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CSA CEMENT TESTING PROGRAMME

PHASE II

by

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MINERAL PROCESSING DIVISION

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N. G. Zoldners* & V. M. Malhotra**

SUMMARY

This report gives the results of Phase II of the Cement Testing Programme sponsored by the Committee on Hydraulic Cements, Canadian Standards Association. The results of tests on 10 samples distributed over a period of 3 years, 1963 - 1965, are reported and analyzed statistcally. The analyses indicate that between-laboratory variation for mortar strength tests appears to be satisfactory, but the physical tests to determine fineness by No. 200 sieve and soundness by the autoclave method may not be suitable for interlaboratory studies. The rather high value of the coefficient of variation for the determination of magnesium oxide indicates that there is room for improvement in the techniques employed.

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INTRODUCTION

The Mines Branch is continuing to act as an impartial center in co-ordinating the cement testing programme originated by the Sub-committee on Physical Requirements and Test Methods of the Committee on Hydraulic Cements, Canadian Standards Association.

The programme was designed in 1960 by the Committee as a means for the cement testing laboratories across Canada to evaluate their testing procedures and techniques.

The first phase of the programme consisted of the distribution over a period of 18 months of a series of identical test samples, prepared from five different cement lots, to 27 participating laboratories. That phase was completed in 1962; the test results and the analysis of the data were reported in Mines Branch report IR 62-102 in December 1962 (1).

This report presents the complete results of Phase II of the testing programme in which 10 samples were distributed over a period of three years (1962-1964) to the participants. The results of both physical and chemical tests were forwarded to the Mines Branch for processing and analyzing. The summary of test results and the preliminary statistical analysis for each test sample have already been reported to each participant.

PARTICIPATING LABORATORIES

The participants in the cement testing programme were the laboratories of every cement plant, 20 across Canada, two laboratories of government corporations, one provincial Department of Highways laboratory, two commercial testing laboratories, one municipal laboratory, and one federal Department of Public Works laboratory - a total of 27 laboratories. A list of the participating laboratories is given in Appendix A of this report. Most of the laboratories tested all the test samples but some laboratories failed to carry out all or some of the tests for any one sample. The maximum and minimum number of participants taking part in any individual test of any of the five samples were 27 and 15, respectively. The number of participants averaged about 23 for any individual test.

Each laboratory was assigned a code number, of which they were informed, but the over-all identification of the laboratories was kept confidential. Thus, each laboratory could evaluate the accuracy of its own results by comparison with those of the other laboratories and the average for all the participants, while still preserving the anonimity of the other participants.

TYPE OF TESTS AND TEST METHODS

Each participating laboratory was asked to carry out the following physical and chemical tests as per instructions issued in November 1963 by N. Argendeli, the then Chairman, Sub-Committee on Co-ordination of Tests, Committee on Hydraulic Cements.

A. Physical Tests (General)

Normal Consistency	(a) Amount of water by weight, in per cent of dry cement. (b) Rod penetration, mm.
Time of Setting	(a) Vicat test, initial and final set, hr and min. (b) Gillmore test, initial and final set, hr and min.
Determination of Fineness	(a) Residue retained on No. 200 sieve, per cent. (b) Air permeability test (Blaine), cm^2 per g.

Soundness Test: Autoclave expansion, per cent.

B. Physical Tests (Mortar Strength)

Tensile Strength at 3, 7, and 28 days, psi.
Compressive Strength at 3, 7, and 28 days, psi.

C. Chemical Analysis

To determine the following chemical constituents, in per cent:

Insoluble residue
Aluminum oxide (Al_2O_3)
Ferric oxide (Fe_2O_3)
Combined oxides (SiO_2, CaO)
Magnesium oxide (MgO)
Sulphur trioxide (SO_3)
Loss on ignition (LOI)

The test methods followed were those of the C.S.A. Standard Specification for Portland Cements A5-1961. The only exception was the Air Permeability Test, for which the ASTM Standard Test Method C204-55 was used.

As the instructions by Mr. Argendeli were not issued until November 1963 samples 6, 7, 8 and 9 were tested exactly in the same fashion as those of phase I.

PREPARATION AND DISTRIBUTION OF TEST SAMPLES

Test samples were prepared and distributed among the participating laboratories every six months starting in October 1962. A total of 10 samples were sent out to the laboratories. For each distribution, a 10-bag sample of cement was obtained from the current production of a cement mill chosen at random from the participating companies. The following cement companies are credited with supplying the required amount of cement free of charge for phase II of the cement testing programme.

1. Canada Cement Company, Limited, Plant No. 1, Montreal, P.Q.
2. Ciment Quebec Inc., St. Basile, P.Q.
3. Lafarge Cement of North America Ltd., Lulu Island, B.C.
4. North Star Cement Limited, Corner Brook, Nfld.
5. St. Mary's Cement Co., Limited, St. Mary's, Ont.

Each 10-bag sample was blended for one hour in a Silex lined 4 x 8 ft drum of a Taylor ball mill and then dumped into a stainless steel tank. The entire lot was then divided by successive riffling operations into 64 individual samples, each weighing about 13 to 15 lb. Two of these samples were split further into a total of 64 smaller portions by riffling, resulting in 75 g samples for chemical analyses.

The larger test samples were packed in plastic bags, which in turn were placed in paper bags. The smaller samples were placed in 2-oz glass bottles. All four samples were packed in a sealed cardboard box and shipped to the participating laboratory, with the instructions regarding the testing programme enclosed. Thus each shipment contained 2 test samples from the same batch of cement.

TEST RESULTS

The test results were forwarded by the participants for processing to this laboratory within three months following the distribution of the sample.

The results are compiled in Tables shown in Appendix B* of this report. For calculation of the statistical analyses, the compressive strength results and tensile strength results were rounded up to the nearest 10 and 5 psi, respectively.

Clerical Errors and Corrections in Original Reports

Several corrections were made in the values originally reported as shown in Table 1. Some of the corrections were requested by the participants, others were typographical and clerical errors. The corrected values were used for the final statistical analyses.

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*In Appendix B: For Samples 6 and 7, refer to Tables 1 to 6
For Samples 8 and 9, refer to Tables 13 to 18
For Samples 10 and 11, refer to Tables 25 to 30
For Samples 12 and 13, refer to Tables 37 to 42
For Samples 14 and 15, refer to Tables 49 to 54

TABLE I

Errors and Corrections in Original Reports

Sample No.	Participant	Type of Test	Reported Value	Corrections, Deletion and Additions
6	T	Fineness retained on 200 mesh	9.9%	Delete
6	D	Tensile strength 28-day	415 psi	410 psi
7	D	Tensile strength		
		3-day	250 psi	Change to 240
		7-day	320 psi	Change to 370
		28-day	415 psi	Change to 460
	D	Calcium oxide	62.39	Change to 62.93
7	T	Fineness retained on 200 mesh	4.3%	Delete
8	T	Autoclave expansion	-0.01	Change to +0.004
8	W	Time of set, Gillmore	Initial-hr:min 5:05	Change to 3:05 hr:min
			Final-hr:min 7:32	Change to 4:50 hr:min
8	Z	Calcium oxide	64.17%	Change to 65.17%
9	H	Compressive strength		
		3-day	1600 psi	Change to 1710 psi
		7-day	3210 psi	Change to 3240 psi
		28-day	6250 psi	Change to 6570 psi
9	H	Normal consistency	26.0%	Change to 25.0%
9	H	Autoclave expansion	0.003%	Change to 0.01%
9	H	Time of set, Vicat	Initial-hr:min 2:38	2:15 hr:min
			Final-hr:min. 4:23	4:20 hr:min
		Time of set, Gillmore	Initial-hr:min 2:37	2:45 hr:min
			Final-hr:min. 4:23	4:20 hr:min
9	-T	Autoclave expansion	-0.01%	Change to +0.004%
9	Z	Calcium oxide	65.17%	Change to 65.11%
12	XX	Rod penetration	10.7mm	10.0mm
12	XX	Time of set, Gillmore	Not reported	Add Initial 2:50 hr:min
				Final 4:55 hr:min

STATISTICAL ANALYSIS OF TEST RESULTS

The test results were analyzed using standard statistical methods. The maximum and minimum values, average, standard deviation and coefficient of variation, which are defined below, were calculated for each set of test results. These calculations for the ten test samples together with the statistical analyses of the average values for the various samples are shown in the Tables in Appendix B*.

Explanation of Statistical Terms

Maximum and Minimum Values

These are the greatest and least values obtained in any of the individual tests.

Average (Arithmetic Mean)

This is the average value of all the results of any individual test, i.e.

$$\bar{X} = \frac{X_a + X_b + X_c + X_d + \text{------} + X_z}{n}$$

where X_a, X_b, X_c ---- X_z are the results for any individual test from the participating laboratories A, B, C and so on, and n is the total number of the laboratories performing this particular test. Thus the average represents the value about which test results have a tendency to centre.

Standard Deviation (of a population)

This is a measure of the spread of observations about the central value. The standard deviation of the population is found by extracting the square root of the average of the squares of deviations of individual test values from their average.

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*In Appendix B: For Samples 6 and 7, refer to Tables 7 to 12
For Samples 8 and 9, refer to Tables 19 to 24
For Samples 10 and 11, refer to Tables 31 to 36
For Samples 12 and 13, refer to Tables 43 to 48
For Samples 14 and 15, refer to Tables 55 to 60

$$\sigma = \sqrt{\frac{(X_1 - \overline{X})^2 + (X_2 - \overline{X})^2 + \text{----} + (X_n - \overline{X})^2}{n}}$$

For ease of computation, when a calculating machine is available standard deviation can be obtained by dividing the sum of the squares of the individual observations by the number of observations, substracting the square of their average and extracting the square root, i e.

$$\sigma = \sqrt{\frac{X_1^2 + X_2^2 + X_3^2 + \text{------} + X_n^2}{n} - (\overline{X})^2}$$

or by re-arranging,

$$\sigma = \sqrt{\frac{\Sigma X^2 - \frac{(\Sigma X)^2}{n}}{n}}$$

Standard Deviation (of a sample)

In computing Standard Deviation of a sample the divisor "n" in the above calculations is replaced by (n-1), i.e.,

$$S = \sqrt{\frac{\Sigma X^2 - \frac{(\Sigma X)^2}{n}}{n-1}}$$

This definition has been used for the analysis under consideration. It is to be noted that the difference due to the use of (n-1) instead of n becomes significant when the number of test results is less than 30, as is the case for this analysis.

Coefficient of Variation

The Coefficient of Variation (C. V.) is simply the Standard Deviation expressed as a percentage of the Arithmetic Mean, i.e.,

$$C.V. = \frac{S}{X} \times 100$$

The main use of this function is to illustrate the degree of dispersion in terms of the mean.

Expected Range

The distribution commonly encountered in materials testing is a bell-shaped curve resembling the theoretical normal frequency curve. The inflection points of the curve occur at values equal to plus and minus the value of one, two and three standard deviations. The percentage of observations which theoretically fall within the above limits are shown below. These limits are sometimes termed "Expected Ranges".

Limits	Percentage of Results Lying Within These Limits
$\bar{X} \pm 1$ Standard Deviation	68.30
$\bar{X} \pm 2$ Standard Deviation	95.46
$\bar{X} \pm 3$ Standard Deviation	99.73

DISCUSSION OF TEST RESULTS

A comparison of the results of this phase of the investigation with those of Phase I (1) reveals no decrease in the coefficient of variation values for the various tests; the over-all trends of the analyses being very similar to those of Phase I. The causes of the variations in results of various tests do not come within the scope of this report and, therefore, will not be discussed. However some detailed comments follow:

Time of Set

The C. V. values for the time-of-set test using Vicat and Gillmore test methods varied between 11.7 and 20.5 per cent (Table II). These values are considered high. The C. V. values for the initial time-of-set test for both methods were consistently lower than those for the final time-of-set test. Furthermore, the C. V. values for the Vicat method are consistently lower than those for the Gillmore method: the average difference being 2.4 per cent for the initial time-of-set test and 2.1 per cent for the final time-of-set test.

Fineness Tests

The analyses show that the Blaine Air Permeability test gives consistently more uniform results than the fineness determination by percentage retained on No. 200 sieve. The C. V. values for the Blaine test vary from 1.4 for samples 6 and 7 to 2,6 for samples 8 and 9, whereas the C. V. values for fineness determination by percentage retained on No 200

sieve vary from 15.4 for samples 14 and 15 to 26.1 for samples 6 and 7 (Table III). This strongly brings out the ineffectiveness of the latter as a means of comparing interlaboratory test results.

Mortar Strength

A comparison of the C.V. values for tensile and compressive strength test results for various samples is given in Table IV. The C.V. values for both tests at 28 days age are less than 8.0 per cent. This shows that at 28-days both tensile and compressive strength test results are equally reproducible. This is rather important since it is generally believed and has often been advocated that the reproducibility of the compressive strength test is superior to that of the tensile strength test.

Chemical Constituents

The C.V. values for silicon dioxide and calcium oxide determinations are consistently uniform and are below 2.5 and 1.0 per cent respectively (Table V). This degree of reproducibility may be considered satisfactory.

The reproducibility of aluminum oxide, ferric oxide and sulphur trioxide test results is relatively poor; the values of C.V. generally vary from a low of 3.0 to a high of 12.3 per cent (Table V).

The reproducibility of magnesium oxide test results is, once again, poor; the C.V. values range from a low of 7.4 for samples 6 and 7 to a high of 21.1 for samples 10 and 11 (Table V).

As expected, insoluble residue and ignition loss test results have extremely poor reproducibility.

Within Laboratory Variation

Two identical test samples from the same cement lot had been distributed to each participating laboratory. In addition to the analysis contained in this report, the purpose of this procedure was to enable each participating laboratory to determine it's own "within laboratory" variation. It is hoped that each laboratory will determine the magnitude of such variation from the test data obtained in this phase of the work

TABLE II

Comparison of Coefficients of Variation for Vicat and Gillmore Time-of-Set Tests

	Coefficients of Variation, per cent				
	Samples 6 and 7	Samples 8 and 9	Samples 10 and 11	Samples 12 and 13	Samples 14 and 15
Vicat					
Initial Time of Set	12.3	12.9	12.4	11.7	15.8
Final Time of Set	12.6	11.9	14.4	11.8	17.7
Gillmore					
Initial Time of Set	13.8	17.6	16.6	11.9	17.1
Final Time of Set	15.1	14.1	17.3	11.8	20.5

Note: Number of laboratories reporting results for various samples varied from 20 to 23.

TABLE III

Comparison of Coefficients of Variation for Determination of Fineness

	Coefficients of Variation, per cent				
	Samples 6 and 7	Samples 8 and 9	Samples 10 and 11	Samples 12 and 13	Samples 14 and 15
Fineness					
Retained on No. 200 Sieve	26.1	21.9	19.3	17.9	15.4
Blaine Air Permeability Method	1.4	2.6	2.0	2.5	1.8

Note: Number of laboratories reporting results for various samples varied from 19 to 24.

TABLE IV

Comparison of Coefficients of Variation in Tests for Tensile and Compressive Strength

	Coefficients of Variation, per cent				
	Samples 6 and 7	Samples 8 and 9	Samples 10 and 11	Samples 12 and 13	Samples 14 and 15
Tensile Strength					
3 - day	10.3	10.9	9.2	7.8	7.7
7 - day	7.9	7.4	6.5	5.3	6.2
28 - day	7.6	6.3	5.3	5.5	5.3
Compressive Strength					
3 - day	7.7	9.7	7.1	5.1	8.0
7 - day	6.3	7.2	5.9	4.2	6.8
28 - day	4.9	5.1	6.3	5.5	6.5

Note: Number of laboratories reporting results for various samples varied from 19 to 24.

TABLE V

Comparison of Coefficients of Variation in Determinations of Chemical Constituents

Chemical Constituents	Coefficients of Variation, per cent				
	Samples 6 and 7	Samples 8 and 9	Samples 10 and 11	Samples 12 and 13	Samples 14 and 15
Insoluble residue	34.2	26.2	21.0	52.4	39.5
Silicon dioxide (SiO_2)	1.1	2.3	1.2	0.9	0.9
Aluminum oxide (Al_2O_3)	4.0	4.3	9.1	12.3	4.2
Ferric oxide (Fe_2O_3)	4.7	6.1	4.3	2.3	1.8
Calcium oxide (CaO_2)	0.4	0.7	0.4	0.6	0.4
Magnesium oxide (MgO)	7.4	14.7	21.1	8.4	9.9
Sulphur trioxide (SO_3)	4.5	3.2	4.3	3.0	5.2
Ignition loss	6.0	18.7	14.1	13.0	7.6

Note: Number of laboratories reporting results for various samples varied from 19 to 24; for combined oxide analysis this number varied from 7 to 9.

CONCLUSIONS

1. The reproducibility of the results of the various test methods reported in this phase of the investigation is of the same order as that obtained during the first phase of the test programme.

2. The abnormally high C.V. values for the determination of fineness by percentage retained on No. 200 sieve and cement soundness by the autoclave expansion method indicate that these test methods may not be satisfactory for interlaboratory studies.

3. The 28-day mortar strength test results show that both compressive and tensile strength test methods give the same degree of reproducibility.

4. The high C.V. values for the magnesium oxide determination indicate that improvement in techniques may be needed.

REFERENCES

1 N. G. Zoldners and V. M. Malhotra, "CSA Cement Testing Programme - Phase 1", Mines Branch Investigation Report IR 62-102, December 1962.

