Mono Kate Book No. 7

July 31, 1968

P.E. Rothfelder

WRG 08105

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Standard

BOORUM & PEASE

MADE IN U.S.A.

112547

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MD - 88.5 5ML 5-50

ND - 124.6

133.2

134.3

130.0

600 meter

Borax - gran 58.75/ton

Mr. Lowndy Powder 71.25/ton

Smelage 75.25/ton

86

86.5¢/lb.

92¢/lb

$Al(OH)_3$ -

8 2 2 1 lb powder

~~20.00~~ 100

5 110

7.25

$MgSO_4 \cdot 7H_2O$ / 100 95.0

112550

145.4 imp wt - 4 gm
0 145.6
147.1
146.1
142.7
727.9
145.4
47.1
98.3

47.1
4

145.4
- 4
141.4
43.1
98.3

98.3 ÷ 141.4 = 69.5% water

72.7
69.5
3.2

300
800
1100 gm total

800 ÷ 1100 = 72.7 % water <u>start</u>

49.1
4
45.1

10% for gyp -

1100
330
770 free water after set

770 ÷ 1100 = 70%

144.9
141.8
146.8
144.5
146.5
724.5
144.9
5
139.9

139.9
45.1
94.8 ÷ 139.9 = 67.7

300
750
1050
330
720

720 ÷ 1050 = 68.6
67.7
.9

700

149.9
− 4
145.9

103.4
141.7
147.0
137.2
142.0
751.3
150.3
− 4
146.3

146.3
45.9
100.4 ÷ 146.3 = 68.7 % — low

1000
− 330
670

670 ÷ 1000 = 67 % start

600

139.7
138.8
144.8
134.3
141.6
699.2
139.8
− 4
135.8

53.4
4
49.4

135.8
49.4
86.4 ÷ 135.8 = 63.7

900
330
570 ÷ 900 = 63.4

112552

16 lbs air

Standard MK — 300 g water — 660 ml
ND — 149.4 300
151.2 960
150.7
3 | 451.3 60 lbs/cu ft 28.8 lbs/ft
150.4

MK + 10 % Borax 300g + 30gm Borax 660 ml H.
ND — 148.1 330
145.8 990
144.8
3 | 438.7 58.4 lbs/cu ft 30.5 lbs/ft
146.2

MK — 20 % Borax 300 g + 60g Borax 660 H.O
ND — 148.5 360
150.4 1020
156.9
3 | 455.8 60.7 lbs/cu ft 30.2 lbs/ft
151.9

[redacted]

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M-K Yields -

We've begun a study on methods to increase the coverage of Monokote as sprayed on the job. Of particular interest at this time are:

1) Increasing yield through the use of additives such as air entraining agents (perhaps more quantity or more effective ones than is now being used), and thickeners such as soluble cellulose products that allow the use of increased rates in the mix or that may act to stabalize the air bubbles in the mass.

2) Determining the effects of bulk density of vermiculite on yield of M-K, since it is added by volume

3) Bubble check on the wet building value of the activator used.

4) Effect of gypsum from different manufacturers.

A small scale laboratory test will be run and large scale tests with standard field

[redacted]

112554

equipment will be run at the site of a plaster machine manufacturer.

Initial test run 7/30/68 with standard plant run MK plus additive results in following:

Standard M-K (check)

			wt 150 cc	Mix time	Vicat test	lb/cu ft
MK	–	300 gm				
H_2O	–	600 ml	95.5 gm	3 min	40	
			91.0 gm	5 min	40	37.8

Addition of 250 HHXR (altered)

			Mix time	Vicat	wt 150 cc	lb/cu ft
MK	–	300 gm				
HHXR	–	0.4				
H_2O		600	3	20		
		650	4	27	111.3	
		700	5	32	112.7	
		750	6	38	112.4	46.5

In the above mixes water bled out of standard MK at 600 ml level but did not start bleeding out of altered mix until 750 ml level was reached.

Assuming 60 lb. density of ea. through a machine yield of standard mix is 27 board ft – yield of altered mix is 30 bd ft @ 700 water and 31.5 bd ft @ 750 water. Altered mix does not appear to set well.

Part I — Water Ratios

It is common knowledge that all else being equal increasing the water in a mix will increase yield. Increasing water can also cause poor setting, weak gypsum and shrinkage.

The amount of water held by a mix can be increased by increasing water absorbing ingredients — Vermiculite & asbestos or by adding gels — hydroxy cellulose.

Standard MK formula per batch is as follows

Vermic	34 cu ft #3	} 16 & 17 - 45 lb. bags
Gypsum	450 lbs	
Asbestos	100 lbs	
Dupanol	1 lbs	

If the density of vermiculite varies the % ingredients in the mix vary as follows:

% ingredients @ following bulk density of vermic.

	4.8	5.0	5.5	6.0	6.5 lbs/cu ft
Vermic	22.9	23.6	25.4	27.1	29.6
Gyp	63.1	62.5	61.0	59.7	58.4
Asbestos	14.0	13.9	13.6	13.3	13.0

7/31/86

300 gm MK — 23 % Vermic 27 % Vermic
 300 300
 69.00 gm 81.00

Assume standard MK contains 23 % Vermic

300 raise to 27 % Vermic
 69
231 gm other
 100
 − 27
 73 other

231 ÷ .73 = 317
 300
 17 gm additional Vermic

Recap results P7

I	time	water	Vicat	lbs/cu ft	yield thru gm
	3	525	25	39.7	
	4	550	20		61.1 avg
	5	600	30	40.6	950 ÷ 61.1 = 15.55 ÷ 300 =
	6	625	34		.0519 x 45 = 2.33 cu ft/bag
	6.5	"	31		x 12
	7.5	650	36	39.8	28 board ft

II					
	3	550	18	40.7	58.7 avg density
	4	600	26	41.1	1000 ÷ 58.7 = 17.04 ÷ 300 =
	5	625	22	~~42.3~~	.0568 x 45 = 2.554 cu
	6	650	28		x 12
	7	675	28		30.7 board ft
	8	700	35	42.6	

9 % increase in yield

[redacted]

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Part I A. - Effect of Vermiculite ~~Densities~~ Quantity on water ratio's

300 g - MK + 17 gm addition #3 -

Procedure

sample I - check

sample II - additional #3 - 17 g vermic added + mixed + 17 gm mix removed to keep at 300 gms.

Add 550 ml H_2O to each - mix 3 minutes and run Vicat check density

Add additional 50 ml water - mix 1 minute and run Vicat - check density

Sample	Mix time	water		Vicat	wt 150cc	lbs/cuft	
I	3	550		25	95.5	39.9	bleeding
	4	550		20			
	5	600		30	97.5	40.6	
II	3	550		18	97.8	40.7	bleeding
	4	600		26	98.7	41.1	
	5	~~625~~		22			
	6	650	2.17	28	~~[illegible]~~ 101.7	42.3 lbs	
	7	675	2.25	28	~~[illegible]~~		
	8	700*	2.33	35	102.5	42.6	
I	6	625		34			
	6.5	"		31			
	7.5	650*		36	95.7	39.8	

Final Mix between the guns* - 150cc lbs/cuft

I	148 gm	61.6	61.1 avg
	145.5	60.5	
II	142.1	59.1	58.7 avg
	140.0	58.2	

[redacted]

112558

8/1/69

12 oz /batch (suggested by Mel Teagle)

.75 lbs /batch ÷ 16 bags = .047 lbs/bag

.047 ÷ 45 = .104 %

∴ in 300 gm use .3 gm retardant

Calculated yield –

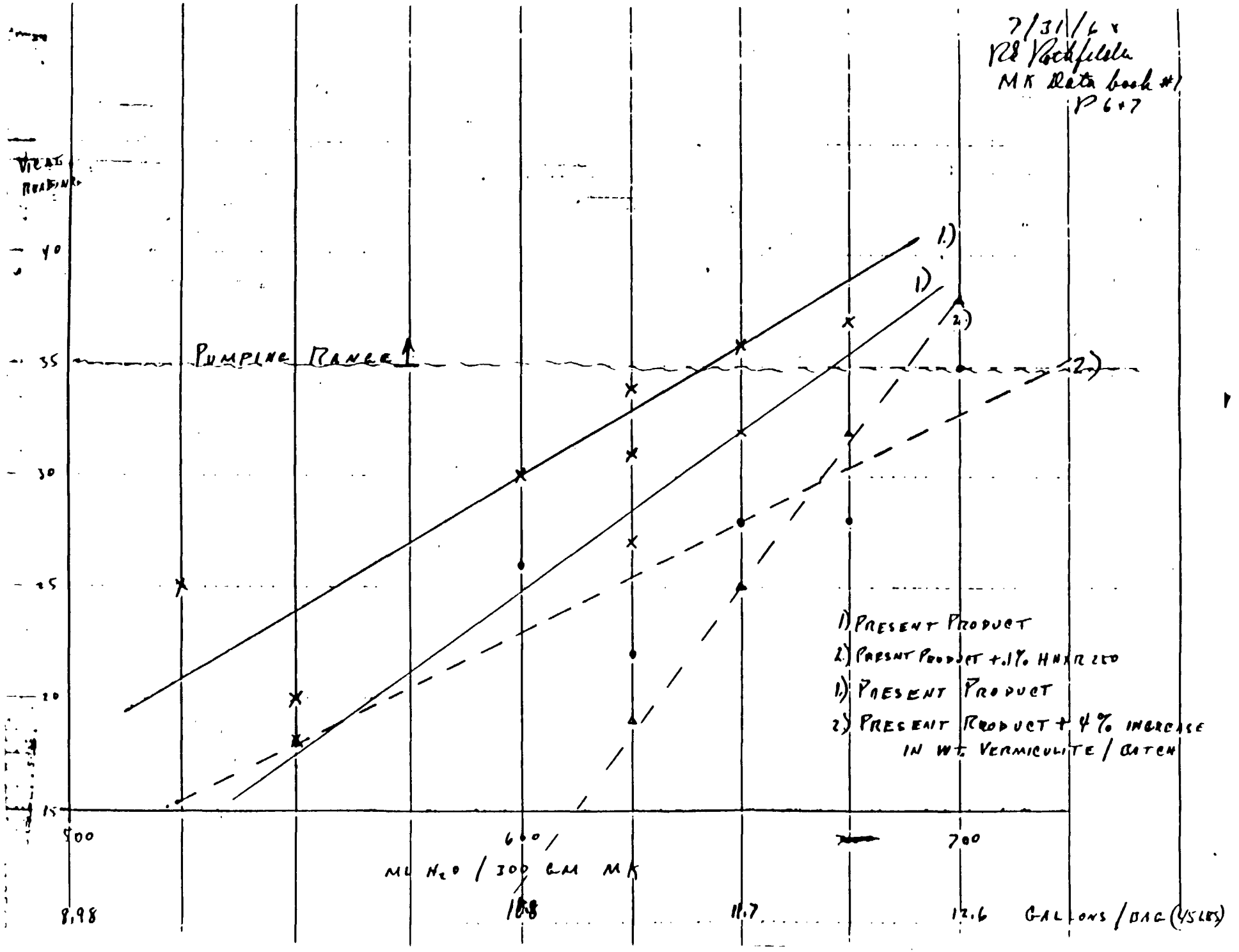
I 300 gm mix
675 water
975 ÷ 60.7 = 16.1 cu ft ÷ 300 = .0535 × 45 = 2.41 cuft/bag (45 lbs)
× 12
28.9 board ft

II 300
700
1000 ÷ 58.7 = 17 cu ft ÷ 300 = .0568 × 45 = 2.55 cuft/bag
× 12
30.7 board ft
(per 45 lbs)

Sample I – Initial Vicat reading after 3 min mix was 36 – this is common when adding water too fast – sample was allowed to time and further mixing to bring vicat readings in line with what is more normal – note drop to 17 after 7 minute mix with 550 ml H_2O.

Recap Sample I –

Mix time (min)	3	4	5	6	7	8	9	10	11
water (ml)	550					600	625	650	675
Vicat	36	38	29	25	17	[illegible]	27	32	37
wt-150 ml	86.2					101.3	102.4		98.7


7/31/64
RB Rockefeller
MK Data book #1
P 6+7
VISCAL READING
40
35
30
25
20
15
PUMPING RANGE
1.)
1)
2.)
2)
1) PRESENT PRODUCT
2) PRESNT PRODUCT +.1% HNKR 250
1.) PRESENT PRODUCT
2) PRESENT PRODUCT + 4% INCREASE IN WT. VERMICULITE / CATCH
500
600
700
ML H2O / 300 GM MK
8.98
10.8
11.7
12.6
GALLONS / BAG (4 SLEEVES)

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Part I B – Effect of Cellulose Sols on Water Ratio

700 gm MK + Natrasol 250 HHXR

Procedure

Sample I – check

Sample II – .3 gm ~~/ 300~~ natrasol / 300 gm MK

Run same as on P7 – start with 550 ml water – run for 3 min – check with Vicat + check density – add 50 ml increments of water + run for 1 min

Sample	Mix time	Water	Vicat	wt 150 ml	lbs/cuft	
	① ② ③ ④ ⑤		① ② ③			1 ① 101.7 g
I *	3 4 5 6 7	550	36 38 29	86.2		2 ② 101.3 g
	~~4~~ 8	600		102.4		
	~~5~~ 9	625	27		then the gun	
	~~6~~ 10	650	32		59.9	143.9 g / 150 cc
	~~7~~ 11	675	37	98.7	61.0	146.7 g
	~~8 12~~	~~700~~			61.3	147.8 } 60.7
II	3	550	8			
	4	600	11	114.9		
	5	625	19	109.3	then the gun	
	6	650	25	105.1	58.5	143.2
	7	675	33	102.0	58.7	141.1 } 58.7
	8	700	38	101.2	59.0	141.9

8/1/68

Dupanol - 1 lb / batch or 1 oz / 45 lb. bag

.0625 % .0625 lbs/45

300

.187500

.00139 = .139%

45 | .0625

.01

16 | 1.000

.00139 × 300 = .41700

.417

use .4 gm / 300 gm MK

Recap Sample I - test

wt three gun (150 cc)

153.0
151.4
153.1

457.5 ÷ 3 = 152.5 ÷ 150 × 62.4 = 63.5 lbs/cu ft

300
815

1115 ÷ 62.4 = 17.9 cu ft ÷ 300 = .0596 cu ft/lb. × 45 = 2.68 cu ft/bag

× 12

32.2 bd ft

Sample II

Dry - 300 gm in 700 ml H_2O -

check V test every 5 minutes

start 5:02	min mix	V test	density
	3	39	102.7
5:09	4	36	100.8
5:14	5	37	99.8
5:19	6	38	97.0
5:24	7	40	94.1
5:29	8	40	100.0
5:34	9	39	

then the gun 142.1 - 59.4 lbs/cu ft

143.7 - 59.7

142.2 - 59.1

3 | 177.9

59.3

1000 ÷ 59.3 = 16.85 ÷ 300 = .0562

× 45 = 2.53 cu ft/bag

× 12

30.3 board ft

Part I C - ~~Effect of Doubling Air Entraining Agent - Daxad~~ Effect of time & Water Ratio on Vicat Reading

300 gm MK + .4 gm Daxad

Procedure - ~~Sample I - Check~~

~~Sample I - 300 gm MK + .4 gm Daxad~~

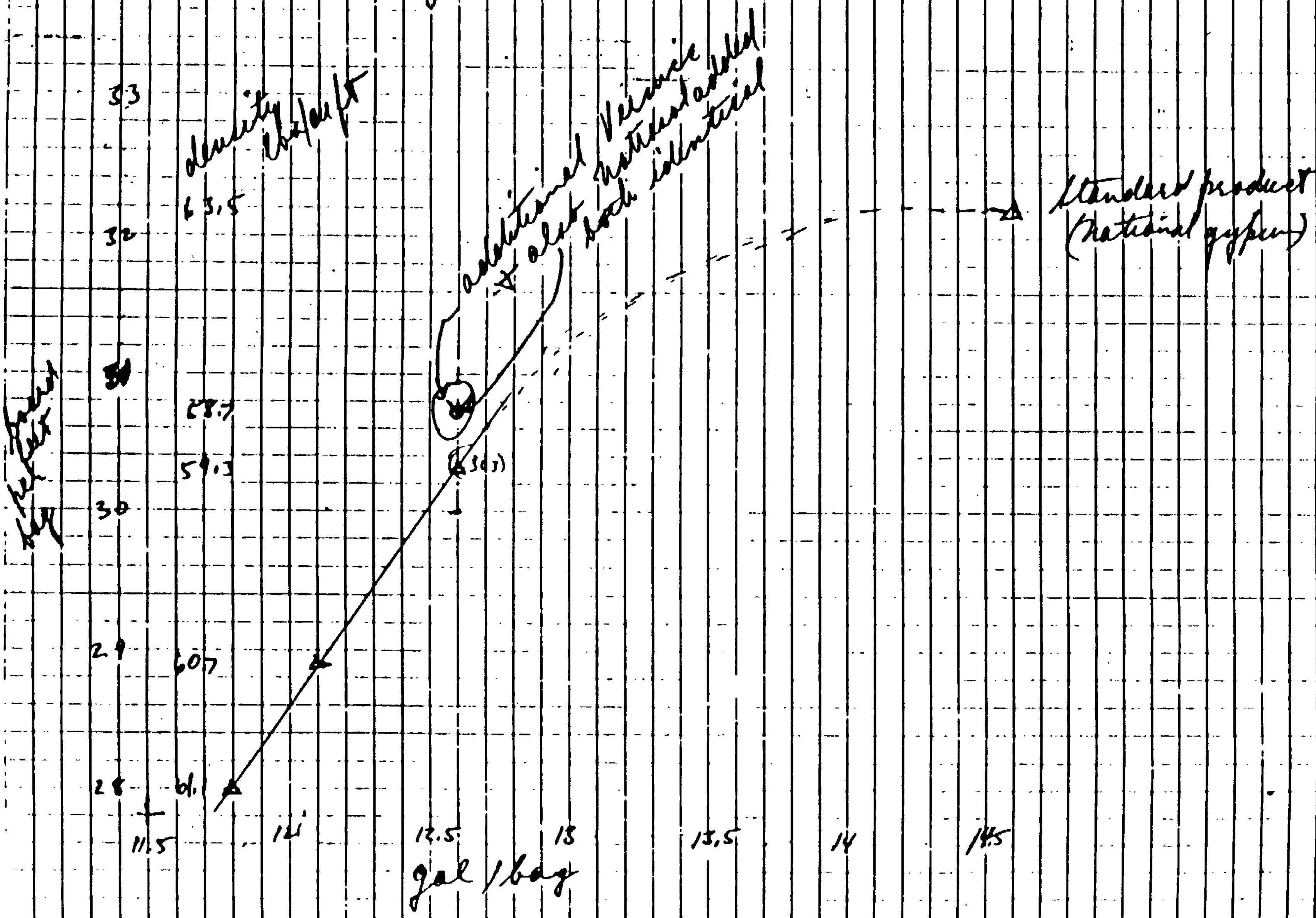
Run same as on P 7 - start with 550 ml water - run for 3 min. - check density & vicat - Add increments of water & run for 1 min after each increment.

Sample	Mix time	Water (ml)	Vicat	wt/15cm	
I	3 min	550	36	89.4	
	4 min		32	92.3	
	5 min		22	99.1	
	6 min		14	106.4	
	7 min	600	25	105.2	
	8 min	625	24	105.1	
15 min time lapse	9 min	650	32	103.9	
30 min time lapse	10	675	25		
	11		11		
	12	700	23	119.9	thru the gun
	13	725	26		153.0
	14	760	31	117.7	151.4
	15	775	31		153.1
	16	815	35	121.5	

Total time involved in testing is a factor in Vicat response - Evidently water take-up by vermiculite as a function of time must be taken into account for vicat discussed as a test procedure. See page 10

8/5/68

Yield + density then the gun -



Part I-D - Effect of Water Rate on Yield

Yield readings at given water ratios can vary depending on mixing procedure and time(21). Yield can be determined only after product has been pumped or forced through a gun. From previous work described in this manual indications are that increasing water reduces density through a gun and that this is about a straight line curve until ~~in the~~ reaching the range of 13 to 14 gallons per bag(45 lbs) when it ~~drops~~ increases again. Similarly board foot coverage increases with increasing water in a straight line until 13 to 14 gallons per bag(45 lbs) has been reached at which point the curve flattens out considerably.

Mixing technique prior to pumping appears to have little effect on final density through a gun - water ratio appears to be the primary determining factor.

