basis using the percent defective approach. The target value to be used is the average of the property determined from the job mix design at the optimum asphalt content.

The properties, typical standard deviations, and tolerances are shown in Table 6.

Table 6

Tolerances for Suggested Specification

Property	Typical Standard Deviation	Tolerance
Asphalt content	.20	0.4
VTM	.90	2.0
VMA	.90	2.0
Flow	.90	2.0

In addition to these properties, the average of each lot shall have a stability of at least 1,500 lb and the VFA shall be calculated for information purposes only.

Quality Index

The specification based on the percent defective approach uses the term quality index to refer to the estimate of the defective percentage. The background used to develop this specification is beyond the scope of this paper. However, the specification is based on the work of Weed (1) and uses the Non Central t computer program developed by Barros (2). This simplified the development of this specification greatly.

The acceptable quality level (AQL) was selected as 10 percent defective and the rejectable quality level (RQL) as 60 percent defective. (The term percent defective is somewhat of a misnomer in that it defines the population outside of the tolerance.) The relationship between target value, tolerance, AQL, and RQL is shown in Figure 1.

The Non Central t program has several options that can be used to produce such information as risks, Q = value tables, operation characteristics (OC) curves, and pay factors.

With the above mentioned AQL and RQL and the producer's risk, α of 10 percent, the buyer's risk, β, is determined to be 6.8 percent, i.e., there is a 6.8 percent chance that a quality level of 60 percent defective will be accepted. With a sample size of N = 4, the acceptable constant, k, is calculated to be 0.617 with a corresponding maximum allowable percent defective, M, of 29.45 percent.

A table of Q values based on a sample size of 4 is shown in Table 7.

The following equations are used to define the lower and upper quality index values, Q_L and Q_U, respectively.

$$Q_L = \frac{\bar{X} - (T.\ V. - Tol.)}{S} \qquad (1)$$

$$Q_U = \frac{(T.\ V. + Tol.) - \bar{X}}{S} \qquad (2)$$

where:

Q_L = lower quality index

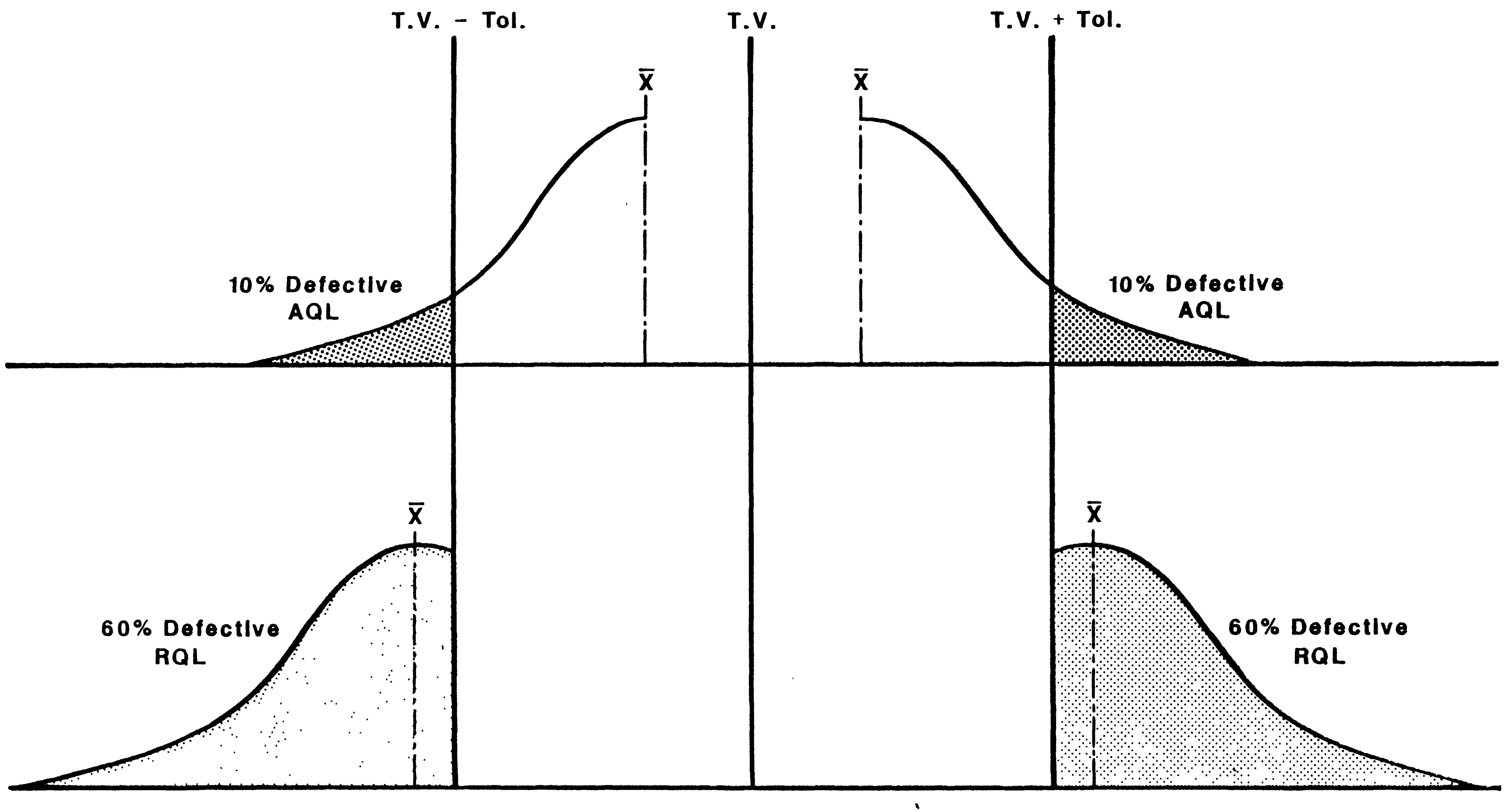
Q_U = upper quality index

$\bar{X}$ = average of lot

Tol. = tolerance

S = standard deviation of lot

T. V. = target value



$$Q_l = \frac{\overline{X} - (T.V. - Tol.)}{s} \qquad Q_u = \frac{(T.V. + Tol.) - \overline{X}}{s}$$

Figure 1. AQL and RQL.