VMM:NGZ:rlm

APPENDIX A

Participating Laboratories and Organizations

Testing Laboratory/Organization	Location
Newfoundland	
North Star Cement Limited	Corner Brook
New Brunswick	
Canada Cement Company, Limited, Plant No. 2	Havelock
Quebec	
Canada Cement Company, Limited, Plant No. 1	Montreal
Canada Cement Company, Limited, Plant No. 3	Hull
Ciment Quebec Inc.	St. Basile
City of Montreal	Montreal
Miron Company Ltd.	St. Michel
St. Lawrence Cement Company	Villeneuve
Warnock Hersey Company Ltd.	Montreal
Ontario	
Canada Cement Company, Limited, Plant No. 4	Woodstock
Canada Cement Company, Limited, Plant No. 5	Belleville
Canada Cement Company, Limited, Plant No. 8	Port Colborne
Department of Public Works	Ottawa
Hydro-Electric Power Commission of Ontario	Toronto
Lake Ontario Portland Cement Limited	Picton
Ontario Department of Highways	Toronto
St. Lawrence Cement Company	Clarkson
St. Mary's Cement Co. Limited	St. Mary's
Manitoba	
Canada Cement Company, Limited, Plant No. 13	Fort Whyte
National Testing Laboratories Limited	Winnipeg
Saskatchewan	
Department of Agriculture	Saskatoon
Inland Cement Industries Limited	Regina
Alberta	
Canada Cement Company, Limited, Plant No. 11	Edmonton
Canada Cement Company, Limited, Plant No. 12	Exshaw
Inland Cement Industries Limited	Edmonton
British Columbia	
Ocean Cement Limited	Bamberton
Lafarge Cement of North America Ltd.	Lulu Island

APPENDIX B

Compilation of Test Results

TABLES

TABLE 1

Physical Tests - General

Test Sample No. 6

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	23.0	10.0	2:25	4:30	2:05	4:25	5.3	3150	0.54
B	26.5	11.0	-	-	3:15	5:40	7.1	3260	0.56
C	-	-	-	-	-	-	-	-	-
D	25.2	11.0	2:50	4:00	3:00	4:10	5.2	3100	0.40
E	23.0	9.0	2:05	4:10	2:10	4:10	4.8	3170	0.43
F	26.0	9.0	2:50	4:40	3:05	4:50	11.2	3230	0.56
G	25.0	10.0	2:45	4:50	2:40	4:55	5.4	3210	0.52
H	26.0	9.0	2:30	4:30	2:40	4:45	3.9	3262	0.50
I	-	-	-	-	-	-	-	-	-
J	24.5	10.0	2:15	3:00	2:00	3:10	6.4	3160	0.39
K	23.8	9.5	2:20	4:10	2:15	4:10	5.6	3220	0.39
L	25.8	-	-	-	-	-	-	3123	0.50
M	23.3	10.0	2:10	4:00	2:15	4:00	5.1	3200	0.51
N	23.5	10.0	2:00	3:55	2:05	4:00	5.4	3220	0.53
O	23.4	10.5	2:25	4:45	3:05	5:50	4.8	3150	0.39
P	23.5	10.0	2:10	4:10	2:10	4:10	5.3	3240	0.47
Q	26.4	9.0	2:45	4:40	2:55	4:55	9.2	3269	0.50
R	23.0	-	2:00	4:00	2:15	4:15	4.8	3190	0.39
S	24.5	10.0	2:40	4:10	3:10	4:45	5.5	3180	0.47
T	25.0	-	2:47	4:25	2:45	4:20	-	3165	0.31
U	26.0	11.0	2:50	4:45	2:50	4:45	5.8	3170	0.51
V	25.6	11.0	2:25	3:05	2:10	-	5.0	3088	0.26
W	24.5	9.0	2:50	4:20	2:40	4:10	5.6	3243	0.49
X	24.0	9.0	2:25	4:05	2:25	4:05	7.0	3219	0.40
Y	25.2	9.0	3:00	4:50	3:10	5:00	-	3227	0.49
Z	24.8	10.0	2:25	5:35	2:40	5:50	9.1	3218	0.69

*W/C = Water-Cement Ratio.

TABLE 2

Physical Tests - Mortar Strength

Test Sample No. 6

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	375	380	470	2280	3230	4500	47.3
B	295	410	530	2025	3300	4900	-
C	-	-	-	-	-	-	-
D	250	320	410	2470	3570	4470	-
E	355	420	505	2470	3470	4680	49.0
F	280	350	430	2255	3190	4310	48.0
G	365	415	490	2180	3350	4610	46.6
H	-	-	-	2370	3550	5050	51.0
I	-	-	-	-	-	-	-
J	395	487	555	2700	3860	4880	-
K	365	420	495	2190	3180	4440	49.0
L	335	435	460	2177	3225	4800	50.7
M	345	395	490	2400	3500	4570	-
N	350	425	510	2240	3160	4510	47.5
O	-	-	-	2350	3440	4675	47.3
P	380	455	540	2400	3300	4790	-
Q	298	387	469	2125	3083	4167	47.0
R	370	420	460	1990	3100	4670	52.0
S	304	393	467	2303	3275	4694	47.5
T	310	385	470	2100	3180	4390	48.0
U	330	420	495	2260	3250	4570	47.5
V	374	446	528	2242	3417	4760	53.5
W	320	400	428	1975	2790	4525	48.7
X	299	387	395	2243	3243	4541	48.5
Y	348	414	471	2436	3363	4633	-
Z	270	400	470	2510	3530	5010	48.0

TABLE 3

Chemical Analysis

Test Sample No. 6

Participant	Chemical Analysis							
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %
A	0.15	21.24	5.54	2.56	62.78	4.00	2.09	1.28
B	0.10	21.40	5.05	2.50	62.60	3.60	2.25	1.25
C	-	-	-	-	-	-	-	-
D	0.06	20.96	5.08	2.52	63.08	3.76	2.13	1.38
E	0.13	21.24	5.20	2.50	62.73	3.70	2.26	1.27
F	0.08	-	5.08	2.52	-	3.85	2.20	1.30
G	0.12	21.22	5.17	2.51	62.64	3.80	2.28	1.33
H	-	-	-	-	-	-	-	-
I	-	-	-	-	-	-	-	-
J	0.13	-	5.41	2.54	-	3.73	2.36	1.21
K	0.17	21.10	5.20	2.54	62.72	3.65	2.31	1.30
L	0.21	21.31	4.78	2.67	62.68	4.01	2.25	1.15
M	0.13	21.16	5.24	2.56	62.75	3.62	2.31	1.45
N	0.15	21.22	5.23	2.55	62.60	3.87	2.88	1.30
O	0.24	21.02	5.17	2.51	62.52	3.72	2.25	1.28
P	0.19	21.40	5.26	2.62	62.83	4.01	2.22	1.32
Q	0.08	21.24	5.44	2.49	62.64	3.62	2.25	1.40
R	0.08	21.12	5.28	2.46	62.36	3.68	2.25	1.26
S	0.14	21.30	5.19	2.50	62.49	3.86	2.30	1.33
T	0.23	21.12	5.30	2.65	62.83	3.60	2.31	1.45
U	0.16	21.10	5.37	2.50	62.53	3.65	2.20	1.30
V	0.30	20.28	5.71	2.02	63.45	3.85	2.20	1.35
W	0.17	21.45	5.61	2.51	63.26	2.65	2.29	1.27
X	0.28	21.26	5.28	2.56	62.71	3.77	2.11	1.25
Y	0.10	20.80	5.56	2.48	62.82	3.38	2.33	1.29
Z	0.10	21.16	5.45	2.55	62.88	3.56	2.55	1.26

TABLE 4

Physical Tests - General

Test Sample No. 7

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	23.0	10.0	2:10	4:20	2:15	4:20	5.20	3140	0.52
B	25.5	10.0	-	-	2:45	4:50	5.40	3250	0.52
C	-	-	-	-	-	-	-	-	-
D	25.2	10.0	2:45	3:40	2:45	4:00	5.20	3170	0.36
E	23.0	10.0	2:05	4:10	2:10	4:10	5.0	3180	0.43
F	25.0	11.0	2:45	4:30	2:45	4:20	10.2	3250	0.55
G	25.0	10.0	2:50	5:00	2:40	4:55	5.4	3200	0.55
H	26.0	10.0	2:25	4:20	2:40	4:40	5.4	3285	0.49
I	-	-	-	-	-	-	-	-	-
J	24.5	10.0	2:15	3:00	2:00	3:10	6.4	3160	0.39
K	23.8	9.5	2:20	4:15	2:20	4:10	5.6	3210	0.44
L	24.6	-	-	-	-	-	-	3167	0.50
M	23.3	11.0	2:05	4:00	2:10	4:00	4.9	3190	0.51
N	23.5	10.0	2:00	3:50	2:00	3:55	5.4	3200	0.53
O	23.6	10.0	2:15	4:30	2:50	5:55	5.0	3170	0.38
P	23.5	10.0	2:10	4:05	2:10	4:05	5.4	3240	0.45
Q	26.0	10.0	2:45	4:45	2:45	4:50	7.1	3253	0.46
R	23.0	10.0	2:00	4:15	2:20	4:15	5.0	3220	0.39
S	24.5	9.0	2:35	4:10	3:18	4:53	5.1	3180	0.48
T	25.5	-	2:55	4:35	2:35	4:15	-	3210	0.30
U	26.0	11.0	2:55	4:50	2:55	4:50	5.9	3200	0.53
V	25.0	11.0	2:30	3:20	2:10	3:00	6.0	3210	0.35
W	24.5	9.0	2:50	4:20	2:40	4:10	5.4	3285	0.49
X	24.0	9.0	2:20	3:55	2:20	3:55	7.6	3239	0.35
Y	25.0	9.0	2:45	4:10	3:00	5:05	-	3241	0.49
Z	24.8	10 0	2:20	5:25	2:40	5:45	9.6	3218	0.63

*W/C = Water-Cement Ratio.

TABLE 5

Physical Tests - Mortar Strength

Test Sample No. 7

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	350	415	490	2240	3320	4700	47.3
B	330	455	530	2135	3435	5075	-
C	-	-	-	-	-	-	-
D	240	370	460	2470	3570	4470	-
E	345	425	495	2430	3420	4630	49.5
F	305	375	455	2170	3120	4155	48.0
G	335	415	480	2220	3390	4390	46.6
H	-	-	-	2280	3590	4880	52.0
I	-	-	-	-	-	-	-
J	395	487	555	2700	3860	4880	-
K	350	420	505	2170	3200	4470	49.5
L	320	470	505	2180	3317	4675	-
M	350	390	485	2350	3450	4580	-
N	340	435	515	2290	3250	4550	47.5
O	-	-	-	2383	3350	4650	46.6
P	380	455	555	2350	3390	4830	-
Q	300	348	453	2163	3058	4025	47.0
R	360	420	470	1950	3100	4750	52.0
S	326	411	482	2312	3229	4672	48.0
T	310	400	475	2180	3230	4500	48.0
U	320	410	485	2290	3260	4470	47.5
V	303	412	471	2177	3450	5152	54.2
W	318	422	450	1890	2810	4325	48.7
X	303	375	396	2278	3241	4396	49.0
Y	340	411	483	2515	3519	4708	49.0
Z	320	370	460	2540	3520	4810	48.0

TABLE 6

Chemical Analysis

Test Sample No. 7

Participant	Chemical Analysis							
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %
A	0.18	21.14	5.5	2.56	62.69	4.09	2.23	1.37
B	0.15	21.35	5.05	2.50	62.55	3.60	2.25	1.25
C	-	-	-	-	-	-	-	-
D	0.26	21.28	5.40	2.52	62.93	3.76	2.23	1.56
E	0.11	21.40	5.06	2.52	62.65	3.62	2.30	1.28
F	0.08	-	5.10	2.52	-	3.88	2.20	1.43
G	0.12	21.22	5.17	2.49	62.72	3.79	2.31	1.20
H	-	-	-	-	-	-	-	-
I	-	-	-	-	-	-	-	-
J	0.13	-	5.41	2.54	-	3.73	2.36	1.21
K	0.17	21.10	5.20	2.54	62.78	3.67	2.31	1.27
L	0.20	21.32	4.78	2.65	62.66	4.03	2.25	1.13
M	0.12	21.15	5.20	2.58	62.79	3.63	2.31	1.42
N	0.14	21.22	5.22	2.56	62.70	3.81	2.30	1.26
O	0.19	20.95	5.19	2.49	62.47	3.71	2.26	1.34
P	0.25	21.36	5.10	2.62	62.71	3.96	2.25	1.26
Q	0.10	21.23	5.41	2.51	62.64	3.63	2.24	1.34
R	0.10	21.12	5.28	2.48	62.47	3.68	2.26	1.25
S	0.15	21.29	5.17	2.48	62.53	3.91	2.30	1.42
T	0.24	21.12	5.30	2.62	62.03	3.59	2.30	1.31
U	0.16	21.10	5.36	2.48	62.59	3.64	2.27	1.30
V	0.26	20.26	5.87	2.03	63.38	3.70	2.27	1.40
W	0.16	21.40	5.47	2.51	63.22	2.65	2.27	1.23
X	0.22	21.21	5.30	2.54	62.70	3.63	2.30	1.42
Y	0.20	20.84	5.60	2.48	62.86	3.40	2.33	1.10
Z	0.12	21.14	5.47	2.55	62.88	3.56	2.58	1.20

TABLE 7

Physical Tests - General

Average of Test Results of Samples 6 & 7

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	23.0	10.0	2:17	4:25	2:10	4:22	5.2	3145	0.53
B	26.0	10.5	-	-	3:00	4:37	6.2	3255	0.54
C	-	-	-	-	-	-	-	-	-
D	25.2	10.5	2:47	3:50	2:52	4:05	5.2	3135	0.38
E	23.0	9.5	2:05	4:10	2:10	4:10	4.9	3175	0.43
F	25.5	10.0	2:47	4:35	2:55	4:35	10.7	3240	0.55
G	25.0	10.0	2:47	4:55	2:40	4:55	5.4	3205	0.53
H	26.0	9.5	2:27	4:25	2:40	4:42	4.6	3273	0.49
I	-	-	-	-	-	-	-	-	-
J	24.5	10.0	2:15	3:00	2:00	3:10	6.4	3160	0.39
K	23.8	9.5	2:20	4:10	2:17	4:10	5.6	3215	0.41
L	25.2	-	-	-	-	-	-	3145	0.50
M	23.3	10.5	2:07	4:00	2:12	4:00	5.0	3195	0.51
N	23.5	10.0	2:00	3:52	2:02	3:57	5.4	3210	0.53
O	23.5	10.2	2:20	4:37	2:57	5:52	4.9	3160	0.38
P	23.5	10.0	2:10	4:07	2:10	4:07	5.3	3240	0.46
Q	26.2	9.5	2:45	4:42	2:50	4:52	8.1	3261	0.48
R	23.0	10.0	2:00	4:07	2:17	4:15	4.9	3205	0.39
S	24.5	9.5	2:37	4:10	2:14	4:49	5.3	3180	0.47
T	25.2	-	2:51	4:30	2:40	4:17	-	3187	0.30
U	26.0	11.0	2:52	4:47	2:52	4:47	5.8	3185	0.52
V	25.3	11.0	2:27	3:12	2:10	3:00	5.5	3099	0.30
W	24.5	9.0	2:50	4:20	2:40	4:10	5.5	3264	0.49
X	24.0	9.0	2:22	4:00	2:22	4:00	7.3	3229	0.37
Y	25.1	9.0	2:52	4:30	3:05	5:02	-	3234	0.49
Z	24.8	10.0	2:22	5:30	2:40	5:47	9.3	3218	0.66

*W/C = Water-Cement Ratio.

