A COMPARISON OF SIMILAR CONCRETE DESIGNS USING DIFFERENT MIXERS

Lancaster Electric Pan Type 1-3/4 cu. ft. Capacity

vs.

Gilson Electric Drum Type 3 cu. ft. Capacity

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Supervising Concrete Engineer

Materials and Tests Division
Texas Highway Department

LI-15-68-A
December 1968

Subject

A comparison of the pan-type laboratory concrete mixer with the tilting-drum concrete mixer.

Purpose

To determine the effect of the stationary pan-type mixer versus the mobile drum-type mixer as to their effect upon air and strengths with identical mixing time.

Conclusions

Either the stationary pan-type mixer or the mobile drum-type mixer, when large enough to receive the batch as specified, will give satisfactory results.

Materials

Coarse Aggregate - Gravel - from Travis Materials, Caldwell Pit, Austin, Texas.

Coarse Aggregate - Crushed Limestone - from Texas Crushed Stone, Feld Pit, Georgetown, Texas.

Fine Aggregate - Sand - from Travis Materials, Caldwell Pit, Austin, Texas.

Cement - Alamo Type I from San Antonio, Texas.

Water - City of Austin.

Pozzolith #8 - Master Builders - Houston, Texas.

MBVR - Master Builders - Houston, Texas.

Equipment

1. Los Angeles Abrasion Machine.
2. Lancaster Electric Mixer 1.75 cu. ft. maximum capacity.
3. Gilson Electric Mixer 3.0 cu. ft. maximum capacity.
4. Press-ur-meter.
5. Cylinder molds.
6. Beam molds.
7. Slump cone.
8. 400,000 lb. Baldwin Universal Testing Machine.
9. Rainhart Beam Tester.

Methods

1. Los Angeles Abrasion performed in accordance with ASTM C-131.
2. All mixes designed in accordance with Test Methods Tex-414-A, Section B, and 414-A, Section C. All non-air mixes were mixed 2 minutes. Mixes containing air were mixed according to ASTM C-233.
3. Air in the freshly mixed concrete determined according to Test Method Tex-416-A.
4. Compression specimens made in accordance with Test Method Tex-418-A.
5. Compressive strength determined in accordance with Test Method Tex-418-A.
6. Flexure specimens made in accordance with Test Method Tex-420-A.
7. Flexure strength determined in accordance with Test Method Tex-420-A.
8. Slump performed according to Test Method Tex-415-A.

Test Data and Results

Physical Properties of Concrete Aggregates

Coarse Aggregates

	Gravel - Travis Materials	Crushed Limestone - Texas Cr. Stone
Unit Weight	101.09	82.50
Specific Gravity	2.63	2.50
Weight Solid	164.375	156.250
Percent Solids	61.5	52.8
Percent Voids	38.5	47.2

Fine Aggregate

	Sand - Travis Materials First Shipment	Sand - Travis Materials Second Shipment
Unit Weight	92.49	94.52
Specific Gravity	2.61	2.63
Weight Solid	163.125	164.375
Percent Solids	56.7	57.50
Percent Voids	43.3	42.50

Design Data

Design No.	Designation	sks. of cmt./c.y.	conc. yield	gals. H_2O per sk.	CAF	FAF
Lancaster pan-type mixer - crushed limestone and sand						
1	Reference	6.0	4.5	6.5	.82	.8293
2	1 oz. MBVR/sk.	6.0	4.5	5.985	.82	.7526
3	10 oz. Pozz.#8/sk.	6.0	4.5	5.85	.82	.7853
4	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	6.0	4.5	5.40	.72	.7911
Gilson drum-type mixer - crushed limestone and sand						
5	Reference	6.0	4.5	6.5	.82	.8181
6	1 oz. MBVR/sk.	6.0	4.5	5.985	.82	.7423
7	10 oz. Pozz.#8/sk.	6.0	4.5	5.85	.82	.7853
8	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	6.0	4.5	5.40	.72	.7911
Lancaster pan-type mixer - gravel and sand						
9	Reference	6.0	4.5	5.9	.75	.8264
10	1 oz. MBVR/sk.	6.0	4.5	5.43	.75	.7425
11	10 oz. Pozz.#8/sk.	6.0	4.5	5.198	.75	.7647
12	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	6.0	4.5	4.898	.70	.7531
Gilson drum-type mixer - gravel and sand						
13	Reference	6.0	4.5	5.9	.75	.8264
14	1 oz. MBVR/sk.	6.0	4.5	5.43	.75	.7425
15	10 oz. Pozz.#8/sk.	6.0	4.5	5.198	.75	.7647
16	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	6.0	4.5	4.898	.70	.7531