Sample I - 300 / 800 / 1100 = 60.5   2.73 cu ft 32.8

Sample	ml H_2O	Mix time	gm/150 cc	lbs/cu ft	Avg	Calculated Yield
IV	700	3	143.4	59.6		
			141.7	59.0		
			147.0	61.1	59.16	30.9 bd/ft
			137.2	57.1		
			142.0	59.0		
V	675 2.18	3	136.3	56.7		
			141.0	58.6	58.42	~~28.5 bd/ft~~ 30.1 bd/ft
			139.8	58.1		
			144.6	60.1		
			141.0	58.6		
VI	650 WR 2.17	3	144.2	60.0		
			141.3	58.7		
			146.4	60.9	59.28	28.9 bd/ft
			137.4	57.2		
			143.4	59.6		
VII	625	3	146.0	60.7		
			134.6	55.9	58.36	28.5 bd/ft
			140.8	58.5		
			142.5	59.2		
			138.4	57.5		
VIII	600	3	139.7	58.1		
			138.8	57.6	58.12	27.8 bd/ft
			144.8	60.1		
			134.3	55.9		
			141.6	58.9		
IX	575	3	143.2	59.6		
			140.5	58.4	58.96	26.8 bd/ft
			138.8	57.6		
			141.3	58.7		
			145.4	60.5		

Part I-D cont'd Water Ratio Yield—

Use quantities of 550 ml thru 800 ml water with 300 gm MK — Mix + put thru gun test determine density.

Procedure —

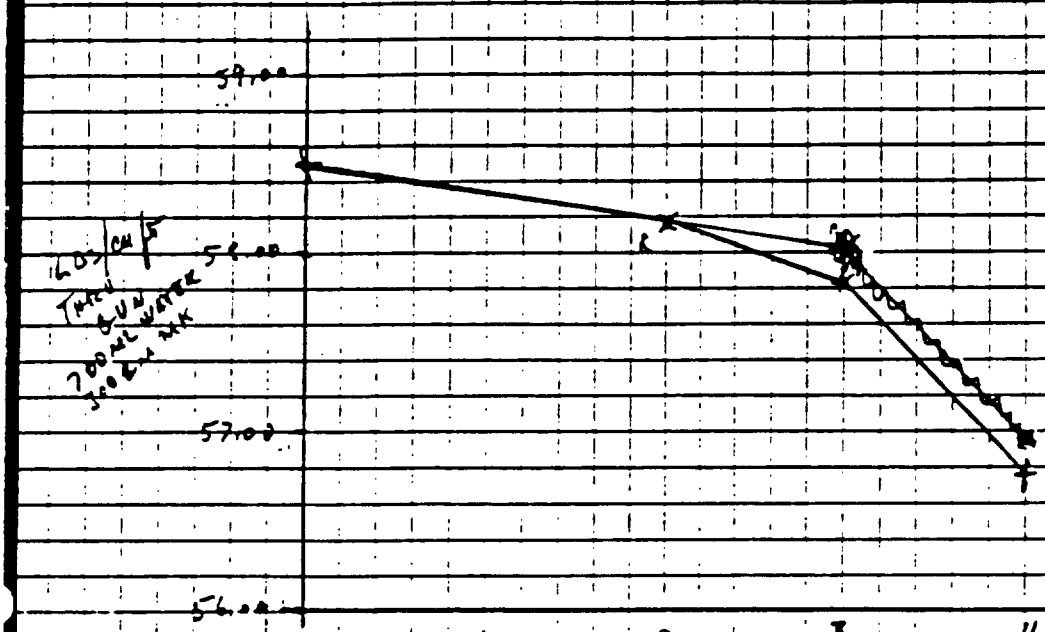
Enter entire amount of water in mixer — add MK + mix for 3 minutes — put through lab gun (standard E-Z flo gun made by Plastering Development Center 4001 S. Keeler Ave Chic) with 7/16" orifice.

Sample*	ml H_2O	mixing time	density gm/150 cc	density lbs/cu ft	AVG	calculated yield
I	800	3 min	145.4	60.5		
			145.6	60.6	60.5	32.8 board ft
			147.4	61.2		
			146.1	60.7		
			142.7	59.3		
II	750	3 min	144.9	60.2		
			141.8	59.0		
			146.8	61.0	60.25	31.4 board ft
			144.5	60.1		
			146.5	60.9		
III	735	3 min	144.5	60.1		
			144.5	60.1	60.20	30.6 board ft
			145.7	60.5		
			141.3	59.0		
			147.4	61.3		

* Standard MK made with Retarded Hyperm

16

28.4 gm / oz



GM NAT / 300 cm MC

Sample	Visc	gm/150cc	Visc	lbs/sq ft (MC)	% yield	Remarks
III	35	137.3	11	57.1		Good set
		137.2		57.1 (56.0)	26.4 cm/s	some bleeding
		135.2		56.3	31.7 lbs/s	wheat
		136.6		56.8		
		133.4		55.5		

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Part I-B Effect of Methyl Cellulose on Water Ratio —

Uses varying amounts of Natrosol 250 HHXR to a 300 gm standard MK - 8, 12, & 16 oz / 46 bag batch —

Sample I .25 oz / 45 lbs .2 gm / 300 gm MK

Sample II 0.55 oz / 45 lb .3 gm / 300 gm MK

Sample III 1.00 oz / 45 lbs .4 gm / 300 gm MK

Add dry & mix for 1-2 min.

Sample IV - Check

Wet Mix - add 700 ml H_2O - mix 5 minutes & spray thru gun - Make Vicat check befor spray

Sample	Vicat	gm/150 cc thru gun	Vicat	lbs/cu ft (Avg)	Yield	Remarks
IV	41	141.5	12	58.9		
		142.1		59.1 (58.48)	2.56 cu ft	
		141.6		58.9	30.75 bd ft	
		137.0		57.0		
		140.7		58.5		
I	39	140.0	13	58.2		Rough[?] flatter than IV
		140.5		58.4 (58.18)		
		142.4		59.2	2.58 cu ft	
		141.2		58.7	30.9 bd ft	
		135.6		56.4		
II	38	139.9	15	58.1		flatter but little bleeds
		139.8		58.1 (57.82)		
		138.3		57.5	2.59 cu ft	
		139.6		58.0	31.1 bd ft	
		138.0		57.4		

8/22/68

Dry Weights of Sample P 14-18

P 14-15 — wt of Cups – 4.0 gm

	Sample	Date	Wt 150 cc (cups)			~~Total~~	Avg		lbs/cuft
800	I	8/21	47.4	49.1	45.9		47.1		
		10/16	44.0	44.2	43.3		43.83		18.23
750	II	8/21	46.9	48.7	51.7		49.1		
		10/16	47.8	46.1	45.3	139.2	46.4		19.30
725		10/16	46.8	46.9	47.7	141.4	~~[illegible]~~	47.13	19.64
700	IV	8/21	48.9	52.7	48.1		49.9		
		10/16	48.0	46.8	46.4	141.2	~~[illegible]~~	47.07	~~19.30~~ 19.58
675		10/16	48.7	47.5	47.7	143.9	47.97		19.99
650	VI	8/21	50.1	57.8	54.4		54.1		
		10/16	50.5	49.5	52.5	152.5	50.83		21.15
625		10/16	50.5	49.9	50.0	150.4	50.13		20.85
600	VIII	8/21	52.8	56.4	51.1		53.4		
		10/16	50.5	52.6	54.2	157.3	52.43		21.81
575		10/16	54.4	55.1	53.8	163.3	54.33		22.60
P1647	IV	8/21	52.8	52.4	50.3		51.8		
		10/16	~~50.2~~ 48.2	46.5	47.3	142.0	47.33		19.69
	I	8/21	55.9	56.7	55.7		56.1		
		10/16	47.3	47.7	46.4	141.4	47.13		19.61
	II	8/21	55.6	57.4	57.8		57.6		
		10/16	46.5	47.1	47.3	140.9	46.97		19.54
	III	8/21	53.3	55.2	55.1		54.8		
		10/16	45.7	46.4	46.3	138.4	46.13		19.19

Part I - E Effect of Bentonite on Water Ratio

Use varying amounts of Bentonite (Na) to 300 gm standard MK - 1, 2, 4, 8 oz / 45 lb bag

Sample I - 1 oz / bag .4 gm / 300 gm MK

Sample II - 2 oz / bag .8 gm / 300 gm MK

Sample III - 4 oz " 1.6 gm / 300 gm MK

Sample IV 8 oz " 3.2 gm "

V - check

Add dry & mix for 1-2 minutes

Wet mix - add 200 ml H_2O & mix 5 minutes

Spray three gun - Make Vicat check before & after spraying

Make density measurement after spraying.

Sample	Vicat gm / 150 cc	Vicat lbs/sq ft	avg	Yield	Remarks
IV	40	144.8	8	59.9	
		146.6		61.0	
		149.8		62.2	60.3 30 lb/ft wet
		138.4		57.6	
		146.0		60.7	NG
dry wt - 10/16		50.2	50.0	49.2	148.4 49.47 20.58

yield 3000
$\frac{400}{400}$ density = lb/ft
950

Check – no Flatwool

VI	700	40	149.3	7			Too wet for job conditions
	ml	39	146.1	8	60.6 lbs/ft³	29.7 bd ft	
	H_2O		145.5				
			141.9				
			146.2				
			729.0				
		AVG	145.8				

Sample	ml H_2O	Vicat	Thru gun gm/150cc	Vicat	lbs/cu ft	bd ft yield	Remarks
IV	750	35	147.8	14			Wet
			147.5			30.8 bd ft	
			148.6		61.4		
			147.4				
			146.5				
			737.8 ÷5 = 147.56				
V	800	37	150.0	18			Extremely Wet
		37	148.6	21			
			148.2			31.1 bd. ft.	
			149.3		61.8		
			147.4				
			743.5				
		AVG	148.7				

Remarks – Vicat reading between 7 & 10 appears to be best for spraying – hangs well – not too wet or dry after spraying

8/21/62 21

Part I-D - Effect of Methylcellulose on Water Ration

Use varying amounts of water with 700 gm MK to which .4 gm Natrosol 250 HHXR has been added

Procedure — Make up 5-700 gm MK + .4 gm Natrosol (equiv to 1 oz / 145 lb bag). To each mix with 600, 650, 700, 750 + 800 ml water — mix 5 minutes — take Vicat - run thru 2-3 tex gun - take density + calculate yield — Run a check with no Nat. at 700 ml H_2O - Using standard MK with National gypsum

Sample	ml H_2O	Vicat	Through gun gm/piece	Vicat	lbs/cu ft	lbs/ft Yield AVG	Remarks
I	600	18	145.9	5	60.6		Hard to spin
			145.6		60.5	26.6 lbs/ft	
			149.3		62.1	60.96	
			146.8		61.1		
			145.5		60.5		
					304.8		
II	650	37	146.8	7	61.0		
			142.9		59.4	27.6 lbs/ft	
			145.9		60.6	59.44	
			142.5		59.3		
			142.7		59.4		
					299.7		
III	700	36	148.1	10			Quite Wet
			147.3				
			148.7		61.4	29.3 lbs/ft	
			146.2				
			147.4				
			737.5				
		AVG	147.46				

be P 32 sample #5

22 Results —

thru gun

Sample	Wt 150cc	Visc	Wt/150cc	AVG	Visc	Density lbs/cu ft	Yield lbs per bag	Remarks
I	92.3	40	149.5		6			good air
	91.1	40	146.8	~~[illegible]~~	7	~~[illegible]~~	~~[illegible]~~	bubbles
	90.6		145.0	145.44		60.5	29.8	
	3)274.0		142.0					
	91.33	38.0 lbs/cu ft	145.9					
			729.2					
II	98.0	40	148.2		8			air OK
	99.7	41	146.4	145.96	9	60.7	29.6	some large bubble
	98.6		144.1					
	3)296.3		143.4					
	98.76	41.1 lbs/cu ft	147.7					
			729.8					
III	106.8	30	~~106.8~~ 149.1		8			
	106.9	30	~~106.9~~ 148.6		8	61.2	29.4	
	107.4		146.8	147.28				
	3)321.1	44.5 lbs/cu ft	145.2					
	107.03		146.7					
			736.4					
IV	94.2	40	(NG) second sample from bag — also no material — add .4 gm IV					no evidence of material
	91.3	41						
	89.0							
IV	103.5	34	147.0		7			
	104.0	33	145.7	146.06	8	61.0	29.5	
	103.4		145.5					
	3)310.9	43.1 lbs/cu ft	144.5					
	103.63		147.6					
			730.3					
V	93.7	38	155.4		5			Grainy - no
	93.9	40	152.2	153.08	5	63.6	28.3	fat
	96.3		150.6					poor air - large
	3)283.9	39.4 lbs/cu ft	153.0					bubbles
	94.63		154.2					
			765.4					
VI	104.6	31	157.4		5			Too stiff for
	103.6	28	159.5	158.22	5	66.9	26.9	gun
	102.0		158.5					
			160.2					
			155.5					
			791.1					

(Margin note with arrow, II to V densities: differences in bubbles)

112574

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Part II A – Comparison of Production Runs Made with Different Vermiculites + Additives

Plant runs made with Kaiser Gyp in So. Calif. – Test @ water ratio 2.32 (12.5 gal per 45 lbs) – 300 gm MK – ~~total~~ water used 700

Products tested —

I	Standard run	50. Cal		(bag = 45 lbs)
II	"	"	"	+ 1 oz Dupont / bag
III	"	"	"	+ 1 oz Natrasol / bag
IV	"	"	"	+ 1 oz Dupont / bag + 1 oz Natrasol / bag
V	"	"	70. Cal	
VI	"	"	"	with #4 vermic instead of #5
VII	"	"	50. Cal – Klue Diamond	

Enter water – then product – mix 4 minutes

Take Vicat + Density – run then gun –

take Vicat + Density

	wt 150 cc	Vicat	Then gun wt/150 cc	Vicat	lbs/cu ft density	bd ft Yield	
VII	90.9	40	143.2	7			excellent Air all small bubbles spaced beautifully
	87.6	41	139.8	9			
	89.5		140.4		58.6	30.7	
	268.0		143.8				
	3 89.33		137.7				
	37.1 lbs/cu ft		704.5	140.9			

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Sample	Wt 150cc	Vcut	Wt 150cc	Vcut	density lbs/ft³	Yield yds/lb 64 ft	Remarks
I	? 87.9	38					
II							
III							
IV							
VIII							

Sample made without dupond in lot showed some foaming indicating retarder used in 9/ff contributes to air entraining

[redacted]

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Part III – Air Entraining

A) Effect of quantity of Dufoam on air entraining.

Production run of MK made without Dufoam for test work. Using 300 gm samples and 200 ml H_2O add varying amounts of Dufoam + determine wet densities. Dufoam mixed dry with sample. Use 4 minute wet mix.

Sample I – Check – no dufo. ✓

II – .1 gm ✓

III – .2 gm ✓

IV – .3 gm

V – .4 gm ✓

VI – .6 gm

VII – .8 gm ✓

Above – standard formula with ~~blue~~ Kaiser gyp.

Material foamed – evidently contaminated with Dufoam – make samples in lab.

[redacted]

9/3/68

Sample	Wt 150cc	Vicat	Thru gun → Wt 150cc	Vicat	density lb/ft³	Yield lbs	Remarks	oz/bag
I	126.5	22	160.9	7	~~160.9~~			
	127.8	27	159.4	8	66.5	27.1		0
	126.9	25	161.7					
	381.2		158.5					
	avg 127.07		158.6	159.82				
			799.1					
II	109.4	40	153.0	10				
	109.4	40	152.4	11				
	109.7		151.1		62.9	28.6		
	328.5		148.7					
	109.5		151.3	151.30			.014% DUP IN WATER	.25
			756.5					
III	101.2	40	155.0	12				
	102.1	41	151.1	11				
	108.3		147.8		62.6	28.8		
	311.6		150.7	150.48			.025% DUP	.5
	103.87		149.8					
			752.4					
IV	112.0	39	148.9	11				
	111.8	40	149.8	12				
	110.7		152.9		62.4	28.9		1
	334.5		149.6	149.90			.057% DUP	
	111.5		148.3					
			749.5					
V	106.9	40	148.4	12			Frothy	
	107.3	40	144.6	11				
	107.4		142.3		60.5	29.8		2
	321.6		144.8	145.32			.11% DUP	
	107.20		146.5					
			726.6					
VI	110.2	40	148.9	10			Frothy	
	107.9	40	145.7	10				
	106.9		144.2		60.6	29.7		1.5
	325.0		143.9	145.90	see p 54 sample I		.086% DUP	
	108.33		146.8					
			729.5					

Above mixes quite wet

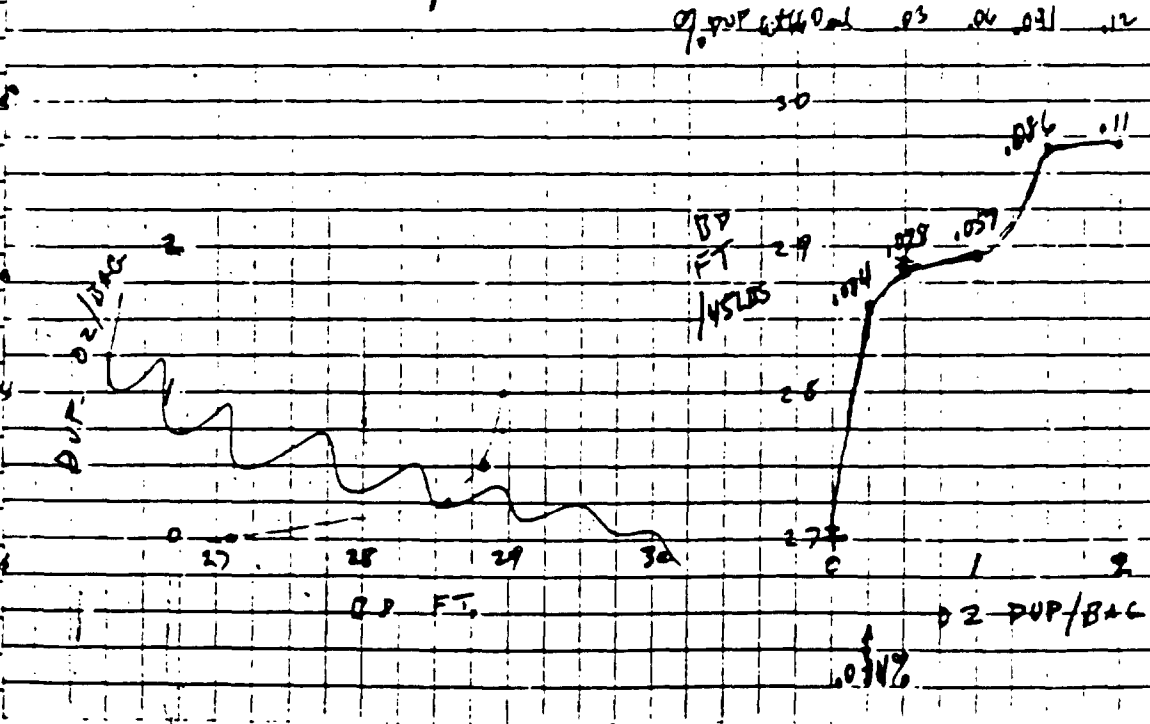
Repeat with 660 ml #20

Part III - Air Entraining Agents

A) Effect of quantity of Dupanol on Air Entraining. Make samples in lab, containing 0.1, 0.2, 0.4, 0.8 gms dupanol along with a control containing none. Take density & Vicat measurements before & after passing through gun. Base samples made by weight assuming density of #3 to be 5.5 lbs/cuft as follows:

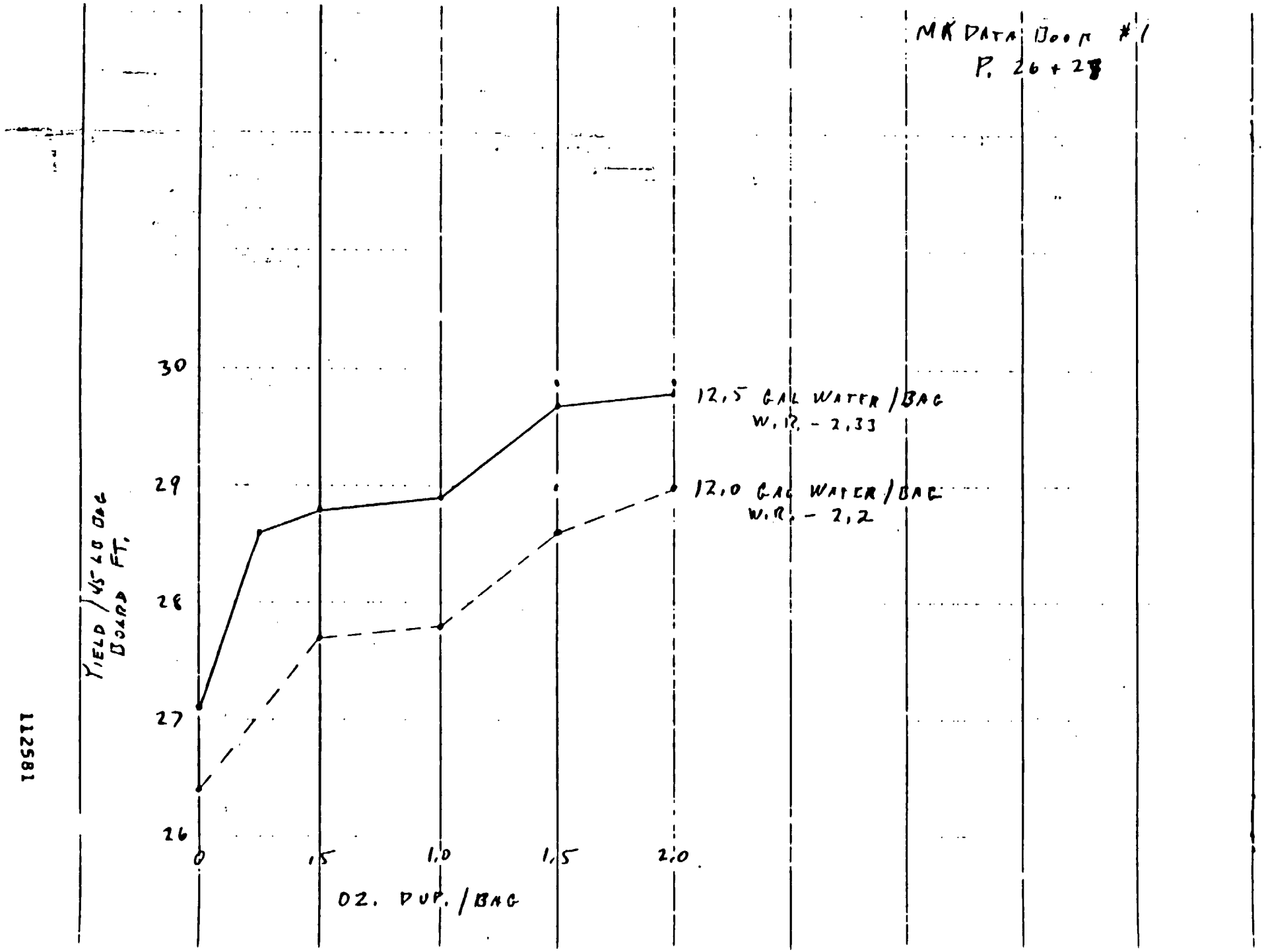
		%	gm	sample #	gm Dup.
76.2	V-lite	25.4	76.2	I	0
40.6	typ (Dairies)	61.0	183.0	II	.1
117.0	asbestos	13.6	40.8	III	.2
1.3			300.0	IV	.4
300.0				V	.8
				VI	.6

Dry mix 1 minute - Use 200 ml water & mix for 4 minutes



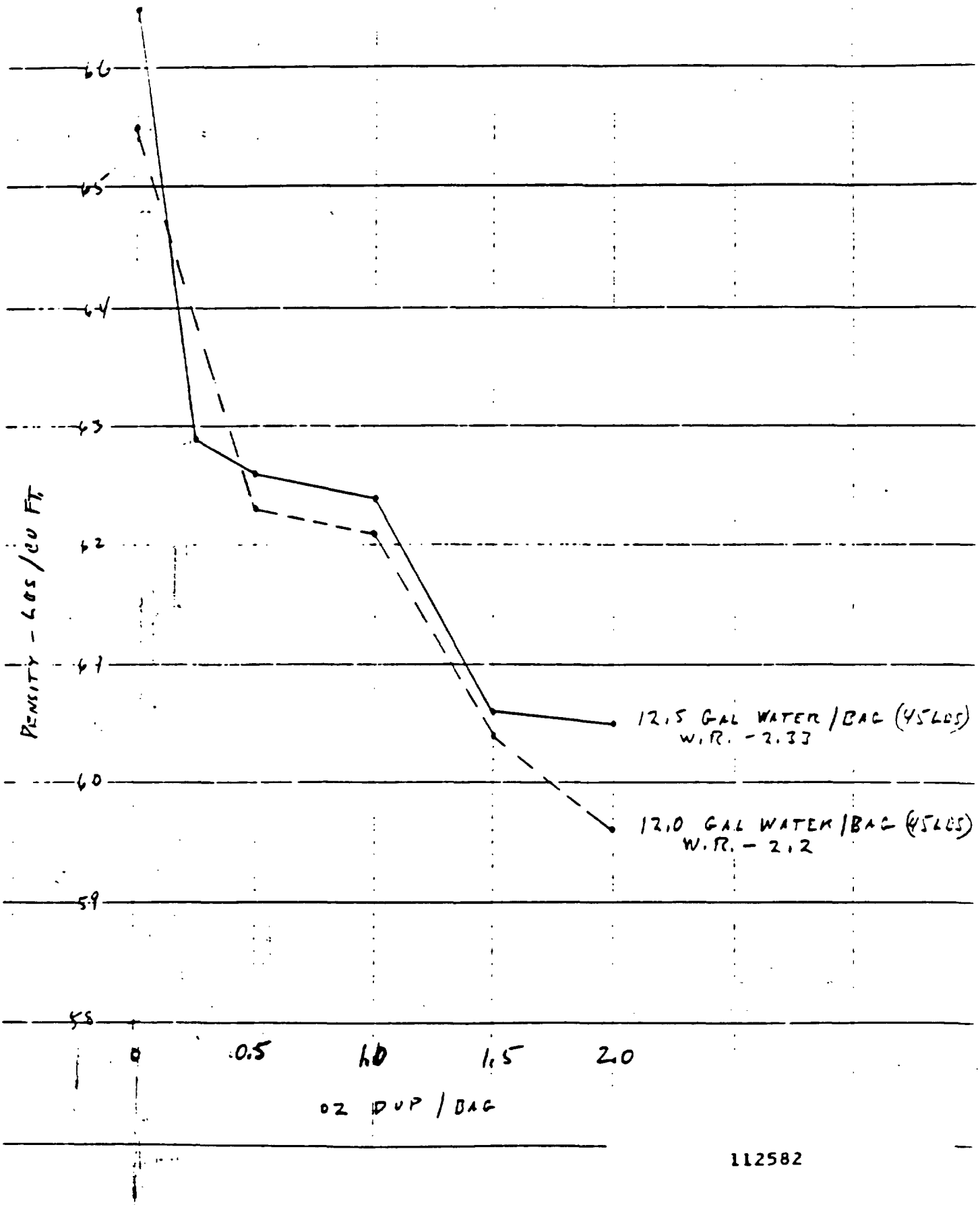
28

Sample	Wt 150cc	Vacat	Wt 150cc	Vacat	Density lbs/ft³	Yield 45 lbs	Remarks	% Lay
I	123.2	19	158.3	5				
	120.8	21	158.6	6	65.5	26.4		0
	120.1		158.5					
			156.4					
			155.5					
			737.3 ÷5 = 152.46					
II	96.8	40	152.6	6	62.3	27.7	103%	.5
	99.1	40	150.7	7			DUP IN WATER	
	94.4		149.4					
			148.0					
			147.9					
			748.6 ÷5 = 149.72					
II	102.5	39	151.1	6				
	99.9	41	150.4	7	62.1	27.8	.06% DUP	x1.0
	92.8		149.2					
			149.2					
			147.4					
			747.3 ÷5 = 149.46					
V	100.1	40	145.5	8				
	99.5	41	144.6	9	59.6	29.0	.12% DUP	x2.0
	93.5		142.3					
			144.5					
			140.7					
			717.6 ÷5 = 143.52					
II	101.7	40	146.7	7				
	101.4	41	148.4	8	60.4	28.6		1.5
	101.5		142.1				.091% DUP	
			145.9					
			142.6					
			725.7 ÷5 = 145.12					


MK DATA BOOK #1
P. 26 + 28
YIELD / 45 LB BAG
BOARD FT.
30
29
28
27
26
0
.5
1.0
1.5
2.0
OZ. DUP. / BAG
12.5 GAL WATER / BAG
W.R. - 2.33
12.0 GAL WATER / BAG
W.R. - 2.2

185211

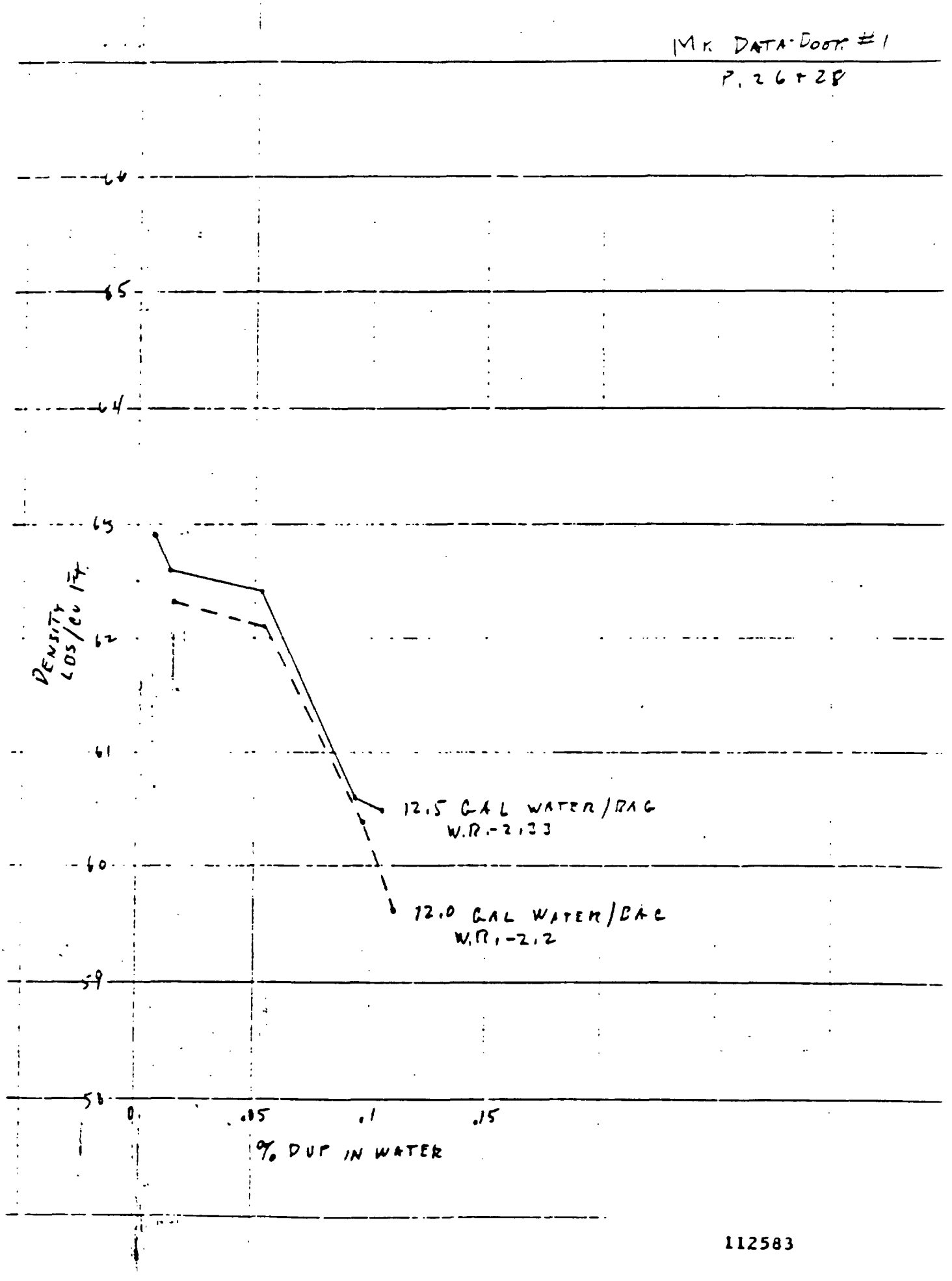
~~MK DATA BOOK #1~~
P. 26 + 28



112582

MK DATA BOOK #1

P. 26 + 28



112583

Part III - Air Entraining Agents

A.) Effect of quantity of Ulefoam on Air Entraining
Repeat Work on P 27 with 660 ml
water instead of 700 ml.

Sample # (300 gm)	gm. Ulefoam	Formulation
I	0	V - 76.2
II	.1	Aeb - 40.8
III	.2	117.0
IV	.4	Ulefoam Buff - 183.0
V	.8	300.0
VI	.6	

30

Sample	Wt 150 cc	Vacuum	Wt 150 cc	Vacuum	Density lbs/ft³	Yield lbs/45 lbs	Remarks
I	100.8	39	151.8	8			
	104.2	40	150.4	10	63.0	28.6	
	100.9		152.2				
			150.4				
			152.0				
			756.8 ÷ 5 = 151.36				
II	94.8	41	146.5	7			
	97.6	40	144.7	6	61.4	29.3	
	95.9		146.7				
			148.9				
			148.5				
			737.3 ÷ 5 = 147.46				

112585

I-A

Part ~~II~~ - Effect of Varying Ratios of Vermiculite - Hyfo - Asbestos on Wet Density

Variations in bulk density of vermiculite will change % ingredients in the product - ba P5 - Using 4 gm Duponol / 300 gm and 700 ml water 1 minute dry mix and 4 min wet mix.

Sample #		%	gm	
I	Vermic	23.6	~~27~~ 70.9	20.9
Vermic @ 5 lb/cu ft	Hyfo	62.5	187.4	41.7
	Asbestos	13.9	41.7	112.6
			300	
II	Vermic	27.1	81.3	51.3
Vermic @ 6 lb/cu ft	Hyfo	59.7	179.0	39.7
	Asbestos	13.25	39.7	121.0
			320.0	

[illegible] gun — 9/18/68

Sample	Wt 150cc	Visc	Wt 150cc	Visc	Density lb/ft³	Yield bd ft/45 lbs	(Nos)	Remarks
I	100.7	40	146.8	7				
	99.6	40	146.2	7	61.0	29.5	(0)	
	98.0		148.9					
			143.1					
			147.1					
			732.1 ÷ 5 = 146.42					
II	99.9	40	151.4	7				
	100.0	39	149.3	8	62.0	29.0	(.1)	
	99.8		151.1					
			145.7					
			147.5					
			745.0 ÷ 5 = 149.0					
III	98.3	39	152.5	8				Excellent foaming action
	100.1	40	148.1	6	61.9	29.1	(.2)	
	103.5		149.7					
			146.4					
			146.8					
			743.5 ÷ 5 = 148.7					
IV	103.7	38	150.6	8				Excellent working no bleeding fat
	103.6	39	149.6	11	~~62.3~~			
	104.9		151.8		62.4	28.8	(.3)	
			146.9					
			151.2					
			750.1 ÷ 5 = 150.02					
V	108.5	34	149.8	8				fat
	105.4	34	147.3	9	61.6	29.2	(.4)	
	106.5		149.3					
			145.8					
			148.7					
			740.9 ÷ 5 = 148.18					

see p 21 sample #5

Part I-F - Soluble Cellulose + Yield

Work to date has indicated Natrosol increases yield by allowing the use of greater amounts of water. This is to determine the effect of varying amounts of Natrosol 250 HHXR on yield at a given water ratio with sufficient Pluronol for maximum air entraining as determined on P 28-29 this volume - 1.5 oz per bag (45 lbs) or more specifically 0.6 gm per 300 gm MK mix - All samples mixed in the lab as follows - Dry mix 1 minute

Vermi #3	76.2 gm	117.0 gm
Asbestos	40.8 gm	
Plain Kyp.	180.0 gm	
	300.0	+ 0.6 gm Pluronol

Sample #	Natrosol/300 gm
	gm
I	0
II	.1
III	.2
IV	.3
V	.4

Use 700 ml water - mix 4 minutes

Sample	Wt 150cc	Visc	Thru gun → Wt 150cc	Visc	Density lb/ft³	Yield bd ft/bale	Remarks
IV	101.1	40	175.0	7			
	96.3	41	152.2	8	62	29.0	looks poor
	101.7		149.3				try again
			148.7				
			149.6				
			745.2 ÷ 5 = 149.04				
III	97.9	39	150.0	7			
	98.1	40	148.1	7	61.3	29.4	
	44.9		146.3				
			143.5				
			149.1				
			737.0 ÷ 5 = 147.4				
repeat IV A	96.3	38	146.7	7			
	98.3	39	144.6	8	60.3	29.9	
	100.2		145.9				
			142.9				
			145.1				
			725.2 ÷ 5 = 145.04				
II	94.5	38	150.0	8			
	97.1	41	148.5	8	61.5	29.3	
	48.0		145.1				
			147.7				
			148.2				
			739.5 ÷ 5 = 147.9				
I	95.8	41	142.2				
	97.3	40	144.2		59.5	30.2	see sample VI p 26
	46.3		140.3				
			144.5				
			143.8				
			715.0 ÷ 5 = 143.0				

Check difference due to air pressure in gun

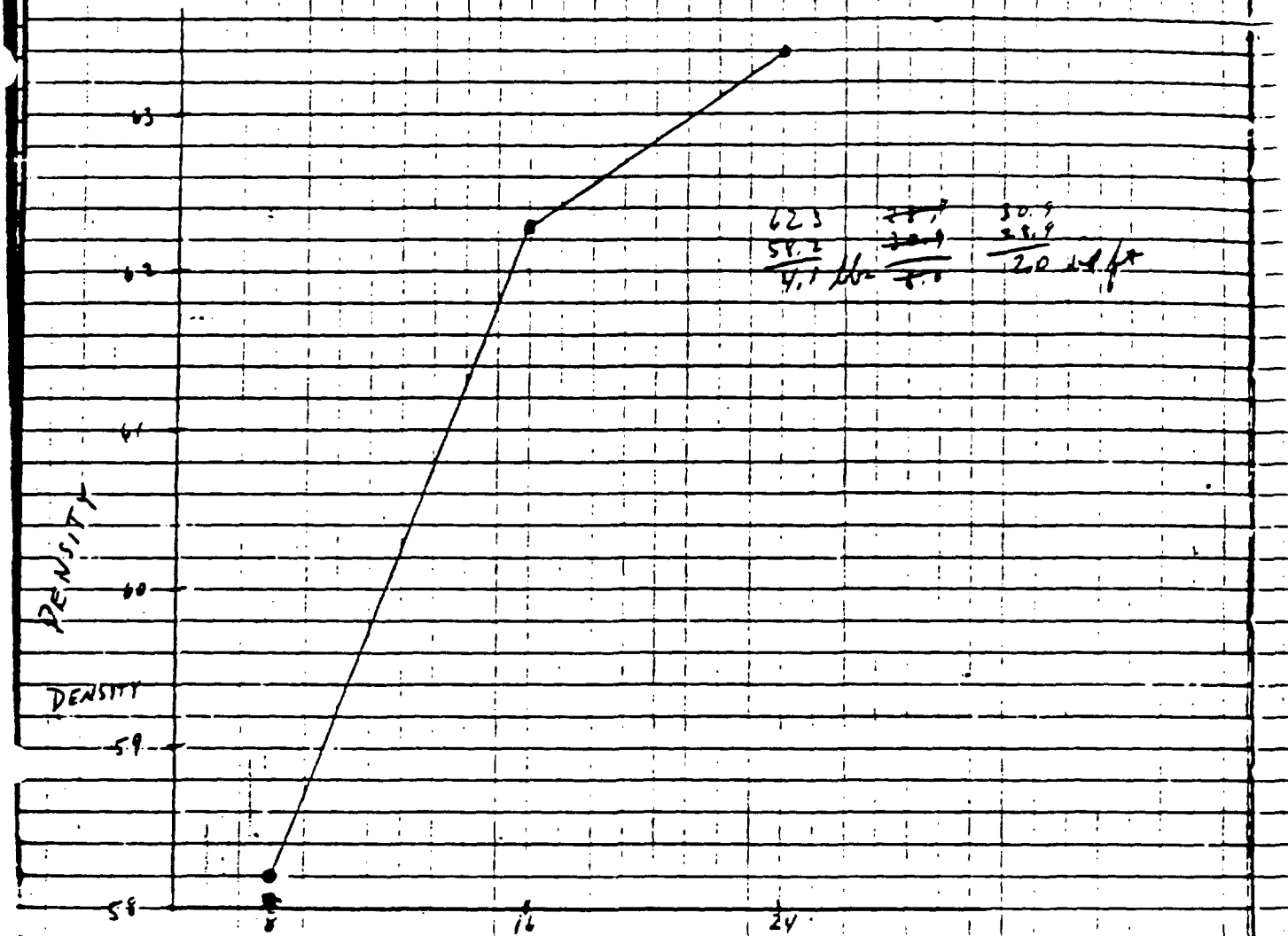
Part B Comparison Dufonal & Maprofix NEV

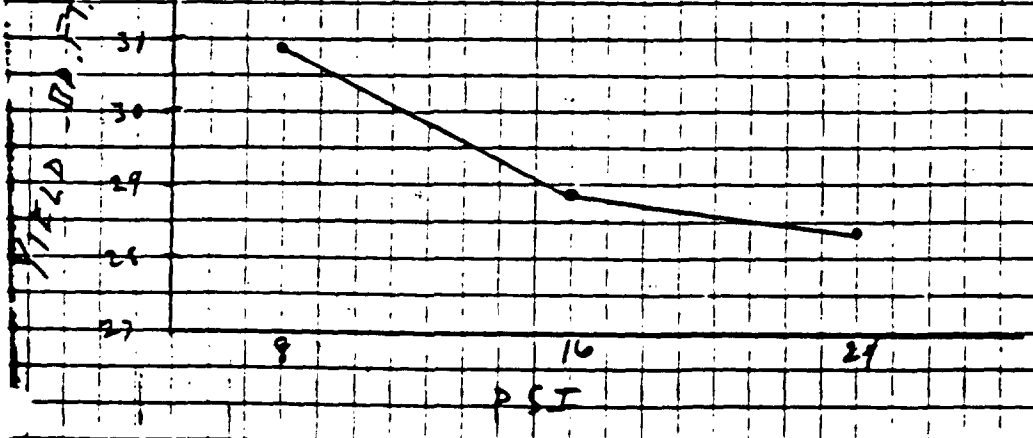
Using 300 gm MK (Lot Mix) add varying quantities Mapprofix & measure yield as done previously—

1 minute dry mix

4 minute wet mix 300 ml water

Sample #	Mapprofix NEV gm/300	Dufonal gm/300
I	0	.6
II	.2	
III	.4	
IV	.6	
V	0	.2


63
62
61
60
59
58
DENSITY
DENSITY
8
16
24
PSI
62.3
58.2
4.1 lbs
20 cu. ft


31
30
29
28
27
YIELD - Pct.
8
16
24
PSI

Part III - C - Effect of Air Pressure on Wet Density

Use ~~400~~ 450 gms MK (Plant production) and ~~974~~ 1050 ml water (2.33 ratio) - mix ~~5~~ minutes. Spray thru gun using 8 lbs pressure + 16 & 24 lbs pressure ~~thru~~ in air line - fill 3 cups (150 cc) at each pressure.

Mixer density

gm/150 cc	lbs/cu ft	Vicat
101.4		38
98.5		38
106.1		
306.0 ÷ 3 = 102.0		

thru gun

Sample #	air pressure	gm/150 cc	lbs/cu ft	yield	Vicat
I	8	141.3	58.2	30.9	12
		136.7			8
		143.3			12
		420.3 ÷ 3 = 140.1			
II	16	150.0	62.3	28.9	8
		150.4			9
		149.4			8
		449.8 ÷ 3 = 149.93			
III	24	152.4	63.4	28.4	6

112592

38.

Dry bulk density - 500 ml cylinder

	gm/500ml	lbs/cu ft
A	135.6	
	132.2	
	267.8	
	133.9	16.7
B	135.0	
	132.1	
	267.1	
	133.6	16.7

Asbestos

A - 10.6 lbs/cu ft

B - 13.3 lbs/cu ft

112593

Part IV-B Asbestos Density and Yield

Make samples of MK with samples of asbestos A + B analyzed in Quality Control Data Book #1 Page 5.

300 gm samples made:

Vermic	76.2 gm
Asb	40.8
	117.0
Gyp.	183.0
Dup	.6 gm / 300

Dry mix 1 min.
Wet mix 700 ml water – mix 4 min.

Put thru texture gun – use ~~of~~ air pressure of 16lbs

Sample	Wt 150cc	Visc	thru gun Wt 150cc	Visc	Density lbs/ft³	Yield bd ft/40lbs	Remarks
A	98.8		150.3	8			
	104.5		149.2	9			
	100.8		148.4				
			144.8				
			150.1				
			742.8 ÷ 5 = 148.56		61.7	29.15	
B new	110.6		149.9	8			poor air (MD)
	112.2		147.0	8			
	113.8		151.5				
			149.2				
			149.2				
			737.8 ÷ 5 = 147.56		61.8	29.30	

Oct 4-7, 1947

Formula II

Mixer density - 115.5 g/150 cc 48 lbs/cu ft

Nozzle density - 147.7
146.3
147.7
441.7 ÷ 3 = 147.2/150 cc
61.2 lbs/cu ft

Yield of 45 lb. bag = 27.5 board feet

331
70
1031

1031 ÷ 61.2 = cu ft/min
cu ft/min ÷ 331 = cu ft/lb.
cu ft/lb x 45 = cu ft/bag
cu ft/bag x 12 = bd ft/45 lb. bag

∴ Yield down over present product

More important mix was still very wet and did not hold up well when sprayed on vertical surfaces.

Weight / dry set board foot + cubic foot

226 - 331 = 68.3 lb gyp

45 lbs x 68.3 = 30.7 lbs gyp/bag
30.7 x 15 = 4.6 lbs H_2O for hydration
30.7
35.3

45
4.6
49.6 lbs dry set wt

49.6 ÷ 27.5 = 1.8 lbs/board ft
= 21.7 lbs/cubic foot

Conclusion — use more retarder + less gyp.
Retarder necessary for wet bulk - holds more water than originally calculated.

Part III C - Proportions Asbestos + Yield

Theoretical analyses + calculations indicates 1/3 of air in our present product (after going thru gun) is from disposal and 2/3 of air is in vermic. Therefore increasing vermiculite and reducing asbestos should produce a lighter density (asbestos holds no air).

Following was made and tried with 700 ml water — I Vermiculite 80 gm, Asbestos 15 gm, Gypsum 193 gm = 288 g — mixer density 1362 g/250 cc, 56.6 lbs/cu ft

This mix was much too wet — showed very poor air entraining with .6 gm disposal. Adding 10 gm more vermic improved consistency and reduced mixer density — 114.7 gm/150 cc or 47.6 lbs/cu ft. To keep the gypsum vermic ratio the same 32.3 gm additional gyp was added to make the final formula:

II Vermic	90 gm	
asbestos	15 gm	
gyp	226 gm	
	331 g	+ 700 ml H_2O

112596

[redacted]

 Oct 7, 1968

Wet mixes of samples I + II —

sample	Wt 150cc	Thru gun Wt 150cc	Vicat	density lbs/ft³ (16 lbs air press)	yield bd ft/45 lbs
I	92.6	132.9	6		
	93.8	138.5	6		
		136.5		57.1	30.3
		139.2			
		139.4			
		686.5 ÷ 5 = 137.3			
II	91.9	137.6			
	92.1	131.1			
		134.9		56.2	32.0
		135.1			
		137.3			
		676.0 ÷ 5 = 135.2			

Set dry density II —

45 ÷ 32 = 1.4
 .12
1.52 lbs/bd ft   18.2 lbs/cu ft

Cost – II –

	lbs/batch		cost
Vermic	269	48 ft³	8.40
asb	50		1.63
gyp	395		4.66
	714		14.69
			.50 dep
			15.19

1519 ÷ 15.7 = 96.7 ¢/bag

16.6 bags at 42.2 lbs = 700 lbs
16.6 bags at 43.0 lbs = 714 –
91.5 ¢ per bag
2.99 ¢ per bd ft

[redacted] 112597

Oct 7, 1968

Part IV C – Ratios Vermic – Asbestos and Yield

Indications from work P41 are that water taken by various ingredients are as follows

	W. Ratio	% in Mix	H_2O req'd	% in Mix	H_2O req'd
Vermic	~~3~~ 3.5	25.4	89 ~~85.4~~	27.2	95
Asb	6.5	13.6	8.4	4.5	31.5
Gyp	.85	61.0	51.9	68.4	58.1
		229.3 × 3 = 687.9	229.3 × 3 = 687.9		184.6 × 3 = 553.8

553.8 – too wet on P41

Try following mixes to require 700 ml H_2O/300 g

I	part by wt	H_2O req'd	per 700 ml H_2O
Vermic	37.7	132.0	113.1
Asb	7.0	45.5	21.0
Gyp	61.0	51.9	183.0
	105.7	229.4 × 3 = 688.2	317.1

II	part by wt	H_2O req'd	per 700 ml H_2O
Vermic	37.7	132.0	113.1
Asb	7.0	45.5	21.0
Gyp	55.4	47.1	166.0
	100.1	224.6 × 3 = 673.8	300.1

use ~~.6~~ .6 gm dup./batch

Dry bulk density of mix I & II (gm/500 ml)

I 118.8 or 14.8 lbs/cu ft

II 110 or 13.7 lbs/cu ft

112598

Wet Mix

Sample	Mil WT 150cc	Nozzle WT 150cc	Density Vicat	(16 lbs gal) lbs/ft³	Yield ft 45 lbs
I	93.1	135.5	5		
	96.1	135.3	4	56.4	33.5
		137.6			
		137.1			
		137.7			
		679.2 ÷ 5 = 135.82			
II	93.4	145.3	5		
	94.5	147.6	5		
Vicat 38		147.7		60.6	31.2
		142.3			
		146.4			
		729.3 ÷ 5 = 145.86			
III	92.9	135.1	6		
	92.5	134.8	6		
		134.6		55.9	33.8
		132.3			
		134.9			
		671.7 ÷ 5 = 134.34			

looks fat compared to sample I can use more water

Cont

Part IV C – Ratios Vermic-Asbestos Gypsum and Yield

Continuing work from P 42 – further increase vermic & ~~sugar~~ reduce gypsum to reduce wet density & increase yield.

Try following with #3 + #4 vermic

					Volumes with #3
Vermic –	42	×3	= 126	×3.5	441
Asb	8		= 24	×6.5	156
Gyp	50		= 150	×.85	127
					724 – (Use 750 ml / 300 g)

Sample I – with #3 Sample II with #4

Use .4 gm dupanol / batch

Dry density – gm/500 ml

I – 101.5 gm 12.7 lbs/cu ft

II – 102.5 gm

Sample III — 750 ml H_2O .4 g dup.

Vermic	43	×3	= 129	#3
Asb	7		= 21	
Gyp	50		= 150	

Oct 9, 1966

Wet Mixes

16 lbs air - then gun

Sample	Vicat	MD WT 150 cc	ND WT 150 cc	Vicat	lbs/cu ft	Yield lbs/ft/hr lbs	Remarks
I	40	94.5	136.6	7			
some		96.5	135.3	5	55.9	32.2	
bleeding			136.0	Very little			
			134.2	bleeding			
			129.7				
			671.8 ÷ 5 = 134.36				
II	40	73.9	135.7	6			
~~too much~~		78.8	138.2	5	56.7	36.5	
~~water~~			134.5	some			
shy on dope?			132.6	bleeding			
or mix time			136.2				
			682.2 ÷ 5 = 136.44				
III							
shy on dope?		71.0	134.6	4			should have
or mix time		71.1	132.9	5	54.6	41.2	used more
~~should have~~			132.2	some			water.
			130.2	bleeding			
			127.3				water bleeding
			657.2 ÷ 5 = 131.44				on top when set
							(2 hr set)

Part II C - Ratio Vermic - Asb - Gyp

Vermic holds air - asbestos holds water

Determine effect of asbestos on water ratio.

Make following

Sample		partially wt	water factor	water req.	total water 300 gm
I	Vermic	43	x 3.5 =	150	
	Asb	3.5	x 6.5 =	22.8	
	Gyp	53.5	x .85 =	45.5	
		100.0		218.3 x 3 = 654.9	
II	Vermic	43	x 3.5 =	150	III 43 / 32 / 86
	Asb	14	x 6.5 =	91	
	Gyp	43	x .85 =	36.5	
		100		277.5 x 3 = 832.5	

per 300 gms — use .4 gm disp. mix 4 min wet

I	Vermic	129	
	Asb	10.5	Use 700 ml water
	Gyp	160.5	
		300.0	
II	Vermi	129	
	Asb	42	Use 850 ml water
	gyp	129	
		300	

III	Vermi	43	129	x 3.5 =	450
	Asb	21.6	64	x 6.5 =	415
	gyp		107	x .85 =	91
			300		956

Use 950 ml water

Dry bulk density —

	gms/500 ml	lbs/cu ft
I	110	13.7
II	88.4	11.0
III	78.8	9.8

112602

Sample	MD	HD	Vicat	density	Yield (?)	
I	86.9	130.6	17			wet
	89.1	129.9	15	53.7	57	reduce water
Vicat 40		129.5	bleedy			will not stick
bleeding		129.5				
		126.9				
		646.4 ÷ 5 = 129.28				
II	63.5	127.4				too stiff
	64.5	130.0		53.0	57.7	to spray &
Vicat 31		128.5				screed well
some bleeding		126.9				
but good & stiff		123.5				
		636.3 ÷ 5 = 127.26				
I A	62.7	127.3		52.6	51.3	
	61.5	125.8				
Vicat 41		126.2				
no bleeding		379.3 ÷ 3 = 126.43				

Con'd for P 47

			water factor	water req'd
Soil I	V	167	× 3.5	= 585
27.7	ash	83	× 6.5	= 540
16.7	gyp	50	× 1.85	= 42
100.0		300		1167

~~Use 1200 ml water~~

~~#~~ used 934/200 increase

II	V	200	× 3.5	= 700
	ash	300	× 6.5	= 650
	~~gyp~~	300		1350

Use 1400 ml water

200 gm 934 ml

Use .4 gm dusp - mix 5 minutes

Dry bulk density - gm/500 ml lbs/cu ft

I	66	8.2
II	53.4	6.7

I & - run with 100 gm + 400 ml H_2O

300	300	300
1200	1400	1400
1500	1700	1700

Sample	MD	WD	Vesat	density	yield	
I	91.4	140.5				800 ml
Vesat	94.4	140.5		57.9	34.2	
38		138.5				
		140.4				
		135.9				
		695.8 ÷ 5 = 139.16				

II	82.9	131.4				
Vesat	82.4	132.9		55.0	~~38.3~~	800 ml → 36 bd ft
40		134.5			35.3	780 ml 35.2 bd ft
		133.3				
		129.9				
		662.0 ÷ 5 = 132.4				

Cost – per lb. (cents) per bd ft (cents)

I	V	36	1.09	133 bd/ft	
	A	14	.48		~~2.18~~
	C	50	.59		2.23
			2.16		
			.07 diff		
			2.23		

II	V	50	1.52	1.17 lb/bd ft		2.11
	A	7	.23		~~2.76~~	2.74
	C	43	.51		2.74	.37 / lb
			2.26			30
			.07 diff			11.10 / 45 lb bag
			2.33			saving

Cont'd from P49

Shrinkage of sampler previously made starts with number 47-II thru 49 series 47-I showed no shrinkage

Try following variations

Sample		parts/100	water req.	gms	
I	V	36	x3.5 = 126	108	
	A	14	x6.5 = 91	42	
	C	50	x1.85 = 92	150	
			264 x3 = 792	300	+ 800 ml water
II	V	50	175	150	
	A	7	46.5	21	
	C	43	36.5	129	780
			257.0 x3 = 771	300	+ ~~600~~ ml water

Alloy bulk - gms/500 ml

I	123.7	12.8
II	89.7	11.2

52

	Assembly		Reading		Total	Avg
15	I	200	220	220	440	220
	II	750	220	240	460	230
	IV	700	220	240	460	230 —
	VI	600	320	240	560	280
	VIII	600	360	420	780	380
17	IV	0	280	320	600	300 —
	I	.2	300	300	600	300
	II	.3	280	320	600	300
	III	700 .4	300	320	620	310
21	I	600 (4HRS)	480	460 500	1440	480
	III	650	360	460 380	1200	400
	III	700	320	340 320	980	327 —
	IV	850	320	340 360	1020	340
	V	800	260	300 280	840	280
	VI	700 0	360	320 320	1000	333 —
27	I	700 (DRY) 0	300	300 240	840	280
	II	.1	320	280 240	840	280
	III	.2	240	260 260	760	253
	IV	.4	240	240 260	740	247
	V	.6	220	240 220	680	227 —
	VI	V .8	240	260 220	720	240

112607

Hardness of MK Formulations Previously Made —

Hardness was ~~obt~~ determined with a Soiltest penetrometer CT-421 made for concrete. It was pushed by hand into the surface of the samples to a depth of 1 inch (to the second mark on the penetrometer needle. Readings are in lbs/sq inch.

Formula #	Reading			total	Avg
Y7 III	240	200	220	660	220
S1 II	220	200	220	640	213
Y7 II	260	220	220	700	233
S1 I	280	280	220	780	260
Y5 III	220	200	200	620	207
Y5 I	280	200	240	720	240
Y7 I	200	220	200	620	207
Y3 II	240	220	200	660	220
Y5 II	220	300	280	800	267
Y3 I	220	260	260	740	247
37 II					

Nov 16, 1961

Vermiculite – bulk density – 35 lbs 1 oz gross
– 29 lbs 8 tare
per cubic ft 6 lbs 1 oz net

Asbestos – fluffed – 39.5 lbs gross
29.0 lbs tare
per cubic ft 10.5 lbs net

Screen analysis – Vermiculite – 500 ml – 49.4 gm
Total wt – 100.4 gm screened. (1000 ml) 500 ml – 51.0
100.4 gm

	Wt	Vol	% by wt
8	6.15	65	
16	54.0	600	
30	34.8	320	
50	4.0	25	
pan	.6		

Asbestos Wet bulk test – 12.5 gm 500 ml water displacement

	start	1 hr	2 hr			
A	10:04	11:14 – 400 ml	12:04	385	77%	45 ml
B	10:06	425 ml	12:06	415	83%	47 ml

2 | 100
80% wet bulk

Nov 18, 1968

Production Run - New MK Formulation

Raw materials -

Two new formulations were made labeled X and R. One batch of each

Ingredients / batch	X	R
Vermic (cu ft)	~~36~~ 34	~~36~~ 34
Gypsum (lbs)	450	187
Asbestos (lbs)	90	25
Dupanol	1 lb.	1 lb.

Formula X is a stop-gap ~~the~~ meant to be sufficiently different as to not to infringe on existing patents. Formula R is completely different - an effort to get greater yields and more economical coverage on the job.

Plant equipment was thoroughly emptied prior to making each batch. - Asbestos and vermiculite were checked for quality -

Sample	WND 150cc	Vicat (thru gun)	WD 150 cc	cu ft	yield
R (750ml)	88.7	5	133.0	54.7 lbs	34.5 bd ft / 45 lbs
	89.5		132.9		27.5 bd ft / 36 lbs
			133.6		750 ml H_2O
			130.4		
			127.1		
			5 / 657.0		
			131.4		
17-1 (800ml)	92.2	6	132.8	55.0 lbs	36.0 ft / 45 lbs
	93.0		133.2		37.5 lbs to get 30 ft
much better workability @ 800 ml H_2O			133.2		
			128.6		
			133.2		800 ml
			5 / 661.0		
			132.2		
X (660ml)	89.0	5	147.8	61.0 lbs	~~31 ft / 45 lbs~~ (at 750 ml)
	92.5		144.5		28.3 ft / 45 lbs @ 660 ml
			147.4		(11.9 gal/bag)
			147.5		
			145.4		
			5 / 732.8		
			146.6		

Hand mix Consistency

		W.R.	Vicat	H_2O	W.R.	
130 gr	X -	2.2	11, 13			286
286 H_2O +35 ml			26			60
+60 ml			33-35	346 ÷ 130 =	2.58	13.8 gal (346)
112 gr	R	2.66	28			
298 H_2O		315 ml	37	315 ÷ 112 =	2.81	15.2 gal

112611

Nov 18, 1968

Production Run – New MK Formulation

Mixed product analysis on X + R

	lbs / cu ft X	R *
Dry bulk density	27.25	24.13
(cu ft box) tare	12.25	12.25
lbs/cu ft	15.00	11.88

* Asbestos not sufficiently broken up – present in large balls or lumps.

Wet mixes for yield test –

use 16 lbs air – 4 minute mix time

		water
Formula X – use water ratio	2.2	660 ml
Formula R – use water ratio	2.5	750 ml

Using 300 gms of each – Run yield test

Formula D – 47.6 lbs/cu ft – hand mix for set test

% ingredients

	X		R	
Vermic	26.6	36 cu ft	50.4	36 cu ft
Asbestos	12.2	90 lbs	5.84	25 lbs
gyp	61.1	450 lbs	43.8	187 lbs
	99.9		100.0	

to bring to 50% gyp – add 12.4 lbs gyp/100
44.8 % V 5.19 % A
to bring to 52% gyp – add 17.3 lbs gyp/100
43.0 % V 4.98 % A
to bring to 55% gyp – add 24.0 lbs gyp/100
40.6 % V 4.71 % A

Nov 20, 1968

III - 2nd batch of 57X - same water

gross wt wet - 5 lbs 7 oz - 5.44 lbs
tare 1.5 lbs 1.5
3.94

3.94 ÷ .0625 = 62.4 lbs/cu ft

460
300
960 total ÷ 63 cyls = 27.4 cu ft/bag

IV - 5D20K8 - standard production WR 2,2

gross wt wet - 5 lbs 6 oz 5.38
tare 1.437 1.44
3.94

3.94 ÷ .0625 = 63.0 lbs/cu ft

Weight of sampler -

	I			II			III			IV		
	GR.	TARE	NET	GR.	TARE	NET	GR.	TARE	NET	GR.	TARE	NET
INITIAL 11/20 PM	5.63	1.43	4.20	4.94	1.45	3.49	5.4	1.5	3.9	5.38	1.44	3.94
11/22 AM	4.94		3.51	4.32		2.87	4.88		3.4	4.88		3.44
11/25 AM	4.14		2.76	3.63		2.18	4.13		2.63	4.00		2.56
11/29 AM	3.70			3.00			3.50			3.38		
12/2 AM	2.94		1.51	2.56		1.11	2.88		1.38	2.88		1.44
12/4 AM	2.94		1.51	2.56		1.11	2.88		1.38	2.88		1.44
Final density lbs/cu ft			24.2			17.8			22.1			23.0

Nov. 20, 1968 59

Yield & Density Check — 57R & 57X

To check wet density & drying rates of new formulations a 12 x 12 x 3/4 inch pan of each wet sprayable mixture was made up by mixing sufficient batches in Hobart mixer & spraying through E-2 Tex gun. 10 lb AIR

I - 57X - 300 gm/batch - water ratio 2.2-660ml

II - 57R - 300 gm/batch - water ratio 2.6-780ml

I - Made 4 batches - used 3+ - screeded off level with top of tray -

weight 5 lbs 10 oz gross (5.625 lbs)
tare 650.5 gm - 1.43 lbs 1.143
4.20 lbs net

12 x 12 = 144 x .75 = 108 cu" = .0625 cu ft

4.2 ÷ .0625 = 67.2 lbs/cu ft (domes)

II - Made 3 batches used 2+ - screeded off

net 4 lbs 15 oz gross 4.99 lbs
tare 659.1 gm - 1.45 lbs 1.45
3.49 lbs net

3.49 ÷ .0625 cu ft = 55.8 lbs/cu ft 34.9 lbs/ft

slightly wet - reduce water? use retard?
Also considerable rebounding -

60

Dec 4, 1968

Job test with 57 X —

Shot Hole 3 - Wilson & Sunset - 2nd floor

5 minute mix 12 - 12.5 gal water —

M.D. 55.0 N.D. 61.2 ND on air - 55.6
56.8

Yield (12.5 gal) 29.64 bd ft

[redacted]

Dec 31, 1968 61

General Trends + Considerations

See MK Progress Report this Lab Nov 1968 —

1.) Increasing Vermic increases yield
2.) As vermic – gyp ratio is increased Retector must be decreased to eliminate shrinkage
3.) It appears that approx equal parts by wt of Vermic + Kyp with about 5-6% retector (based on wt of total) is near to end point in making a product that will set properly, not shrink, and be sufficiently hard for the purpose
4.) Tests run at Shohl Lab indicate: —
all fiber can be eliminated: —
starch can be added to increase bond: —
reducing gyp and increasing vermic increase performance of product under fire (Test report #1276 1/20/66)
5.) Retector must be eliminated from product because of its notoriety as a cause of lung problems.

112616

Dec 31, 1968

Paper pulp - Weyerhaeuser soft alpha D
ground dry in Waring blender and
mixed in following:—

50	1'	—	150 gm
1.7	paper*	=	5 gm (tried 15 but too much)
48.4	Gyp	=	145 gm
100.1			300

*would not mix in until water added

800 ml water — MD — 95.2 gm/150 cc
300 — ND — 142.5
1100 g — 141.5
23.4 ft/45 lb — 140.0
138.0 — 58 lb/cu ft
140.0

Some paper remained as soft fibrous lumps in mix but went thru gun O.K.

6) ~~Fiber~~ Rock wool + paper pulp tried as substitute for asbestos. Rock wool tried in July-August '64 on paper pulp thin data (P. 62). Both have same problem - must be ground - difficult if not impossible to mix with ceramic - fibers too cohesive - too long to stay pulled apart.

7.) Try stared and fiber glass (chopped into 1/4" lengths)

8.) Try no fiber.

Use equal parts gyp + ceramic -
Use 1g slip / bag rate = .4 gm / 300
Use 0 starch + 4g / bag rate = 1.6 gm / 300
National Stared Hydroseal #3
Use 1/4 inch chopped fiber - 5% based on wt of gyp + ceramic

	MD	WD	lbs/cu ft	
I	86.7	114.1		
		116.3	47.6	34.7 ft/45 - Kamener too fast - use 650 watts
		112.8		
		117.5		should be about 36 bd ft
		113.2		
		5|573.1 = 114.6		
IV	83.0	120.0		
		120.3	49.2	36.7 ft/45 lb bag
		119.7		
		118.9		
		113.3		
		5|592.2 = 118.4		
II	74.2	117.5		
		118.1	48.1	37.7 ft/45 lb bag
		110.6		
		117.3		
		114.6		
		5|578.1 = 115.6		try again - loofer too good to be true

crumbles when dry (? measurements)

OK when dry

OK when dry

Effect of fiber on MK.

Use equal parts by wt vermic & gyp as control - add 18 g asbestos & 18 g glass to mix II & III. 4 g duponol in each.

			%	water - 10 lbs air	
I	V	150 gm			must air
	gyp	150 gm		750 ml	too soft use less water
II	V	150	48.6		
	gyp	150	48.6	~~800~~	
	asb	~~18~~ 9 gm	2.9	700	OK
			100.1		
III	V	150			
	gyp	150		~~750~~	
	glass	18			
IV	V	150			still soft - use less water
	gyp	150		~~750~~	
	starch	1.6 gm		700	

At peak exposure of 9.9 mg/M³ would bring asbestos below .3 mg/M³ suggested as maximum by State health authorities.

9 ÷ 309 = 2.91 % × 9.9 = 2.8

Jan 2, 1969

Clay 65 II series without asbestos

66 I – 750 ml water MD – 79.1 150 Vermi
150 Gyp

ND – 1# lbs air.
112.4
110.6 Too much
110.7 water
108.5
110.3
551.9 ÷ 5 = 110.4 = 45.9 lbs/cu ft

1050 – 45.9

41.2 bd ft/clay

66 II – 66 I made with #4 instead of #3
dry wt – 500 ml – 103.5 gm

Crumbler broken dry
2/24/69

750 water – MD – 92.5 gm
wet – sat air down # 5 lbs

ND
170.0 5 lbs air
108.5 "
125.5 10 lbs air
120.2 "
129.2 "
593.4 ÷ 5 = 118.7
49.3 lbs/cu ft

66 III 2nd 700 ml water
still too wet
MD – 94.6

Crumbler dry
2/24/69

Trim ND – 115.8
114.8
116.2 47.8 lbs/cu ft 37.6 bd ft
112.8
114.9
574.5 ÷ 5 = 114.9

66 IV – 650 ml water MD – 85.4
37.8 bd ft

ND – 106.5 Trim
110.0
45.2 lbs 109.0
109.3
109.8
543.6 ÷ 5 =
108.7

Repeat of Work on P65

		%	gm
65 II —	Vermic	48.5	150 gm
	Gyp	48.5	150
	Air	2.9	9

} 500cc – 80.8 gm
10.1 lbs/cu ft

Using 700 water — MD — 65.5 gm/150 cc

67 I 10 psi air – ND – 114.5, 113.2, 111.2 = 338.9 → 113.0
47 lbs/cu ft
38.7 bd ft

15 PSI air – MD – 114.5/150cc, 119.3, 119.9 = 353.7 → 117.9
49 lbs/cu ft
37.1 bd ft

Good thick foam but too dry to be workable after spraying – increase water — try 750 ml

67 II – 750 ml water = MD – 70.4

ND 10 lbs air	15 lbs air
115.0	120.6
113.3	117.8
108.9	119.7
337.2	358.1
112.4	119.4
46.7 lbs	49.6

1050 ÷ 48
39.4 bd ft/bag

67 III – 800 ml water – MD – 80.0 10 lbs air

ND 10 lbs	15 lbs
118.8	117.4
118.2	120.0
118.5	114.9
3 | 355.5	3 | 352.3
118.5	117.4

1100 ÷ 44.1 – 300 × 1/5 × 12 –
40.3 board feet/bag
(45 lbs)
800 ÷ 300 = WR 2.67

118 ÷ 150 × 62.4 = 49.1 lbs

Jan 6, 1969

Recap of 69

Sample #		ml water per 300gm	Wt 72 cu" Gross	Tare	Net	lbs/cu ft	8 lbs air pressure Yield/cu ft
I	#3 7.91%	800	3.250	1.313	~~1.947~~ 1,937	46.5	42.6
II	#3 Toast.	750	3.125	1.313	1.812	43.5	43.4
III	#4 Toast	680	3.313	1.313	2,000	48.0	36.7
IV	control	700	3.50	1.063	1.437	58.5	30.8

Wts on Jan 6 —	Gross	Tare	Net (.0416 cu ft)	lbs/cu ft
IV	2.625	1,063	1.562	37.5
III	2.625	1.313	1.312	31.5
II	2.437	1.313	1.124	27.0
I	2.500	1.313	1.187	28.5

Wts Jan 9

IV	1 kg	1.938		.875	21.0
III	2 kg	2.063		.750	18.0
II	1 1/4 kg	1.875		.562	13.5
I	1 kg	1.938		.625	15.0

Wts Sept 10

IV	1 15g			.875	21.0
III	2 1g			.750	18.0
II	1 15g	1.938	1.313	.625	15.0
I	1 15g	1.938		.625	15.0

all soft air and blow before.

112623

[redacted]

Heat Transmission Tests —

Make samples and spray into 1/2 inch deep pans 12" x 12" square. Let dry & check for heat transmission.

I - 67 III (800 ml water) All containing .4 gm
II - 66 I (750 water) duponol —
III - 66 IV (650 ml water) dry mix for 1 minute
IV 31 II (700 ml water) wet mix for 5 minutes

IV - 400 gm dry mix - .4 - - .13 dup.
~~100~~ air - used 700/3 = 233 ~~wat~~
used 8 lbs air 700
wet wt 72 cu" - 3.5 lbs gross 933 water/400 cut
~~tare - 1 lb. 1 oz~~ (high water) ~~750~~
58.5 lbs / cu ft 750

III 175 #4
175 gyp .466 dup.
350 total ~~759 water (too wet)~~ 759
2nd batch - 300 gm 600
600 water - 48 1359
680
wet wt - 3 lbs 5 oz
tare 1 lb. 5 oz) 48 lbs/cu ft

II 150 #3
150 gyp } 750 ml water (a bit soft) - too wet
.4 gm dup
wet wt - 3 lbs 2 oz
tare 1 5 oz.) 43.5 lbs/cu ft 8 lbs air

I - same as II + 9 gm asb + 800 ml water - too wet
needed 2nd batch wet wt - 3 lbs 4 oz) 46.5 lbs/cu ft
tare 1 lb 5 oz

[redacted]

70

Sample II (same as I but lighter density)

	Time	Heat with	Coolant	
start	11:00	Room temp	23°C	wt 2 lbs 11 oz 2.69 lbs/gal
	11:03	120°F		
	11:05	200°F		
	11:10	400°F		
	11:12	470°F	200°F	
	11:13.5	500°F		
	11:17	600		
	11:22	700		
	11:30	780		
	11:34	800		
	11:36	810	300°F	
	11:39	820		
	11:48	847	400	
	12:15	850 - still under 500		

During Burner Runs on Sample I (57X) got to 400°F in 12 minutes with flame temp of 1320-1250 on sample.

4 min 200°
10 min 300°
12 min 400°

could not get to 500°F

Heat Transmission Test — Jan 9

Run on samples made Nov 18 (P 55) and sprayed into 12 x 12 x 3/4 inch panels as described on P 59.

Procedure — samples were inserted on a hot plate and a thermocouple placed between sample and hot plate. The sample rested on the surface of the hot plate and pressure was exerted initially to imbed the thermocouple into the material. Surface temperature measured with wax "Tempilstiks"

Sample I (57?) placed on hot ~~tray~~ plate at a temperature of 400°F

	time	hot side	cool side	cool wt after test
start	10:55	400°F	~~100~~ 26°C	
	11:00	500	200°F	2.75 lbs
	11:12	700	200+	1.43 tare
	11:20	780	300+	1.32 net
	11:40	800	300+	
	11:56	780	300+	

Sample II (57R) — placed on hot plate at room temp.

	Time	hot side	cool side	wt after fire
start	2:00	Rm temp	Rm temp	2.44
	2:06	200°F		1.45
	2:09	300		.99 net
	2:11	400		
	2:14	500	200°F	
	2:17	600		
	2:22	700		
	2:30	790		
	2:31	800	300°F	
	2:35	810		
	2:45	860	400	
	3:15	870	still under 500	

Jan 10, 1967

The general objective is to find a product that:

1.) Will yield 35 ft / 45 lbs

2.) 42.5 lbs of the product will cost no more than 45 lbs of the present product

3.) Will have dry set properties as similar to the present product as possible — particularly in regard to hardness — and possibly better in regard to fine cuttings;

4.) Can be marketed in a 42.5 lb. bag for the same price as the present 45 lb. bag but will yield a full 33 bd ft per bag instead of the present 30.

[redacted]

'67 Jan 10, 1969 73

Some Conclusions to Date —

1) Reducing gyp below 50% tends to make the product quite soft - possibly too soft for the market

2) Reducing asbestos to 0 to 5% make the product very light and ~~cannot~~ produces large pours. While replacing the asbesto with vermiculite does increase yield the finished product may allow faster heat transmission because the openings are connected. This is indicated by the difference between sample I & II P 71. However sample III tends to disprove this theory.

3) Based on cost, hardness, yield & theoretical fireproofing value the following formulas will be tested as final candidates for a new product:

	% V	ASB	GYP
45 III	43	7	50
43 II	38	7	55
73 I	40	7	53
73 II	40	10	50

[redacted]

112628

	MD	ND	lbs/cu ft	Yield/45 lbs bd ft
I	72.6	122.8	51.1	37 bd ft
		124.9		
		127.5		
		129.5		
		129.7		
		634.4		
	÷5	~~126.9~~		
		122.9		

dry bulk – 84.5 g per 500 ml
Water – 750 – dry
Good stiff foam

See p. 44
33 ft yield
dry bulk 12.7 lbs
MP 99.2 ND 55.9

More water added – go now
& increase ?
Effect on ?

Costs —

	Cost/lb. × 45 =		+ Dup =	~~Cost/bd ft~~	lbs/33 ft	Cost/ft
I	2.12 × 45 =	.954 + 0.31 =	.985	2.16	40.1	.8782
II	2.03	.914	.945	2.71	42.5	.9925
III	2.07	.931	.962	2.77–2.83	34.8	.9138
IV	2.13	.959	.990	2.74	41.1	.9042

Conclusion – Eliminate #II mix – Keep #IV
try ~~42~~ 50

V same as IV – but 0.9 g Dup – 750 H_2O
1½ min mix 73.4 g
3 minute mix 72.5

750
25
1050

ND
125.6 51.5 lbs/cu ft 36.7 bd ft
118.5
125.0
125.3
124.7
÷5 619.1
123.8

VI same as above – no Dup. – 800 H_2O start
950 H_2O Wet 28

MD – 103.9 ND
142.0
142.9 58.7 lbs/cu ft 38.3 bd ft
139.8
141.9
140.0
706.6
÷5 141.3

950
30
1250

1/13/69 — Shrinks on drying

112629

Field Test in Lab - New M K

Make 300 gm ea - 1 minute mix in hobart dry - 5 minutes wet - put thru E-Z Tex gun at 16 lbs air - 1 oz slurry / 45 lbs or .4 gm / 300 g batch

Water req. ml/300 g			% V	% Asb	% Hyp	Per 300 g V	As	Hyp
710	I	700 - 750	43	7	50	129	21	150
685	II	700	38	7	55	114	21	175
690	III	700	40	7	53	120	21	159
740	IV	750	40	10	50	120	30	150

	MD	V	ND	lbs/cu ft	Yield/45 lbs	
IV	85.7	40	126.1	53.6	36.1 board ft @ 775 water	Water - 750 ml; dry bulk - 79.6 gm per 500 ml
			130.3			750 ml - too dry
			130.7			775 OK
			129.5			much foam
			128.6			Too dry after
			645.2			spraying
		÷5	129.0			
III	73.8		131.7	54.3	34.0 board ft @ 725 water	dry bulk 89 g per 500 ml
			131.1		34.8 bd ft @ 750 water	725 - OK
			126.9			dry after spraying
			132.6		35.6 bd ft @ 725	
			130.7			
			653.0			
		÷5	130.6			
II	83.1		128.5	54.2	34.9 bd ft	Dry bulk 94.6 g / 500
			130.3			Water - ~~725~~ 750
			131.2			
			130.2			
			131.4			
			651.6			
		÷5	130.3			

Jan 15 '59

Sample	Primer Vacuum	Wt 150 cc	Then gun 16 lbs Vacuum	Wt 150 cc	Density	Yield/45 lbs
II	40	77.1	4	142.9	58.8	29.4 bd/ft
		76.5		137.8		
				141.9		
				143.3		
				565.9 ÷ 4 = 141.5		
V	39	85.4	4+	143.5	58.8	29.4 bd/ft
		86.7		141.0		
				143.6		
				137.9		
				566.0 ÷ 4 = 141.5		
III	39	84.2	5	140.1	58.7	29.45
		86.2		141.9		
				141.2		
				141.8		
				565.0 ÷ 4 = 141.25		
IV	40	72.3	3	137.2	57.9	29.8
		74.7		139.2		
				139.7		
				141.1		
				557.2 ÷ 4 = 139.3		
IIA	39	73.2	5	140.4	58.9	29.3
		74.7		140.0		
				143.8		
				142.6		
				566.8 ÷ 4 = 141.7		

II: Bubbles do not look as fine as with Dup

III: Bubbles up very quickly just like Dup!

IV: Looks almost like II

Jan 15 '69 II

New Air Entraining Agent + MK

Very new air entraining agent - Thomad E, made by Colgate-Palmolive Co - Make standard MK - use Thomad E at rate of 1/2, 1, 2 +/- 1/2 oz / bag -
.2 .4 .8 1.6 gm / 300 gm batch
Use WR of 2.2 or 660 ml / 300 gm

Standard formula -

		%	gm / 300	Sample	Treatment
76.2	V	25.4	76.2	I	.2 gm Thomad E
40.8	A	13.6	40.8	II	.4 gm Thomad E
183.0	H	61.0	183.0	III	.8 gm Thomad E
				IV	1.6 gm Thomad E
300				V	.4 gm Darex
610					
960					

7S 660 ml water — 16 lbs air —

Using .4 gm Dup try varying ratio of retarder + determine effect on air entrain

MK - 61% gyp - 27.45 lbs/bag standard MK

sample	lbs retarder/ton gyp	lbs/bag MK	gms/bag MK	gms/300 gm MK
I	2	.02745	12.49	.183
II	4	.05490	24.93	.366
III	6	.08235	37.39	.549
IV	8			.732
V — no retarder				

sample #	MD	Vicat	ND	Vicat	lbs/cu ft per 45 lbs	bd ft
V	81.9	38	144.1	set	60.7 lbs/cuft	28.5 bd ft
Almost too	84.1		147.2			
stiff to spray			147.0			
started to set			146.7			
			÷4 585.0 = 146.3			
IV						
softer than	86.3	39	141.8	4	59.5	29.0
IV - spray	87.2		140.8			
better			146.5			
			142.9			
			÷4 572.0 = 143.0			
II	81.9	38	143.9	4	60.0	28.8
	84.3		145.8			
			145.1			
			145.8			
			÷4 580.6 = 144.2			

VI — Regular gyp + C9 (no Dup) .8 gms C9/300 g

660 to dry — added 200 ml more water — insufficient air

860
300
1160

	100.0	38	148.8	9	62.4	30.7 bd ft/45 lbs
	101.0		150.0			
			150.8			
			150.4			
			÷4 600.0 = 150.0			

112633

Jan 17, 1939

Effect of Retarder on Air Entraining

Kaiser Gypsum makes retarder for their gypsum as follows:

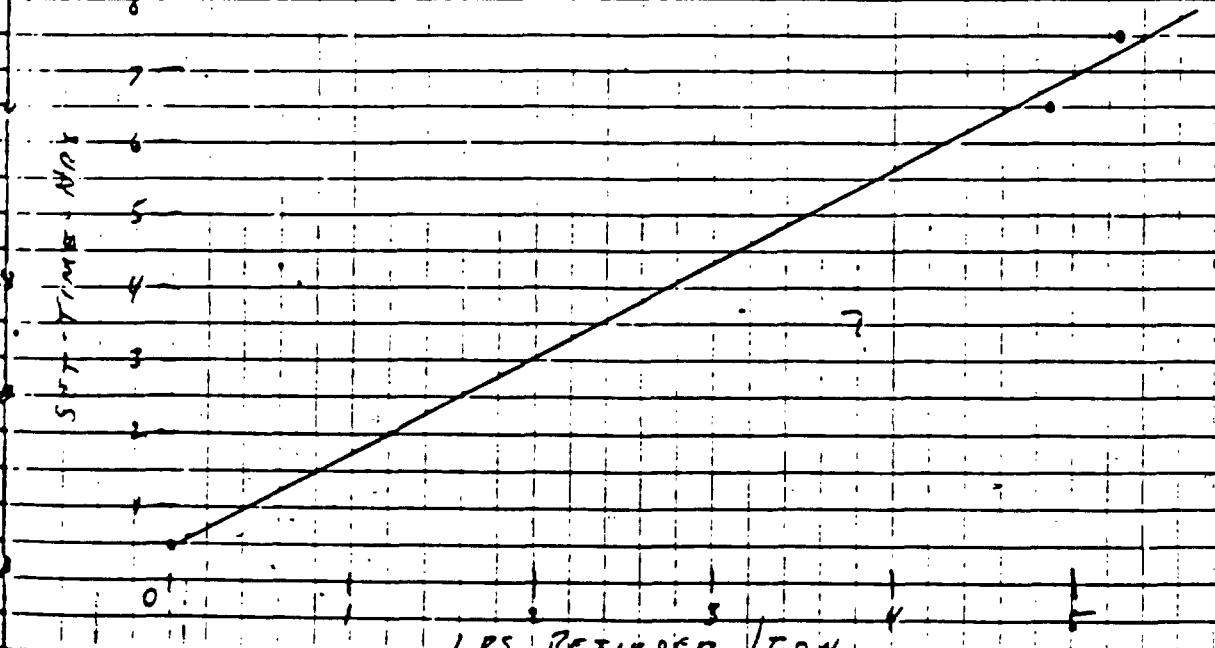
Hoof & Horn	800 lbs
Lime	300
Caustic soda	40
Water	5 gal

This is digested and dried.