Table 7

Estimation of Lot Percent Defective
N = 4

Q	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.00	50.03	49.70	49.37	49.03	48.70	48.37	48.03	47.70	47.36	47.03
0.10	46.70	46.36	46.03	45.70	45.36	45.03	44.70	44.36	44.03	43.70
0.20	43.36	43.03	42.70	42.36	42.03	41.69	41.36	41.03	40.69	40.36
0.30	40.03	39.69	39.36	39.03	38.69	38.36	38.03	37.69	37.36	37.02
0.40	36.69	36.36	36.02	35.69	35.36	35.02	34.69	34.36	34.02	33.69
0.50	33.36	33.02	32.69	32.35	32.02	31.69	31.35	31.02	30.69	30.35
0.60	30.02	29.69	29.35	29.02	28.69	28.35	28.02	27.69	27.35	27.02
0.70	26.68	26.35	26.02	25.68	25.35	25.02	24.68	24.35	24.02	23.68
0.80	23.35	23.02	22.68	22.35	22.01	21.68	21.35	21.01	20.68	20.35
0.90	20.01	19.68	19.35	19.01	18.68	18.35	18.01	17.68	17.34	17.01
1.00	16.68	16.34	16.01	15.68	15.34	15.01	14.68	14.34	14.01	13.68
1.10	13.34	13.01	12.68	12.34	12.01	11.67	11.34	11.01	10.67	10.34
1.20	10.01	9.67	9.34	9.01	8.67	8.34	8.01	7.67	7.34	7.00
1.30	6.67	6.34	6.00	5.67	5.34	5.00	4.67	4.34	4.00	3.67
1.40	3.34	3.00	2.67	2.33	2.00	1.67	1.33	1.00	0.67	0.33
1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 8 shows the probability of acceptance for each percent defective. This information is used to plot the Operational Characteristics (OC) curve in Figure 2.

Table 8

Points on OC Curve

Percent Defective	Probability of Acceptance
10.00 (AQL)	0.900080
15.00	0.801191
20.00	0.690543
25.00	0.578127
30.00	0.470678
35.00	0.372522
40.00	0.286176
45.00	0.212797
50.00	0.152530
55.00	0.104702
60.00 (RQL)	0.068189
65.00	0.041602
70.00	0.023331
75.00	0.011677
80.00	0.004962
85.00	0.001630
90.00	0.000335
95.00	0.000022
100.00	0.000000

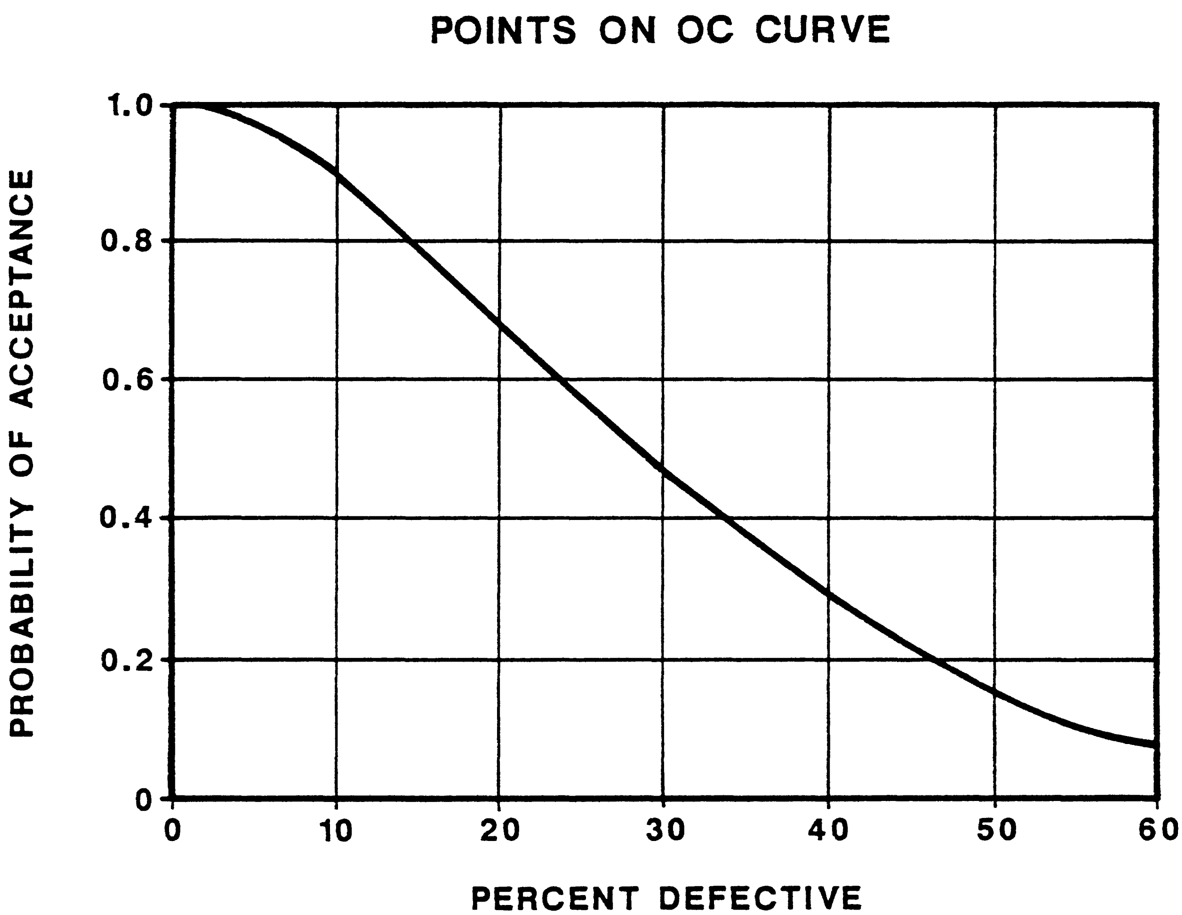


Figure 2. OC Curve.