Mix Results

Design No.	Designation	Inches Slump	Percent Air	Lbs./cu.ft. Wet Weight
Lancaster pan-type mixer - crushed limestone and sand				
1	Reference	3	2.0	142.7
2	1 oz. MBVR/sk.	2½	5.0	138.8
3	10 oz. Pozz.#8/sk.	3	5.7	139.4
4	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	2½	6.0	139.7
Gilson drum-type mixer - crushed limestone and sand				
5	Reference	3¼	1.9	142.3
6	1 oz. MBVR/sk.	3½	5.5	139.3
7	10 oz. Pozz.#8/sk.	3½	5.0	140.0
8	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	3	5.5	140.8
Lancaster pan-type mixer - gravel and sand				
9	Reference	3	1.1	148.3
10	1 oz. MBVR/sk.	3	5.5	143.4
11	10 oz. Pozz.#8/sk.	3½	5.0	144.7
12	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	3½	7.0	142.7
Gilson drum-type mixer - gravel and sand				
13	Reference	3¼	1.2	148.1
14	1 oz. MBVR/sk.	3½	4.9	143.1
15	10 oz. Pozz.#8/sk.	3½	4.1	145.9
16	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	3½	6.0	143.1

Strength Comparison

Design No.	Designation	Flexure (psi) 7-day	Compressive (psi) 3-day	7-day	14-day	28-day
Lancaster pan-type mixer - crushed limestone and sand						
1	Reference	720	4332	5397	5818	5868
2	1 oz. MBVR/sk.	731	4344	5567	5803	5852
3	10 oz. Pozz.#8/sk.	808	5464	6479	6518	6319
4	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	786	5450	6208	6614	6815
Gilson drum-type mixer - crushed limestone and sand						
5	Reference	750	3876	5141	6222	6221
6	1 oz. MBVR/sk.	759	3881	5188	5365	5619
7	10 oz. Pozz.#8/sk.	748	5094	6168	6225	6349
8	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	777	4688	6047	5814	6301
Lancaster pan-type mixer - gravel and sand						
9	Reference	781	4965	5857	6448	6913
10	1 oz. MBVR/sk.	722	4315	5211	5742	5728
11	10 oz. Pozz.#8/sk.	835	5438	6665	6845	7409
12	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	879	5826	7028	7073	7427
Gilson drum-type mixer - gravel and sand						
13	Reference	727	4335	5640	6017	6461
14	1 oz. MBVR/sk.	673	3864	4877	5776	6169
15	10 oz. Pozz.#8/sk.	823	4859	6660	6716	7302
16	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	809	4983	6342	6933	7106

Percentage Comparison Lancaster Mixer vs. Gilson Mixer

Design No.	Designation	Flexure Gilson % of Lancaster	Compressive Gilson % of Lancaster 7-Day	28-Day
Crushed Limestone and sand				
1	Reference	plus 4.2	minus 4.7	plus 6.0
2	1 oz. MBVR/sk.	plus 3.8	minus 7.7	minus 4.0
3	10 oz. Pozz.#8/sk.	minus 7.4	minus 6.8	plus 0.5
4	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	minus 1.1	minus 2.6	minus 7.5
Gravel and sand				
1	Reference	minus 6.9	minus 3.7	minus 6.5
2	1 oz. MBVR/sk.	minus 6.8	minus 6.4	plus 7.7
3	10 oz. Pozz.#8/sk.	minus 1.4	0	minus 1.4
4	10 oz. Pozz.#8/sk. ¼ oz. MBVR/sk.	minus 8.0	minus 9.8	minus 4.3

Discussion

A complete investigation was conducted using both gravel and crushed limestone rock as coarse aggregates, with and without air on both mixers. Different combinations of admixtures were used. Identical designs were used on both mixers with identical mixing time. It was hoped by keeping this equality that percent air and strengths could be compared; the only variable being the mixing equipment.