Normal set of unretarded gypsum is 20-30 min.

To increase set to between 6 & 7 hours they added 4 lbs 14 oz retarder to our gyp.

To increase set to 7 to 8 hrs they add 5 lbs 4 oz to a ton of gyp.



80

Sample	wt/156 cc	Visual	wt/100 cc	Visual	density lbs/cu ft	Yield/45 lb
I	89.2	drafted	146.5	5	58.4	29.6
	90.0	to bottom	145.3			
		42	144.8			
			143.4			
			4)580.2 = 145.1			
II	88.2	40	147.8	4	58.9	29.4
	89.6		143.0			
			146.4			
			147.4			
			4)584.6 = 146.1			

III - 660 H_2O - not sufficient - added Daxad 11 + 300 ml water more.

968 / 1260

134	22	155.9	10	62.8	37.1	
		156.4				
		156.2				
		156.1				
		4)624.6 = 156.2				

w/dry air entraining 2 - Reduce water - prevent shrinkage!!!

Jan 20, 1969 91

Additives – Soy Protein

To determine the effect of addition of protein on air entraining, bubble size + strength etc. Using Kaysoy 200-C flour from ADM Co. (may effect set time) – try in combination with Daxad 11 dispersing agent –

Stars at 2 lbs/batch – .8 gm/300 gms of gms of cement

formula – V – 76.2   660 water –
A 40.8   .4 gm disp.
117.0   new cups–use 155 ml as
Hyp – 183.0   volume

I – .8 gm Kaysoy .4 g disp – no Daxad
II – Control – standard material .4 g disp.
III – 1 gm Kaysoy – no disp.

Jan 21

IV – 3 g Kaysoy ~~+ disp~~
V – 3 g ~~Starch Hydroseal #3 Natural Starch Co~~
+ disp.

Sample	MD g/156 cc	Vicat	MD g/156cc	Vicat	Bulk Density lbs/cu ft		Yield / VC lbs / board ft		
II	96.2	40	139.8	6	55.1		32.6		(700 water)
soft with 700 H_2O - not bad?	94.6		137.7						
			137.4						
			136.0						
			÷4 550.6 = 137.7						
III	93.8	40	134.7	6	53.6		33.2		(660 water)
still soft	92.2		135.4						
			134.7						
			131.8						
			÷4 536.6 = 134.2						
I	79.4	40	129.2	4	51.5		33.5		(660 water)
quality of foam different than II + III small bubbles	82.0		130.8						
			129.3				Very soft when dry		
			126.5						
			÷4 515.8 = 129.0						
V	80.0		132.7		52.4		33.0 ft		(660)
	83.0		129.3						
			132.0						
			130.1						
			÷4 524.1 = 131.0						
VI	69.6	39	127.3		50.6		34.1		(660 water)
small tougher bubble - stiffer mix	71.0		127.6						
			128.2						
			122.7						
			÷4 505.8 = 126.5						
VII	67.6	39	16 lbs air		10 lbs air		16	10	(700)
Very stiff @ 760 easily sprayable	67.5		126.9	51.4	130.9	52.1	35.1 ft	34.5 ft	
			130.0		130.5		harder when dry		
			128.2		129.7				
			÷3 385.1 = 128.4		÷3 391.1 = 130.4				
VIII	74.0	40	16 lbs air		10 lbs air		16	10	(700)
slightly softer than VII Easier to spray	74.5		129.7	51.2	127.2	50.6	35.1 ft	35.6 ft	
			125.9		126.0				
			128.9		126.2				
			÷3 384.5 = 128.2		÷3 379.4 = 126.5				

① 10 psi - some moisture on surface when cubes were formed during spraying.

Jan 21, 1969

Low [illegible] – High [illegible] MK

Use formulation R P57 production run as base – add 17.3 gm gypsum bring up to following – V – 43
A – 5
B – 52

Use 700 ml water – EZ [illegible] – 16 [illegible] air

I – Formula R – Production run 17.3

II – Formula R + 17.3 g gyp /100 gm mix 51.9

III – " " 660 water

IV – Formula R + 10 asb + 40 gyp. /300 gm

V – Formula R – 3 min mix instead of 5

Jan 22, 1969

VI – Formula (83 III) Hand mixed –

43 × 3 = 129
5 × 3 = 15 [illegible] – .4 gm
52 × 3 = 156

VII – 43 × 3 = 129
7 21 [illegible] .4 gm
50 150

VIII – same as VII + .4 gm [illegible] 11

Density of Vermic used – Cubic foot box

Tare	Gross	Net
12 lbs 7 oz	17 lbs 14 oz	5.437
V-P44 12 lb 7 oz	18 lbs 6 oz	5.938

112638

Sample	Vicat	wt/150 cc	wt/150	Density lbs/cu ft	Yield vs Bu lbs/ft
I	30	90.3	135.2		
		90.1	136.7	54.6	33.0 bd ft
Too stiff to spray – use more water			139.1		
			136.6		
			÷4 547.6 = 136.9		
II	35	55.9/90.6 ml 7	133.7		
good consistency		96.4/150 ml	136.0	54.4	34.8
			134.2		
			137.4		
			136.0		
			÷5 679.3 = 135.9		
III	15	104.4	142.4 (150 ml)		
		105.0	142.4	58.0	32.6
			141.0		
			÷3 425.8 = 141.9		

added dup –
30 94.7

Sample	Vicat	wt/150 cc	wt/150	Density lbs/cu ft	Yield vs Bu lbs/ft
IV	(27)	91.9/150	137.3		
		90.1/cc	135.8	57.0	33.2
			137.0		
more water –			137.7		
hard to spray			137.0		
			÷5 684.8 = ~~136.9~~ 137.0/150		

Jan 22, 1969

Hand Mix Vs Machine Mix

Using formula 83 VIII + 83 VII mix by hand in beaker for 3 min.

I VII (no Daxad) - V - 43 X3 - 129
Ack - 7 21 .4 dup
700 ml water gyp 50 150

II ~~#~~ Same as I - use 750 ml water

III same as II (750 water) - no Dup - 1gm Daxad II in water

IV - Same as II (750 water) - ~~.6~~ gm dup. .8gm dup

Jan 23, 1969

V - IV + 800 water

VI - I + 800 water

(4 II) ?

Sample	Wet wt/156	Vol	Dry wt/156	Density	Yield
I good stiff foam	100	6	150.0		
	98.2		146.7	59.1	30.5
			148.5		
			146.5		
			147.3		
			÷5 739.0 = 147.8		
II also good stiff foam	91.6	5	150.1		
	91.3		144.0	59.1	30.5
			149.3		
			147.0		
			149.3		
			739.7 = 147.9		
III	92.1	6	144.1		
	92.7		146.8	58.1	31.0
			146.5		
			147.0		
			140.9		
			÷5 725.3 = 145.1	use 835	

Compare Foaming Agents at .2 gm/300 + .4 g/300
(1/2 oz/bag + 1 oz/bag) 16 lbs air

Standard MK formula - V - 76.2 - 700 water
A - 40.8
117.0 1 min dry mix
C - 183.
300 5 min Wet mix

I - Duponol
II - Nopcofix
III Nopcofix @ .4 gm

Feb 25

Celite in MK

II

Vermic	35 %	105	500 water
Gyp	60	180	16 lbs/cu
Celite	5	15	2 min Wet Mix

MD - 91.9 ND 128.5
130.1
125.6
129.5
4 | 513.7
128.4 = 51.3 lbs/cu ft.
28.1 bd ft

III Glass in MK

Vermic	35 %	105	450 water
Gyp	60	180	3 min mix
Glass	5	15	

used 425 ml - then 25 ml more
good stuff foam
too dry after spraying
use 500 ml

MD - 66.7
ND - 123.9 / 156 ml
122.9
122.3
125.5
4 | 494.6
123.7 44.4 lbs/cu ft

450
300
750

27.7 bd ft @ 450 water
29.1 bd ft @ 500 water

Feb 24, 1969

Glass Fiber + Celite in MK

Used combination of 1/8 inch chopped glass roving (Owens Corning) and Celite for concrete (fly) in place of asbestos —

Vermiculite	96 gm	32 %	
Type	154 gm	61.4	—
Celite	10	3.3	
Glass	10	3.3	
Mix	0.4		

Dry mix for 2 min — Wet mix 5 min

Used 500 ml water — too wet

Sprayed at 40 PSI — wt / 156 cc

9 gal / bag

127
124
120.1
125.0
496

124 ÷ 156 = 49.6 lbs/cu ft

yield — ~~37.6 bd ft/45 lbs~~
29 bd ft/45

Feb 25

No Vermic — MK

Gyp - 60 % 180 gm slurp - 18 gm approx -
Asbestos - 40 120 poor air entraining in mix

water 910 ml
5 min mix

MD - 122.6

ND - 157.4 40 lbs air total 1210 gm
156.7
155.8 heavy but seems to stick + hold well.
157.1
5 | 782.6
156.5 = 62.5 lbs/cu ft Yield 34.8 bd ft/45 lbs.
~~per 150 cc~~

Discussion — Insulation value a function of
1.) density
2.) Pore size + structure —
Low density not sufficient - must have small pores preferably not interconnected to prevent convection currents through material - asbestos should provide the small pores required -

at 34.8 bd ft dry density would be about 1.3 lbs/bd ft, or 15.5 lbs/cu ft -

Check for shrinkage of samples

Feb 26 —

Shrinking badly - reduce water 1st and then try reducing asbestos.

Glass in MK

I Vermi #3 40 % — 120 g — water – 500
Gyp 55 — 165 — + 25
glass 5 — 15 — just about right
300

MD – 76.6 ND – 122.3 } 10 lbs air considerable
120.8 } bounce of individual
825 123.5 } 16 lbs air particles
525/300 119.0 }
63.1 gal – 9 gal/bag 4 | 485.6
121.4 ÷ 156 = 48.6 lbs/cuft
approx 1 lb./bd ft lighter 30.6 bd ft
from 5 lbs # 4 lbs

Feb 26

II Vermi #4 – 40 % — 120 g — water – 500
Gyp 56 — 168 — + 100 soft
Glass 4 — 12
MD – 85.1 ND – 127.6 3 min mix 10 lbs air
127.6 reduce water
123.3
119.0
4 | 497.5
124.4 ÷ 156 = 49.7 lbs/cu ft
32.6 bd ft @ 600 water
31.3 @ 550 water

III Vermi #4 – 42 — 126 g
Gyp 55 — 165 — water – 500
Alb 3 — 9 — + 85
soft but bangs well
ND – 82.3 MD – 131.4 too dry to spray
135.1 need more water
130.5
3 | 397.0
132.3 = 52.9 lbs/cu ft
30.5 bd ft

Low Resb Low Hyp

I	V #4	42	126	Water - 650
	Hyp	55	165	Sponge well 10 lbs air
	Resb	3	9	

MD - 86.5 ND 131.1
132.6
128.7
124.0
4 | 516.4
129.1 = 51.6 lbs/cu ft
33.1 bd ft/45 lbs

II	V #4	48.5	145.5	water 500
	Hyp	48.5	145.5	+ 200
	Resb	3.0	9.0	~~[illegible]~~ 0

soft - sponge well
[illegible] smell is ?
[illegible] sponge [illegible]
10 lbs air

MD - 74.3 ND - 126.0
127.1
129.8
125.8
4 | 508.7
127.2 = 50.9 lbs/cu ft
35.7 bd ft/45 lbs

1001

Feb 28

Sample #II

Na Sil G	20 gm	water 350 ml
Vermic #4	77 gm	a bit soft –
Talc	50 gm	reduce water
Asb	3 gm	

sprayed with 10 lbs air

MD – 69.7 gm/156   ND 106 gm/156

20 × 14¢ 2.80
77 × 3¢ 2.31
50 × 3¢ 1.50
3 × 3 .10
6.71

4.5¢/lb.

42.4 lbs/cu ft
42.5 bd ft/30 lbs – 3.18 ¢/bd ft

Conclusion – Increase activator? leave out talc?

Feb. 28, 1968 85

Na Silicate binder for Vermic

Used Na_2SiO_3 from Philadelphia Quartz Co. — their No. 52 (liquid) mixed with #4 ore (unexpanded) and 1/8 inch chopped glass roving — spread on sheet metal — when heated with bunsen burner intumescence of Na_2SiO_3 + expansion of Vermic increased thickness from 1/8 inch to 1/2 inch. Ended up with combination of expanded vermic in glass foam.

Then mixed powdered Na_2SiO_3 #6 dry with expanded vermic + small amt of asbestos. Used Duponol for air entraining — mixed with water and sprayed on sheet metal

Sample I

Na Sil #6	5 gm	125 ml water
Vermic #4	25 g	
Talc	15 g	
Asb	3	
Dup	.2 gm	

Reduced Water in MK —

Using Dapsal 21 — took standard production run 700 gm — added 3 gm Dapsal 21 — Entered 570 ml water into mixer — 3 min mix had good air — was soft

MD — 89.5 / 156 ml   ND — 152.3   not as "fat"
149.8
115.2
147.6   16 drain
4 | 594.9
148.7 ÷ 156 = 59.1 lbs/cuft
26.5 bd ft / 45 lbs

16 % less water
8-9 % less yield

Asbestos settling or wet bulk test —
10 gm in 250 ml water

time	D (1 gm dapsal 11) ml	C (Check) ml
1 hr	410	490
2 hr	315	455

Objective — increase hardness and eliminate shrinkage when going to high rates of asbestos and low rates of gyp along with increased rates of vermic.

Mar 18

Sample 99II - fairly open

Sample 99III - still some openness - not bad banding

	II	III	NKIII
V	45±4	45±4	26±3
ASB	15	20	13
Ratio V/ASB	3.0	2.25	2

Mar 17, 1949

#4 — high asb — low gyp
(7M 62)

I
V – 50 ×3 = 150 Dispersant 21 – 3g
A – 20 60 Disp = .4 — not enough
G – 30 90 air — increased to
100 300 about 1g

water 1075 — stiff foam formed gel
1135 — OK

MD — 105.2 ND — 153.3
153.2 42.5 bd ft/45 lb
153.0
shrink 151.5
151.5 16 days
5)760.5
152.1 = 60.9 lbs/cu ft

II
V – 45 ×3 = 135 Dispersant 21 – 3g
A – 15 × 45 Disp 1g
G – 40 120
water 795

MD — 75.5 ND — 137.5 Very dry after spraying — needs more "tack"
134.1
w. 795 131.7
shrinkage 300 129.1
1095 135.4
5)669.8
133.9 134 ÷ 2.46 = 54.5 lbs/cu ft

36.2 bd ft/45 lbs

III
V – 45 ×3 = 135 Dispersant 21 – 3g
A – 20 60 Disp 1g water 855 total
G – 35 105 somewhat dry after spray

SLT
shaky MD – 80.3 ND – 139.4 855
139.1 300
135.0 1155
142.3 37.8 bd ft/45 lb
132.3
5)688.1
137.6 = 55 lbs/cu ft

II. V - 40 - 120 Dar 21 - 3 g. water 700 initial
A - 20 60 Alup 1 g. 740 total
G - 40 120

too much water
soft -
runny after
spraying

MD - 105.1 ND - 143.5
146.1
144.6
144.8
740
300
1040
5)579.0
2.12/lb
2.94/bd ft
144.8 ÷ 156×67.1 - 57.9 lbs/cu ft
32.4 bd ft/45 lbs

III V - 44 132 Dar 21 - 3 g. water 725 initial
A - 22 66 Alup 1 g.
G - 34 102 water 775 total
100

MD - 99.9 ND - 143.3
139.6
139.8
1075
136.5
34.8 bd ft/45 lbs 138.0
5)697.1
139.4 ÷ 156 = 55.7 lbs/cu ft

Mar 19

shrinkage in some sample

sample	shrinkage	% gyp	% alum	V
99 I	severe	30	20	50
99 II	none	40	15	45
99 III	~~slight~~ moderate	35	20	45
101 I	~~[illegible]~~ slight	35	20	45
101 II*	none - very slt	40	20	40
101 III	~~slight~~ moderate	34	22	44

*sample from mixer - not shrinkage

Asbestos Floats – Coalinga – (J M)

Objective – Longer fiber tend to stay in balls surrounded by vermic when using high rates of vermic. Use of Daxad reduces water req. but does not completely disperse asbestos – As a consequence there remains openings between Vermic particles that allows the passage of heat. Using shorter fibers to better surround the vermiculite should provide a more homogeneous mix with well distributed uniformly sized air spaces – hopefully allowing for reduction in thickness.

I#1 V – 45	x3 =	135	Dax 21	3 g	700 water	+35
A – 20		60	Dup	1 g	735 total	
C – 35		105				

MD – 92.5/156 ml ND – 143.0 16 lbs/air

138.8

142.7

143.5

142.2

5 | 710.2

142 ÷ 156 = 56.7 lbs/cu ft

1) good foam – 2) fairly stiff 3) good workability after spraying,

1035 total wt

32.9 bd ft/45 lb

~~2.57 ¢/bd ft~~

2.20 / lb.

3.01 ¢/bd ft

Mar 19, 1961

Vermic - Celite - asbestos

	Approx wt		
500 ml #4	52	} 700 ml when mixed	} 750 ml when mixed -
250 ml Celite	26		
50 ml JM floats	10		
+ 3g dup	actual wt about 90 g		

water - 370 ml - good foam stiff stiff.
- too wet after spraying -
use 325 - 350 ml water

MD - 78.5   ND 121.6
121.8
246.4 ÷ 2 = 123.2 = 49.1 lbs/cu ft

350 water
90 g
440 ÷ 49.1 = 8.95 cu ft
.994 cu ft/lb

~~4.47~~
4.47 cu ft/45 lbs = 53.6 bd ft/45 lbs
7.5 lbs/cu ft dry dens.

try 30 - 40 gm gyp + Vesoid 21
- cased - should give 40 ft / 45 lb -

Mar 19, 1969

Effect of Daxad on Vermi-Gyp Mixes -

Determine effect on water requirements, yield, density + resulting pore structure -

#4 V - 5013 150 Daxad 21 - 3 g ~~water ~~
G - 50 150 Gyp 1 g

I - 608 ml water - good foam fairly stiff
MD - 73.3 WD 131.3 - ~~too~~ dry to spray
much rebound at 16 lb air
foam breaks

II - 700 water - good foam - soft
MD - 83.4 WD - 127.4 too wet after spraying 1st sample
131.0
135.3 2nd just about right
393.4 3rd too dry

34.3 bd ft

131.1 Water evidently came out
1.95 ¢/lb. 52.5 lbs could not finish spraying
2.56 ¢/bd ft /cu ft need more "fat" - air goes to pot
2.73 ¢ with 2 lbs dup

Daxad - tends to weaken foam - allows water to run out decreasing "fat" + destroys gel

Mar 19

III Same as I plus 3.0 g Daxad 21

water - 650

MD - 93.5 WD - 148.8 water - 710 total

145.1

145.8 just right after drying

142.7

145.6

710
300
1010

5 | 727.6

145.5 58.1 lbs/cu ft 31.3 lb/ft / 45 lbs

Mar 19

Celite - Asbestos Combination

Objective - use celite (6 lbs/cu ft) as a filler between vermic granules to reduce pore size - Asbestos used as filler & binder along with gyp.

I #4 V - 40 ×3 = 120 Klup - 1 gm
celite - 20 60
asb (plast) 10 30
gyp - 30 90

water 700 initial
850 total

MD = 98.6 ND - 140.4
139.4
135.4
137.4
136.7
5|689.3
137.9 - 55.1 lbs/cu ft 15.5 lbs/cu ft dry

250 g/lbs
275 g/bd ft

good foam -
Slightly wet after spraying
reduce water 1 to 800

37.6 bd ft / 45 lbs

dry
Has set but is powdery - not hard

II Same as above with 300 g ~~~ 21 & no Klup

ND - 119.7 MD - 155.0
153.4
154.9
151.5
154.0
5|768.8
153.8 61.5 lbs/cu ft

water - 780 -
large bubbles -
Too wet after spraying

780
300
1080

31.5 bd ft / 45 lbs
(29.2 with 700 water)

106

OBI - MD - 111.2 — water 900 ml
ND - 146.6
142.6
146.1
144.9
√580.5 = 145.1 — 58 lbs/cu ft
37.2 lbs ft/45 lbs
couple shrinking moderately

OBII - ND 142.0 — water - 735 ml
140.4
141.5
138.9
142.3
705.1 ÷ 5 = 141. — 56.4 lbs/cu ft
no shrinkage — 33.1 lbs ft/45 lbs

OBIII ND - 134.2 — water - 700 (~~100 ml~~)
133.2
130.8
132.0
135.2
665.4 ÷ 5 = 133.1 — 53.2 lbs/cu ft
34.8 lbs ft
no shrinkage

Hydrophobic Asbestos in MK

Oilbestos – Union Carbide Co.

Union Carbide Co is producing, in King City experimental quantities, asbestos floats (standard grade) treated with a chemical to make the surface organophylic. The product does not wet with water. Can this be substituted for standard asbestos and be used in higher quantities without increasing the water requirement and eliminating subsequent shrinkage?

Sample	V	Asb	Hyp	Celite	1 gm Dup 2 ea.
OB I	40#4	10	30	20	
OB II	36#3	14	50		
OB III	40#3	10	50		

Results — Oilbestos is effected by Dupanol and vice versa – and results in poorer yield and in general same water req.

108

MK made with Na Oleate and Arquad S-50 (Armour Co)

V - 43
Ads 7
Gyp 50

Na Oleate in water —

750 ml water
MD 87.3
WD - 133.8
132.1
135.3
137.3
135.2
679.1 ÷ 5 = 135.8 - 87.2 lb/cu ft
34.9 lbs/cu ft

Sample made by using Arquad S-50 (soya trimethyl ammonium chloride) produced volumes of large bubbles - filling the mixer bowl — these subsequently broke on spraying ~~reducing~~ increasing the density to normal figures - no increase in yield - however this product may make a more effective foaming agent than Bufonol if added to the water as a liquid - continue trials

Surface Active Agent + Asbestos
Wet Bulk asbestos + Paper fiber

Effect of wet bulk of various surfactants was determined by adding a quantity of the agent to 10 gm of asbestos (7M02) in 500 ml water or by pre-mixing with asbestos

Additive	CC remaining 1 hr	18 hrs	48 hrs
Na Oleate (added to asb. lot)	500	500 (heavoid)	330
30 wt motor oil (added to asbestos lot)	210	200	200
Igepal	200	200	185
Pluracol E6000	420	420	360
Na Oleate (5cc in water)	485	325	305
Dapral 21	155	145	140
Dapral 11	300	200	175
Control	490		390 (1 wk

Paper fiber - 10 gm/500 - too much material
5 gm/500 - 12 hrs - still at 500 ml mark

Oilbestos run in Waring blender held up very well.

sample 1g – Dup #4
111 I – Ver 51.0 MD – 86.9 52 ~~lbs~~/cu ft
fibers 3.5
Gyp 46.5 ND – 132.3
133.0 57.6 bd ft/45 lb
water – 785 ml 127.9
(~~too~~ dry for good 128.0
consistency after 129.1
spraying) 5⟌650.6 = 130.1

1g – dup #5
111 II – Ver 48.5 145.5 MD – 90.0
fiber 3 9
Gyp 48.5 145.5 ND – 129.8 52.5 lbs/cu ft
131.6
water 750 132.9 36 bd ft/45
7 132.7
1050 131.2
Dust did not seem 5⟌658.2 = 131.6
good in this sample

[redacted]

Dec 28

Paper fiber substitute for Asbestos

Obtained sample of shredded paper fiber from U. S. Filter Corp in Whitten — The sample ~~apparently~~ contains 50% asbestos fibers ground together in a hammer mill. It appears that this product has about twice the bulk of our present asbestos. When put in a mix the gypsum must be mixed with the fiber first to break down some of the large "balls" of fiber. Even then subsequent mixing with #4 shows considerable small balls remaining.

Mix made with #3 — fiber not sufficiently separated — considerable balling.

112 4/11/69

I - | | gms |
|---|---|
| asbestos | 5 |
| Vermiculite | 45 |
| gyp | 30 |
| Mg $SO_4 \cdot 7H_2O$ | 20 |
| | 100 |

} 200 ml water

ND - 7 lbs air

111.0
106.5
217.5 ÷ 2 = 108.3 - 43.1 lbs/cu ft

32.6 bd ft/45 lbs

set very quickly after spraying into cup - try adding borax.

wt - 4/14 - 10 lbs/cu ft

4/14/69

II - | | |
|---|---|
| asbestos | 8 |
| Vermiculite | 35 |
| gyp | 30 |
| Mg $SO_4 \cdot 7H_2O$ | 20 |
| Borax | 7 |
| | 100 |

} 200 ml water

ND - 8 lbs air - 125 g - 11 oz - 50 lbs/cu ft

32.6 bd ft/45 lbs

changed - 2:30

set - 4/16 - did not set - dried on top to form a skin but no set

reduce borax

Hydrated Salts in MK

Search of Russ Index and other literature suggests hydrated salts may be of value as an "intumescent" material in MK in that water of hydration will be given up and heat used up in the process. Chloride salts are ruled out because of their galvanic effect on zinc and other metals. Aluminum hydroxide is too expensive. Magnesium sulfate $MgSO_4 \cdot 7H_2O$ (51.16% H_2O) appears to be the best candidate. It accelerates set however. Borax $Na_2B_4O_7 \cdot 10H_2O$ (47.2% water) retards set. A proper combination of the two along with gypsum may provide an efficient binder system for MK.

Hydrated salts in MR

Sample # 113 II did not set - reduce Borax and increase asbestos to come closer to present formula -

I

Ard	- 10	water - 195 ml	good workability for asbestos fat thickened
vermic	35		
gyp	30	8 lbs air -	
$MgSO_4$	23		
Borax	2	ND - 123.7	
	100	49.5 lbs/cu ft	

sprayed @ 10:25 AM
set - 11:00 AM
water running out

295 ÷ 49.5
3 2.2 cu ft / 45 lbs

II

Ard	- 10
vermic	35
gyp	30
$MgSO_4$	24.5
Borax	0

8/5/69 117

Intumescent Coatings –

For the past few weeks I have gathered info on intumescent paint formulations – principle sources:

1.) Advances in Chemistry Series #9 – ACS 1953

2.) National Starch & Chem. Corp. – Bulletin on Resyn 5000 – a ~~org~~ vinyl acetate copolymer latex sold as a binder for such paints

3.) Monsanto Co – Technical Bulletin 1-270 on Phos-Chek P/30

4.) Diamond Chemicals Bulletin 5/20/60 on fire retardant paints.

Only one source mentions mercaptotriazine as an intumescent that was tried – T. M. Murray, F. Liberti & A. O. Allen – Vitro-Var Corp. Newark N.J. in ACS publication #9 – article entitled Practical Aspects of the Formulation of Fire-Retardant Paints.

We sent sample of intumescent paint by Diamond Chem Co – mixed it with unexpanded #4 and painted gyp board – after drying 24 hr got excellent intumescence – paint held Vermiculite as it expanded.

112672

8/5/69

Addition of #1 unexpanded Vermiculite to sample of intumescent paint (National Starch #R623-102E)

#1 - 75.5 g paint
75.5 g #4 ore
151.0 g total - 100 ml - too thick - no cohesion - must be trowelled on

#2 - 61 g paint
45.75 g #4 ore
106.75 g - 80 ml thick but spreads well

#3 - 42 gm paint
21 g #4
63 g - 48 ml - thin - could probably be used

Formula	gm/cc	lbs/gal	cost/100	cost/gal	Cost/sq ft 3/16" thick (9 sq ft)
Control (paint		10.8	22.25	2.52	$.28
#1	1.51	12.6	19.63	1.16	.13
#2	1.33	11.1	14.40	1.48	.16
#3	1.31	10.9	18.83	1.73	.19

Raw materials for intumescent paint are high - Phos Chek P/30 - 60¢/lb

Melamine	22-24¢
Dipentaerythritol	40-47¢
Chlorowax 70	23-27¢
PVA	20¢

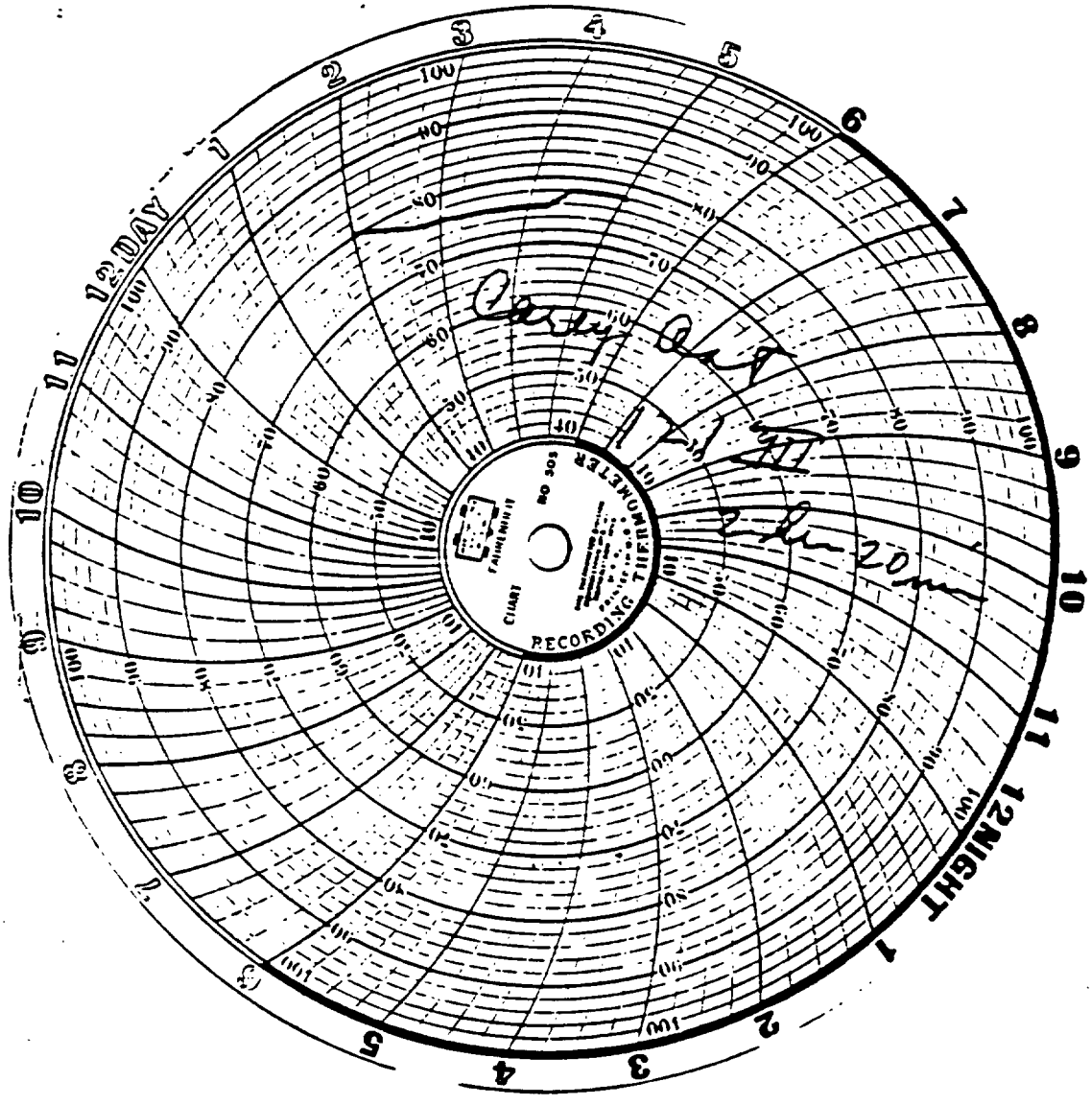
typical formulae contain - by wt

		#/100 lbs
Phos-Chek P/30	22-26 %	15.60
Melamine	8-9 %	2.16
Dipenta	8 %	3.44
Chlorowax 70	4-5 %	1.25
PVA resin	22-24 %	4.80
water	25-30 %	
		27.25/100

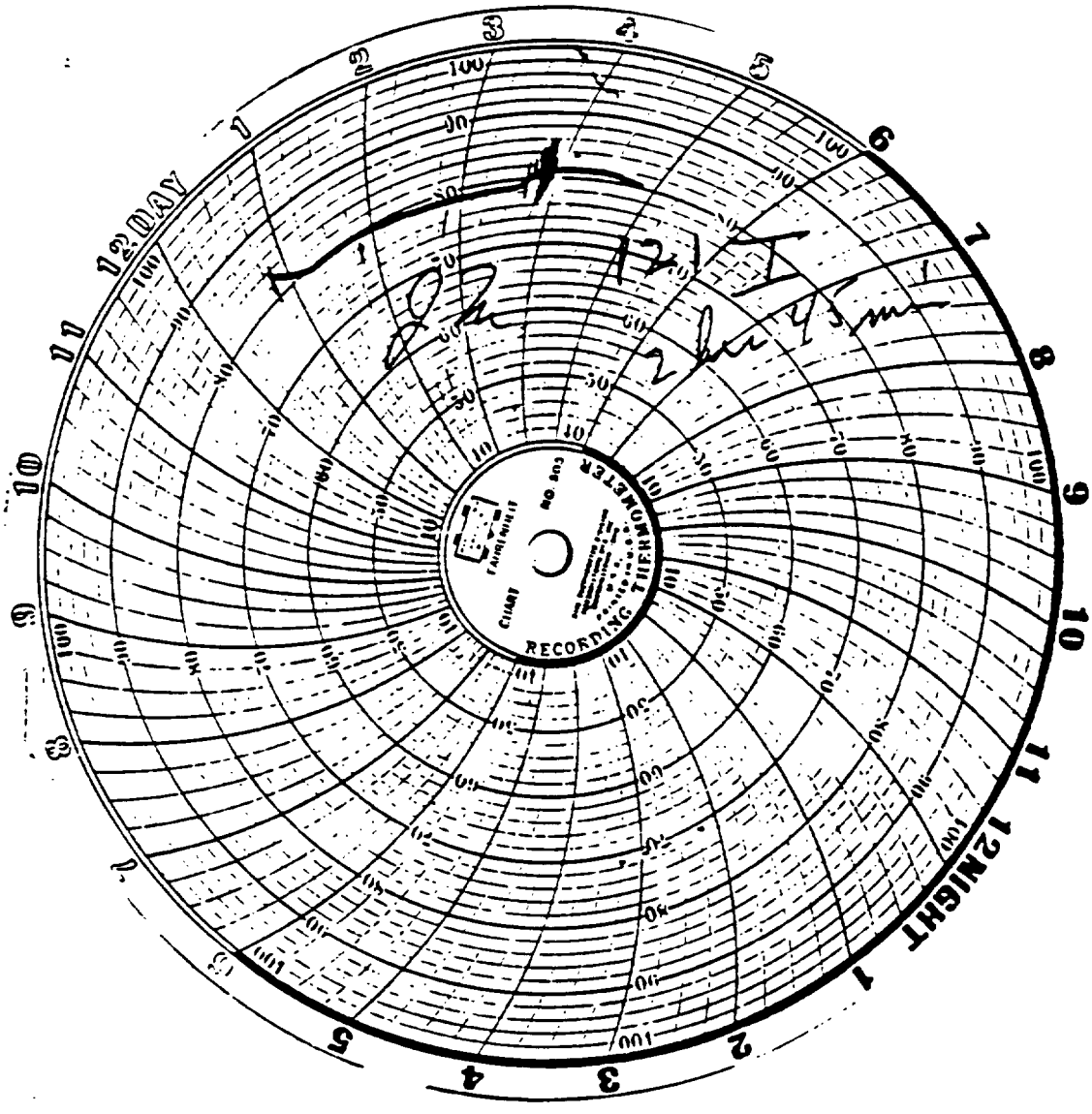
K tripolyphosphate is common dispersant
PMA & Alfosan are also used

If we can add 30 lbs of #4 @ 2¢/lb to 100 lbs of above - cost is cut to 21¢/lb. from 27¢/lb.

Paint formulation run 10+lbs/gal
Also if mono-ammonium phosphate can be substituted for PhosChek price would be considerably reduced - as would water resistance.



112675



112676

 12 lbs air –

Sample	MD	ND		lbs/cu ft	bd ft / 15 lbs	gm/500cc DD
121 I – Standard mix 700 ml water – 12.1 gal/bag						
	102.8	150.6	very lt	59.8	30.1	127.5
		151.5	foam			
		149.0	before	color too light ?		
		150.4	spray			
		147.2	good – set after	must also be		
		748.7 ÷ 5 = 149.6		Carey asbestos.		
				9/19 re-do		
121 II – P-32 for Asbestos – same wt						
	95.7	143.5	too much	57.1	31.5	116.8
		144.2	water –			
		138.6	too soft			
		144.0	after spray.			
		143.6				
		713.9 ÷ 5 = 142.8				
121 III – Standard mix Carey Asb. 7MS-1 for JM-7MC						
	101.3	149.8	same as I.	59.4	30.3	130.8
		146.0				
		149.3				
		150.7				
		147.3				
		743.1 ÷ 5 = 148.6				

112677

9/17/69

Paper fibers on M K

Georgia-Pacific P-32 unbleached flocking fiber (cellufloc) — Puget Sound Div Bellingham Wash

Bulk density in 156 cc cups - gms —

loose —	12.5	Fluffed	12.0	
from bag	16.0	in blender	11.5	
	14.0		12.0	
	15.0	5.8 lbs/cu ft	12.0	4.76 lbs/cu ft
	14.0		12.0	
	72.5 ÷ 5 = 14.5		59.5 ÷ 5 = 11.9	

Wet bulk — 12.5 gm / 100 ml — inverted 12 times

start 11:AM
265 ml 12:AM 53% wet bulk - not good —
260 ml 1:AM

Vermiculite - 1D16I9 - 22 lbs 2 oz gross - dark in color - loose not fully exfoliated

Loose bulk - 156 cc - 13.6 gm
13.5
13.5 5.83 lbs/cu ft
13.5
13.7

Standard M-K formula -	% by wt	gm / 300 total	
V	25.4	76.2	
A	13.6	40.8	117.9
C	61.0	183.0	
1 oz DVP / bag		.4 gm / 300	

112678

No Activator – Starch + Celite

Made 100 gm sample as follows on 9/18 —

#3 V – 40 g
gyp – 55 gm
Starch .5 gm (Hydroseal-Nat. Starch Co)
Celite 4.5 gm
paper 5 gm ?

WD — after spraying 132.9 ①
134.1 ②

good set – does not stick as well to waxed paper cup as 121 III –

Make up 300 g sample —

I #3 V – 44 ~~40~~ ×3 13.2
gyp – 55 16.5
Starch – 1 Pulp – ~~4~~ 5 gm 3

DD – 116.3 gm / 500 cc MD – 73.4 560 ml water
good + stiff – fast

ND – 126.7 }
123.3 } too dry – much rebound –
250.0
125 avg 50 lbs/cu ft WD

2.1 ||lb. 3.04|| bdft 31 bdft ~~34.5~~ bd ft / 45 lbs

good + hard — 9/29

132 / 35 / 616 / 396 / 4620 / 134 / 596 cc

168 / .8 / 134.4

300 / 560 / 960

112680

9/29/69

Vermi - Gyp + Starch

Following formulas made Sept 22 —

I #3V - 44 } 600 ml water {132 MD - 81.7
Gyp - 55 {165
starch - 0.5 {1.5 ND - 128.4
127.7
3.05¢/lb 2.88¢/bd ft WD - 50.5 lbs/cuft 127.9
126.6
32.1 bd ft/45 lb 120.8
631.4 ÷ 5 = 126.3

II #3V - 44 600 water {132 MD - 79.1 somewhat easier
Gyp - 55 {165 to screed than
Star 1.0 {3 ND - 123.6 #I but still
131.2 not good
2.32¢/lb, WD - 51.6 lbs/cuft 132.2 needs more fat
3.32¢/bd ft 130.5
31.4 bd ft/45 lbs. 517.5 ÷ 4 = 129.4

III #3V - 132 } 625 water MD = 85.3 too dry - hard
G - 165 ND = 135.2 to screed -
sta 6 129.9 increase water
WD - 53 lbs/cuft 132.7
133.9
531.7 ÷ 4 = 132.9
31.4 bd ft/45 lbs

All above set well - somewhat soft yet - have to be completely dry for starch to ~~harden~~ harden
no shrinkage as yet

10/2/69

All above good + hard — no shrinkage

9/29/69

Use of lime to increase Flat + Workability

three samples made Sept 22

I. V#3 - 45 x3 = 135 } 600 water   MD - 71.5   grainy
gyp - 33   99   WD - 122.5   too wet
lime - 22   66   126.0
124.6
WD - 49.6 lbs/cu ft   373.9 ÷ 3 = 124.3

32.7 bd for 145 lbs.

set O.K. ~~but dry product on this is powdery and soft~~ --

II V - 30   90 } 450 water   MD - 85   too wet
G - 33   99   WD - 135.8   hard to screed
lime - 22   66   138.0   - slides off
paper - 10   30   135.1   of tin sheet
boric acid 5   15

no set whatever - severe shrinkage.

% liquidiate			MD	ND		
VI	[illegible] as V —	600 watts	85.5	135.5		works well
				137.1	(50.0)	[illegible] well
				130.6		
				137.7		
				540.9 = 135.2		

	(no defoam) Cost/lb.	Cost/bd ft
I	2.8	4.01
II	2.72	4.04
III	2.27	3.34
IV	~~2.07~~ 1.92	2.8
V	2.07	3.2
VI	2.27	3.1 Temp-3.2

[illegible]

NO2 Clay
A. J. Lynch
583-2271

Starch + Vermiculite Fines — (−325 mesh)

Gypsum – Vermo #3 base

#		%	/300g	water		ND	yield/15lb bd ft.	Remarks
I	V	40	120	600	89.7	130		Too wet –
	G	50	150			130.5	(31.4)	slides off steel
	fine	10	30			125.8		hard to work
						124.3		
						515.6 = 128.9		
II	V	40	120	550	78.9	128.3		not bad
	G	55	165			126.2	(30.3)	sticks OK,
	Fine	5	15			127.3		but still hard
	[illegible] (Am Viscose)	3	9			121.3		to screed
						503.1 = 125.8		
III	V	40	120	550	85.8	121.3		seems wet in
	Fine G	50	150			126.2		cup but
	[illegible] (HO2)	10	30			127.0	(30.6)	sticks O.K. to
						126.1		steel – screeds
						500.6 = 125.2		pretty well
								best all around
IV	V	40	120	550	83.7	128.0		too wet
	G	60	180			127.8	(30.9)	
						123.9		
						123.5		
						503.2 = 123.6		
V	V	40	120	550	78.8	129.8		Too stiff
	G	60	180			133.5	(29.1)	
	starch	1	3			134.0		
	dup	V				128.4		
						525.7 = 131.4		

Try V 40
G 55
[illegible] 5
[illegible]

112686

Kaoli HO2

Celite – Starch + Kaolin – Vermic – Gyp base

I #3 V – 40 { 120 } 600 water   WD – WD   yield   workability fair
G – 55 | 165 | 135.0
K – 5 | 15 } MD 88.5   135.1   (54.6)   (29.7)
st – 1 | 3 | 129.2
dup – .4   135.6
534.9 = 133.7

					WD	WD		
II	V	40	120	600 water	139.6			stiff but workability fair
	G	55	165		138.0	(55)	(29.5)	
	celite	5	15	MD 87.5	134.5			
	st	1	3		138.0			
					550.1 = 137.5			

III	V	40	120	550	127.3			fair work.
	G	55	165	MD – 85.5	130.0	(51.3)	(29.8)	
	K	5	15		129.5			
					126.0			
	2.07¢/lb.	3.12¢/bd ft			512.8 = 128.2			

IV	V	40	120	720	133.7			try next run off steel
	G	40	120		138.5	54.4	(33.8)	
	celite	20	60	MD – 101.6	136.5		33 @ 700 water	
	starch	1	3		135.2			
	dup	.5			543.9 = 136.0			
	3.03 cents/lb.	4.1¢/bd ft						

V #4	V	40	120
	G	40	120
	Celite	20	60
	starch	1	3

112688

132

				ND	
I	V 40	120	650 mata	130.0	Too wet
	R 55	165		129.4	Use 630 mata
	Refer 4	12	MD-85.9	132.3	
	Attach 1	3		124.5	
	disp-.6			516.2 = 1291	
		WD-51.6		33.1 bd ft	
	2.4 ¢/bd ft				
		3.27 ¢/bd ft			

Oct 8, 1969

Bentonite — Paper —

Feel more slip + fat needed to facilitate pumping — try bentonite — Verm — Gypsum

I #3 V 40 120 } 600 water; G 55 165 } MD-86.0; Na Bent 5 15 }
1.96¢/lb. 2.8¢/bdft

ND: 130.8, 133.7, 133.7, 127.4 — 525.6 = 131.4

WD 52.5 lbs — 30.8 bdft

~~too wet~~ better off with starch!

Starch — National Starch Co Hydroseal #3 cold water soluble.

II #3 V 40, G 60, starch, Dup- 5gm, 600 water } — see #129 VI, spray on steel, MD - 87.4

slightly wet but hangs pretty well — can put on up to ½ inch before slides off fresh gold sheet.

III Mix second batch with modified paddle as used in making concrete —
3 minute mix — MD - 91.9, 91.2, 91.9 — ND - 135.2, 135.3, 135.1, 132.3 — 537.9 = 134.5

53.9 lbs/cu ft — 30 ft/45 lbs

IV - #3 V 40 120 620 water
G 55 165 MD 79.7
320 paper 5 15 stiff
dish .6
starch 1 3

ND: 130.0, 128.3, 132.5, 134.7 — 525.5 = 131.4

hard to work but dry — needs more water

2.5¢/lb. — WD 53.7 lbs — 30.8 ft/45 lb

3.65¢/bdft

112690

Magnesium Carbonate — + Celite

Mg CO₃ to act as heat sink — @ 1292°F
CO₂ ↑ to form Mg O —

I				ND	WD	yield	
V	40	120	water 720	138			Excellent
G	40	120	MD-74	136.5	54.9	33.5 ft	drying,
Mg C	20	60	(stiff)	138.5			& wet and
				135.7			sticks well
5.1 ¢/lb.		6.85 ¢/bd ft		548.7 = 137.2			

II		
V	40	120
G	40	120
Mg C	20	60
starch	1	3

III				ND	WD	yield	
V	40	120	water 670	129.5			much
G	50	150	MD-96.5	132.1	52.5	33.2 ft	stiff wet
Mg C	10	30		132.4			
				132.0			
3.5 ¢/lb.		4.75 ¢/ft (4.75)		526.0 - 131.5			

IV				ND	WD		
V	40	120	water 635	132.7			water 0.1
G	40	120	MD-93.1	135.5	53.7		
Celite	20	60		134.0		31.3 ft	
				134.5			
2.9 ¢/lb		4.17 ¢/ft		536.7 - 134.2			

11/21/69 —

· I + III Very hard on surface — soft underneath
Mg CO₃ evidently migrates to surface

112692

				water	ND	WD	YLD	
11/11	IV ~~water~~ 50	150	700	122.7				Could see more water
no bond	G – 40	120	MD	127.2	49.8	36.1		
	lime – 10	30	~~76.6~~	133.8	lbs	bd/ft		
	ST – 1	3	72.2	130.7				
				514.9 = ~~128.6~~				
				124.6				

11/11	V V – 50	150	700	129.3				Water just at – can take more
poor bond	G – 45	135	MD	123.0	49.9	36.1		
	lime – 5	15	~~29.5~~	133.0	lbs	bd/ft		
	ST – 1	3	75.5	130.0				
	2,75¢/lb.	2,82¢/bf		515.3 = ~~128.8~~				
				124.8				

11/11	VI V – ~~50~~	150	700	136.5				Air very mixed breaks fast & gets thick & heavy
fair bond	G – 50	150	MD	138.1	54.4	~~34.1~~ 33.1		
	ST – 1	3	84.6	133.3				
				407.9 = 135.0				
	2,25¢/lb.	3.08¢/bdft						

VI

Oct/15/69

#4 in MK — + Leven

#3 + Gyp without asbestos do not mix well dry — try #4 to reduce segregation in dry mix Dupanol — .4 gm (—4 tare)

			water	ND	WD	Yield	
I V - 45	135		650	150.0		30.2	needs more
C - 55	165		MD	145.7	~~58.3lb~~	~~29.4~~	water - good
ST - 1	3		92.7	147.0	56.6	bd ft	cohesion
			thick	140.0		145lbs	very hard
				582.7 = ~~145.7~~ 141.7			

+ Dup + starch = 2.22 ¢/lb. 3.33 ¢/bd ft 3.31 @ 680 water - 30 ft

— Dup + st 2.01 3.01

Lime formulation very strong (P 127 I) — under 10 minutes of firing (burner burning) — seasoning strong = try with #4 —

		water	ND	WD	yield	
II V - 50	150	750+70	125.5			Much too wet
C - 30	90	MD	109.5	45.3lbs		use 700 water
lime - 20	60	84.2	109.5		44.5 bdft	sprayed with 5lb
ST 1	3		110.0			of air - still too
			457.5 = 113.4			humid
			109.4			

2.37 ¢/lb. 2.3 ¢/bd ft

III - Same as II reduce water	water	ND	WD	yield	Excellent !!
	700	127.1	~~49.3~~	~~56.5~~	thixotropic
	MD	128.3	~~50.9~~	~~35.9~~	holds well
	75.8	129.0	lbs	bd ft	sprays well
	stiff	124.3	~~123.3~~	35.4	
		509.1 = ~~127.5~~ ~~133.3~~		bd ft	forgot to tare cup

2.31 ¢/lb ~~2.45~~ ¢/ft 2.75 ¢/ft

123.3 36.15 bd ft

Oct 24/69

MK - LIME + asb #4

#4 + some asbestos (3%) + lime (2%) to increase yield + strength   dup. 4 gr

				water	ND	WD	Yield	
I	V	45	x3 = 135	710	132.5			could use some more water
	asb	3	9	MD - 79.3	137.0	52.8	34.5 bd/ft	
	Gyp	50	150		127.4			
	Lime	2	6		130.7			
	starch	1	3		527.6 = 131.9			

2.44¢/lb. 3.18¢/bd foot

II	V	45	135	700	138.0			soft - too wet to hold after spraying
	gyp	53	159	MD - 95.7	130.0	52.7	33.5 bd/ft	
	lime	2	6		134.0			
	starch	1	3		135.5			
					537.5 = 134.4			

III	V	45	x3 = 135	760	140.4			Mixes well but too dry to spray well
	asb	5	15	MD	143.2	56.5	33.7 bd/ft	
	gyp	50	150	85.3	141.0			
	st	1	3		424.6 = 141.5			

IV	V - 45		x3 = 135	750 + 20	126.4			Water just right sprays + handles well
	asb - 5		15	MD	134.4	52.3	36.8 bd/ft	
	gyp - 45		135	78.5	132.3			
	lime 5		15		130.0			
	st 1		3		523.1 = 130.8			

2.25¢/lb. 2.75¢/bdft

Oct 27

I III + IV - slt shrinkage cracks on surface

112696

Nov 13/69

MK – LIME – #3 + #4 (0.4g [illegible])

Close in gaps in formulations made on previous pages 137 + 139

				water	ND	WD	yield	
I	V #4	50	150	700	136.7			air not
	Gyp	48	144	+40 ml	133.3	54.1	34.6	stable
	lime	2	6		137.2			
	st	1	3		134.2		still moist	
					541.4 = 135.4			
	2.25/lb.	2.92 ¢/ft						
II	V #4	50	150	700	135.8			
	Gyp	50	150	+20	135.0	58.0	33.4	
	st	1	3	MD	139.5			
				88.8	139.2		still moist	
	2.25/lb	3.02 ¢/bd ft			549.5 = 137.4			
III	V #3	40	120	600	130.0			much too
	Gyp	55	165	MD	125.9	51.0	31.8	wet –
	lime	5	15	82.7	128.5			
	st	1	3	wet	126.3			fair bond
					510.7 = 127.7			
IV	V #3	40	120	500 134	126.6			still too
	Gyp	55	165	MD	129.4	50.7	29.6	wet
	lime	5	15	79.2	128.5			
	st	1	3		133.1			~~good~~ bond
					507.6 = 126.9			

142

III Stanolind #78-1596

WATER	MD	ND	WD	YLD	
720	85.4	133.3			Better more like Hydrocol
		132.0	52.6	34.9	
		133.3			
		126.4			
		525 ÷ 4 = 131.5			

Use 50-5404 – Hydrocol – 50 lb sack – 40 ft/sack

water ratio 7.33

Batch for field test –

11/4/69

Comparison of Starches -

Hydroseal #3 used until now is no longer available from Nat. Starch Co. Hydroseal 50-5404 was made to take its place. In addition 50-5452 used by gypsum board co's is used because it migrates well to the surface + binds to paper. 78-1596 is used in tape joint cement because it does not migrate. Try all three in formula no. 137 IV -

V - 50%			150 gm
Gyp 45		700 water	135
lime 5			15
starch 1			3

I - Starch # 50-5404 - Hydroseal -

water	MD	ND	WD	YLD.	
720	79.2	126.4			slttly wet
		120.5	50.1	36.6	
		127.0			set time 1.5 hrs
		128.0			
		501.9 = 125.5			

II - Starch # 50-5452 - migrates

water	MD	ND	WD	YLD.	
720	89.6	139.1			takes a little long
		140.7	55.0	33.4	to mixing -
		135.8			could use more
		135.0			water
		550.6 = 137.7			
					set time 1.5 hrs

112700

IV same as I but no retarder — 3 gm borax/100
9 gm/300

* water MD ND WD YLD

water	MD	ND	WD	YLD
700 stiff	79.6	121.4		
		127.5	50.9 lbs	35.4 ft
		130.7		
		129.2		
		508.8 = 127.2		

V same as above - no retarder - 1 gm borax/100
3 gm/300

water	MD	ND	WD	YLD
700	78.8 stiff	123.5		
		127.8	50.7 lbs	35.5 ft
		128.6		
		127.3		
		507.2 = 126.8		

Set time

	Start	End	Time	
I	12:45 PM	showed no temp rise after 20 hrs, set but soft		4-4:15 set on tin board
II	1:10	9:30 PM	8:20 hrs	Very small temp rise
III	1:30	9:00 AM } never set		
IV	2:10	9:00 AM }		} not set tin sheet 4. ~~both set on fiberglass board~~ 4 set on plywood board 4
V	2:35	4-4:15	1:25-1:30 hrs	}

* dried to fairly hard product —

112701

11/5/69

Adjust Set Time

Formula 137 V (143 T) sets in 1.5 hrs — too short for job conditions — try standard retarder for Kaiser Gypsum (formula P 79 this book) — Using 5 lbs/ton rate to get 7 hr set (3 hr finished MK) double the rate to 10 lbs/ton gyp to bring set back to 3+ hrs. Also try Borax at 3 gm per 100 gm batch (P 113 this book) + 4 gm per 100 g batch

I #4 V - 50, Gyp - 45, Lime - 5, Starch 1 } + .225 gm retarder (15%) X 3 = 150, 135, 15, 3 + .7 gm retarder

water	MD	ND	WD	YLD
700	76.1	118.0		
	stiff	123.7	49 lbs	36.7 ft
		124.9		
		124.1		
		490.7 = 122.7		

II same as I using .4 gm retarder

	MD	ND	WD	YLD
	76.2	125.0		
	stiff	123.6	49.3 lbs	36.5
		120.2		
		124.4		
		493.2 = 123.3		

III same as I using 1.0 gm retarder

	MD	ND	WD	YLD
	81.8	119.5		
		127.5	50.1 lbs	35.9 ft — slightly thinner than I + II
		126.1		
		127.7		
		500.8 = 125.2		

VI - mix - spray into cups - re-temper + mix - spray into cups - measure wt loss in spraying and water req'd to re-temper

A) water MD ND YLD

water	MD	ND	YLD
700.	83.2	127.9	
		125.8	36 bd ft
		125.9	
		375.6 = 125.2	
		50 lbs/cuft	

B) water MD ND YLD

	water	MD	ND	YLD
Retemper	44	~~78~~	141.1	
		105.2	139.3	31.3 bd ft after 2nd spraying.
			140.0	
			420.4 = 140.1	
			56 lbs/cuft.	

tare - mixer bowl 653.2 gm
full - 3.5 lbs - 1587 g
-653
934 gm + 40 water = 974 gm total

934
40
974 gm total

VII same as I but .2 g retarder + .5 gm Hep

MD	ND
77.8	127.5
	122.3
	126.5
	121.7
	503.0 = 125.8

set Time - 2½ hrs

11/6/69

Adjust set time

Formula 135 V - con't'd from P 145.

I V - 150 | 150 | 700 water | ND | WD | YLD
Gyp - 45 | 135 | stiff | 123.8
lime 5 | 15 | MD-76.2 | 125.3 | 49.0 | 36.4
starch 1 | 3 | | 119.7
retarder | .1 gm .15 | | 125.7
Dispersal - .6 gm | | | 494.5 = 123.6

2 hour set

II Same as above with .05 gm retarder

water	MD	ND	WD	YLD
700	76.5	130.8		
		129.0	51.4	35.0 ft
Dispersal - .4 gm		130.9		
		123.6		
		514.3 = 128.6		

Set time 2 hrs.

III
V - 45 | 135
Gyp - 50 | 150
lime 5 | 15
st 1 | 3
retarder ~~.1 gm~~ | ~~.1 gm~~ 0.15

IV Same as above with .05 g retarder.

water	MD	ND	WD	YLD
700	95.6	134.4		
	sl wet	136.3	54.0	33.3
		136.7		
		133.1		
		540.5 = 135.1		

Set time 2 hrs

V Same as I - use altered paddle in mixer as for concrete

water	MD	ND	WD	YLD
700	79.2	122.5		
		122.6	49.1	36.7 ft
		123.9		
		123.4		
		492.4 = 123.1		

Set time 2 hrs

Re - Cap —

Best yielding product appears to be between 45 & 50% #4 V with 45 to 50% Gyp and 5% lime — Can get 36 ft/45 lbs — 3 problems remain —

1.) adjusting set time and
2.) hardness.
3.) bond

Initially hardness seemed excellent — 137 V is hard on tin sheet. Softer in cups but O.K. 139 — hardness O.K. I II + III the best. IV on the soft side. 141 all on soft side in cups — all samples soft on tin. 143 all soft on tin sheet 143 I is softest. 145 all soft but still moist in cups. 145 I hard on transite board. 145 IV fairly hard on tin sheet and in cups — no shrinkage in cups. 147 all soft in cups & on sheet. Units moist in cups — may be moisture in sheet samples

Hydroseal #4 — gelatinized further than #3 — dissolves faster in water, etc. — Try reducing time and dispersal to increase hardness.

Part II - Raw Materials
A) Vermiculite, density + Yield
B) Asbestos density + Yield
C) Proportion Asbestos + Yield

Lab Book Title ___

Part I – Water Ration + Yield
A) Vermiculite Density + Water Ratio
B) Soluble Cellulose + Water Ratio
C) Time and Vacat Readings
D) Water Ratio + Yield
E) Beatmate – Water Ratio – Yield
F) Soluble Cellulose + Yield

Part II – Production Runs
A.) Production Runs + Additives

Part III – Air Entraining Agents
A) Varying quantities Hyfoam
B) Comparison Dufoam + Neprofin NFU (OXXXX OIL ICE
C) Effect of air pressure on density + Yield

152

Conversion Factors

To determine coverage or yield MK

$$\frac{\text{Weight wet mix}}{\text{density}} = \text{cu ft}$$

$$\frac{\text{cu ft}}{\text{Original dry wt}} = \text{cu ft per lb.}$$

cu ft per lb x 45 lbs (wt/bag) = cu ft/bag

cu ft per bag x 12 = board ft/bag

300 gms MK
600 gms H_2O
900 ÷ 60 lbs/cu ft = 15
(WD)

15 ÷ 300 = .05 cu ft/lbs

.05 X 45 = 2.25 cu ft/bag

2.25 X 12 = 27.0 board ft

5 oz dixie cups = 150 cc

112709