Table 9 shows the expected pay factors for each percent defective. Since the AQL is established as 10 percent, this established the pay factor at 100 percent.

A plot of pay factors is shown in Figure 3.

Table 9

Pay Factors

Percent Defective	Expected Pay Factors, % Background
10.00	100.0
15.00	99.3
20.00	98.0
25.00	96.0
30.00	93.1
35.00	89.5
40.00	85.3
45.00	80.6
50.00	75.7
55.00	70.7
60.00	65.9

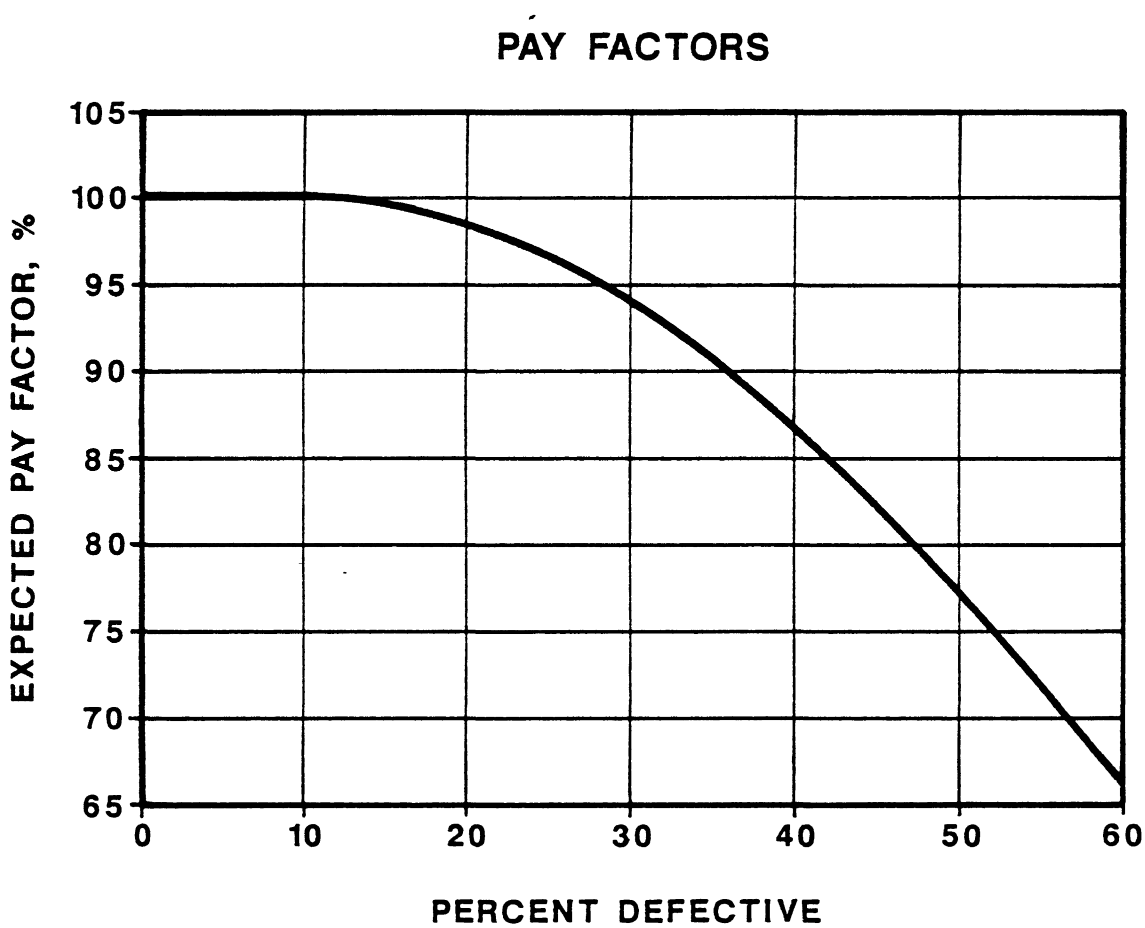


Figure 3. Pay Factor.

The pay factors will be determined for each of the properties of AC, VTM, VMA, and flow, and the four pay factors will be averaged for the lot pay factor (3).

Example Pay Factor Calculation:

A contractor has the following target values

Asphalt Content	6.2%
VTM	4.0%
VMA	17.5
Flow	8.0

The four tests from the lot have the following averages and standard deviations

	$\bar{X}$	S
Asphalt Content	6.0	.10
VTM	5.1	1.5
VMA	18.9	0.9
Flow	7.6	0.8

The tolerances in Table 6 are used.

1. Asphalt Content $Q_L = \frac{\bar{X} - (T.V. - Tol)}{S}$

$$= \frac{6.0 - (6.2 - 0.4)}{.10} = 2.0$$

Percent defective = 0 pay factor = 100%

2. VTM $Q_U = \frac{(T.V. + Tol) - \bar{X}}{S}$

$$= \frac{(4.0 + 2.0) - 5.1}{1.5} = 0.60$$

Percent defective = 30% pay factor = 92.9%

3. VMA $Q_U = \frac{(T.V. + Tol) - \bar{X}}{S}$

$$= \frac{(17.5 + 2.0) - 18.9}{.9} = .67$$

Percent defective = 27.69 pay factor = 94.4%

4. Flow $Q_L = \frac{\bar{X} - (T.V. - Tol)}{S}$

$$= \frac{7.6 - (8.0 - 2.0)}{0.8} = 2.0$$

Percent defective = 0 pay factor = 100%

	Pay factor for lot percent
Pay Factor, AC	100.0
Pay Factor, VTM	92.9
Pay Factor, VMA	94.4
Pay Factor, Flow	100.0
Pay Factor, Lot	96.8%

CONCLUSIONS

1. The averages of stabilities determined on hot and reheated samples often are statistically different.

2. The averages of volumetric properties and flow values are not statistically different when run on hot and reheated samples. VTM's tend to be consistently lower for hot samples but not significantly lower.

3. The variances for hot and reheated samples are generally not significantly different.

4. The variance of properties between contractors often tends to be significantly different.

5. The variances of properties between the 1/2-in top-sized mix and the 3/4-in top-sized mix are not significantly different.

REFERENCES

1. Weed, Richard M., "Revision of a Flawed Acceptance Standard," Transportation Research Record 1056, 1986, pg. 21.

2. Barros, Record T., Richard M. Weed, and Jack H. Willenbrock, "Software Package for Design and Analysis of Acceptance Procedures Based on Percent Defective," TRR 924, 1983, pg. 85.

3. Nnaji, Soronadi, James L. Burati, Jr., and M. G. Tarakji, "Field Validation of Statistically Based Acceptance Plan for Bituminous Airport Pavements - Volume 4 - Computer Simulation of Multiple Acceptance Criteria," DOT/FAA/PM-84/12, IV, August 1984.

APPENDIX A
SUMMARY of MARSHALL RESULTS

Plant: B & S

Mix Type: S-5

HOT							REHEAT						
	A.C.	VTM	VMA	VFA	Stab.	Flow		A.C.	VTM	VMA	VFA	Stab.	Flow
	6.06	8.7	22.0	60.4	1398	6.0		5.99	7.9	21.1	62.6	1636	6.5
	5.87	9.5	22.2	57.3	1398	6.0		5.89	9.7	22.4	56.8	1446	6.2
	5.91	4.7	18.1	74.3	1875	8.0		5.98	5.2	18.8	72.2	1933	6.7
	6.06	5.9	19.5	70.0	1733	8.0		5.92	6.1	19.4	68.5	1850	7.7
AVG =	5.98	7.2	20.5	65.5	1601	7.0	AVG =	5.95	7.2	20.4	65.0	1716	6.8
STD =	0.099	2.27	1.99	7.98	241.5	1.15	STD =	0.048	2.00	1.64	6.76	219.4	0.65
	6.05	6.4	20.0	68.0	1678	6.7		6.13	6.5	20.3	67.8	1708	7.2
	5.50	3.5	16.0	78.3	2240	8.7		5.58	4.0	16.6	76.1	2590	9.3
	5.94	4.8	18.4	74.0	2025	7.7		5.89	4.7	18.2	74.4	2532	7.0
	5.65	6.4	19.2	66.7	1737	7.2		5.86	7.2	20.5	64.7	1943	7.3
AVG =	5.79	5.3	18.4	71.8	1920	7.6	AVG =	5.87	5.6	18.9	70.8	2193	7.7
STD =	0.254	1.40	1.73	5.40	261.7	0.85	STD =	0.225	1.50	1.85	5.39	436.0	1.07
	5.89	5.4	18.8	71.0	1750	6.8		5.93	5.6	19.0	70.6	1763	6.8
	6.25	3.7	18.2	79.7	1848	9.0		6.11	3.9	18.0	78.3	1990	8.0
	6.22	5.2	19.2	73.1	1712	7.5		6.29	4.9	19.2	74.5	1755	7.8
	6.03	5.9	19.5	69.6	1665	7.2		6.15	6.0	19.9	69.8	2165	7.7
AVG =	6.10	5.1	18.9	73.4	1744	7.6	AVG =	6.12	5.1	19.0	73.3	1918	7.6
STD =	0.169	0.95	0.56	4.47	77.7	0.96	STD =	0.148	0.92	0.78	3.91	197.3	0.53
	5.98	6.2	19.6	68.4	1603	6.8		6.17	6.3	20.1	68.7	1882	7.7
	6.21	5.5	19.5	71.7	1638	7.3		6.25	5.3	19.4	72.8	1830	7.5
	6.34	3.8	18.3	79.1	1864	8.0		6.19	4.6	18.7	75.2	1997	8.0
	5.94	5.4	18.8	71.5	1763	7.7		5.89	5.7	19.1	69.9	1927	7.5
AVG =	6.12	5.2	19.1	72.7	1717	7.5	AVG =	6.13	5.5	19.3	71.7	1909	7.7
STD =	0.190	1.01	0.61	4.54	119.7	0.52	STD =	0.160	0.71	0.59	2.93	70.8	0.24
	6.13	3.4	17.5	80.6	1968	8.2		6.04	3.7	17.6	78.9	1887	8.2
	5.86	5.3	18.6	71.7	1833	7.8		5.97	5.5	18.8	71.0	1778	8.0
	6.31	3.7	18.2	79.5	2019	8.7		6.20	4.4	18.6	76.5	2273	8.7
	6.11	6.0	19.7	69.3	1643	7.3		6.15	5.6	19.4	71.3	1918	7.8
AVG =	6.10	4.6	18.5	75.3	1866	8.0	AVG =	6.07	4.8	18.6	74.4	1964	8.2
STD =	0.185	1.25	0.92	5.62	168.0	0.59	STD =	0.146	0.91	0.75	3.91	214.6	0.39
	5.97	4.7	18.2	74.1	1667	8.0		6.09	4.9	18.7	73.6	1659	7.3
	6.14	4.0	18.2	77.8	1757	8.5		6.06	4.9	18.8	73.8	1710	9.0
AVG =	6.06	4.4	18.2	76.0	1712	8.3	AVG =	6.08	4.9	18.8	73.7	1685	8.2
STD =	0.120	0.49	0.00	2.62	63.6	0.35	STD =	0.021	0.00	0.00	0.14	36.1	1.20
STD =	0.170	1.23	0.97	5.11	155.4	0.74	AVG STD =	0.125	1.01	0.94	3.84	195.7	0.68
ALL =	6.02	5.4	19.0	72.1	1764	7.6	AVG ALL =	6.03	5.6	19.2	71.3	1917	7.6
ALL =	0.202	1.55	1.34	5.99	194.1	0.82	STD ALL =	0.166	1.39	1.22	5.20	273.4	0.77

SUMMARY of MARSHALL RESULTS

Plant: B & S

Mix Type: S-10

	HOT							REHEAT					
	A.C.	VTM	VMA	VFA	Stab.	Flow		A.C.	VTM	VMA	VFA	Stab.	Flow
	5.55	3.4	16.0	79.0	2317	9.2		5.70	3.5	16.5	78.6	2608	10.5
	5.71	3.4	16.4	79.1	2025	8.2		5.69.	4.1	17.0	75.7	2242	9.8
	5.81	1.8	15.2	88.4	2250	11.5		5.84	2.2	15.7	85.8	2545	12.8
	5.82	3.2	16.4	80.7	2307	9.3		6.09	3.8	17.6	78.6	2502	10.0
AVG =	5.72	3.0	16.0	81.8	2225	9.6	AVG =	5.83	3.4	16.7	79.7	2474	10.8
STD =	0.125	0.77	0.57	4.47	136.4	1.39	STD =	0.186	0.84	0.80	4.31	160.8	1.38
	5.57	3.8	16.6	76.9	2438	9.0		5.48	3.9	16.4	76.1	2620	9.3
	5.50	3.5	16.0	78.3	2240	8.7		5.58	4.0	16.6	76.1	2590	9.3
	5.76	3.2	16.3	80.4	2301	9.0		5.65	3.6	16.5	78.0	2340	9.8
	5.53	5.0	17.4	71.2	2010	8.2		5.55	5.1	17.5	71.0	2173	8.2
AVG =	5.59	3.9	16.6	76.7	2247	8.7	AVG =	5.57	4.2	16.8	75.3	2431	9.2
STD =	0.117	0.79	0.60	3.94	178.5	0.38	STD =	0.070	0.66	0.51	3.00	212.8	0.68
	5.53	4.0	16.6	75.7	2188	8.3		5.51	4.4	16.9	74.0	2393	9.5
	6.23	3.5	17.7	80.1	2099	9.0		6.00	3.2	16.9	80.9	2475	11.2
	5.78	3.3	16.5	79.8	2227	9.3		5.70	2.9	16.0	81.9	2499	9.2
	5.83	3.6	16.8	78.4	1978	8.7		5.92	3.9	17.4	77.4	2317	8.5
AVG =	5.84	3.6	16.9	78.5	2123	8.8	AVG =	5.78	3.5	16.8	78.6	2421	9.6
STD =	0.290	0.29	0.55	2.01	110.5	0.43	STD =	0.222	0.68	0.58	3.59	82.9	1.15
	5.86	3.6	17.0	78.6	2160	8.3		6.00	3.6	17.2	79.3	2147	8.5
	5.95	3.5	17.0	79.4	2262	9.2		5.69	5.0	17.9	71.8	2203	8.3
	5.10	3.4	15.1	77.6	2486	9.2		5.47	3.0	15.6	81.1	2657	9.5
	5.31	5.5	17.5	68.4	2173	8.2		5.30	5.9	17.8	65.9	2343	8.2
AVG =	5.56	4.0	16.7	76.0	2270	8.7	AVG =	5.62	4.4	17.1	74.8	2338	8.6
STD =	0.415	1.00	1.06	5.12	150.8	0.55	STD =	0.302	1.32	1.06	6.62	228.4	0.60
	5.41	3.7	16.0	77.0	2301	9.0		5.52	4.1	16.6	75.7	2392	9.3
	5.64	3.6	16.5	78.2	2178	10.3		5.69	4.0	16.9	76.5	2183	9.5
	5.43	5.2	17.4	70.2	2125	8.8		5.47	5.1	17.4	70.9	2313	8.2
	5.60	2.5	15.4	84.0	2545	10.3		5.60	2.5	15.4	83.8	2496	9.3
AVG =	5.52	3.8	16.3	77.4	2287	9.6	AVG =	5.57	3.9	16.6	76.7	2346	9.1
STD =	0.117	1.11	0.85	5.66	187.0	0.81	STD =	0.096	1.07	0.85	5.33	132.0	0.59
AVG STD =	0.213	0.79	0.73	4.24	152.6	0.71	AVG STD =	0.175	0.91	0.76	4.57	163.4	0.88
AVG ALL =	5.65	3.6	16.5	78.1	2231	9.1	AVG ALL =	5.67	3.9	16.8	77.0	2402	9.4
STD ALL =	0.250	0.84	0.74	4.45	150.1	0.82	STD ALL =	0.207	0.92	0.72	4.63	161.8	1.12

SUMMARY of MARSHALL RESULTS

Plant: APAC

Mix Type: S-5 W/RECYCLED ASPHALT

HOT

	A.C.	VTM	VMA	VFA	Stab.	Flow
	5.70	4.9	18.1	72.9	2575	9.7
	5.39	4.7	17.2	72.7	2356	10.2
	5.45	4.9	17.5	72.0	2016	9.7
	5.38	5.1	17.4	70.7	2458	9.9
AVG =	5.48	4.9	17.6	72.1	2351	9.9
STD =	0.150	0.16	0.39	0.99	240.7	0.24
	5.73	3.4	16.9	79.9	2782	10.6
	5.45	4.5	17.1	73.7	2315	10.4
	5.73	3.1	16.8	81.5	2702	10.6
	5.73	3.0	16.2	81.5	2637	8.8
AVG =	5.66	3.5	16.8	79.2	2609	10.1
STD =	0.140	0.69	0.39	3.71	204.8	0.87
	5.48	3.8	16.4	76.8	2122	9.1
	5.40	3.1	15.9	80.5	2675	9.0
	5.46	3.4	16.1	78.9	2287	9.4
	5.43	4.5	17.0	73.5	2651	8.0
AVG =	5.44	3.7	16.4	77.4	2434	8.9
STD =	0.035	0.61	0.48	3.02	273.3	0.61
	5.43	5.7	17.9	68.2	2485	8.2
	5.67	3.1	16.3	81.0	2539	8.9
	5.36	4.1	16.5	75.2	2398	8.9
	5.34	4.4	16.7	73.7	2337	8.2
AVG =	5.45	4.3	16.9	74.5	2440	8.6
STD =	0.152	1.07	0.72	5.26	89.8	0.40
	5.45	4.0	16.7	76.0	2203	9.1
	5.43	4.6	17.1	73.1	2468	8.3
	5.68	4.2	17.0	75.3	2446	10.1
	5.33	4.8	16.9	71.6	2067	8.4
AVG =	5.47	4.4	16.9	74.0	2296	9.0
STD =	0.148	0.37	0.17	2.02	194.2	0.83
	5.67	5.0	17.9	72.1	2095	8.3
	5.48	5.5	18.1	69.6	2663	10.6
AVG =	5.58	5.3	18.0	70.9	2379	9.5
STD =	0.134	0.35	0.14	1.77	401.6	1.63
AVG STD =	0.127	0.54	0.38	2.80	234.1	0.76
AVG ALL =	5.51	4.3	17.0	75.0	2422	9.3
STD ALL =	0.142	0.81	0.64	4.00	223.8	0.88

REHEAT

	A.C.	VTM	VMA	VFA	Stab.	Flow
	5.34	5.4	17.8	69.7	3481	11.1
	4.84	6.4	17.5	63.4	2638	8.5
	5.60	6.0	18.8	68.1	2611	10.1
	5.00	5.7	17.0	66.5	3388	10.8
AVG =	5.20	5.9	17.8	66.9	3030	10.1
STD =	0.341	0.43	0.76	2.69	469.3	1.16
	5.31	4.0	16.5	75.8	3086	8.9
	5.33	5.5	17.7	68.9	2805	9.6
	5.61	3.4	16.7	79.6	4256	11.5
	5.45	4.7	17.2	72.7	3004	11.5
AVG =	5.43	4.4	17.0	74.3	3288	10.4
STD =	0.138	0.91	0.54	4.55	656.2	1.33
	5.47	3.2	15.7	79.6	3065	10.0
	5.19	3.1	15.4	79.9	3390	10.0
	5.54	4.3	17.1	74.9	2765	9.4
	5.65	4.6	17.6	73.9	2810	9.9
AVG =	5.46	3.8	16.5	77.1	3008	9.8
STD =	0.196	0.76	1.07	3.12	287.2	0.29
	5.49	5.7	19.4	70.6	3010	10.3
	5.87	4.6	14.1	67.4	4243	9.4
	5.35	3.6	16.0	77.5	2984	9.8
	5.37	5.6	17.9	68.7	3153	8.6
AVG =	5.52	4.9	16.8	71.1	3348	9.5
STD =	0.241	0.98	2.30	4.50	601.6	0.72
	5.38	5.7	18.1	68.5	2496	7.9
	5.10	5.0	16.8	70.2	2743	8.4
	5.25	3.6	15.8	72.2	3262	9.5
	5.41	5.2	17.6	70.5	3025	9.7
AVG =	5.29	4.9	17.1	70.4	2882	8.9
STD =	0.142	0.90	1.00	1.52	333.2	0.87
	5.68	4.7	17.6	73.3	2641	10.1
	5.29	4.5	16.8	73.2	3252	9.6
AVG =	5.49	4.6	17.2	73.3	2947	9.9
STD =	0.276	0.14	0.57	0.07	432.0	0.35
AVG STD =	0.222	0.69	1.04	2.74	463.3	0.79
AVG ALL =	5.39	4.8	17.1	72.1	3096	9.8
STD ALL =	0.233	0.96	1.18	4.50	462.1	0.95

SUMMARY of MARSHALL RESULTS

Plant: APAC

Mix Type: S-10 W/RECYCLED ASPHALT

	HOT							REHEAT					
	A.C.	VTM	VMA	VFA	Stab.	Flow		A.C.	VTM	VMA	VFA	Stab.	Flow
	4.96	3.6	15.3	76.5	2662	8.3		4.60	3.8	14.6	74.0	2789	7.0
	4.94	5.0	16.6	69.9	2341	8.7		4.83	4.9	16.2	69.8	2609	7.8
	5.09	4.8	16.6	71.1	2285	8.8		4.99	5.9	17.4	66.1	3036	11.3
	4.92	5.2	16.7	68.9	2125	8.1		4.89	5.2	16.6	68.7	2973	11.7
AVG =	4.98	4.7	16.3	71.6	2353	8.5	AVG =	4.83	5.0	16.2	69.7	2852	9.5
STD =	0.077	0.72	0.67	3.39	225.3	0.33	STD =	0.165	0.87	1.18	3.29	192.8	2.40
	5.01	3.3	14.5	82.8	2587	8.9		4.54	4.5	15.2	70.4	3093	10.1
	4.85	3.8	15.3	75.2	3072	9.1		4.95	4.1	15.8	74.1	3630	9.2
	4.92	3.8	15.4	75.3	2591	10.8		5.05	4.2	16.2	74.1	3407	10.4
	4.76	3.7	14.9	75.2	2765	9.3		4.97	3.7	15.5	76.1	2877	9.0
AVG =	4.89	3.7	15.0	77.1	2754	9.5	AVG =	4.88	4.1	15.7	73.7	3252	9.7
STD =	0.106	0.24	0.41	3.78	227.8	0.87	STD =	0.229	0.33	0.43	2.38	333.1	0.68
	5.11	5.5	17.5	68.6	2400	9.2		4.76	4.5	15.7	71.3	3527	7.9
	5.16	4.1	16.4	75.0	2515	10.7		4.88	3.6	15.2	76.3	3517	9.7
	5.08	3.2	14.4	83.3	2712	11.0		4.71	4.2	15.4	72.7	3340	9.5
	5.05	3.0	15.0	80.0	3330	10.1		4.78	3.2	14.5	77.9	4177	10.4
AVG =	5.10	4.0	15.8	76.7	2739	10.3	AVG =	4.78	3.9	15.2	74.6	3640	9.4
STD =	0.047	1.14	1.40	6.40	414.4	0.79	STD =	0.071	0.59	0.51	3.07	368.0	1.06
	4.94	3.1	14.5	78.6	3219	11.2		4.65	3.2	14.3	77.6	3312	13.1
	4.87	3.7	15.3	75.8	2918	11.2		4.66	4.0	15.1	73.5	3245	9.2
	4.99	3.7	14.4	79.9	2570	8.8		4.71	3.2	14.4	77.8	3591	11.5
	4.79	3.5	14.9	76.5	2715	9.7		4.71	4.3	15.3	71.9	4167	9.8
AVG =	4.90	3.5	14.8	77.7	2856	10.2	AVG =	4.68	3.7	14.8	75.2	3579	10.9
STD =	0.087	0.28	0.41	1.89	281.2	1.18	STD =	0.032	0.56	0.50	2.96	419.8	1.76
	5.11	4.2	15.4	72.7	2630	8.3		4.64	4.6	15.5	71.0	3073	7.6
	5.04	4.2	16.0	73.8	2835	8.8		4.61	4.1	14.8	72.3	3393	9.6
	5.12	4.1	16.2	74.7	2550	8.7		4.65	4.4	15.5	71.6	3866	8.0
	5.15	3.4	15.7	72.6	2447	8.8		4.93	3.6	15.4	76.6	3512	9.4
AVG =	5.11	4.0	15.8	73.5	2616	8.7	AVG =	4.71	4.2	15.3	72.9	3461	8.7
STD =	0.047	0.39	0.35	0.99	164.4	0.24	STD =	0.149	0.43	0.34	2.54	327.5	1.00
	4.90	3.5	15.2	77.0	2828	8.6		4.84	3.3	14.8	78.4	3788	7.4
	4.90	3.8	15.5	75.5	2457	8.1		4.68	3.7	14.8	75.0	2920	9.8
AVG =	4.90	3.7	15.4	76.3	2643	8.4	AVG =	4.76	3.5	14.8	76.7	3354	8.6
STD =	0.000	0.21	0.21	1.06	262.3	0.35	STD =	0.113	0.28	0.00	2.40	613.8	1.70
AVG STD =	0.061	0.50	0.58	2.92	262.6	0.63	AVG STD =	0.127	0.51	0.49	2.77	375.8	1.43
AVG ALL =	4.98	3.9	15.5	75.4	2662	9.3	AVG ALL =	4.77	4.1	15.4	73.5	3356	9.5
STD ALL =	0.116	0.68	0.85	3.96	293.4	1.03	STD ALL =	0.145	0.68	0.75	3.28	420.0	1.54

SUMMARY of MARSHALL RESULTS

Plant: MEGA

Mix Type: S-5

HOT

	A.C.	VTM	VMA	VFA	Stab.	Flow
	6.02	2.8	16.6	83.0	2311	11.3
	5.84	2.9	16.4	82.0	2201	11.5
	5.78	2.8	16.1	83.0	2314	11.0
	5.75	3.5	16.7	79.0	2179	11.2
AVG=	5.85	3.0	16.5	81.8	2251	11.3
STD=	0.121	0.34	0.26	1.89	71.3	0.21
	6.10	3.2	17.1	82.0	1935	10.2
	6.35	3.7	17.6	82.0	2167	10.5
	6.27	3.4	18.2	81.0	2033	10.3
	6.23	3.6	18.3	80.0	1930	11.2
AVG=	6.24	3.5	17.8	81.3	2016	10.6
STD=	0.104	0.22	0.56	0.96	111.1	0.45
	6.23	3.2	17.1	83.0	2106	10.8
	6.26	3.1	18.1	83.0	2113	10.3
	5.78	3.8	16.7	77.0	2158	11.8
	5.77	2.9	15.8	82.0	2007	10.8
AVG=	6.01	3.3	16.9	81.3	2096	10.9
STD=	0.272	0.39	0.95	2.87	63.7	0.63
	6.18	3.0	16.3	85.0	2402	11.3
	6.19	3.8	17.9	79.0	2121	11.5
	6.23	2.5	15.9	85.0	2316	10.8
	6.04	3.0	15.9	84.0	2181	11.2
AVG=	6.16	3.1	16.5	83.3	2255	11.2
STD=	0.083	0.54	0.95	2.87	127.5	0.29
	5.98	2.5	15.0	86.0	2191	11.5
	6.05	2.7	15.6	86.0	2293	11.0
	6.24	2.2	16.1	87.0	2338	11.3
	6.12	2.2	16.2	87.0	2342	12.5
AVG=	6.10	2.4	15.7	86.5	2291	11.6
STD=	0.111	0.24	0.55	0.58	70.3	0.65
	6.23	2.4	16.8	86.0	2297	11.3
	6.06	2.9	18.1	85.0	2324	12.3
AVG=	6.15	2.7	17.5	85.5	2311	11.8
STD=	0.120	0.35	0.92	0.71	19.1	0.71
AVG STD =	0.135	0.347	0.698	1.647	77.167	0.490
AVG ALL =	6.08	3.0	16.8	83.0	2194	11.2
STD ALL =	0.188	0.49	0.94	2.73	135.6	0.59

REHEAT

	A.C.	VTM	VMA	VFA	Stab.	Flow
	6.08	3.4	17.3	80.0	2086	11.0
	5.89	3.3	16.8	80.0	2332	12.3
	6.04	3.2	16.8	81.0	2030	10.2
	5.94	3.5	17.1	80.0	2122	10.7
AVG=	5.99	3.4	17.0	80.3	2143	11.1
STD=	0.088	0.13	0.24	0.50	131.9	0.90
	6.23	3.5	17.7	80.0	2303	11.0
	6.28	3.7	16.9	81.0	1948	10.5
	6.22	2.9	17.0	83.0	2120	12.2
	6.22	3.4	17.0	82.0	2033	11.8
AVG=	6.24	3.4	17.2	81.5	2101	11.4
STD=	0.029	0.34	0.37	1.29	151.9	0.77
	6.23	3.3	17.1	83.0	2132	11.2
	6.20	3.3	17.6	82.0	2122	10.5
	5.76	3.7	16.6	77.0	2150	11.8
	5.73	3.1	16.1	81.0	2152	12.8
AVG=	5.98	3.4	16.9	80.8	2139	11.6
STD=	0.272	0.25	0.65	2.63	14.5	0.97
	6.15	2.8	17.0	84.0	2489	12.0
	6.28	3.0	16.5	82.0	2376	11.2
	6.20	2.4	16.0	85.0	2512	10.7
	5.92	3.4	16.5	80.0	2222	12.5
AVG=	6.14	2.9	16.5	82.8	2400	11.6
STD=	0.155	0.42	0.41	2.22	132.6	0.80
	5.89	3.1	16.4	81.0	2220	11.5
	5.95	2.9	16.6	82.0	2404	12.0
	6.18	2.9	16.7	84.0	2510	12.0
	6.21	2.5	16.8	85.0	2231	11.5
AVG=	6.06	2.9	16.6	83.0	2341	11.8
STD=	0.161	0.25	0.17	1.83	140.6	0.29
	6.07	2.8	16.7	83.0	2278	11.8
	6.05	3.5	17.4	80.0	2430	12.3
AVG=	6.06	3.2	17.1	81.5	2354	12.1
STD=	0.014	0.49	0.49	2.12	107.5	0.35
AVG STD =	0.120	0.313	0.388	1.765	113.167	0.680
AVG ALL =	6.08	3.2	16.8	81.6	2236	11.5
STD ALL =	0.167	0.36	0.43	1.94	164.8	0.73

SUMMARY of MARSHALL RESULTS

Plant: MEGA

Mix Type: S-10

HOT

	A.C.	VTM	VMA	VFA	Stab.	Flow
	5.25	3.0	15.0	80.0	2319	9.8
	4.72	4.6	15.4	70.0	2480	11.3
	4.88	4.9	16.0	70.0	2191	11.5
	5.33	4.3	16.5	74.0	2152	11.8
AVG =	5.05	4.2	15.7	73.5	2286	11.1
STD =	0.292	0.84	0.66	4.73	148.0	0.89
	5.50	3.1	15.8	80.0	2569	10.2
	5.28	3.1	15.1	80.0	2274	10.7
	5.09	3.9	15.6	75.0	2267	10.5
	5.16	5.2	17.0	69.0	2308	12.0
AVG =	5.26	3.8	15.9	76.0	2355	10.9
STD =	0.180	0.99	0.81	5.23	144.1	0.79
	4.87	5.0	16.2	69.0	2119	9.7
	5.08	4.8	16.4	71.0	2062	10.2
	5.11	4.3	16.1	73.0	2262	10.0
	5.16	4.1	16.0	74.0	2010	10.3
AVG =	5.06	4.6	16.2	71.8	2113	10.1
STD =	0.128	0.42	0.17	2.22	108.7	0.26
	5.14	4.4	16.2	73.0	2222	10.8
	5.30	4.5	16.7	73.0	2330	10.8
	5.29	4.7	16.8	72.0	2160	10.8
	5.18	4.3	16.2	73.0	2223	11.2
AVG =	5.23	4.5	16.5	72.8	2234	10.9
STD =	0.080	0.17	0.32	0.50	70.6	0.20
	5.20	4.4	16.3	73.0	2407	11.2
	5.21	4.0	16.0	75.0	2190	9.7
	5.36	4.4	16.6	73.0	2268	9.8
	5.17	4.1	15.9	74.0	2280	11.0
AVG =	5.24	4.2	16.2	73.8	2286	10.4
STD =	0.085	0.21	0.32	0.96	89.8	0.78
	5.37	4.5	16.7	73.0	2493	11.2
	5.28	4.6	16.6	72.0	2348	10.5
AVG =	5.33	4.6	16.7	72.5	2421	10.9
STD =	0.064	0.07	0.07	0.71	102.5	0.49
AVG STD =	0.139	0.45	0.39	2.39	110.6	0.57
AVG ALL =	5.18	4.3	16.1	73.5	2270	10.7
STD ALL =	0.179	0.59	0.53	3.16	136.7	0.68

REHEAT

	A.C.	VTM	VMA	VFA	Stab.	Flow
	5.29	2.7	14.9	82.0	2441	12.0
	4.70	5.0	15.7	68.0	2208	11.5
	4.86	5.2	16.3	68.0	2297	11.3
	5.42	4.2	16.5	75.0	2568	11.3
AVG =	5.07	4.3	15.9	73.3	2379	11.5
STD =	0.342	1.14	0.72	6.70	158.7	0.33
	5.51	3.3	15.9	79.0	2043	9.3
	5.46	3.6	16.1	77.0	2216	10.2
	4.89	4.7	15.9	71.0	2018	10.7
	5.23	4.9	16.9	71.0	2179	10.5
AVG =	5.27	4.1	16.2	74.5	2114	10.2
STD =	0.283	0.79	0.48	4.12	98.1	0.62
	5.01	4.1	15.6	73.0	2135	10.7
	5.10	4.7	16.4	72.0	2328	10.2
	4.94	4.4	15.8	72.0	2052	10.0
	5.05	4.4	16.1	72.0	2181	9.8
AVG =	5.03	4.4	16.0	72.3	2174	10.2
STD =	0.068	0.24	0.35	0.50	115.7	0.39
	4.86	4.4	15.5	71.0	2452	10.3
	5.10	4.8	16.5	71.0	2348	10.2
	5.14	4.8	16.7	71.0	2545	9.8
	5.30	4.1	16.3	75.0	2091	9.7
AVG =	5.10	4.5	16.3	72.0	2359	10.0
STD =	0.182	0.34	0.53	2.00	196.0	0.29
	5.08	4.5	16.2	72.0	2110	10.5
	5.04	4.2	15.7	73.0	2063	10.7
	5.46	4.5	17.0	73.0	2333	10.7
	5.34	4.7	16.8	72.0	2300	10.5
AVG =	5.23	4.5	16.4	72.5	2202	10.6
STD =	0.203	0.21	0.59	0.58	134.8	0.12
	5.25	4.0	16.1	75.0	2494	11.0
	5.05	4.1	15.7	74.0	2470	10.5
AVG =	5.15	4.1	15.9	74.5	2477	10.8
STD =	0.141	0.07	0.28	0.71	9.9	0.35
AVG STD =	0.203	0.465	0.492	2.435	118.867	0.350
AVG ALL =	5.14	4.3	16.1	73.0	2266	10.5
STD ALL =	0.222	0.58	0.51	3.24	173.4	0.64