As noted under Materials, a new shipment of sand from Travis Materials, same source, was received here at the Laboratory in order to complete this investigation. It was not necessary to re-pour a new reference design as the new design checked the design being used within reasonable limits. 1184 lbs. versus 1175 lbs. saturated surface dry weight per cubic yard of fine aggregate was this calculation.

The compressive strength varied from 8.07 times the flexural strength to 8.92 times the flexural strength. When all tests were taken into consideration the overall average was compressive 8.42 times the flexural. The above comparisons were based on 7-day flexural strengths and 28-day compressive strengths.

Each flexural result shown represents an average of ten specimens. The top and bottom ten percent breaks were discarded according to instructions in Bulletin C-11 when obtaining this average. Each compressive result

shown represents an average of three breaks.

As a precautionary measure at least a 3 cu.ft. mixing capacity drum-type mixer should be specified. It should be further specified that this mixer drum be watertight. It might be well to check this drum volume before use; both in the mixing position and in an upright position. This may be done by water, either measuring the water or by weighing it. Not all of these small portable drum-type mixers are satisfactory for Laboratory use.

There is not much to be deducted from the attached results except when concrete is carefully designed, then carefully mixed in two mixers of this type, satisfactory results may be obtained. This will apply to both percent air and concrete strengths.

APPENDIX

Texas Highway Department
Form 272 (Revised)

AGGREGATE TEST REPORT

Laboratory No. .....
Date Received 5-22-68 Date Reported .....
Dist. or Res. Engr. .....
Address .....
Contractor .....
Sampler .....
Sampler's Title .....
Sampled from (Pit, quarry, car or stockpile) .....
Producer So. West Nat'ls., Caldwell Pit, Austin
Quantity represented by sample .....
Has been used on .....
Proposed for use as .....

Material: Gravel

D-9, Gen. THD Use
Control No. Sect. No. Job No.

County Federal Project No. Hwy No.

Dist. No. I.P.E. No. Req. No. 5-22-68 Date Sampled

Identification Marks .....
Specification Item No. .....
Material from property of .....

SIZES	Grams	Per Cent
Ret'd. on 3½" sieve		
Ret'd. on 3" sieve		
Ret'd. on 2½" sieve		
Ret'd. on 2" sieve		
Ret'd. on 1¾" sieve		
Ret'd. on 1½" sieve	0	0.0
Ret'd. on 1¼" sieve		
Ret'd. on 1" sieve	510	8.0
Ret'd. on ⅞" sieve		
Ret'd. on ¾" sieve	1296	20.3
Ret'd. on ⅝" sieve		
Ret'd. on ½" sieve	2821	44.3
Ret'd. on ⅜" sieve	4655	73.0
Ret'd. on ¼" sieve	5745	90.1
Ret'd. on #4 sieve	6165	96.7
Ret'd. on #8 sieve	6321	99.1
Ret'd. on #10 sieve		
Ret'd. on #16 sieve		
Ret'd. on #20 sieve		
Ret'd. on #30 sieve		
Ret'd. on #40 sieve		
Ret'd. on #50 sieve		
Ret'd. on #60 sieve		
Ret'd. on #80 sieve		
Ret'd. on #100 sieve		
Ret'd. on #200 sieve		
Loss by elutriation		
Total	6374	100.0
Fineness Modulus		

GRADING OF FINE-AGGREGATE

Grams	Per Cent
	100.0

TENSILE STRENGTH
1:3 Mortar at 3 days H.E.S.
This Sand Ottawa

L.A. Abrasion 26.4
Type A
Organic Color .....
Type of Soundness $MgSO_4$
% Unsound 2.6%

Loss By Decantation 0.4%
Wt. Per C.F. S.S.D. 101.09

Specific Gravity 2.63
Absorption 1.2

Weight Solids 164.375
% Solids 61.5
% Voids 38.5

Remarks: This sample of material consists of limestone and siliceous gravel.

Texas Highway Department
Form 272 (Revised)

AGGREGATE TEST REPORT

Laboratory No. ....

Date Received 5-3-68 Date Reported ....

Dist. or Res. Engr. ....

Address ....

Contractor ....

Sampler ....

Sampler's Title ....

Sampled from .... (Pit, quarry, car or stockpile)

Producer Texas Crushed Stone, Georgetown, Texas

Quantity represented by sample ....

Has been used on ....

Proposed for use as ....

Material: Limestone

D-9 General THD Use

Control No. ...... Sect. No. ...... Job No. ......