TABLE 8

Physical Tests - Mortar Strength

Average of Test Results of Samples 6 & 7

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	360	395	480	2260	3275	4600	47.3
B	310	430	530	2080	3365	4985	-
C	-	-	-	-	-	-	-
D	245	345	435	2470	3570	4470	-
E	350	420	500	2450	3445	4655	49.2
F	290	360	440	2210	3155	4230	48.0
G	350	415	485	2200	3370	4500	46.6
H	-	-	-	2325	3570	4965	51.5
I	-	-	-	-	-	-	-
J	395	485	555	2700	3860	4880	-
K	360	420	500	2180	3190	4455	49.2
L	325	450	480	2180	3270	4735	50.7
M	345	390	485	2375	3475	4575	-
N	345	430	510	2265	3205	4530	47.5
O	-	-	-	2365	3395	4660	46.9
P	380	455	545	2375	3345	4810	-
Q	300	365	460	2145	3070	4095	47.0
R	365	420	465	1970	3100	4710	52.0
S	315	400	475	2305	3250	4685	47.7
T	310	390	470	2140	3205	4445	48.0
U	325	415	490	2275	3255	4520	47.5
V	340	430	500	2210	3435	4960	53.8
W	320	410	440	1930	2800	4425	48.7
X	300	380	395	2260	3240	4470	48.7
Y	345	410	475	2475	3440	4670	49.0
Z	295	385	465	2525	3525	4910	48.0

TABLE 9

Chemical Analysis

Average of Test Results of Samples 6 & 7

Participant	Chemical Analysis							
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %
A	0.16	21.19	5.52	2.56	62.73	4.04	2.16	1.32
B	0.12	21.37	5.05	2.50	62.57	3.60	2.25	1.25
C	-	-	-	-	-	-	-	-
D	0.13	21.12	5.24	2.52	63.00	3.76	2.18	1.47
E	0.12	21.32	5.13	2.51	62.69	3 66	2.28	1.27
F	0.08	-	5.09	2.52	-	3.86	2.20	1.36
G	0.12	21.22	5.17	2.50	62.68	3.79	2.29	1.26
H	-	-	-	-	-	-	-	-
I	-	-	-	-	-	-	-	-
J	0.13	-	5.41	2.54	-	3.73	2.36	1.21
K	0.17	21.10	5.20	2.54	62.75	3.66	2.31	1.28
L	0.20	21.31	4.78	2.66	62.67	4.02	2.25	1.14
M	0.12	21.15	5.22	2.57	62.77	3.62	2.31	1.43
N	0.14	21.22	5.22	2.55	62.65	3.84	2.59	1.28
O	0.21	20.98	5.18	2.50	62.50	3.71	2.25	1.31
P	0.22	21.38	5.18	2.62	62.77	3.98	2.23	1.29
Q	0.09	21.23	5.42	2.50	62.64	3.62	2.24	1.37
R	0.09	21.12	5.28	2.47	62.41	3.68	2.25	1.25
S	0.14	21.29	5.18	2.49	62.51	3.88	2.30	1.37
T	0.23	21.12	5.30	2.63	62.43	3.59	2.30	1.38
U	0.16	21.10	5.36	2.49	62.56	3.64	2.23	1.30
V	0.28	20.27	5.79	2.02	63.41	3.77	2.23	1.37
W	0.16	21.42	5.54	2.51	63.24	2.65	2.28	1.25
X	0.25	21.23	5.29	2.55	62.70	3.70	2.20	1.33
Y	0.15	20.82	5.58	2.48	62.84	3.39	2.33	1.19
Z	0.11	21.15	5.46	2.55	62.88	3.56	2.56	1.23

TABLE 10

Summary of Statistical Analyses of Test Results — Sample No. 6

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C. V.**
Physical Tests - General							
Normal Consistency - water/cem.	24	%	26.5	23.0	24.6	1.15	4.7
Normal Consistency - Rod Penetr.	21	mm	11.0	9.0	9.8	0.74	7.5
Vicat - Initial Time of Set	22	hr:min	3:00	2:00	2:30	0:18	12.2
- Final Time of Set	22	hr:min	5:35	3:00	4:18	0:34	13.1
Gillmore - Initial Time of Set	23	hr:min	3:15	2:00	2:36	0:25	15.9
- Final Time of Set	22	hr:min	5:50	3:10	4:34	0:39	14.2
Fineness - Retained on No. 200M	22	%	11.2	3.9	6.07	1.77	29.1
Fineness - Blaine	24	cm^2/g	3269	3088	3194	49.63	1.5
Soundness - Autoclave Expansion	24	%	0.69	0.26	0.47	0.09	19.4
Physical Tests - Mortar Strength							
Tensile Strength, 3-day--	22	psi	395	250	330	40	11.9
7-day--	22	psi	487	320	405	35	8.5
28-day--	22	psi	555	395	480	40	8.4
Compressive Strength, 3-day--	24	psi	2700	1975	2280	175	7.7
7-day--	24	psi	3860	2790	3315	212	6.4
28-day--	24	psi	5050	4167	4630	212	4.6
Water Content ----------	18	%	53.5	46.6	48.7	1.9	3.9
Chemical Analysis							
Insoluble residue ----------	23	%	0.30	0.06	0.15	0.06	42.6
Silicon dioxide (SiO_2) -------	21	%	21.45	20.28	21.14	0.25	1.2
Aluminum oxide (Al_2O_3) ------	23	%	5.71	4.78	5.3	0.21	3.9
Ferric oxide (Fe_2O_3) -----	23	%	2.67	2.02	2.5	0.12	4.7
Calcium oxide (CaO) -------	21	%	63.45	62.36	62.70	0.25	0.4
Magnesium oxide (MgO) ------	23	%	4.01	2.65	3.7	0.30	7.4
Sulphur trioxide (SO_3) -------	23	%	2.88	2.09	2.3	0.16	7.0
Loss on Ignition (LOI) -------	23	%	1.45	1.15	1.3	0.07	5.36

* Number of laboratories reporting.

** Coefficient of Variation, per cent.

TABLE 11

Summary of Statistical Analyses of Test Results — Sample No. 7

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C.V.**
Physical Tests - General							
Normal Consistency - water/cem.	24	%	26.0	23.0	24.5	0.98	4.0
Normal Consistency - Rod Penetr.	22	mm	11.0	9.0	9.98	0.63	6.3
Vicat - Initial Time of Set	22	hr:min	2:55	2:00	2:27	0:19	12.8
- Final Time of Set	22	hr:min	5:25	3:00	4:15	0:32	12.5
Gillmore - Initial Time of Set	23	hr:min	3:18	2:00	2:32	0:21	13.6
- Final Time of Set	23	hr:min	5:55	3:00	4:25	0:41	15.5
Fineness - Retained on No. 200M	22	%	10.2	4.9	6.01	1.47	24.4
Fineness - Blaine	24	cm^2/g	3285	3140	3211	38.48	1.2
Soundness - Autoclave Expansion	24	%	0.63	0.30	0.46	0.08	18.6
Physical Tests - Mortar Strength							
Tensile Strength, 3-day--	22	psi	395	250	330	30	9.2
7-day--	22	psi	485	320	415	34	8.3
28-day--	22	psi	555	396	485	35	7.3
Compressive Strength, 3-day--	24	psi	2700	1890	2280	179	7.8
7-day--	24	psi	3860	2810	3340	212	6.3
28-day--	24	psi	5150	4025	4620	263	5.7
Water Content ----------	18	%	54.2	47.0	48.8	2.1	4.2
Chemical Analysis							
Insoluble residue ----------	23	%	0.26	0.08	0.16	0.05	32.6
Silicon dioxide (SiO_2) -------	21	%	21.40	20.26	21.15	0.25	1.2
Aluminum oxide (Al_2O_3) ------	23	%	5.87	4.78	5.29	0.22	4.2
Ferric oxide (Fe_2O_3) -----	23	%	2.65	2.03	2.51	0.11	4.6
Calcium oxide (CaO) -------	21	%	63.38	62.03	62.69	0.27	0.4
Magnesium oxide (MgO) ------	23	%	4.09	2.65	3.68	0.27	7.5
Sulphur trioxide (SO_3) -------	23	%	2.58	2.20	2.30	0.07	3.2
Loss on Ignition (LOI) -------	23	%	1.56	1.10	1.30	0.11	8.3

* Number of laboratories reporting.

** Coefficient of Variation, per cent.

TABLE 12

Summary of Statistical Analyses of Test Results — Samples 6 & 7

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C. V. **
Physical Tests - General							
Normal Consistency - water/cem.	24	%	26.2	23.0	24.6	1.05	4.3
Normal Consistency - Rod Penetr.	22	mm	11.0	9.0	9.9	0.57	5.8
Vicat - Initial Time of Set	22	hr:min	2:52	2:00	2:28	0:18	12.3
- Final Time of Set	22	hr:min	5:30	3:00	4:16	0:32	12.6
Gillmore - Initial Time of Set	23	hr:min	3:05	2:00	2:31	0:21	13.8
- Final Time of Set	23	hr:min	5:52	3:00	4:25	0:40	15.1
Fineness - Retained on No. 200M	21	%	10.7	4.6	6.0	1.57	26.1
Fineness - Blaine	24	cm^2/g	3273	3099	3200	45	1.4
Soundness - Autoclave Expansion	24	%	0.66	0.30	0.46	0.08	18.3
Physical Tests - Mortar Strength							
Tensile Strength, 3-day--	22	psi	395	245	330	34	10.3
7-day--	22	psi	485	345	410	33	7.9
28-day--	22	psi	555	395	480	37	7.6
Compressive Strength, 3-day--	24	psi	2700	1930	2280	175	7.7
7-day--	24	psi	3860	2800	3325	209	6.3
28-day--	24	psi	4985	4095	4620	227	4.9
Water Content ----------	19	%	53.8	46.6	48.8	1.93	3.9
Chemical Analysis							
Insoluble residue ----------	23	%	0.28	0.08	0.16	0.05	34.3
Silicon dioxide (SiO_2) -------	21	%	21.42	20.27	21.15	0.24	1.1
Aluminum oxide (Al_2O_3) ------	23	%	5.79	4.78	5.29	0.21	4.0
Ferric oxide (Fe_2O_3) -----	23	%	2.66	2.02	2.51	0.12	4.7
Calcium oxide (CaO) -------	21	%	63.41	62.41	62.73	0.25	0.4
Magnesium oxide (MgO) ------	23	%	4.04	2.65	3.68	0.27	7.4
Sulphur trioxide (SO_3) -------	23	%	2.59	2.16	2.29	0.10	4.5
Loss on Ignition (LOI) -------	23	%	1.47	1.14	1.30	0.08	6.0

* Number of laboratories reporting.

** Coefficient of Variation, per cent.

TABLE 13

Physical Tests - General

Test Sample No. 8

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	24.0	9.0	2:30	4:20	2:25	4:40	2.6	3050	0.00
B	25.0	-	-	-	3:00	5:10	2.7	-	0.02
C	-	-	-	-	-	-	-	-	-
D	25.0	10.0	3:35	4:25	3:30	4:40	4.2	2933	0.01
E	24.0	9.0	2:30	4:30	2:30	4:30	2.5	2970	0.00
F	24.0	11.0	2:35	4:35	2:45	4:40	4.4	3050	0.022
G	24.0	10.0	2:40	4:30	2:35	4:25	2.5	3010	0.004
H	26.0	10.0	2:38	4:23	2:37	4:23	1.8	3006	0.003
I	-	-	3:00	4:30	2:50	4:15	2.5	-	0.01
J	25.0	11.0	-	-	2:40	4:25	3.0	2950	0.19
K	24.0	11.0	2:35	4:30	2:40	4:30	4.3	2980	0.01
L	24.8	-	-	-	-	-	-	2909	0.02
M	24.2	10.0	2:35	4:45	2:45	4:45	2.8	2990	0.01
N	24.5	9.0	3:00	4:55	3:10	5:10	2.8	-	0.01
O	24.0	10.0	2:50	5:40	3:20	6:00	2.4	3110	0.017
P	24.5	9.0	2:25	4:30	2:40	4:50	2.8	2950	0.004
Q	-	-	-	-	-	-	-	-	-
R	24.5	10.0	2:00	4:20	2:00	4:30	2.5	2980	0.01
S	24.0	10.0	3:05	5:00	3:30	5:25	2.6	2929	0.01
T	25.0	-	3:13	5:35	3:00	5:20	2.6	3126	+0.004
U	24.0	10.0	2:45	4:25	2:45	4:25	2.6	2970	0.01
V	24.0	10.0	3:00	3:55	2:50	4:05	4.0	3035	0.00
W	24.0	11 0	3:00	4:45	3:05	4:50	3.0	3039	0.01
X	24.2	11.0	2:30	4:35	2:30	4:35	3.5	28.62	0.02
Y	23.4	-	3:00	4:50	3:55	5:40	-	3125	0.001
Z	25.0	10.0	3:10	6:25	3:35	6:40	3.5	3049	0.02

*W/C = Water-Cement Ratio.

TABLE 14

Physical Tests - Mortar Strength

Test Sample No. 8

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	325	425	535	2010	3390	5580	49.3
B	290	390	445	2385	3910	6150	-
C	-	-	-	-	-	-	-
D	220	300	456	2470	3470	5600	48.5
E	335	420	495	2300	3790	5780	46.5
F	285	360	470	2105	3465	5240	47.3
G	385	430	500	2510	4060	5900	46.6
H	-	-	-	1600	3210	6250	52.0
I	350	445	505	2025	3600	5800	-
J	327	363	587	2300	4000	6200	-
K	300	420	490	2120	3570	5760	49.0
L	303	392	503	2122	3483	5325	50.7
M	305	405	505	2240	3780	5630	48.5
N	335	440	555	2180	3690	5900	47.0
O	-	-	-	2150	3558	5333	46.0
P	335	425	535	2360	3830	5610	-
Q	-	-	-	-	-	-	-
R	355	420	465	2720	4060	6130	49.0
S	320	460	540	2166	3481	5356	46.0
T	-	-	-	2080	3480	5240	48.0
U	285	375	490	2170	3430	5400	47.0
V	330	423	517	2275	4107	5970	-
W	305	385	488	2008	3325	5475	-
X	249	374	445	2484	4134	6245	-
Y	330	420	507	2219	3650	5825	-
Z	310	410	540	2160	3730	5480	48.0

TABLE 15

Chemical Analysis

Test Sample No. 8

Participant	Chemical Analysis							
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %
A	0.24	22.82	4.75	2.47	65.45	1.74	1.47	0.79
B	0.20	22.80	4.45	2.45	65.30	1.80	1.60	0.75
C	-	-	-	-	-	-	-	-
D	0.26	22.72	4.92	2.36	65.52	1.95	1.54	0.68
E	0.19	22.80	4.68	2.34	65.52	1.92	1.64	0.66
F	0.39	-	5.12	2.37	-	1.92	1.62	0.84
G	0.21	22.90	4.75	2.37	65.15	1.90	1 61	0.69
H	-	-	-	-	-	-	-	-
I	0.21	20.30	4.18	2.58	67.58	2.08	1.72	1.00
J	0.30	-	4.42	2.38	-	1.82	1.66	0.79
K	0.23	22.46	4.72	2.40	65.24	2.12	1.55	1.19
L	-	22.65	4.56	2.46	64 95	2.10	1.70	0 91
M	0.21	22.72	4.82	2.40	64.94	2.02	1.61	0.79
N	0.30	22.62	4.76	2.38	65.17	1.84	1 68	0.98
O	0.17	22.55	4.51	2.31	65.05	1.79	1.70	0.84
P	0.24	22.74	4.77	2.39	65.33	1.96	1.57	0.72
Q	-	-	-	-	-	-	-	-
R	0.22	22.74	4.82	2.30	65.32	1.92	1.62	0.70
S	0.24	22.78	4.61	2.37	65.32	1.79	1.67	0.75
T	0.35	22.70	4.99	2.38	65.20	1.89	1.62	0.75
U	0.22	22.70	4.61	2.41	65.19	1.96	1.65	0.75
V	-	22.43	5.37	1.88	64.75	1.95	1.37	1.26
W	0.20	23.05	4.68	2.70	65.80	0.65	1.75	0.70
X	0.24	22.76	4.91	2.34	65.47	1.81	1.60	0.73
Y	0.17	22.88	4.85	2.37	65.31	1.95	1.74	0.61
Z	0.10	22.80	5.05	2.41	65.17	1.92	1.66	0.67

TABLE 16

Physical Tests - General

Test Sample No. 9

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	24.0	10.0	2:30	4:30	2:25	4:30	2.5	3040	0.02
B	24.5	-	-	-	2:55	4:40	3.0	-	0.02
C	-	-	-	-	-	-	-	-	-
D	25.0	11.0	3:40	4:30	3:40	4:50	4.0	2933	0.03
E	24.0	9.0	2:40	4:50	2:40	4:50	2.7	2980	0.01
F	24.0	11.0	2:25	4:15	2:55	4:30	4.4	3060	0.02
G	24.0	10.0	2:35	4:25	2:35	4:20	3.5	3010	0.002
H	25.0	10.0	2:15	4:20	2:45	4:20	2.6	3076	0.01
I	-	-	3:15	4:30	2:50	4:20	1.8	3006	0.00
J	24.5	10.0	-	-	2:10	4:00	3.0	2940	0.01
K	24.0	11.0	2:45	4:40	2:35	4:35	3.2	2970	0.01
L	24.0	-	-	-	-	-	-	2931	0.018
M	24.4	10.0	2:35	4:50	2:50	4:50	2.8	2970	0.01
N	-	-	-	-	-	-	-	-	-
O	24.4	10.0	2:45	5:40	3:15	6:10	2.5	3130	0.011
P	25.0	10.0	2:30	4:40	2:45	4:50	2.9	2980	0.004
Q	-	-	-	-	-	-	-	-	-
R	24.5	10.0	2:00	4:20	2:10	4:20	2.6	2980	0.01
S	24.0	10.0	3:15	5:10	3:35	5:20	2.6	2921	0.01
T	25.0	-	3:15	5:40	3:00	5:40	2.5	3159	+0.004
U	24.0	10.5	2:50	4:35	2:50	4:35	2.6	2970	0.00
V	24.4	11.0	3:05	3:45	2:50	3:55	4.0	3330	0.00
W	24.0	9.0	3:00	4:50	3:05	4:55	2.6	3008	0.01
X	24.0	10.0	2:35	4:32	2:35	4:32	3.7	2906	0.01
Y	23.5	-	3:05	5:00	4:10	6:00	-	3100	-0.002
Z	25.0	10.0	3:15	6:30	3:35	6:30	3.6	2960	0.03

*W/C = Water-Cement Ratio.

