BULKING OF CONCRETE DUE TO USING CELITE SAND AS AN ADMIXTURE

Thesis for the Degree of B. S.

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Bulking Of Concrete Due To Using Celite Sand As An Admixture

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Of

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The purpose of my work has been to determine the added amount of concrete obtained due to adding different quantities of Celite to the concrete mixture. From this data, I have attempted to determine whether it is economical to use Celite from the contractor's viewpoint.

After considerable experimenting, I found that the work required very accurate weighing, and also an accurate measuring device. A sketch of this device is shown on the next page.

The first step in my work was to design the concrete mix. The data for said mix is as follows:

Maximum size of aggregate - ¾"
Stength - 2000# / sq. in. at 28 days
Water cement ratio - .9
Slump - 3" to 4"

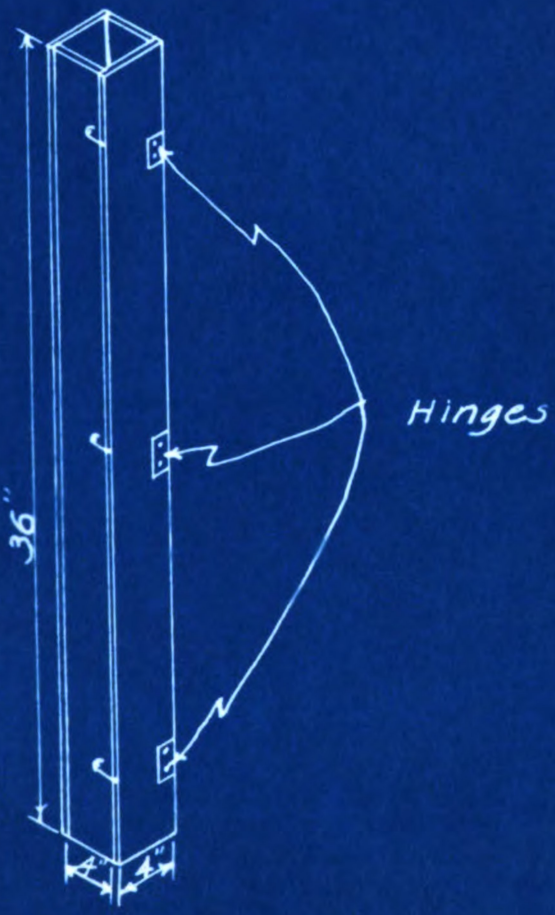
Fine aggregate:
Fineness modulus - 2.66
Wt. of sand damp and loose - 100#
" " same sand dry - 97.18#
" / cu. ft. dry and rodded - 115#

Coarse aggregate:

Fineness modulus - 6.48
Wt./ cu. ft. damp and loose - 105#
" of same when dry - 103.75#
" / cu. ft. dry and rodded - 112.5#

Wt. of combined aggregates dry and rodded - 112.5#

Real Mix: 1:4.7



Measuring Device

Fineness modulus of mixed aggregate - 4.9

Field mix:

$$v = \frac{6.48 - 4.9}{6.48 - 2.66} = .414$$

Percentage of sand = 41.4

" " stone = 58.6

.414 cu. ft. of sand weighing	115# / cu. ft.	=	47.6#
.586 " " " stone "	112.5# / cu. ft.	=	65.8#
	Total		113.4#

Wt. of mixed aggregate = 125#

$\frac{113.4}{125}$ = .908 volumes of mixed aggregate to correspond to one volume of the aggregate measured separately.

The equivalent of the 4.7 mix = $\frac{4.7}{.908}$ = 5.17 cu. ft. of aggregates measured separately

Proportions of materials to be used in the field:

Sand damp and loose = $5.17 \times .414 \times \frac{115}{97.18} = 2.5$

Stone damp and loose = $5.17 \times .586 \times \frac{112.5}{103.75} = 3.3$

Field mix = 1:2.5:3.3

Corrections for absorption and moisture:

Water cement ratio - 0.9
.9 x 7.48 = 6.73 gal. / sack of cement

Assume absorption of sand and stone = 1%

Absorption for sand	= .01 x 2.5 x 97.18 = 2.425#	=	.29 gal.
" " stone	=.01 x 3.3 x 103.75 = 3.42#	=	.41 gal.
	Total for each sack of cement	=	0.7 gal.

Moisture content / cu. ft. of sand = 2.82#
" " " " " " stone = 1.25#

Deductions for moisture content:

2.82 x 2.5 = 7.05# = .845 gallons
1.25 x 3.3 = 4.125# = .490 "
Total / sack of cement = 1.335 "

Net quantity of water to be added = 6.73 + .7 - 1.335
= 6.09 gallons

Of course with 4" x 4" x 36" measuring device, I was unable to use a full sack of cement. The proportions that I used are as follows:

Cement - 5.025#
Sand - 12.63#
Stone - 17.57#
Water - 3.08#

The results that I have obtained are as follows:

Mix	# of Celite/ sack of cement	Yield
1:2.5:3.3	0	1.0
"	1	1.001
"	2	1.002
"	3	1.008
"	4	1.015
"	5	1.0175
"	6	1.020
"	7	1.038
"	8	1.049
"	9	1.058
"	10	1.069
"	11	1.075
"	12	1.082
"	13	1.089
"	14	1.094
"	15	1.100

From the above results it can be seen that the first appreciable increase in bulking occurs when 7# of Celite per sack of cement are added. From the viewpoint of the contractor, this would be the most favorable amount to use. Thus, from the above data we can determine whether it is economical for the contractor to use Celite.

$$C = \frac{11}{C+S+G}$$

C = Number of barrels of cement / cu. yd. of concrete.

$$C = \frac{11}{1+2.5+3.3} = 1.618 \text{ bbls.} = 6.472 \text{ sacks}$$

Number of pounds of Celite / sack of cement = 7.
" " " " " / cu. yd. of concrete = 7 x 6.472
= 45.304

Cost of Celite / ton = $45.00
" " Cement / bbl.= $2.35
" " Gravel / yd. = $2.50

From the above data, the cost of materials for .038 cu. yds. of concrete can be determined. Also the cost of Celite for .038 cu. yds. of concrete.

Cost of gravel = C x (S+G) $\frac{3.8}{27}$ x .038

= 1.618 (2.5+3.3) $\frac{3.8}{27}$ x .038 x $2.50

= $.126 or $0.13

Cost of cement = 1.618 x $2.35 x .038 = $0.145 or $0.15

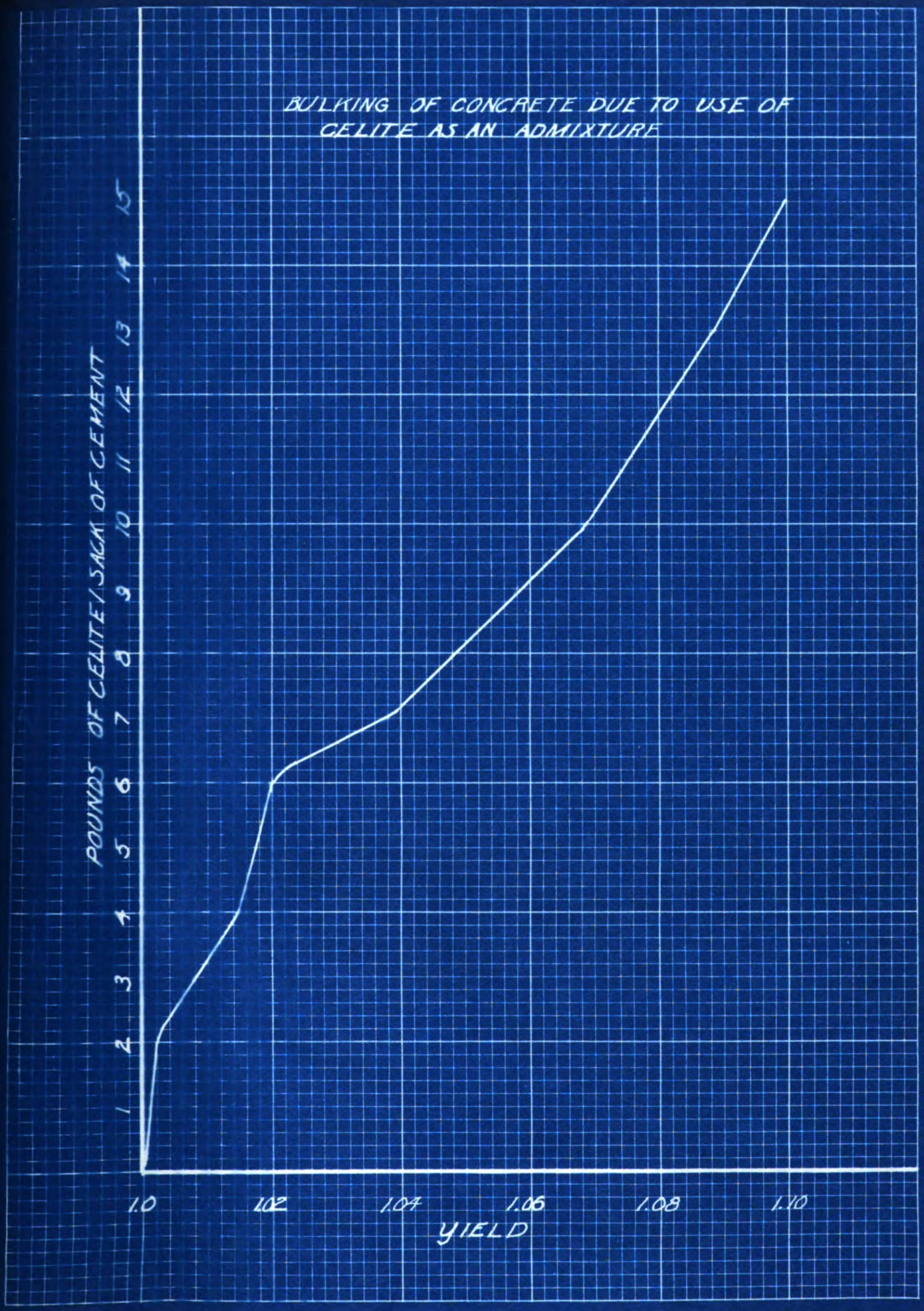
Cost of cement and gravel = $0.13 + $0.15 = $0.28

Cost of Celite = $\frac{45.304}{2000}$ x $45.00 = $1.02

From the above data it can be seen that the Celite that is used in the concrete would cost $1.02. The cost of cement and grave = $.28. Thus, it would cost the contractor $.74 more to use Celite. A graph showing the increase in volume due to adding different quantities will be shown in the back.

In conclusion I would like to say that my results were very much different than those that I expected to

obtain. Celite was recommended to me to bulk concrete 5% after 3# of Celite per sack were added. I do believe that Celite would be advantageous to use in intricate forms where it would be hard to puddle the concrete a sufficient amount; also, without a doubt, Celite makes a denser concrete.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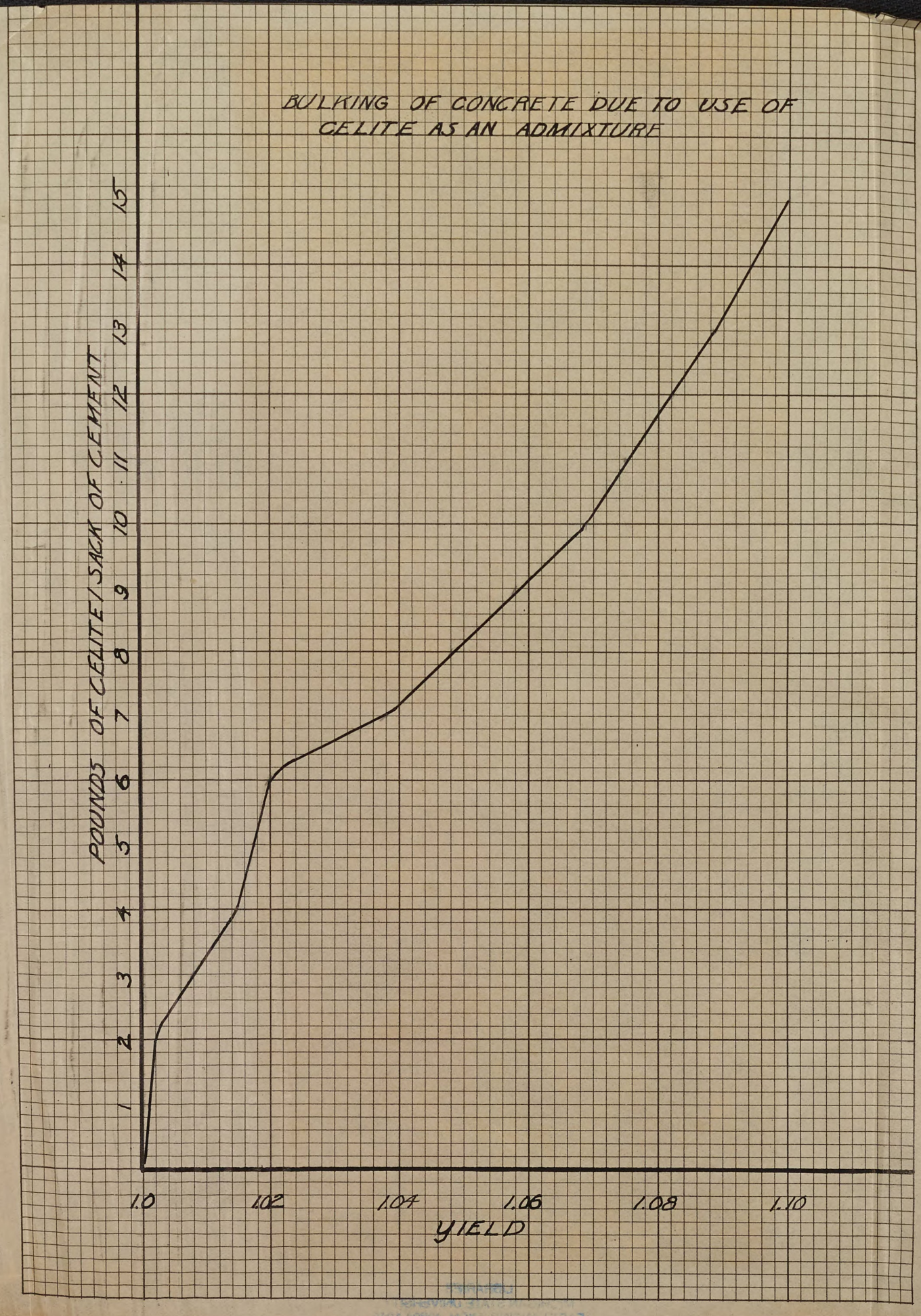
POUNDS OF CELITE / SACK OF CEMENT
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
1.0
1.02
1.04
1.06
1.08
1.10
YIELD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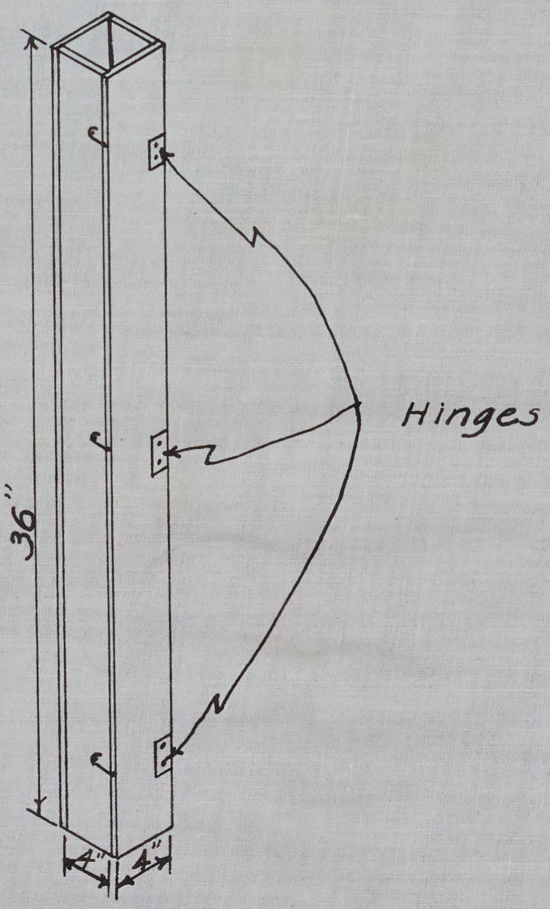
YIELD



Measuring Device