County ...... Federal Project No. ...... Hwy No. ......

Dist. No. ...... I.P.E. No. ...... Req. No. ...... Date Sampled 5-3-68

Identification Marks ....

Specification Item No. ....

Material from property of Sec. A- Bin C

SIZES	Grams	Per Cent	GRADING OF FINE-AGGREGATE Grams	GRADING OF FINE-AGGREGATE Per Cent
Ret'd. on 3½" sieve				
Ret'd. on 3" sieve				
Ret'd. on 2½" sieve				
Ret'd. on 2" sieve				
Ret'd. on 1¾" sieve				
Ret'd. on 1½" sieve	0	0.0		
Ret'd. on 1¼" sieve				
Ret'd. on 1" sieve	2	0.1		
Ret'd. on ⅞" sieve				
Ret'd. on ¾" sieve	821	22.8		
Ret'd. on ⅝" sieve				
Ret'd. on ½" sieve	2343	65.2		
Ret'd. on ⅜" sieve	3113	86.6		
Ret'd. on ¼" sieve	3416	95.1		
Ret'd. on #4 sieve	3447	95.9		
Ret'd. on #8 sieve	3465	96.4		
Ret'd. on #10 sieve				
Ret'd. on #16 sieve				
Ret'd. on #20 sieve				
Ret'd. on #30 sieve				
Ret'd. on #40 sieve				
Ret'd. on #50 sieve				
Ret'd. on #60 sieve				
Ret'd. on #80 sieve				
Ret'd. on #100 sieve				
Ret'd. on #200 sieve				
Loss by elutriation				
Total	3593	100.0		100.0
Fineness Modulus				

TENSILE STRENGTH

1:3 Mortar at 3 days H.E.S.

This Sand ...... Ottawa

L.A. Abrasion ....

Type ....

Organic Color ....

Type of Soundness ....

% Unsound 10.6

Loss By Decantation 0.5

Wt. Per C.F. S.S.D. 82.50

Specific Gravity 2.50

Absorption 4.0

Weight Solids 156.250

% Solids 52.8

% Voids 47.2

Remarks:

D4-P-3069-F74 12-67 30M

Texas Highway Department
Form 272 (Revised)

AGGREGATE TEST REPORT

Laboratory No. .....
Date Received ..... Date Reported .....
Dist. or Res. Engr. .....
Address .....
Contractor .....
Sampler .....
Sampler's Title .....
Sampled from ..... (Pit, quarry, car or stockpile)
Producer Travis Materials, Austin, Texas
Quantity represented by sample .....
Has been used on .....
Proposed for use as .....

Material: Sand

D-9 General THD Use
Control No. | Sect. No. | Job No.

County | Federal Project No. | Hwy No.

Dist. No. | I.P.E. No. | Req. No. | Date Sampled

Identification Marks .....
Specification Item No. .....
Material from property of .....
Sec. A- Bin B

SIZES	Grams	Per Cent	GRADING OF FINE-AGGREGATE Grams	Per Cent
Ret'd. on 3½" sieve				
Ret'd. on 3" sieve				
Ret'd. on 2½" sieve				
Ret'd. on 2" sieve				
Ret'd. on 1¾" sieve				
Ret'd. on 1½" sieve				
Ret'd. on 1¼" sieve				
Ret'd. on 1" sieve				
Ret'd. on ⅞" sieve				
Ret'd. on ¾" sieve				
Ret'd. on ⅝" sieve				
Ret'd. on ½" sieve				
Ret'd. on ⅜" sieve				
Ret'd. on ¼" sieve				
Ret'd. on #4 sieve			7	0.7
Ret'd. on #8 sieve			53	5.3
Ret'd. on #10 sieve				
Ret'd. on #16 sieve			232	23.2
Ret'd. on #20 sieve			352	35.2
Ret'd. on #30 sieve			538	53.8
Ret'd. on #40 sieve			734	73.4
Ret'd. on #50 sieve			879	87.9
Ret'd. on #60 sieve			919	91.0
Ret'd. on #80 sieve			956	95.6
Ret'd. on #100 sieve			973	97.3
Ret'd. on #200 sieve			984	98.4
Loss by elutriation			16	1.6
Total		100.0	1000	100.0
Fineness Modulus				

TENSILE STRENGTH
1:3 Mortar at 3 days H.E.S.