TABLE 17

Physical Tests - Mortar Strength

Test Sample No. 9

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	310	395	495	2120	3540	5870	47.3
B	365	400	475	2260	3635	5450	-
C	-	-	-	-	-	-	-
D	220	326	457	2570	3600	6000	48.2
E	330	425	500	2330	3850	5810	46.5
F	295	400	470	2080	3525	5240	47.3
G	370	435	490	2620	4200	6000	46.6
H	-	-	-	1710	3240	6570	52.0
I	350	450	500	2200	3450	5575	-
J	377	480	533	2850	4660	5970	-
K	310	415	500	2070	3470	5420	49.0
L	293	358	482	2288	3708	5558	48.0
M	315	400	485	2200	3720	5730	48.0
N	-	-	-	-	-	-	-
O	-	-	-	2158	3658	5558	46.0
P	320	420	535	2260	3760	5620	-
Q	-	-	-	-	-	-	-
R	345	410	485	2480	3980	5680	49.0
S	326	430	530	2119	3612	5500	46.5
T	-	-	-	1960	3380	5130	48.0
U	280	385	485	2130	3370	5250	47.0
V	319	376	487	2307	3945	6327	-
W	285	375	475	2125	3642	6083	-
X	269	389	444	2290	3940	6158	47.0
Y	301	439	506	2175	3675	5608	48.0
Z	300	410	530	2340	3730	5560	47.5

TABLE 18

Chemical Analysis

Test Sample No. 9

Participant	Chemical Analysis							
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %
A	0.28	22.70	4.87	2.37	65.61	1.81	1.65	0.74
B	0.20	22.70	4.40	2.45	65.35	1.80	1.60	0.75
C	-	-	-	-	-	-	-	-
D	0.16	22.64	4.68	2.36	65.38	1.95	1.54	0.92
E	0.20	22.80	4.68	2.34	65.46	2.00	1.63	0.66
F	0.37	-	5.02	2.33	-	1.96	1.61	0.82
G	0.21	22.84	4.79	2.37	65.23	1.90	1.57	0.63
H	-	-	-	-	-	-	-	-
I	0.28	20.56	4.84	2.74	66.81	1.93	1.62	0.93
J	0.44	-	4.45	2.38	-	1.83	1.69	0.85
K	0.19	22.56	4.72	2.40	65.17	2.31	1.67	0.81
L	-	22.65	4.60	2.40	64.98	2.20	1.70	0.80
M	0.22	22.70	4.78	2.42	65.07	2.00	1.62	0.83
N	-	-	-	-	-	-	-	-
O	0.22	22.62	4.65	2.35	65.00	1.81	1.67	0.88
P	0.21	22.70	4.77	2.39	65.29	2.13	1.61	0.76
Q	-	-	-	-	-	-	-	-
R	0.24	22.76	4.86	2.34	65.32	1.90	1.62	0.70
S	0.24	22.76	4.65	2.36	65.49	1.81	1.67	0.77
T	0.34	22.70	5.07	2.18	65.30	1.91	1.66	0.76
U	0.24	22.72	4.61	2.39	65.19	1.95	1.66	0.79
V	-	22.23	5.16	1.82	65.00	1.89	1.82	1.40
W	0.19	22.71	4.95	2.60	65.90	0.78	1.70	0.77
X	0.22	22.81	4.91	2.35	65.43	1.85	1.53	0.75
Y	0.18	22.82	4.84	2.35	65.38	1.91	1.72	0.63
Z	0.21	22.80	4.95	2.41	65.11	1.96	1.66	0.70

TABLE 19

Physical Tests - General

Average of Test Results of Samples 8 & 9

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	24.0	9.5	2:30	4:25	2:25	4:35	2.5	3045	+0.010
B	24.7	-	-	-	2:57	4:55	2.8	-	+0.020
C	-	-	-	-	-	-	-	-	-
D	25.0	10.5	3:37	4:27	3:35	4:45	4.1	2933	+0.020
E	24.0	9.0	2:35	4:40	2:35	4:40	2.6	2975	+0.005
F	24.0	11.0	2:30	4:25	2:50	4:35	4.4	3055	+0.021
G	24.0	10.0	2:37	4:27	2:35	4:22	3.0	3010	+0.003
H	25.5	10.0	2:26	4:21	2:41	4:21	2.2	3041	+0.006
I	-	-	3:07	4:30	2:50	4:17	2.1	3000*	+0.005
J	24.7	10.5	-	-	2:25	4:12	3.0	2945	+0.100
K	24.0	11.0	2:40	4:35	2:37	4:32	3.7	2975	+0.010
L	24.4	-	-	-	-	-	-	2920	+0.019
M	24.3	10.0	2:35	4:47	2:47	4:47	2.8	2980	+0.01
N	24.5**	9.0 **	3:00 **	4:55**	3:10**	5:10**	-	-	+0.010*
O	24.2	10.0	2:47	5:40	3:17	6:05	2.4	3120	+0.014
P	24.7	9.5	2:27	4:35	2:42	4:50	2.8	2965	+0.004
Q	-	-	-	-	-	-	-	-	-
R	24.5	10.0	2:00	4:20	2:05	4:25	2.5	2980	+0.010
S	24.0	10.0	3:10	5:05	3:32	5:22	2.6	2925	+0.010
T	25.0	-	3:14	5:37	3:00	5:30	2.5	3142	+0.004
U	24.0	10.2	2:47	4:30	2:47	4:30	2.6	2970	+0.005
V	24.2	10.5	3:02	3:50	2:50	4:00	4.0	3182	+0.000
W	24.0	10.0	3:00	4:47	3:05	4:52	2.8	3023	+0.010
X	24.1	10.5	2:32	4:33	2:32	4:33	3.6	2884	+0.015
Y	23.4	-	3:02	4:55	4:02	5:50	-	3112	-0.001
Z	25.0	10.0	3:12	6:27	3:35	6:35	3.5	3004	+0.025

*W/C = Water-Cement Ratio.

**One test result only.

TABLE 20

Physical Tests - Mortar Strength

Average of Test Results of Samples 8 & 9

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	315	410	515	2065	3465	5725	48.3
B	325	395	460	2320	3770	5800	-
C	-	-	-	-	-	-	-
D	220	315	455	2520	3535	5800	48.3
E	330	420	495	2315	3820	5795	46.5
F	290	380	470	2090	3495	5240	47.3
G	375	430	495	2565	4130	5950	46.6
H	-	-	-	1655	3225	6410	52.0
I	350	445	500	2110	3525	5685	-
J	352	420	560	2575	4330	6085	-
K	305	415	495	2095	3520	5590	49.0
L	295	375	490	2205	3595	5440	49.3
M	310	402	495	2220	3750	5680	48.2
N	335*	440*	555*	2180*	3690*	5900*	47.0*
O	-	-	-	2155	3608	5445	46.0
P	325	420	535	2310	3795	5615	-
Q	-	-	-	-	-	-	-
R	350	415	475	2600	4020	5905	49.0
S	320	445	535	2140	3545	5430	46.2
T	-	-	-	2020	3430	5185	48.0
U	280	380	485	2150	3400	5325	47.0
V	325	400	500	2290	4026	6150	-
W	295	380	480	2065	3485	5780	-
X	260	380	445	2385	4035	6200	47.0*
Y	315	430	505	2195	3660	5715	48.0*
Z	305	410	535	2250	3730	5520	47.7

*One test result only.

TABLE 21

Chemical Analysis

Average Test Results of Samples 8 & 9

Participant	Chemical Analysis							
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %
A	0.26	22.76	4.81	2.42	65.53	1.77	1.56	0.76
B	0.20	22.75	4.42	2.45	65.32	1.80	1.60	0.75
C	-	-	-	-	-	-	-	-
D	0.21	22.68	4.80	2.36	65.45	1.95	1.54	0.80
E	0.19	22.80	4.68	2.34	65.49	1.96	1.63	0.66
F	0.38	-	5.07	2.35	-	1.94	1.61	0.83
G	0.21	22.87	4.77	2.37	65.19	1.90	1.59	0.66
H	-	-	-	-	-	-	-	-
I	0.24	20.43	4.51	2.66	67.19	2.00	1.67	0.96
J	0.37	-	4.43	2.38	-	1.82	1.67	0.82
K	0.21	22.51	4.72	2.40	65.20	2.21	1.61	1.00
L	-	22.65	4.58	2.43	64.96	2.15	1.70	0.85
M	0.21	22.71	4.80	2.41	65.00	2.01	1.61	0.81
N	0.30*	22.62*	4.76*	2.38*	65.17*	1.84*	1.68*	0.98*
O	0.19	22.58	4.58	2.33	65.02	1.80	1.68	0.86
P	0.22	22.72	4.77	2.39	65.31	2.04	1.59	0.74
Q	-	-	-	-	-	-	-	-
R	0.23	22.75	4.84	2.32	65.32	1.91	1.62	0.70
S	0.24	22.77	4.63	2.36	65.40	1.80	1.67	0.76
T	0.34	22.70	5.03	2.28	65.25	1.90	1.64	0.75
U	0.23	22.71	4.61	2.40	65.19	1.95	1.65	0.77
V	-	22.33	5.26	1.85	64.87	1.92	1.59	1.33
W	0.19	22.88	4 81	2.65	65.85	0.71	1.72	0.73
X	0.23	22.78	4.91	2.34	65.45	1.83	1.56	0.74
Y	0.17	22.85	4.84	2.36	65.34	1.93	1.73	0.62
Z	0.15	22.80	5.00	2.41	65.14	1.94	1.66	0.68

*One test result only.

TABLE 22

Summary of Statistical Analyses of Test Results — Sample No. 8

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C.V.**
Physical Tests - General							
Normal Consistency - water/cem.	23	%	26.0	23.4	24.4	0.57	2.3
Normal Consistency - Rod Penetr.	19	mm	11.0	9.0	10.0	0.70	7.0
Vicat - Initial Time of Set	21	hr:min	3:35	2:00	2:47	0:21	12.5
- Final Time of Set	21	hr:min	6:25	3:55	4:44	0:33	11.7
Gillmore - Initial Time of Set	23	hr:min	3:55	2:00	2:54	0:27	15.29
- Final Time of Set	23	hr:min	6:40	4:05	4:52	0:37	12.64
Fineness - Retained on No. 200M	22	%	4.4	1.8	3.0	0.70	23.4
Fineness - Blaine	21	cm^2/g	3126	2862	3001	70	2.3
Soundness - Autoclave Expansion	24	%	0.02	0.00	0.0098	0.0072	73.5
Physical Tests - Mortar Strength							
Tensile Strength, 3-day--	21	psi	385	220	315	36	11.5
7-day--	21	psi	460	300	405	36	8.9
28-day--	21	psi	587	445	505	37	7.3
Compressive Strength, 3-day--	24	psi	2720	1600	2215	219	9.9
7-day--	24	psi	4135	3210	3675	265	7.2
28-day--	24	psi	6250	5240	5715	327	5.7
Water Content ----------	16	%	52.0	46.0	48.1	1.6	3.5
Chemical Analysis							
Insoluble residue ----------	21	%	0.39	0.10	0.23	0.06	27.1
Silicon dioxide (SiO_2) -------	21	%	23.05	20.30	22.6	0.54	2.4
Aluminum oxide (Al_2O_3) ------	23	%	5.37	4.18	4.75	0.25	5.3
Ferric oxide (Fe_2O_3) -----	23	%	2.70	1.88	2.38	0.14	5.9
Calcium oxide (CaO) -------	21	%	67.58	64.17	65.32	0.61	0.9
Magnesium oxide (MgO) ------	23	%	2.12	0.65	1.86	0.28	15.2
Sulphur trioxide (SO_3) -------	23	%	1.75	1.37	1.62	0.09	5.3
Loss on Ignition (LOI) -------	23	%	1.26	0.61	0.81	0.16	20.3

* Number of laboratories reporting.

** Coefficient of Variation, per cent.

TABLE 23

Summary of Statistical Analyses of Test Results — Sample No. 9

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C. V. **
Physical Tests - General							
Normal Consistency - water/cem.	22	%	25.0	23.5	24.3	0.44	1.8
Normal Consistency - Rod Penetr.	18	mm	11.0	9.0	10.1	0.59	5.8
Vicat - Initial Time of Set	20	hr:min	3:40	2:00	2:49	0:25	14.6
- Final Time of Set	20	hr:min	6:30	3:45	4:47	0:36	12.7
Gillmore - Initial Time of Set	22	hr:min	4:10	2:10	2:55	0:29	16.7
- Final Time of Set	22	hr:min	6:30	3:55	4:51	0:41	14.1
Fineness - Retained on No. 200M	21	%	4.4	1.8	3.0	0.64	21.3
Fineness - Blaine	22	cm^2/g	3330	2906	3016	97	3.2
Soundness - Autoclave Expansion	23	%	0.03	0.00	0.02	0.0088	82.6
Physical Tests - Mortar Strength							
Tensile Strength, 3-day --	20	psi	375	220	314	37	11.9
7-day --	20	psi	480	325	405	34	8.4
28-day --	20	psi	535	445	493	24	5.0
Compressive Strength, 3-day --	23	psi	2850	1600	2245	233	10.4
7-day --	23	psi	4660	3210	3710	302	8.2
28-day --	23	psi	6570	5130	5725	357	6.2
Water Content ----------	17	%	52.0	46.0	47.7	1.4	2.9
Chemical Analysis							
Insoluble residue ----------	20	%	0.44	0.16	0.24	0.07	28.8
Silicon dioxide (SiO_2) -------	20	%	22.84	20.56	22.59	0.49	2.2
Aluminum oxide (Al_2O_3) ------	22	%	5.16	4.40	4.78	0.19	3.9
Ferric oxide (Fe_2O_3) -----	22	%	2.74	1.82	2.37	0.16	6.8
Calcium oxide (CaO) -------	20	%	66.81	64.98	65.37	0.40	0.6
Magnesium oxide (MgO) ------	22	%	2.31	0.78	1.89	0.28	14.8
Sulphur trioxide (SO_3) -------	22	%	1.82	1.53	1.65	0.06	3.8
Loss on Ignition (LOI) -------	22	%	1.40	0.63	0.80	0.15	19.5

* Number of laboratories reporting.

** Coefficient of Variation, per cent.

TABLE 24

Summary of Statistical Analyses of Test Results — Sample 8 & 9

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C. V.**
Physical Tests - General							
Normal Consistency - water/cem.	23	%	25.5	23.4	24.4	0.54	2.2
Normal Consistency - Rod Penetr.	19	mm	11.0	9.0	10.1	0.55	5.5
Vicat - Initial Time of Set	21	hr:min	3:37	2:00	2:48	0:22	13.19
- Final Time of Set	21	hr:min	6:27	3:50	4:45	0:34	11.95
Gillmore - Initial Time of Set	23	hr:min	4:02	2:05	2:55	0:27	15.65
- Final Time of Set	23	hr:min	6:35	4:00	4:51	0:38	13.11
Fineness - Retained on No. 200M	21	%	4.4	2.1	3.0	0.65	21.9
Fineness - Blaine	22	cm^2/g	3182	2884	3008	77	2.6
Soundness - Autoclave Expansion	24	%	+0.100	-0.000	0.014	0.02	142.1
Physical Tests - Mortar Strength							
Tensile Strength, 3-day --	21	psi	375	220	315	34	10.9
7-day --	21	psi	445	315	405	30	7.5
28-day --	21	psi	560	445	499	31	6.3
Compressive Strength, 3-day --	24	psi	2600	1655	2230	209	9.4
7-day --	24	psi	4330	3225	3690	264	7.1
28-day --	24	psi	6410	5185	5720	306	5.3
Water Content ----------	18	%	52.0	46.0	47.8	1.4	3.0
Chemical Analysis							
Insoluble residue ----------	21	%	0.38	0.15	0.24	0.06	26.2
Silicon dioxide (SiO_2) -------	21	%	22.88	20.43	22.60	0.51	2.3
Aluminum oxide (Al_2O_3) ------	23	%	5.26	4.42	4.77	0.20	4.3
Ferric oxide (Fe_2O_3) -----	23	%	2.66	1.85	2.37	0.15	6.1
Calcium oxide (CaO) -------	21	%	67.19	64.87	6.54	0.47	0.7
Magnesium oxide (MgO) ------	23	%	2.21	0.71	1.87	0.28	14.7
Sulphur trioxide (SO_3) -------	23	%	1.73	1.54	1.63	0.05	3.2
Loss on Ignition (LOI) -------	23	%	1.33	0.62	0.81	0.15	18.7

* Number of laboratories reporting.

** Coefficient of Variation, per cent.

TABLE 25

Physical Tests - General

Test Sample No. 10

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	23.5	9.5	2:00	3:50	2:00	3:40	6.0	3040	0.05
B	24.0	9.0	-	-	3:00	4:45	7.4	3105	0.06
C	-	-	-	-	-	-	-	-	-
D	24.8	10.0	2:40	3:30	2:40	3:35	8.0	2865	0.03
E	24.0	11.0	2:10	3:50	2:20	3:50	5.9	3000	0.04
F	23.5	9.0	2:21	4:15	2:30	4:15	7.8	3210	0.062
G	24.0	10.5	2:20	4:15	2:20	4:15	6.2	3050	0.05
H	25.0	11.0	2:15	3:15	2:15	3:45	5.0	3059	0.03
I	-	-	3:00	4:30	2:50	4:20	6.8	-	0.03
J	25.0	9.0	2:20	3:05	2:00	3:05	6.0	2980	0.02
K	23.8	9.0	2:05	4:00	2:00	4:00	8.3	3040	0.02
L	24.4	-	-	-	-	-	-	3005	0.053
M	24.0	10.0	2:25	4:20	2:30	4:20	5.8	3010	0.04
N	-	-	-	-	-	-	-	-	-
O	24.4	9.5	2:30	4:35	3:05	6:00	5.3	3090	0.026
P	25.0	10.0	2:25	4:35	2:25	4:30	5.9	3070	-
Q	24.5	-	2:35	4:35	2:50	4:40	8.0	3031	0.01
R	-	-	-	-	-	-	-	-	-
S	24.0	9.0	2:35	4:30	3:30	5:30	6.1	3070	0.06
T	23.0	-	2:55	4:40	2:50	4:40	5.4	3135	0.05
U	24.0	10.0	2:15	3:25	2:15	3:25	5.4	3020	0.04
V	23.0	11.0	2:15	3:05	2:10	3:05	2.5	3129	0.01
W	24.5	9.0	2:29	3:58	2:15	4:00	6.6	3148	0.04
X	23.0	10.0	2:00	4:00	2:00	4:00	7.6	3005	0.07
Y	24.0	10.5	2:40	4:30	3:25	5:15	6.2	3056	0.03
Z	24.0	10.0	-	-	2:35	5:50	7.8	3036	0.053

*W/C = Water-Cement Ratio.

TABLE 26

Physical Tests - Mortar Strength

Test Sample No. 10

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	360	420	505	2710	3490	4670	-
B	300	375	445	2700	3735	4700	-
C	-	-	-	-	-	-	-
D	300	430	470	2730	3400	4400	48.0
E	365	430	495	3100	3980	4940	47.5
F	320	405	480	2885	3630	4425	47.3
G	345	400	510	2940	3620	4420	47.3
H	-	-	-	2440	3240	4760	51.0
I	360	480	495	3100	3800	5505	-
J	370	425	510	3170	3510	4580	-
K	350	425	540	3070	3840	4950	48.5
L	300	405	485	2710	3820	4695	50.7
M	405	445	475	2850	3620	4570	48.5
N	-	-	-	-	-	-	-
O	380	430	495	2875	3500	4365	48.6
P	385	445	505	3280	4040	5170	-
Q	315	385	500	2745	3370	4260	46.2
R	-	-	-	-	-	-	-
S	365	405	510	2965	3545	4450	46.7
T	-	-	-	3065	3815	4750	48.0
U	370	435	535	2680	3400	4230	49.0
V	355	440	510	2370	4270	5185	52.1
W	395	465	510	2750	3335	4285	48.7
X	325	385	435	3005	3800	5025	46.5
Y	345	395	480	2770	3690	4770	48.0
Z	370	440	570	3000	3810	4580	-

TABLE 27

Chemical Analysis

Test Sample No. 10

Participant	Chemical Analysis							
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %
A	0.28	20.94	5.43	1.95	64.11	2.51	3.02	1.09
B	0.25	20.95	5.00	2.00	64.10	2.55	3.05	1.00
C	-	-	-	-	-	-	-	-
D	0.28	-	5.72	2.00	-	2.24	3.05	1.82
E	0.30	-	5.71	1.90	-	2.70	3.13	1.24
F	0.20	-	7.64	1.91	-	2.74	3.01	1.11
G	0.26	20.64	5.51	1.89	64.16	2.62	3.15	1.06
H	-	-	-	-	-	-	-	-
I	0.62	21.44	5.25	2.05	62.78	1.17	3.18	1.05
J	0.40	-	5.80	1.98	-	3.19	3.09	1.14
K	0.28	20.76	5.42	1.92	63.97	2.31	3.16	1.12
L	0.25	20.68	5.23	1.93	64.46	2.68	3.14	1.01
M	0.26	-	5.58	1.96	-	2.54	3.14	1.11
N	-	-	-	-	-	-	-	-
O	0.27	-	5.39	1.93	-	1.53	3.09	1.15
P	0.35	-	5.30	1.98	-	2.64	3.10	1.10
Q	0.26	20.77	5.57	1.95	64.20	2.50	3.00	1.10
R	-	-	-	-	-	-	-	-
S	0.33	20.72	5.41	1.90	63.96	2.59	3.10	1.05
T	0.33	20.89	5.40	1.91	64.40	2.63	3.10	0.92
U	0.17	20.88	5.46	1.98	64.12	2.47	3.02	1.20
V	0.34	20.20	6.02	1.58	64.50	2.48	2.57	1.50
W	0.36	21.32	5.63	1.99	64.75	1.22	3.02	1.05
X	-	20.80	5.48	1.93	64.18	2.62	3.04	1.08
Y	0.27	-	5.54	1.94	-	4.03	3.28	0.97
Z	0.25	20.94	5.56	1.94	64.05	2.50	3.09	1.03

TABLE 28

Physical Tests - General

Test Sample No. 11

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	23.5	11.0	2:05	3:40	2:00	3:45	5.8	3040	0.05
B	24.5	10.0	-	-	3:20	5:20	7.4	3065	0.07
C	-	-	-	-	-	-	-	-	-
D	24.8	11.0	2:20	2:50	2:20	3:05	4.5	2910	0.05
E	24.0	10.0	2:15	3:50	2:20	3:50	5.9	3010	0.04
F	24.0	10.0	2:28	4:05	2:25	4:05	8.9	3130	0.068
G	24.0	10.5	2:20	4:15	2:20	4:15	6.3	3010	0.05
H	25.0	10.0	2:15	3:45	2:20	4:15	6.6	3076	0.03
I	-	-	3:30	4:20	3:15	4:10	7.0	-	0.03
J	25.0	10.0	2:10	3:15	2:20	3:10	6.6	2980	0.04
K	24.2	10.5	2:25	4:15	2:25	4:10	7.8	3040	0.04
L	24.4	-	-	-	-	-	-	2972	0.055
M	24.0	10.0	2:20	4:20	2:25	4:20	5.9	3020	0.04
N	-	-	-	-	-	-	-	-	-
O	24.6	9.5	3:10	6:00	2:35	4:35	5.1	3115	0.027
P	25.0	10.0	2:25	4:35	2:25	4:30	6.0	3060	-
Q	24.8	-	2:20	4:20	2:40	4:25	8.1	3071	0.01
R	-	-	-	-	-	-	-	-	-
S	24.0	10.5	2:30	4:30	3:20	5:10	6.0	3026	0.05
T	23.0	-	2:55	4:35	2:50	4:30	5.3	3125	0.04
U	24.0	9.0	2:15	3:25	2:15	3:25	5.4	3020	0.04
V	23.5	11.0	2:20	2:55	2:15	3:15	3.0	3050	0.02
W	24.5	11.0	2:25	3:59	2:20	3:55	6.6	3155	0.04
X	23.5	9.0	2:00	3:50	2:00	3:50	7.0	3005	0.05
Y	24.1	10.0	2:45	4:20	3:30	5:15	6.8	3035	0.04
Z	24.0	10.0	-	-	2:35	5:54	7.7	3026	0.052

*W/C = Water-Cement Ratio.

TABLE 29

Physical Tests - Mortar Strength

Test Sample No. 11

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	345	435	495	2750	3510	4510	-
B	310	435	520	2765	3850	5000	-
C	-	-	-	-	-	-	-
D	285	355	445	2630	3200	4370	48.0
E	365	425	490	3040	3870	4850	48.0
F	320	385	475	2795	3510	4400	47.3
G	350	400	470	2970	3680	4530	47.3
H	-	-	-	2630	3370	4690	50.0
I	400	455	510	2800	3430	5000	-
J	405	450	495	2690	3470	4330	-
K	300	360	505	2950	3670	4940	48.5
L	310	405	500	2715	3865	5035	50.7
M	415	440	460	2830	3700	4770	48.5
N	-	-	-	-	-	-	-
O	345	395	435	2865	3540	4360	48.6
P	385	440	505	3270	4020	5140	-
Q	345	360	505	2915	3510	4400	46.2
R	-	-	-	-	-	-	-
S	375	420	475	2895	3535	4425	47.0
T	-	-	-	3065	3735	4675	48.0
U	365	430	530	2680	3380	4250	49.0
V	345	420	490	2240	3880	5110	52.6
W	410	480	515	2590	3450	4720	48.7
X	325	385	435	2960	3905	5000	46.5
Y	335	390	480	2755	3620	5010	48.0
Z	330	420	540	2830	3480	4250	-

TABLE 30

Chemical Analysis

Test Sample No. 11

Participant	Chemical Analysis							
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %
A	0.28	20.80	5.43	1.95	64.20	2.52	3.00	1.09
B	0.20	20.90	5.00	1.95	64.15	2.55	2.90	1.15
C	-	-	-	-	-	-	-	-
D	0.32	-	5.72	1.96	-	2.39	3.05	1.60
E	0.29	-	5.71	1.89	-	2.57	3.11	1.22
F	0.26	-	7.62	1.91	-	2.76	3.01	1.09
G	0.31	20.66	5.35	1.93	64.16	2.61	3.19	1.03
H	-	-	-	-	-	-	-	-
I	0.34	21.12	5.46	1.98	66.70	1.22	3.14	1.02
J	0.32	-	5.60	1.93	-	3.03	3.06	1.15
K	0.28	20.64	5.54	1.96	63.94	2.62	3.12	1.13
L	0.33	20.80	5.12	2.00	64.42	2.70	3.12	0.99
M	0.25	-	5.60	1.98	-	2.54	3.18	1.10
N	-	-	-	-	-	-	-	-
O	0.30	-	5.33	1.89	-	1.35	3.03	1.35
P	0.37	-	5.23	2.03	-	2.61	3.09	1.08
Q	0.28	20.77	5.52	1.93	64.18	2.49	3.05	1.06
R	-	-	-	-	-	-	-	-
S	0.31	20.75	5.40	1 90	63.98	2.61	3.11	1.10
T	0.31	20.68	5.32	1.94	64.60	2.51	3.10	0.98
U	.0 19	20.82	5.50	1.98	64.12	2.47	2.99	1.17
V	0.30	20.56	6.05	1.61	64.48	2.46	2.59	1.20
W	0.30	21.44	5.70	1.94	64.44	1.22	3.09	1.18
X	-	20.83	5.38	1.95	64.15	2.60	3.06	1.10
Y	0.26	-	5.37	1.95	-	2.50	3.32	1.00
Z	0.26	20.90	5.56	1.94	64.05	2.50	3.09	1.01

TABLE 31

Physical Tests - General

Average of Test Results of Samples 10 & 11

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
			Vicat		Gillmore				
	W/C*, %	Penetration, mm	Initial	Final	Initial	Final	Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
A	23.5	10.2	2:02	3:45	2:00	3:42	5.9	3040	0.050
B	24.2	9.5	-	-	3:10	5:02	7.4	3085	0.060
C	-	-	-	-	-	-	-	-	-
D	24.8	10.5	2:30	3:10	2:30	3:20	6.2	2887	0.040
E	24.0	10.5	2:12	3:50	2:20	3:50	5.9	3005	0.040
F	23.7	9.5	2:24	4:10	2:27	4:10	8.3	3170	0.065
G	24.0	10.5	2:20	4:15	2:20	4:15	6.2	3030	0.050
H	25.0	10.5	2:15	3:30	2:17	4:00	5.8	3067	0.030
I	-	-	3:15	4:25	3:02	4:15	6.9	-	0.030
J	25.0	9.5	2:15	3:10	2:10	3:07	6.3	2980	0.030
K	24.0	9.7	2:15	4:07	2:12	4:05	8.0	3040	0.030
L	24.4	-	-	-	-	-	-	2988	0.054
M	24.0	10.0	2:22	4:20	2:27	4:20	5.8	3015	0.040
N	-	-	-	-	-	-	-	-	-
O	24.5	9.5	2:50	5:17	2:50	5:17	5.2	3102	0.026
P	25.0	10.0	2:25	4:35	2:25	4:30	5.9	3065	-
Q	24.6	-	2:27	4:27	2:45	4:32	8.0	3051	0.010
R	-	-	-	-	-	-	-	-	-
S	24.0	9.7	2:32	4:30	3:25	5:20	6.0	3048	0.055
T	23.0	-	2:55	4:37	2:50	4:35	5.3	3130	0.045
U	24.0	9.5	2:15	3:25	2:15	3:25	5.4	3020	0.040
V	23.2	11.0	2:17	3:00	2:12	3:10	2.7	3089	0.015
W	24.5	10.0	2"27	3:58	2:17	3:57	6.6	3151	0.040
X	23.2	9.5	2:00	3:55	2:00	3:55	7.3	3005	0.060
Y	24.0	10.2	2:42	4:25	3:27	5:15	6.5	3045	0.035
Z	24.0	10.0	-	-	2:35	5:52	7.7	3031	0.052

*W/C = Water-Cement Ratio.

TABLE 32

Physical Tests - Mortar Strength

Average of Test Results of Samples 10 & 11

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	350	425	500	2730	3500	4590	-
B	305	405	480	2730	3790	4850	-
C	-	-	-	-	-	-	-
D	290	375	455	2680	3300	4385	48.0
E	365	425	490	3070	3925	4895	47.7
F	320	395	475	2840	3570	4410	47.3
G	345	400	490	2955	3650	4475	47.3
H	-	-	-	2535	3305	4725	50.5
I	380	465	500	2950	3615	5250	-
J	385	435	500	2930	3490	4455	-
K	325	390	520	3010	3755	4945	48.5
L	305	405	490	2710	3840	4865	50.7
M	410	440	465	2840	3660	4670	48.5
N	-	-	-	-	-	-	-
O	360	410	465	2870	3520	4360	48.6
P	385	440	505	3275	4030	5155	-
Q	330	370	500	2830	3440	4330	46.2
R	-	-	-	-	-	-	-
S	370	410	490	2930	3540	4435	46.8
T	-	-	-	3065	3775	4710	48.0
U	367	430	530	2680	3390	4240	49.0
V	350	430	500	2305	4075	5145	52.3
W	400	470	510	2670	3390	4500	48.7
X	325	385	435	2980	3850	5010	46.5
Y	340	390	480	2760	3655	4890	48.0
Z	350	430	555	2865	3645	4415	-

TABLE 33

Chemical Analysis

Average of Test Results of Samples 10 & 11

Participant	Chemical Analysis							
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %
A	0.28	20.87	5.43	1.95	64.15	2.51	3.01	1.09
B	0.22	20.92	5.00	1.97	64.12	2.55	2.97	1.07
C	-	-	-	-	-	-	-	-
D	0.30	-	5.72	1.98	-	2.31	3.05	1.71
E	0.29	-	5.71	1.89	-	2.63	3.12	1.23
F	0.23	-	7.63	1.91	-	2.75	3.01	1.10
G	0.28	20.65	5.43	1.91	64.16	2.61	3.17	1.04
H	-	-	-	-	-	-	-	-
I	0.48	21.28	5.35	2.01	64.74	1.19	3.16	1.03
J	0.36	-	5.70	1.95	-	3.11	3.07	1.14
K	0.28	20.70	5.48	1.94	63.95	2.46	3.14	1.12
L	0.29	20.74	5.17	1.96	64.44	2.69	3.13	1.00
M	0.25	-	5.59	1.97	-	2.54	3.16	1.10
N	-	-	-	-	-	-	-	-
O	0.28	-	5.36	1.91	-	1.44	3.06	1.25
P	0.36	-	5.26	2.00	-	2.62	3.09	1.09
Q	0.27	20.77	5.54	1.94	64.19	2.49	3.02	1.08
R	-	-	-	-	-	-	-	-
S	0.32	20.73	5.40	1.90	63.97	2.60	3.10	1.07
T	0.32	20.78	5.36	1.92	64.50	2.57	3.10	0.95
U	0.18	20.85	5.48	1.98	64.12	2.47	3.00	1.18
V	0.32	20.38	6.03	1.59	64.49	2.47	2.58	1.35
W	0.33	21.38	5.66	1.96	64.59	1.22	3.05	1.11
X	-	20.81	5.43	1.94	64.16	2.61	3.05	1.09
Y	0.26	-	5.45	1.94	-	3.26	3.30	0.98
Z	0.25	20.92	5.56	1.94	64.05	2.50	3.09	1.02

TABLE 34

Summary of Statistical Analyses of Test Results — Sample No. 10

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C. V. **
Physical Tests - General							
Normal Consistency - water/cem.	22	%	25.0	24.0	24.1	0.61	2.5
Normal Consistency - Rod Penetr.	19	mm	11.0	9.0	9.8	0.72	7.4
Vicat - Initial Time of Set	20	hr:min	3:00	2:00	2:25	0:16	11.3
- Final Time of Set	20	hr:min	4:40	3:05	4:02	0:32	13.1
Gillmore - Initial Time of Set	22	hr:min	3:30	2:00	2:32	0:27	17.5
- Final Time of Set	22	hr:min	6:00	3:05	4:18	0:48	18.6
Fineness - Retained on No. 200M	22	%	8.3	2.5	6.3	1.3	20.6
Fineness - Blaine	22	cm^2/g	3210	2865	3052	70	2.3
Soundness - Autoclave Expansion	22	%	0.07	0.01	0.039	0.016	42.6
Physical Tests - Mortar Strength							
Tensile Strength, 3-day --	21	psi	405	300	350	31	8.9
7-day --	21	psi	480	375	420	27	6.5
28-day --	21	psi	570	435	500	30	6.1
Compressive Strength, 3-day --	23	psi	3280	2370	2865	223	7.8
7-day --	23	psi	4270	3240	3365	249	6.8
28-day --	23	psi	5505	4230	4680	330	7.0
Water Content ----------	17	%	52.1	46.2	48.4	1.6	3.3
Chemical Analysis							
Insoluble residue ----------	21	%	0.62	0.17	0.30	0.09	30.1
Silicon dioxide (SiO_2) -------	14	%	21.44	20.20	20.85	0.29	1.4
Aluminum oxide (Al_2O_3) ------	22	%	7.64	5.00	5.59	0.50	9.0
Ferric oxide (Fe_2O_3) -----	22	%	2.05	1.58	1.93	0.09	4.6
Calcium oxide (CaO) -------	14	%	64.75	62.78	64.12	0.44	0.7
Magnesium oxide (MgO) ------	22	%	4.03	1.17	2.47	0.60	24.1
Sulphur trioxide (SO_3) -------	22	%	3.28	2.57	3.07	0.13	4.2
Loss on Ignition (LOI) -------	22	%	1.82	0.92	1.13	0.19	16.9

* Number of laboratories reporting.

** Coefficient of Variation, per cent.

TABLE 35

Summary of Statistical Analyses of Test Results — Sample No. 11

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C. V. **
Physical Tests - General							
Normal Consistency - water/cem.	22	%	25.0	23.0	24.2	0.54	2.2
Normal Consistency - Rod Penetr.	19	mm	11.0	9.5	10.1	0.60	5.9
Vicat - Initial Time of Set	20	hr:min	3:30	2:00	2:28	0:22	14.8
- Final Time of Set	20	hr:min	6:00	2:50	4:03	0:42	17.1
Gillmore - Initial Time of Set	22	hr:min	3:30	2:00	2:33	0:26	16.7
- Final Time of Set	22	hr:min	5:54	3:05	4:14	0:43	17.1
Fineness - Retained on No. 200M	22	%	8.9	3.0	6.3	1.3	20.6
Fineness - Blaine	22	cm^2/g	3155	2910	3043	56	1.8
Soundness - Autoclave Expansion	22	%	0.07	0.01	0.04	0.014	33.0
Physical Tests - Mortar Strength							
Tensile Strength, 3-day --	21	psi	415	285	350	37	10.6
7-day --	21	psi	480	405	415	33	8.1
28-day --	21	psi	540	435	490	29	5.9
Compressive Strength, 3-day --	23	psi	3270	2240	2810	203	7.2
7-day --	23	psi	4020	3200	3615	209	5.8
28-day --	23	psi	5140	4250	4685	302	6.4
Water Content ----------	17	%	52.6	46.2	48.4	1.5	3.2
Chemical Analysis							
Insoluble residue ----------	21	%	0.37	0.19	0.29	0.04	14.8
Silicon dioxide (SiO_2) -------	14	%	21.44	20.56	20.83	0.22	1.1
Aluminum oxide (Al_2O_3) ------	22	%	7.62	5.00	5.57	0.51	9.1
Ferric oxide (Fe_2O_3) -----	22	%	2.03	1.61	1.93	0.08	4.1
Calcium oxide (CaO) -------	14	%	66.70	63.98	64.39	0.69	1.1
Magnesium oxide (MgO) ------	22	%	3.03	1.22	2.40	0.48	20.0
Sulphur trioxide (SO_3) -------	22	%	3.32	2.59	3.06	0.13	4.4
Loss on Ignition (LOI) -------	22	%	1.60	0.98	1.13	0.14	12.2

* Number of laboratories reporting.

** Coefficient of Variation, per cent.

TABLE 36

Summary of Statistical Analyses of Test Results — Sample No. 10 & 11

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C. V.**
Physical Tests - General							
Normal Consistency - water/cem.	22	%	25.0	23.0	24.1	0.58	2.4
Normal Consistency - Rod Penetr.	19	mm	11 0	9.5	10.0	0.46	4.6
Vicat - Initial Time of Set	20	hr:min	3:15	2:00	2:26	0:18	12.4
- Final Time of Set	20	hr:min	5:17	3:00	4:03	0:35	14.4
Gillmore - Initial Time of Set	22	hr:min	3:27	2:00	2:33	0:25	16.6
- Final Time of Set	22	hr:min	5:52	3:07	4:16	0:44	17.3
Fineness - Retained on No. 200M	22	%	8.3	2.7	6.3	1.22	19.3
Fineness - Blaine	22	cm^2/g	3170	2887	3047	61	2.0
Soundness - Autoclave Expansion	22	%	0.065	0.010	0.04	0.014	35.3
Physical Tests - Mortar Strength							
Tensile Strength, 3-day--	21	psi	410	290	350	32	9.2
7-day--	21	psi	470	370	415	27	6.5
28-day--	21	psi	555	435	490	26	5.3
Compressive Strength, 3-day--	23	psi	3275	2305	2835	201	7.1
7-day--	23	psi	4075	3300	3640	216	5.9
28-day--	23	psi	5250	4240	4680	297	6.3
Water Content ----------	16	%	52.3	46.2	48.4	1.6	3.3
Chemical Analysis							
Insoluble residue ----------	21	%	0.48	0.18	0.29	0.06	21.0
Silicon dioxide (SiO_2) -------	14	%	21.38	20.38	20.84	0.25	1.2
Aluminum oxide (Al_2O_3) ------	22	%	7.63	5.00	5.58	0.51	9.1
Ferric oxide (Fe_2O_3) -----	22	%	2.01	1.59	1.93	0.08	4.3
Calcium oxide (CaO) -------	14	%	64.74	63.95	64.26	0.24	0.4
Magnesium oxide (MgO) ------	22	%	3.26	1.19	2.44	0.51	21.1
Sulphur trioxide (SO_3) -------	22	%	3.17	2.58	3.07	0.13	4.3
Loss on Ignition (LOI) -------	22	%	1.71	0.95	1.13	0.16	14.1

* Number of laboratories reporting.

** Coefficient of Variation, per cent.

TABLE 37

Physical Tests - General

Test Sample No. 12

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	24.0	10 0	2:40	4:20	2:45	4:30	7.6	3000	0.21
B	25.0	11.0	-	-	3:45	5:45	9.4	3085	0.203
C	24.5	10.5	2:50	4:35	2:20	5:30	6.0	2950	0.166
D	24.8	9.0	3:15	4:20	3:10	4:25	7.9	2910	0.16
E	24.0	9.0	2:35	4:30	2:40	4:30	7.7	3130	0.19
F	24.0	9.0	3:03	4:45	3:00	4:50	10.8	3100	0.222
G	24.0	9.0	3:00	4:55	3:00	4:55	7.8	3000	0.12
H	25.2	11.0	3:10	4:55	2:40	4:30	7.4	3112	0.18
I	-	-	-	-	-	-	-	-	-
J	-	-	-	-	-	-	-	-	-
K	24.6	10.0	3:20	5:20	3:10	5:10	9.0	2980	0.18
L	24.2	-	-	-	-	-	-	2998	0.219
M	23.8	10.0	2:25	4:25	2:25	4:25	7.5	3170	0.21
N	-	-	-	-	-	-	-	-	-
O	24.4	10.0	2:40	4:50	3:25	6:15	7.1	3050	0.175
P	25.0	-	3:50	5:35	3:15	5:45	8.0	2990	0.22
Q	24.8	-	2:55	5:00	3:20	5:00	12.5	3052	0.18
R	24.0	10.0	2:20	4:40	2:20	4:40	7.0	3210	0.35
S	24.5	9.75	3:10	4:30	3:30	5:45	7.0	2992	0.24
T	25.0	-	3:28	5:00	3:30	4:50	8.5	3190	0.204
U	24.0	9.0	3:00	4:50	3:00	4:50	7.5	3060	0.18
V	23.0	10.5	2:40	3:40	3:05	3:45	6.5	3140	0.15
W	-	-	-	-	-	-	-	-	-
X	24.0	9.0	2:50	4:30	2:50	4:30	9.3	3044	0.23
Y	24.0	9.5	3:25	4:50	2:50	5:05	7.7	3029	0.12
Z	24.8	9.5	3:10	6:10	-	-	-	3067	0.21
XX	25.0	10.7	-	-	-	-	-	-	0.16

*W/C = Water-Cement Ratio.

TABLE 38

Physical Tests - Mortar Strength

Test Sample No. 12

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	370	430	495	2400	3060	4140	-
B	340	410	475	2450	3325	4300	-
C	350	418	453	2490	3390	4353	-
D	280	380	430	2270	2900	4030	48.0
E	360	410	485	2600	3280	4240	48.0
F	300	390	500	2495	3020	4005	47.3
G	345	405	505	2390	3160	4180	48.0
H	-	-	-	2640	3360	4430	50.0
I	-	-	-	-	-	-	-
J	-	-	-	-	-	-	-
K	335	445	485	2460	3230	4230	49.0
L	325	405	495	2560	3533	4758	-
M	385	460	500	2500	3250	4230	-
N	-	-	-	-	-	-	-
O	315	403	428	2583	3208	4266	47.3
P	375	435	505	2570	3260	4190	-
Q	303	388	446	2281	2896	3608	47.5
R	355	400	455	2600	3350	4500	53.0
S	368	403	469	2409	3125	3988	48.0
T	-	-	-	2315	3065	3775	46.6
U	370	430	480	2350	2900	3750	49.0
V	352	402	462	2242	3022	4630	51.2
W	-	-	-	-	-	-	-
X	305	396	436	2581	3325	4429	48.0
Y	325	414	470	2357	3083	4171	50.0
Z	330	410	480	2510	3260	4240	49.0
XX	292	387	442	2525	3310	4210	-

TABLE 39

Chemical Analysis

Test Sample No. 12

Participant	Chemical Analysis								
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %	Combined Oxides %
A	0.27	21.16	5.46	2.46	63.0	3.01	2.76	0.85	-
B	0.15	21.10	5.25	2.50	62.90		2.75	0.85	-
C	0.33	-	2.14	2.84	-	3.28	2.75	0.84	4.98
D	0.20	-	5.88	2.48	-	2.68	2.71	0.88	-
E	0.17	-	5.63	2.41	63.40	2.84	2.76	0.82	8.04
F	0.16	-	5.69	2.43	-	2.66	2.75	0.66	-
G	0.15	21.00	5.63	2.43	63.12	3.01	2.82	0.81	-
H	0.18	-	5.39	2.42	-	3.06	2.78	0.88	7.81
I	-	-	-	-	-	-	-	-	-
J	-	-	-	-	-	-	-	-	-
K	0.12	20.96	5.68	2.52	63.07	2.99	2.72	1.01	-
L	0.15	21.15	5.54	2.49	63.32	2.69	2.82	0.90	-
M	0.17	-	5.66	2.48	-	2.77	2.75	0.92	8.14
N	-	-	-	-	-	-	-	-	-
O	0.18	-	5.29	2.55	-	2.02	2.95	1.53	-
P	0.28	-	5.64	2.42	-	3.08	2.81	0.82	8.06
Q	0.13	21.06	5.59	2.44	63.13	2.76	2.77	0.95	-
R	0.19	21.54	5.64	2.50	62.22	3.37	2.81	0.90	-
S	0.18	21.27	5.56	2.44	62.93	3.07	2.78	0.85	-
T	0.33	-	5.64	2.50	-	2.88	2.75	0.83	8.14
U	0.14	-	5.62	2.44	-	2.90	2.80	0.88	8.06
V	0.24	21.00	5.47	2.43	63.75	2.71	2.40	1.38	-
W	-	-	-	-	-	-	-	-	-
X	0.20	21.11	5.56	2.41	63.31	2.88	2.77	0.90	-
Y	0.35	-	5.80	2.46	-	2.82	2.89	0.77	8.25
Z	0.22	20.96	5.79	2.39	63.06	2.85	2.81	1.07	-
XX	0.76	-	6.20	2.44	-	2.88	2.79	0.96	8.64

TABLE 40

Physical Tests - General

Test Sample No. 13

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	24.0	10.0	2:40	4:20	2:45	4:30	7.7	2950	0.20
B	24.5	9.0	-	-	3:45	5:40	8.5	3075	0.188
C	25.0	10.0	3:05	4:45	2:45	5:35	6.0	2976	0.18
D	24.8	10.0	3:15	4:15	3:10	4:30	6.1	2980	0.14
E	24.0	9.0	2:30	4:30	2:40	4:35	7.9	3130	0.19
F	24.0	9.0	3:08	4:45	2:50	4:45	10.6	3120	0.226
G	24.5	10.0	2:55	5:05	2:55	5:05	7.8	2990	0.12
H	25.2	10.0	3:10	4:50	2:50	4:25	8.6	3096	0.18
I	-	-	-	-	-	-	-	-	-
J	-	-	-	-	-	-	-	-	-
K	24.6	10.0	3:00	5:00	3:00	5:00	9.1	3030	0.16
L	24.4	-	-	-	-	-	-	3000	0.221
M	23.8	9.0	2:20	4:20	2:25	4:20	7.2	3210	0.21
N	-	-	-	-	-	-	-	-	-
O	24.6	9.5	2:30	4:45	3:15	6:20	7.0	3050	0.183
P	25.0	-	3:10	5:45	3:15	5:50	8.0	2940	0.22
Q	25.0	-	2:50	5:00	3:10	5:00	12.1	3043	0.19
R	24.0	-	2:20	4:30	2:20	4:30	7.0	3230	0.16
S	24.5	10.0	3:05	4:30	3:20	5:40	7.5	2992	0.22
T	25.0	-	3:20	4:50	3:30	4:50	8.1	3125	0.209
U	24.0	9.0	3:00	4:50	3:00	4:50	7.5	3050	0.18
V	22.0	11.0	2:15	3:10	3:05	3:55	7.0	3010	0.17
W	-	-	-	-	-	-	-	-	-
X	24.0	9.5	2:47	4:32	2:47	4:32	9.2	3035	0.23
Y	24.6	11.0	3:30	5:00	3:10	5:15	7.8	3012	0.12
Z	24.8	10.0	3:20	6:20	-	-	-	3115	0.21
XX	25.0	10.7	-	-	-	-	-	-	0.16

*W/C = Water-Cement Ratio.

TABLE 41

Physical Tests - Mortar Strength

Test Sample No. 13

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	380	420	500	2500	3140	4080	-
B	365	405	450	2725	3285	4250	-
C	323	363	382	2525	3113	3811	-
D	280	390	435	2330	3120	4120	48.0
E	360	415	490	2610	3300	4240	48.0
F	350	360	470	2560	3275	4085	48.0
G	345	415	500	2400	3200	4160	48.6
H	-	-	-	2590	3350	4400	50.7
I	-	-	-	-	-	-	-
J	-	-	-	-	-	-	-
K	360	430	515	2460	3190	4240	49.0
L	330	445	540	2432	3250	4550	-
M	375	425	495	2650	3260	4100	-
N	-	-	-	-	-	-	-
O	326	398	477	2541	3266	4258	47.3
P	370	415	485	2470	3170	4130	-
Q	343	381	456	2081	2775	3508	-
R	345	390	470	2680	3350	4230	51.0
S	358	396	-	2362	3116	4156	48.0
T	-	-	-	2485	3250	4110	46.6
U	365	430	495	2350	2950	3780	49.0
V	349	488	523	2210	3253	4335	52.0
W	-	-	-	-	-	-	-
X	312	355	437	2462	3275	4246	48.5
Y	333	412	474	2434	3142	4096	50.0
Z	330	400	450	2490	3240	4160	48.5
XX	292	385	496	2760	3192	4614	-

TABLE 42

Chemical Analysis

Test Sample No. 13

Participant	Chemical Analysis								
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %	Combined Oxides %
A	0.25	21.08	5.44	2.46	62.91	2.99	2.72	0.88	-
B	0.15	21.15	5.30	2.50	62.90	2.75	2.75	0.85	-
C	0.27	-	2.90	2.48	-	3.11	2.82	0.85	5.38
D	0.20	-	5.96	2.40	-	2.61	2.71	0.86	-
E	0.15	-	5.55	2.41	63.40	2.80	2.76	0.87	7.96
F	0.15	-	5.61	2.43	-	2.75	2.77	0.70	-
G	0.16	21.02	5.53	2.49	63.04	2.96	2.82	0.83	-
H	0.19	-	5.97	2.41	-	3.08	2.78	0.85	-
I	-	-	-	-	-	-	-	-	-
J	-	-	-	-	-	-	-	-	-
K	0.14	21.34	5.68	2.44	62.92	2.96	2.68	0.93	-
L	0.16	21.18	5.55	2.49	63.20	2.92	2.84	0.93	-
M	0.17	-	5.62	2.48	-	2.78	2.77	0.92	8.10
N	-	-	-	-	-	-	-	-	-
O	0.10	-	5.41	2.55	-	2.09	2.73	0.84	-
P	0.32	-	5.62	2.44	-	3.02	2.82	0.84	8.06
Q	0.17	21.09	5.64	2.46	63.16	2.76	2.82	0.85	-
R	0.15	21.72	5.50	2.54	62.40	3.23	2.79	0.91	-
S	0.18	21.11	5.52	2.43	62.85	3.06	2.75	0.83	-
T	0.28	-	5.57	2.50	-	2.86	2.74	0.80	8.07
U	0.13	-	5.54	2.44	-	2.94	2.79	0.89	7.98
V	0.20	20.90	5.51	2.49	63.75	2.81	2.46	1.00	-
W	-	-	-	-	-	-	-	-	-
X	0.22	21.04	5.61	2.38	63.32	2.95	2.85	0.87	-
Y	0.32	-	5.68	2.44	-	2.78	2.76	0.78	8.13
Z	0.20	20.92	5.82	2.41	63.06	2.85	2.78	0.98	-
XX	0.56	-	6.38	2.50	-	2.63	2.71	0.79	8.88

TABLE 43

Physical Tests - General

Average of Test Results of Samples 12 & 13

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	24.0	10.0	2:40	4:20	2:45	4:30	7.6	2975	0.205
B	24.7	10.0	-	-	3:45	5:42	8.9	3080	0.195
C	24.7	10.2	2:57	4:40	2:32	5:32	6.0	2963	0.173
D	24.8	9.5	3:15	4:17	3:10	4:27	7.0	2945	0.150
E	24.0	9.0	2:32	4:30	2:40	4:32	7.8	3130	0.190
F	24.0	9.0	3:05	4:45	2:55	4:47	10.7	3110	0.224
G	24.2	9.5	2:57	5:00	2:57	5:00	7.8	2995	0.120
H	25.2	10.5	3:10	4:52	2:45	4:27	8 0	3104	0.180
I	-	-	-	-	-	-	-	-	-
J	-	-	-	-	-	-	-	-	-
K	24.6	10.0	3:10	5:10	3:05	5:05	9.0	3005	0.170
L	24.3	-	-	-	-	-	-	2999	0.220
M	23.8	9.5	2:20	4:22	2:25	4:22	7.3	3190	0.210
N	-	-	-	-	-	-	-	-	-
O	24.5	9.7	2:35	4:47	3:15	6:17	7.0	3050	0.179
P	25.0	-	3:07	5:40	3:15	5:47	8.0	2965	0.220
Q	24.9	-	2:52	5:00	3:15	5:00	12.3	3047	0.185
R	24.0	10.0*	2:20	4:35	2:20	4:35	7.0	3220	0.255
S	24.5	9.9	3:07	4:30	3:25	5:42	7.2	2992	0.230
T	25.0	-	3:24	4:55	3:30	4:50	8.3	3157	0.206
U	24.0	9.0	3:00	4:50	3:00	4:50	7.5	3055	0.180
V	22.5	10.7	2:27	3:25	3:05	3:50	6.7	3075	0.165
W	-	-	-	-	-	-	-	-	-
X	24.0	9.2	2:48	4:31	2:48	4:31	9.2	3039	0.230
Y	24.3	10.2	3:27	4:55	3:00	5:10	7.7	3020	0.120
Z	24.8	9.7	3:15	6:15	-	-	-	3091	0.210
XX	25.0	10.0	-	-	3:00	5:07	-	-	0.160

*W/C = Water-Cement Ratio.

TABLE 44

Physical Tests - Mortar Strength

Average of Test Results of Samples 12 & 13

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	375	425	495	2450	3100	4110	-
B	350	405	460	2585	3305	4275	-
C	335	390	415	2505	3250	4080	-
D	280	385	430	2300	3010	4075	48.0*
E	360	410	485	2605	3290	4240	48.0
F	325	375	485	2525	3145	4045	47.9
G	345	410	500	2395	3180	4170	48.3
H	-	-	-	2615	3355	4415	50.3
I	-	-	-	-	-	-	-
J	-	-	-	-	-	-	-
K	345	435	500	2460	3210	4235	49.0
L	325	425	515	2495	3390	4655	-
M	380	440	495	2575	3255	4165	-
N	-	-	-	-	-	-	-
O	320	400	450	2560	3235	4260	47.3
P	370	425	495	2520	3215	4160	-
Q	320	380	450	2180	2835	3560	47.5*
R	350	395	460	2640	3350	4365	52.0
S	360	400	470*	2385	3120	4070	48.0
T	-	-	-	2400	3155	3940	46.6
U	360	430	485	2350	2925	3765	49.0
V	350	445	490	2225	3135	4480	51.6
W	-	-	-	-	-	-	-
X	305	375	435	2520	3300	4335	48.2
Y	330	410	470	2395	3110	4130	50.0
Z	330	405	465	2500	3250	4200	48.7
XX	290	385	470	2640	3250	4410	-

*One test result only.

TABLE 45

Chemical Analysis

Average of Test Results of Samples 12 & 13

Participant	Chemical Analysis								
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %	Combined Oxides %
A	0.26	21.12	5.45	2.46	62.95	3.00	2.74	0.86	-
B	0.15	21.12	5.27	2.50	62.90	2.75	2.75	0.85	-
C	0.30	-	2.52	2.66	-	3.19	2.78	0 84	5.18
D	0.20	-	5.92	2.44	-	2.64	2.71	0.87	-
E	0.16	-	5.59	2.41	63.40	2.82	2.76	0.84	8.00
F	0.15	-	5.65	2.43	-	2.70	2.76	0.68	-
G	0.15	21.01	5.58	2.46	63.08	2.98	2.82	0.82	-
H	0.18	-	5.68	2.41	-	3.07	2.78	0.86	7.81*
I	-	-	-	-	-	-	-	-	-
J	-	-	-	-	-	-	-	-	-
K	0.13	21.15	5.68	2.48	62.97	2.97	2.70	0.97	-
L	0.15	21.16	5.54	2.49	63.26	2.80	2.83	0.91	-
M	0.17	-	5.64	2.48	-	2.77	2.76	0.92	8.12
N	-	-	-	-	-	-	-	-	-
O	0.14	-	5.35	2.55	-	2.05	2.84	1.18	-
P	0.30	-	5.63	2.43	-	3.05	2.81	0.83	8.06
Q	0.15	21.07	5.61	2.45	63.14	2.76	2.79	0.90	-
R	0.17	21.63	5.57	2.52	62.31	3.30	2.80	0.90	-
S	0.18	21.19	5.54	2.43	62.89	3.06	2.76	0.84	-
T	0.30	-	5.60	2.50	-	2.87	2.74	0.81	8.10
U	0.13	-	5.58	2.44	-	2.92	2.79	0.88	8.02
V	0.22	20.95	5.49	2.46	63.75	2.76	2.43	1.19	-
W	-	-	-	-	-	-	-	-	-
X	0.21	21.07	5.58	2.39	63.31	2.91	2.81	0.88	-
Y	0.33	-	5.74	2.45	-	2.80	2.86	0.77	8.19
Z	0.21	20.94	5.80	2.40	63.06	2.85	2.79	1.02	-
XX	0.66	-	6.29	2.47	-	2.75	2.75	0.87	8.76

*One test result only.

TABLE 46

Summary of Statistical Analyses of Test Results — Sample No. 12

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C. V. **
Physical Tests - General							
Normal Consistency - water/cem.	23	%	25.2	23.0	24.4	0.53	2.2
Normal Consistency - Rod Penetr.	19	mm	11.0	9.0	9.8	0.67	6.9
Vicat - Initial Time of Set	20	hr:min	3:28	2:20	2:57	0:19	10.9
- Final Time of Set	20	hr:min	6:10	3:40	4:47	0:31	10.8
Gillmore - Initial Time of Set	21	hr:min	3:45	2:20	3:00	0:23	13.1
- Final Time of Set	21	hr:min	6:15	3:45	4:57	0:35	11.9
Fineness - Retained on No. 200M	20	%	12.5	6.0	8.1	1.51	18.6
Fineness - Blaine	22	cm^2/g	3210	2910	3057	79	2.6
Soundness - Autoclave Expansion	23	%	0.35	0.12	0.19	0.047	24.0
Physical Tests - Mortar Strength							
Tensile Strength, 3-day--	21	psi	385	280	335	30	8.9
7-day--	21	psi	460	380	410	20	4.9
28-day--	21	psi	505	428	470	25	5.3
Compressive Strength, 3-day--	23	psi	2640	2242	2460	118	4.8
7-day--	23	psi	3533	2896	3185	171	5.4
28-day--	23	psi	4758	3608	4200	268	6.4
Water Content ----------	16	%	53.0	46.6	48.7	1.6	3.4
Chemical Analysis							
Insoluble residue ----------	23	%	0.76	0.12	0.23	0.13	58.5
Silicon dioxide (SiO_2) -------	11	%	21.54	20.96	21.11	0.17	0.8
Aluminum oxide (Al_2O_3) ------	23	%	6.20	2.14	5.46	0.75	13.7
Ferric oxide (Fe_2O_3) -----	23	%	2.84	2.39	2.47	0.09	3.6
Calcium oxide (CaO) -------	12	%	63.75	62.22	63.10	0.36	0.6
Magnesium oxide (MgO) ------	23	%	3.37	2.02	2.87	0.26	9.1
Sulphur trioxide (SO_3) -------	23	%	2.95	2.40	2.77	0.10	3.5
Loss on Ignition (LOI) -------	23	%	1.53	0.66	0.92	0.19	20.3
Combined Oxides - - - - - - - - -	9	%	8.64	4.98	7.79	1.08	13.8

*Number of laboratories reporting.
**Coefficient of Variation, per cent.

TABLE 47

Summary of Statistical Analyses of Test Results — Sample No. 13

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C.V.**
Physical Tests - General							
Normal Consistency - water/cem.	23	%	25.2	22.0	24.4	0.67	2.7
Normal Consistency - Rod Penetr.	18	mm	11.0	9.0	9.8	0.62	6.4
Vicat - Initial Time of Set	20	hr:min	3:30	2:15	2:54	0:22	12.7
- Final Time of Set	20	hr:min	6:20	3:10	4:45	0:37	12.9
Gillmore - Initial Time of Set	21	hr:min	3:45	2:20	3:00	0:20	11.3
- Final Time of Set	21	hr:min	6:20	3:55	4:58	0:36	12.0
Fineness - Retained on No. 200M	20	%	12.1	6.0	8.0	1.4	17.8
Fineness - Blaine	22	cm^2/g	3230	2940	3052	78	2.6
Soundness - Autoclave Expansion	23	%	0.226	0.120	0.18	0.032	17.1
Physical Tests - Mortar Strength							
Tensile Strength, 3-day --	21	psi	380	280	340	26	7.6
7-day --	21	psi	488	355	405	30	7.5
28-day --	20	psi	540	382	477	36	7.5
Compressive Strength, 3-day --	23	psi	2760	2081	2485	157	6.3
7-day --	23	psi	3350	2775	3195	128	4.0
28-day --	23	psi	4614	3508	4160	234	5.6
Water Content ----------	15	%	52.0	46.6	48.9	1.46	3.0
Chemical Analysis							
Insoluble residue ----------	23	%	0.56	0.10	0.21	0.096	46.0
Silicon dioxide (SiO_2) -------	11	%	21.72	20.90	21.14	0.23	1.1
Aluminum oxide (Al_2O_3) ------	23	%	6.38	2.90	5.52	0.61	11.1
Ferric oxide (Fe_2O_3) -----	23	%	2.55	2.38	2.46	0.044	1.8
Calcium oxide (CaO) -------	12	%	63.75	62.40	63.08	0.33	0.5
Magnesium oxide (MgO) ------	23	%	3.23	2.09	2.86	0.23	7.9
Sulphur trioxide (SO_3) -------	23	%	2.85	2.46	2.76	0.079	2.8
Loss on Ignition (LOI) -------	23	%	1.00	0.70	0.86	0.07	7.6
Combined Oxides ----------	8	%	8.88	5.38	7.82	1.03	13.2

*Number of laboratories reporting.
**Coefficient of Variation, per cent.

TABLE 48

Summary of Statistical Analyses of Test Results — Samples 12 & 13

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C. V.**
Physical Tests - General							
Normal Consistency - water/cem.	23	%	25.2	22.5	24.4	0.58	2.4
Normal Consistency - Rod Penetr.	19	mm	10.7	9.0	9.8	0.49	5.1
Vicat - Initial Time of Set	20	hr:min	3:27	2:20	2:55	0:20	11.7
- Final Time of Set	20	hr:min	6:15	3:25	4:46	0:34	11.8
Gillmore - Initial Time of Set	21	hr:min	3:45	2:20	3:00	0:21	11.9
- Final Time of Set	21	hr:min	6:17	3:15	4:57	0:35	11.8
Fineness - Retained on No. 200M	20	%	12.3	6.0	8.05	1.44	17.9
Fineness - Blaine	22	cm^2/g	3220	2945	3055	75	2.5
Soundness - Autoclave Expansion	23	%	0.255	0.120	0.190	0.034	17.9
Physical Tests - Mortar Strength							
Tensile Strength, 3-day--	21	psi	380	280	340	26	7.8
7-day--	21	psi	445	375	405	21	5.3
28-day--	21	psi	515	415	470	26	5.5
Compressive Strength, 3-day--	23	psi	2640	2180	2470	126	5.1
7-day--	23	psi	3390	2835	3190	135	4.2
28-day--	23	psi	4655	3560	4180	231	5.5
Water Content ----------	16	%	52.0	46.6	48.8	1.5	3.1
Chemical Analysis							
Insoluble residue ----------	23	%	0.66	0.13	0.22	0.11	52.4
Silicon dioxide (SiO_2) -------	11	%	21.63	20.94	21.13	0.19	0.9
Aluminum oxide (Al_2O_3) ------	23	%	6.29	2.52	5.49	0.68	12.3
Ferric oxide (Fe_2O_3) -----	23	%	2.66	2.39	2.46	0.06	2.3
Calcium oxide (CaO) -------	12	%	63.75	62.31	63.08	0.35	0.6
Magnesium oxide (MgO) ------	23	%	3.30	2.05	2.86	0.24	8.4
Sulphur trioxide (SO_3) -------	23	%	2.86	2.43	2.76	0.08	3.0
Loss on Ignition (LOI) -------	23	%	1.19	0.68	0.89	0.11	12.8
Combined Oxides ----------	9	%	8.76	5.18	7.80	1.02	13.0

*Number of laboratories reporting.
**Coefficient of Variation, per cent.

TABLE 49

Physical Tests - General

Test Sample No. 14

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	22.8	10.0	2:00	3:45	2:00	3:45	8.1	3960	0.690
B	23.0	9.0	-	-	2:00	3:15	8.0	4020	0.486
C	-	-	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-	-	-
E	23.5	9.5	2:10	4:00	2:10	4:00	7.5	4000	0.480
F	23.0	9.0	2:09	2:53	2:20	2:59	9.3	4110	0.752
G	23.5	11.0	2:20	3:40	2:20	3:40	7.1	4020	0.360
H	25.0	10.0	2:35	3:40	2:20	3:40	7.0	4021	0.560
I	23.5	10.5	2:05	3:40	2:05	3:40	6.6	4000	0.590
J	23.0	9.0	1.30	2:25	1:30	2:25	7.2	3980	0.920
K	23.8	9.5	2:05	3:55	2:05	3:55	8.0	3970	0.560
L	23.6	-	2:10	3:50	2:25	4:00	-	4069	0.688
M	-	-	-	-	-	-	-	-	-
N	22.6	10.0	1:45	-	1:50	-	7.0	3960	0.930
O	23.6	9.5	2:30	4:45	2:50	5:50	7.2	3975	0.520
P	23.0	-	2:05	3:30	-	-	7.0	3930	0 710
Q	24.3	-	2:15	4:15	2:25	4:20	7.4	3891	0.670
R	23.0	10.0	2:25	4:30	2:20	4:30	6.0	3970	0.210
S	23.0	10.5	2:05	3:40	2:15	3:38	6.2	4052	0.710
T	23.5	9.0	2:20	4:45	2:25	4:35	5.9	4300	-0.303
U	23.0	9.0	2:15	3:15	2:15	3:15	7.0	4050	0.410
V	22.4	10.5	2:50	3:40	3:05	4:05	6.0	3960	0.320
W	23.8	10.0	2:00	3:05	-	-	8.0	4105	0.550
X	22.5	9.2	1:45	3:05	1:45	3:05	10.5	4020	0.610
Y	23.0	10.5	1:50	3:15	2:25	4:40	8.8	3956	0.500
Z	23.5	9.0	2:35	5:00	-	-	-	4023	0.280

*W/C = Water-Cement Ratio.

TABLE 50

Physical Tests - Mortar Strength

Test Sample No. 14

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	340	400	490	2530	3260	4280	-
B	320	390	505	2680	3600	4250	-
C	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-
E	360	420	475	2890	3600	4540	46.0
F	305	380	460	2610	3185	4115	49.3
G	305	410	480	2750	3470	4530	47.3
H	-	-	-	2780	3430	3830	50.0
I	360	425	505	2700	3450	4380	-
J	370	410	490	3090	3620	4975	48.6
K	330	365	500	2710	3530	4780	48.5
L	330	390	540	2253	3083	4508	49.3
M	-	-	-	-	-	-	-
N	-	-	-	2670	3420	4330	48.5
O	301	366	436	2766	3483	4533	47.3
P	360	415	510	2830	3720	4760	-
Q	269	353	451	2406	3116	4050	47.0
R	360	395	505	2800	3450	4500	51.0
S	323	369	429	2644	3281	4300	48.0
T	-	-	-	2575	2990	3890	48.0
U	365	405	490	2850	3480	4730	48.0
V	352	424	518	2372	3320	4630	51.0
W	-	-	-	2200	2800	3875	50.1
X	300	362	455	2556	3212	4600	50.0
Y	301	378	463	2282	2975	4088	49.0
Z	340	390	490	2880	3720	4580	47.5

TABLE 51

Chemical Analysis

Test Sample No. 14

Participant	Chemical Analysis								
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %	Combined Oxides %
A	0.38	21.00	5.17	2.15	62.08	3.97	3.19	1.75	-
B	0.20	20.85	4.70	2.20	61.75	3.95	3.10	1.90	-
C	-	-	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-	-	-
E	0.21	20.84	4.90	2.14	61.99	3.96	3.15	1.90	7.04
F	0.38	-	5.33	2.20	-	4.23	3.12	1.73	-
G	0.26	20.86	4.87	2.19	61.86	4.13	3.21	1.79	-
H	0.24	-	4.88	2.13	-	4.28	3.13	1.63	7.01
I	0.22	-	4.70	2.24	-	3.83	3.06	1.60	6.94
J	0.27	-	5.06	2.18	-	4.74	3.24	1.70	-
K	0.22	21.00	4.92	2.20	62.24	3.90	3.08	1.67	-
L	0.18	20.31	5.07	2.27	62.08	4.06	3.10	1.65	-
M	-	-	-	-	-	-	-	-	-
N	0.20	21.00	5.05	2.15	62.04	4.00	3.05	1.83	-
O	0.32	-	4.70	2 20	-	3.53	3.15	1.67	-
P	0.24	-	4.94	2.14	-	4.20	3.14	1.78	7.08
Q	0.38	20.94	5.01	2.16	61.40	3.96	3.31	1.90	-
R	0.20	21.02	5.03	2.15	62.07	4.02	3.07	1.82	-
S	0.25	20.89	4.89	2.17	62.15	4.21	3.10	1.67	-
T	0.31	20.82	4.92	2.20	61.85	4.09	3.12	1.63	7.12
U	0.15	20.82	4.58	2.20	61.99	4.05	3.21	1.95	6.78
V	0.30	20.50	5.05	2.20	62.50	3.75	2.40	2.20	-
W	0.16	21.17	4.90	2.10	62.53	3.04	3.25	1.55	-
X	0.21	20.87	4.93	2.17	61.71	4.09	3.17	1.70	-
Y	0.30	-	5.02	2.19	-	3.83	3.09	1.59	7.21
Z	0.26	21.00	4.97	2.15	61.91	3.85	3.29	1.68	-
XX	0.90	-	6.44	2.20	-	5.22	3.02	1.66	-

TABLE 52

Physical Tests - General

Test Sample No. 15

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	22.7	10.0	1:50	3:50	2:00	3:55	7.7	4000	0.730
B	23.0	9.0	2:05	-	2:10	3:10	8.8	4020	0.607
C	-	-	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-	-	-
E	23.5	10.0	2:10	4:00	2:10	4:00	7.5	4010	0.480
F	23.0	9.0	2:07	2:46	2:10	2:49	8.9	4090	0.772
G	23.5	10.0	2:15	3:30	2:15	3:30	7.0	4000	0.360
H	25.0	11.0	2:50	3:55	2:20	3:50	7.6	4078	0.570
I	23.5	10.5	2:05	3:40	2:05	3:40	6.7	4000	0.520
J	23.0	9.0	1:35	2:20	1:30	2:15	7.0	3990	1.030
K	23.8	9.5	1:35	3:20	1:35	3:20	8.6	3980	0.540
L	23.6	-	2:05	3:50	2:20	3:55	-	4069	0.693
M	-	-	-	-	-	-	-	-	-
N	22.8	-	1:50	-	1:45	-	-	3960	-
O	23.6	10.0	2:35	5:00	3:05	6:10	6.8	4000	0.576
P	23.5	-	2:10	3:30	-	-	7.1	3940	0.660
Q	24.0	-	2:04	3:54	2:42	4:05	8.1	3937	0.630
R	23.0	10.0	2:30	4:40	2:30	4:40	6.0	3970	0.210
S	22.75	10.0	2:03	3:40	2:15	3.43	6.0	3951	0.700
T	23.5	10.5	2:05	4:30	2:20	4:20	5.8	4230	-0.294
U	23.5	9.5	2:15	3:25	2:15	3:25	6.8	4050	0.420
V	23.0	10.0	3:10	4:00	3:00	3:50	6.0	3940	0.300
W	23.8	10.0	2:00	3:05	-	-	8.8	4120	0.560
X	22.5	9.0	1:32	2:52	1:32	2:52	10.2	4038	0.610
Y	23.0	9.0	1:55	3:25	2:30	4:30	8.9	3984	0.480
Z	23.5	9.0	2:35	5:00	-	-	-	4009	0.280

*W/C = Water-Cement Ratio.

TABLE 53

Physical Tests - Mortar Strength

Test Sample No. 15

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	340	410	480	2640	3250	4230	-
B	315	345	455	2585	3500	4700	-
C	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-
E	355	415	475	2860	3570	4520	46.5
F	320	350	465	2575	3235	4165	49.3
G	335	415	500	2790	3540	4500	47.3
H	-	-	-	2780	3400	3930	50.5
I	370	415	520	2680	3400	4370	-
J	340	440	500	2900	3250	4930	48.6
K	295	410	465	2710	3440	4690	48.5
L	315	383	490	2220	3142	4450	49.3
M	-	-	-	-	-	-	-
N	-	-	-	2400	3270	4140	49.5
O	293	326	441	2800	3500	4441	47.0
P	365	425	510	2860	3720	4760	-
Q	304	409	452	2625	3154	4041	47.5
R	365	425	505	2670	3380	4500	51.0
S	319	363	440	2665	3253	4363	48.0
T	-	-	-	2640	3100	4115	48.0
U	335	395	475	2770	3430	4700	48.0
V	352	429	487	2307	3285	4500	52.0
W	-	-	-	2167	2833	3850	50.1
X	301	365	445	2606	3168	4395	50.0
Y	296	373	480	2305	3025	4258	49.0
Z	300	380	410	2690	3700	4530	48.0

TABLE 54

Chemical Analysis

Test Sample No. 15

Participant	Chemical Analysis								
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %	Combined Oxides %
A	0.37	21.02	5.18	2.18	62.08	3.93	3.11	1.71	-
B	0.20	20.95	4.65	2.20	61.80	3.95	3.10	1.80	-
C	-	-	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-	-	-
E	0.22	20.78	4.94	2.16	61.91	4.00	3.12	1.94	7.10
F	0.32	-	5.28	2.16	-	4.20	3.15	1.75	-
G	0.26	21.00	4.91	2.15	61.94	4.26	3.20	1.65	-
H	0.26	-	5.06	2.13	-	4.18	3.13	1.72	7.19
I	0.22	-	4.68	2.24	-	3.55	3.07	1.70	6.92
J	0.29	-	5.01	2.19	-	4.73	3.22	1.58	-
K	0.26	21.04	4.98	2.16	62.06	4.02	2.92	1.82	-
L	0.17	20.39	5.06	2.24	61.64	4.16	3.12	1.84	-
M	-	-	-	-	-	-	-	-	-
N	0.20	21.00	5.13	2.15	61.94	4.05	3.00	1.75	-
O	0.27	-	5.07	2.25	-	3.41	3.10	1.87	-
P	0.23	-	4.94	2.12	-	4.18	3.16	1.76	7.06
Q	0.32	20.96	5.02	2.20	61.70	3.90	3.32	1.70	-
R	0.19	21.00	5.13	2.15	61.97	4.06	2.99	1.72	-
S	0.23	20.81	4.96	2.16	61.93	4.19	3.09	1.72	-
T	0.33	20.82	4.82	2.25	62.15	4.09	3.13	1.56	7.07
U	0.15	20.82	4.47	2.17	62.00	4.00	3.24	1.91	6.64
V	0.28	20.56	4.95	2.20	62.50	3.75	2.50	2.20	-
W	0.28	20.90	5.06	2.10	62.74	3.23	3.07	1.69	-
X	0.20	20.84	5.07	2.17	61.74	4.07	3.19	1.74	-
Y	0.31	-	5.08	2.22	-	3.82	3.03	1.62	7.30
Z	0.26	20.98	4.97	2.15	61.82	3.85	3.31	1.72	-
XX	0.49	-	4.80	2.34	-	5.43	3.02	1.78	-

TABLE 55

Physical Tests - General

Average of Test Results of Samples 14 & 15

Participant	Normal Consistency		Time of Setting, hr:min				Fineness		Soundness
	W/C*, %	Penetration, mm	Vicat		Gillmore		Retained on +200M, %	Blaine, cm^2/gm	Autoclave Expansion, %
			Initial	Final	Initial	Final			
A	22.7	10.0	1:55	3:47	2:00	3:50	7.9	3980	0.710
B	23.0	9.0	2:05*	-	2:05	3:12	8.4	4020	0.546
C	-	-	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-	-	-
E	23.5	9.7	2:10	4:00	2:10	4:00	7.5	4005	0.480
F	23.0	9.0	2:08	2:49	2:15	2:54	9.1	4100	0.762
G	23.5	10.5	2:17	3:35	2:17	3:35	7.0	4010	0.360
H	25.0	10.5	2:42	3:47	2:20	3:45	7.3	4049	0.505
I	23.5	10.5	2:05	3:40	2:05	3:40	6.6	4000	0.555
J	23.0	9.0	1:32	2:22	1:30	2:20	7.1	3985	0.975
K	23.8	9.5	1:50	3:37	1:50	3:37	8.3	3975	0.550
L	23.6	-	2:07	3:50	2:22	3:57	-	4069	0.690
M	-	-	-	-	-	-	-	-	-
N	22.7	10.0*	1:47	-	1:47	-	7.0*	3960	0.930*
O	23.6	9.7	2:32	4:52	2:57	6:00	7.0	3987	0.548
P	23.2	-	2:07	3:30	-	-	7.0	3935	0.685
Q	24.1	-	2:09	4:04	2:33	4:12	7.7	3914	0.650
R	23.0	10.0	2:27	4:35	2:25	4:35	6.0	3970	0.210
S	22.9	10.2	2:04	3:40	2:15	3:40	6.1	4001	0.705
T	23.5	9.7	2:12	4:37	2:22	4:27	5.8	4265	-0.298
U	23.2	9.2	2:15	3:20	2:15	3:20	6.9	4050	0.415
V	22.7	10.2	3:00	3:50	3:02	3:57	6.0	3950	0.310
W	23.8	10.0	2:00	3:05	-	-	8.4	4112	0.555
X	22.5	9.1	1:38	2:58	1:38	2:58	10.3	4029	0.610
Y	23.0	9.7	1:52	3:20	2:27	4:35	8.8	3970	0.490
Z	23.5	9.0	2:35	5:00	-	-	-	4016	0.280

*W/C = Water-Cement Ratio.

TABLE 56

Physical Tests - Mortar Strength

Average of Test Results of Samples 14 & 15

Participant	Tensile Strength			Compressive Strength			
	3-day, psi	7-day, psi	28-day, psi	3-day, psi	7-day, psi	28-day, psi	H_2O, %
A	340	405	485	2585	3255	4255	-
B	315	365	480	2635	3550	4475	-
C	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-
E	355	415	475	2875	3585	4530	46.2
F	310	365	460	2510	3210	4140	49.3
G	320	410	490	2770	3505	4515	47.3
H	-	-	-	2780	3415	3880	51.2
I	365	420	510	2690	3425	4375	-
J	355	425	495	2995	3435	4950	48.6
K	310	385	480	2710	3485	4735	48.5
L	320	385	515	2235	3110	4480	49.3
M	-	-	-	-	-	-	-
N	-	-	-	2535	3345	4235	49.0
O	295	345	438	2785	3490	4485	47.1
P	360	420	510	2845	3720	4760	-
Q	285	385	450	2515	3135	4045	47.2
R	360	410	505	2735	3415	4500	51.0
S	320	365	435	2655	3265	4330	48.0
T	-	-	-	2605	3045	4000	48.0
U	350	400	480	2810	3455	4715	48.0
V	350	425	500	2340	3300	4565	51.5
W	-	-	-	2185	2815	3860	50.1
X	300	365	450	2580	3190	4495	50.0
Y	300	375	470	2295	3000	4175	49.0
Z	320	385	450	2785	3710	4555	47.7

TABLE 57

Chemical Analysis

Average of Test Results of Samples 14 & 15

Participant	Chemical Analysis								
	Insoluble, %	SiO_2, %	Al_2O_3, %	Fe_2O_3, %	CaO, %	MgO, %	SO_3, %	LOI, %	Combined Oxides %
A	0.37	21.01	5.17	2.16	62.08	3.95	3.15	1.73	-
B	0.20	20.90	4.67	2.20	61.77	3.95	3.10	1.85	-
C	-	-	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-	-	-
E	0.21	20.81	4.92	2.15	61.95	3.98	3.13	1.92	7.07
F	0.35	-	5.30	2.18	-	4.21	3.13	1.74	-
G	0.26	20.93	4.89	2.17	61.90	4.19	3.20	1.72	-
H	0.25	-	4.97	2.13	-	4.23	3.13	1.67	7.10
I	0.22	-	4.69	2.24	-	3.69	3.06	1.65	6.93
J	0.28	-	5.03	2.18	-	4.73	3.23	1.64	-
K	0.24	21.02	4.95	2.18	62.15	3.96	3.00	1.74	-
L	0.17	20.35	5.06	2.25	61.86	4.11	3.11	1.74	-
M	-	-	-	-	-	-	-	-	-
N	0.20	21.00	5.09	2.15	61.99	4.02	3.02	1.79	-
O	0.29	-	4.88	2.20	-	3.47	3.12	1.77	-
P	0.23	-	4.94	2.13	-	4.19	3.15	1.77	7.07
Q	0.35	20.95	5.01	2.18	61.55	3.93	3.31	1.80	-
R	0.19	21.01	5.08	2.15	62.02	4.04	3.03	1.77	-
S	0.24	20.85	4.92	2.16	62.04	4.20	3.09	1.59	-
T	0.32	20.82	4.87	2.22	62.00	4.09	3.12	1.59	7.09
U	0.15	20.82	4.52	2.18	61.99	4.02	3.22	1.93	6.70
V	0.29	20.53	5.00	2.20	62.50	3.75	2.45	2.20	-
W	0.22	21.03	4.98	2.10	62.63	3.17	3.16	1.62	-
X	0.20	20.85	5.00	2.17	61.72	4.08	3.18	1.72	-
Y	0.30	-	5.05	2.20	-	3.82	3.06	1.60	7.25
Z	0.26	20.99	4.97	2.15	61.86	3.85	3.30	1.70	-
XX	0.69	-	5.62	2.27	-	5.32	3.02	1.72	-

TABLE 58

Summary of Statistical Analyses of Test Results — Sample No. 14

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C. V. **
Physical Tests - General							
Normal Consistency - water/cem.	23	%	25.0	22.4	23.3	0.59	2.5
Normal Consistency - Rod Penetr.	20	mm	11.0	9.0	9.7	0.65	6.7
Vicat - Initial Time of Set	22	hr:min	2:50	1:30	2:10	0:19	14.3
- Final Time of Set	21	hr:min	5:00	2:25	3:44	0:39	17.4
Gillmore - Initial Time of Set	20	hr:min	3:05	1:30	2:14	0:21	15.7
- Final Time of Set	19	hr:min	5:50	2:25	3:15	0:45	19.5
Fineness - Retained on No. 200M	21	%	10.5	5.9	7.4	1.1	15.3
Fineness - Blaine	23	cm^2/g	4300	3891	4015	81.6	2.0
Soundness - Autoclave Expansion	22	%	0.930	0.210	0.36	0.19	52.4
Physical Tests - Mortar Strength							
Tensile Strength, 3-day--	19	psi	370	269	330	29	8.7
7-day--	19	psi	425	353	390	22	5.7
28-day--	19	psi	540	429	485	29	6.0
Compressive Strength, 3-day--	23	psi	3090	2200	2645	225	8.5
7-day--	23	psi	3720	2800	3355	247	7.4
28-day--	23	psi	4975	3830	4395	311	7.1
Water Content ----------	19	%	51.0	46.0	48.7	1.4	2.8
Chemical Analysis							
Insoluble residue ----------	24	%	0.90	0.15	0.28	0.15	52.5
Silicon dioxide (SiO_2) -------	16	%	21.17	20.31	20.87	0.21	1.0
Aluminum oxide (Al_2O_3) ------	24	%	6.44	4.58	5.00	0.35	6.9
Ferric oxide (Fe_2O_3) -----	24	%	2.27	2.10	2.18	0.04	1.7
Calcium oxide (CaO) -------	16	%	62.53	61.40	62.01	0.28	0.5
Magnesium oxide (MgO) ------	24	%	5.22	3.04	4.04	0.39	9.8
Sulphur trioxide (SO_3) -------	24	%	3.31	2.40	3.11	0.17	5.5
Loss on Ignition (LOI) -------	24	%	2.20	1.55	1.75	0.15	8.3

* Number of laboratories reporting.

** Coefficient of Variation, per cent.

TABLE 59

Summary of Statistical Analyses of Test Results — Sample No 15

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C. V. **
Physical Tests - General							
Normal Consistency - water/cem.	23	%	25.0	22.5	23.4	0.54	2.3
Normal Consistency - Rod Penetr.	19	mm	11.0	9.0	9.7	0.61	6.3
Vicat - Initial Time of Set	23	hr:min	3:10	1:32	2:09	0:23	18.2
- Final Time of Set	21	hr:min	5:00	2:20	3:43	0:41	18.5
Gillmore - Initial Time of Set	20	hr:min	3:05	1:30	2:13	0:26	19.2
- Final Time of Set	19	hr:min	6:10	2:15	3:47	0:50	21.9
Fineness - Retained on No. 200M	20	%	10.2	5.8	7.5	1.2	16.2
Fineness - Blaine	23	cm^2/g	4230	3937	4016	68.0	1.7
Soundness - Autoclave Expansion	21	%	1.030	0.210	0.35	0.19	54.0
Physical Tests - Mortar Strength							
Tensile Strength, 3-day--	19	psi	370	293	325	26	7.9
7-day--	19	psi	440	326	395	32	8.2
28-day--	19	psi	520	410	475	28	6.0
Compressive Strength, 3-day--	23	psi	2900	2167	2620	207	7.9
7-day--	23	psi	3720	2833	3330	213	6.4
28-day--	23	psi	4930	3850	4395	274	6.2
Water Content ----------	19	%	52.0	46.5	48.8	1.4	2.9
Chemical Analysis							
Insoluble residue ----------	24	%	0.49	0.15	0.26	0.073	27.7
Silicon dioxide (SiO_2) -------	16	%	21.04	20.39	20.87	0.18	0.9
Aluminum oxide (Al_2O_3) ------	24	%	5.28	4.47	4.97	0.18	3.6
Ferric oxide (Fe_2O_3) -----	24	%	2.34	2.10	2.18	0.047	2.2
Calcium oxide (CaO) -------	16	%	62.74	61.64	61.99	0.28	0.5
Magnesium oxide (MgO) ------	24	%	5.43	3.23	4.04	0.42	10.4
Sulphur trioxide (SO_3) -------	24	%	3.32	2.50	3.10	0.16	5.1
Loss on Ignition (LOI) -------	24	%	2.20	1.56	1.76	0.13	7.5

* Number of laboratories reporting.

** Coefficient of Variation, per cent.

TABLE 60

Summary of Statistical Analyses of Test Results — Sample 14 & 15

Description of Test	N*	Unit	Maximum	Minimum	Average	Standard Deviation	C. V. **
Physical Tests - General							
Normal Consistency - water/cem.	23	%	25.0	22.5	23.3	0.55	2.4
Normal Consistency - Rod Penetr.	20	mm	10.5	9.0	9.7	0.53	5.5
Vicat - Initial Time of Set	23	hr:min	3:00	1:32	2:09	0:20	15.8
- Final Time of Set	21	hr:min	5:00	2:22	3:44	0:40	17.7
Gillmore - Initial Time of Set	20	hr:min	3:02	1:30	2:14	0:23	17.1
- Final Time of Set	19	hr:min	6:00	2:20	3:49	0:47	20.5
Fineness - Retained on No. 200M	21	%	10.3	6.0	7.44	1.14	15.4
Fineness - Blaine	23	cm^2/g	4265	3914	4015	73	1.8
Soundness - Autoclave Expansion	23	%	0.975	0.210	0.557	0.196	35.2
Physical Tests - Mortar Strength							
Tensile Strength, 3-day --	19	psi	365	285	330	25	7.7
7-day --	19	psi	425	345	390	24	6.2
28-day --	19	psi	515	435	480	25	5.3
Compressive Strength, 3-day --	23	psi	2995	2185	2630	211	8.0
7-day --	23	psi	3720	2815	3340	226	6.8
28-day --	23	psi	4950	3860	4395	285	6.5
Water Content ----------	19	%	51.5	46.2	48.8	1.5	3.0
Chemical Analysis							
Insoluble residue ----------	24	%	0.69	0.15	0.27	0.11	39.5
Silicon dioxide (SiO_2) -------	16	%	21.03	20.35	20.87	0.19	0.9
Aluminum oxide (Al_2O_3) ------	24	%	5.62	4.52	4.98	0.21	4.2
Ferric oxide (Fe_2O_3) -----	24	%	2.27	2.10	2.18	0.04	1.8
Calcium oxide (CaO) -------	16	%	62.63	61.55	62.00	0.27	0.4
Magnesium oxide (MgO) ------	24	%	5.32	3.17	4.04	0.40	9.9
Sulphur trioxide (SO_3) -------	24	%	3.31	2.45	3.10	0.16	5.2
Loss on Ignition (LOI) -------	24	%	2.20	1.59	1.75	0.13	7.6
Combined Oxides ----------	7	%	7.25	6.70	7.03	0.17	2.5

*Number of laboratories reporting.
**Coefficient of Variation, per cent.