This Sand	Ottawa
580	520
540	490
580	550
530	520
590	530
610	570
572	530

Sand equivalent value 81

L.A. Abrasion .....
Type
Organic Color Lighter than standard
.....
Type of Soundness .....
% Unsound .....

Loss By Decantation .....
Wt. Per C.F. S.S.D. 92.49

Specific Gravity 2.61
Absorption .....

Weight Solids 163.125
% Solids 56.7
% Voids 43.3

Remarks:
Reference Design No. 25

D4-P-3069-F74 12-67 30M

Texas Highway Department
Form 272 (Revised)

AGGREGATE TEST REPORT

Laboratory No. .....
Date Received ..... Date Reported .....
Dist. or Res. Engr. .....
Address .....
Contractor .....
Sampler .....
Sampler's Title .....
Sampled from ..... (Pit, quarry, car or stockpile)
Producer ... Travis Matls. .....
Quantity represented by sample .....
Has been used on .....
Proposed for use as .....

Material: Sand

D-9, Gen. THD. Use
Control No. | Sect. No. | Job No.

County | Federal Project No. | Hwy No.

Dist. No. | I.P.E. No. | Req. No. | Date Sampled

Identification Marks .....
Specification Item No. .....
Material from property of .....
.....

SIZES	Grams	Per Cent
Ret'd. on 3½" sieve		
Ret'd. on 3" sieve		
Ret'd. on 2½" sieve		
Ret'd. on 2" sieve		
Ret'd. on 1¾" sieve		
Ret'd. on 1½" sieve		
Ret'd. on 1¼" sieve		
Ret'd. on 1" sieve		
Ret'd. on ⅞" sieve		
Ret'd. on ¾" sieve		
Ret'd. on ⅝" sieve		
Ret'd. on ½" sieve		
Ret'd. on ⅜" sieve		
Ret'd. on ¼" sieve		
Ret'd. on #4 sieve		
Ret'd. on #8 sieve		
Ret'd. on #10 sieve		
Ret'd. on #16 sieve		
Ret'd. on #20 sieve		
Ret'd. on #30 sieve		
Ret'd. on #40 sieve		
Ret'd. on #50 sieve		
Ret'd. on #60 sieve		
Ret'd. on #80 sieve		
Ret'd. on #100 sieve		
Ret'd. on #200 sieve		
Loss by elutriation		
Total	100.0	
Fineness Modulus		

GRADING OF FINE-AGGREGATE

Grams	Per Cent
4	0.4
49	4.9
251	25.1
388	38.8
596	59.6
802	80.2
937	93.7
960	96.0
986	98.6
993	99.3
995	99.5
5	.5
1000	100.0
2.63	

TENSILE STRENGTH
1:3 Mortar at 3 days H.E.S.

This Sand	Ottawa
540	470
530	490
520	510
510	500
540	460
550	510
532	490

Sand equivalent value 96

L.A. Abrasion .....
Type .....
Organic Color Lighter than standard
.....
Type of Soundness .....
% Unsound .....

Loss By Decantation .....
Wt. Per C.F. S.S.D. 94.52

Specific Gravity 2.63
Absorption .....

Weight Solids 164.375
% Solids 57.5
% Voids 42.5

Remarks:

D4-P-3069-F74 12-67 30M

Texaxs Highway Department
Form 206 (Revised) 8-68

NO CHARGE

CEMENT TEST REPORT

MATERIAL Cement

Laboratory No. 68-7313-D
Date Received 10-3-68 Date Reported 10-11-68
Dist. or Res. Engr. R. W. Shafer
Address D-9
Sampler Don Johnson
Sampler's Title Engr. Tech. I
Contractor
Sampled from Sacks
Seal Number -
Producer San Antonio Cement Co., San Antonio
Quantity represented by sample 3 bbls.
Has been used on
Proposed for use as

INFORMATIONAL

Control No. | Sect. No. | Job No.

County | Federal Project No. | Hwy. No.

District No. | Req. No. | Date Sampled: 10-3-68

Specification Item No. 421
Identification marks -
Material tested for compliance with specifications for
Type I Cement ASTM-C-150
Brand: Alamo

Specific Surface Area
Sq. Cm. per Gm. 1805

1 Day Tensile Strength

3 Day Tensile Strength 400

7 Day Tensile Strength 477

28 Day Tensile Strength

3 Day Compressive Strength

7 Day Compressive Strength

REMARKS:

HW D4-P-3980 F190-8-68-30M

Texas Highway Department
Form 206

47528-266-30m

CEMENT TEST REPORT

NO CHARGE

Date Reported 9-12-68

Contractor

Resident Engineer R. W. Shafer

Address Austin

Cement Reference Lab. Insp. No. U-91

INFORMATIONAL

Control No. | Section No. | Job No.

County | Federal Project No. | Hwy. No.

District No. | Requisition No.

Laboratory Number	68-6434-D									
Date Sampled	9-3-68									
Date Received	9-3-68									
Sampled by	Don Johnson									
Brand of Cement	Alamo									
Mill	San Antonio									
No. of Barrels in Car	12 Sacks									
Car Initial and Number	---									
Car Seal Number	---									
Identification Marks Sulphuric Anhydride %	---									
Specific Surface Area Sq. Cm. per Gm.	1820									
TIME OF SETTING	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.
Initial (Not less than 60 min.)	OK									
Final (Not more than 10 hrs.)	OK									
SOUNDNESS	OK									
NORMAL CONSISTENCY	26%									
1 DAY TENSILE STRENGTH										
1 to 3 Ottawa Sand										
Min. 275 P.S.I.										
Average										
3 DAY TENSILE STRENGTH	410									
1 to 3 Ottawa Sand	400									
Min. 150 P.S.I.	450									
Average	420									
7 DAY TENSILE STRENGTH	430									
1 to 3 Ottawa Sand	460									
Min. 275 P.S.I.	470									
Average	453									
28 DAY TENSILE STRENGTH										
1 to 3 Ottawa Sand										
Min. 350 P.S.I.										
Average										
3 DAY COMPRESSIVE STRENGTH										
1 to 2.75 gr. Ottawa Sand										
Type 1A Min. 900 P.S.I.										
Average										
7 DAY COMPRESSIVE STRENGTH										
1 to 2.75 gr. Ottawa Sand										
Type 1A Min. 1500 P.S.I.										
Average										

Total number of barrels represented by this report 12 Sacks

Material tested for compliance with specifications for Type I Cement, ASTM-C-150

REMARKS:

Texas Highway Department
Form 206

47528-266-30m

CEMENT TEST REPORT

NO CHARGE

Date Reported 8-13-68

INFORMATIONAL

Contractor PRODUCER: San Antonio Cem. Co.

Control No. | Section No. | Job No.

Resident Engineer

Address

County | Federal Project No. | Hwy. No.

Cement Reference Lab. Insp. No. U-91

District No. | Requisition No.

Laboratory Number	68-5352-D									
Date Sampled	8-2-68									
Date Received	8-2-68									
Sampled by	Don Johnson									
Brand of Cement	Alamo									
Mill	San Antonio									
No. of Barrels in Car	3.00									
Car Initial and Number	---									
Car Seal Number	---									
Identification Marks Sulphuric Anhydride %	---									
Specific Surface Area Sq. Cm. per Gm.	1825									
TIME OF SETTING	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.
Initial (Not less than 60 min.)	OK									
Final (Not more than 10 hrs.)	OK									
SOUNDNESS	OK									
NORMAL CONSISTENCY	26%									
1 DAY TENSILE STRENGTH										
1 to 3 Ottawa Sand										
Min. 275 P.S.I.										
Average										
3 DAY TENSILE STRENGTH	430									
1 to 3 Ottawa Sand	470									
Min. 150 P.S.I.	480									
Average	460									
7 DAY TENSILE STRENGTH	490									
1 to 3 Ottawa Sand	500									
Min. 275 P.S.I.	520									
Average	503									
28 DAY TENSILE STRENGTH										
1 to 3 Ottawa Sand										
Min. 350 P.S.I.										
Average										
3 DAY COMPRESSIVE STRENGTH										
1 to 2.75 gr. Ottawa Sand										
Type 1A Min. 900 P.S.I.										
Average										
7 DAY COMPRESSIVE STRENGTH										
1 to 2.75 gr. Ottawa Sand										
Type 1A Min. 1500 P.S.I.										
Average										

Total number of barrels represented by this report 3.00

Material tested for compliance with specifications for Type I Cement, ASTM-C-150

REMARKS: