

Effect of Oils on the Strength of Cements.

BY

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THESIS

FOR THE DEGREE OF BACHELOR OF SCIENCE IN THE
SCHOOL OF ARCHITECTURE.
COLLEGE OF ENGINEERING.

UNIVERSITY OF ILLINOIS.

1893.

Effects of Oils on the Strength of Cements.

The object of this thesis is to experimentally determine the effect on the strength of cement produced by the mixing of oils with cements.

Oils are sometimes mixed with mortars to prevent the white efflorescence from appearing on the brick work. Vitruvius mentions the use of oils. In speaking of pavements he says: "In order that the joints may not suffer by the frost, at the approach of winter every year it should be saturated with the dregs of oil, which will prevent the frost affecting it."

The oils used in these experiments were: Linseed, Sperm, and Kerosene as suggested. Cements were Louisville and Portland. Did not use any sand with the cement as it would make no difference in the results, except to proportionally diminish the strength.

The proportions of oils were in per cents by weight of the cement used.

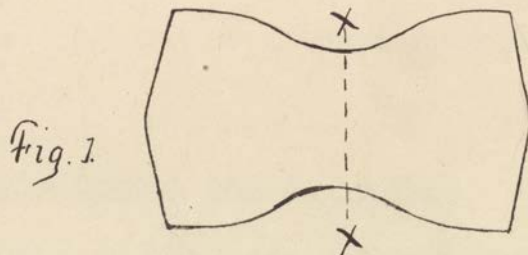
Used different proportions of oils up to 10%, more than that being too expensive to be of practical value.

Proportions of oil were: 2%, 4%, 6%, 8% and 10%. Three briquettes were made of each kind and the average results were used in the final conclusions.

The cement was thoroughly mixed with water and oil, and with the same consistency each time as nearly as possible. The moulds were of

brass so that there was no absorption of either water or oil by the moulds. The cement was pressed into the moulds with the hand and a small trowel, trying each time to use about the same pressure so that no part of the mould should not be filled, and all should be of the same density.

The shape of the briquettes the adopted standard type and as shown in Fig. 1.



The cross section at X X being 1 sq. in. in area.

The briquettes were broken in the testing machine for mortars etc. by tension, the ultimate strength being given in lbs. per sq. in.

An effort was made to maintain the same conditions in each case in order to get an accurate comparison of results.

Cements were tested for fineness and activity, and the results are shown in Plate 7.

Sieve No. 50 has 2500 meshes per sq. in.

" " 80 " 6400 " " " "

" " 100 " 10000 " " " "

The cements were considered to begin to set when the mortar supported a wire $1/12$ " in diameter weighing $1/4$ lb.; fully set when mortar supported a wire $1/24$ " in diameter weighing 1 lb.

The series of briquettes made of Louisville Cement and Linseed oil

were put into the moulds one day and taken out the next. The series with the largest proportion of oil were not very solid, their hardness being in inverse rates to proportion of oil.

Louisville Cement and Kerosene Oil.

Mixed as before. The oil did not seem to have much effect on setting. One series mixed with oil and no water were solid enough to take out of the mould, but at the end of 63 days were so weak that they broke by handling.

Louisville Cement and Sperm Oil.

Noticed no difference in hardness of briquettes at end of one day.

Portland Cement and Linseed Oil.

At the end of one day, those having the largest proportion of oil were slightly softer than neat cement. Linseed oil apparently affected the setting more than the other oils.

Portland Cement with Kerosene Oil.

Could notice no difference in solidity of briquettes.

Portland Cement and Sperm Oil.

Briquettes containing largest proportions of oil were not quite so solid as those without oil, but very little difference existed.

Each set was broken at the end of 63 days. The strain was increased at the rate of about 100 lbs. per minute. The results are given in Tables 1 to 6. The strength of each briquette in each series, and the average are given.

Since graphical tables are more readily understood than any other

kind the results were platted graphically. Ordinates at left of plate are in lbs. per sq. in. Abscissas at bottom of plate are percentages of oil. Red lines show test of briquettes No. 1, No. 2, and No. 3, platted through. Black line indicates average result.

Louisville Cement and Linseed Oil.

Table 1 gives the strength of briquettes. Plate 1 shows results platted. The series with 2% oil was about half as strong as the series without oil. With 4% they were stronger than with 2%, and only about $\frac{2}{3}$ as strong as without oil. The strength diminishing as more oil was added. Briquettes broke fairly regular.

Louisville Cement and Kerosene Oil.

Table 2 and Plate 2 give results of tests. With 2% oil the strength was a little less than with no oil, a little smaller than this with 4%, and considerably stronger with 6% than with no oil, about the same with 8% and a little ^{less} at 10%. Showing that kerosene oil has very little effect on the strength of Louisville cement.

Louisville Cement and Sperm Oil.

Results are given in Table 3 and Plate 3. With 2% oil the strength was little more than one third as much as without oil. A few pounds stronger at 4% and 6% diminishing again at 8% and 10%. Very much weakened by oil.

Portland Cement and Linseed Oil.

Results as shown in Table 4 and Plate 4. With 2% oil, the strength was about $\frac{1}{10}$ as much as without oil, increasing very slightly as oil

was added. The strength was very materially reduced.

Portland Cement and Kerosene Oil.

Table 5 and Plate 5 give results of tests. With 2% oil the briquettes were about $\frac{3}{4}$ as strong as those without oil, a trifle weaker at 4%, and considerably stronger at 6%, at 8% about $\frac{9}{10}$ as strong as without oil, getting weaker at 10%. Oil does not appear to seriously affect the strength of the cement.

Portland Cement and Sperm Oil.

Strength decreases rapidly and very regularly with addition of oil, its graphical representation being nearly a straight line. The strength is seriously affected in most cases, but the greatest strength of cement mixed with oils was found when 6% oil was added.

Conclusions.

It is found that the results all indicate the fact that oils lessen the strength of cements very seriously, as in only one instance was any series of briquettes stronger than a series without oil. That one was the series composed of Louisville cement and Kerosene oil. The results were almost as strong as cement with water alone. With 6% oil the series was strongest. Kerosene oil had very little effect on the strength of the Louisville cement. With the other oils the strength was very materially diminished.

These experiments show that oils have a very injurious effect on the strength of cements, and should never be mixed with them in order to prevent efflorescence or for any other purpose.

Table 1.

Briquettes	No.1	No.2	No.3	Av.	
Louisville Cement	316	334	344	331	
Linseed Oil	29%	168	118	170	152
" "	49%	218	220	200	212 $\frac{2}{3}$
" "	69%	138	158	158	151 $\frac{1}{3}$
" "	89%	48	24	26	32 $\frac{2}{3}$
" "	109%	23	20	22	21 $\frac{2}{3}$

Table 2.

Briquettes	No.1	No.2	No.3	Av.	
Louisville Cement	316	334	344	331	
Kerosene Oil	29%	302	322	314	312 $\frac{2}{3}$
" "	49%	292	306	322	306 $\frac{2}{3}$
" "	69%	392	338	364	364 $\frac{2}{3}$
" "	89%	288	350	336	324 $\frac{2}{3}$
" "	109%	304	294	282	293 $\frac{1}{3}$

Table 3.

Briquettes	No.1	No.2	No.3	Av.
Louisville Cement	316	334	344	331
Sperm Oil 2%	164	138	110	138
" " 4%	150	172	168	163 $\frac{1}{2}$
" " 6%	148	138	156	147 $\frac{1}{3}$
" " 8%	78	78	76	77 $\frac{1}{3}$
" " 10%	80	68	58	68 $\frac{2}{3}$

Table 4.

Briquettes	No.1	No.2	No.3	Av.
Portland Cement	364	420	406	396 $\frac{2}{3}$
Linseed Oil 2%	44	44	44	44
" " 4%	42	42	42	42
" " 6%	40	42	46	42 $\frac{2}{3}$
" " 8%	58	48	62	56
" " 10%	80	52	66	66

Table 5.

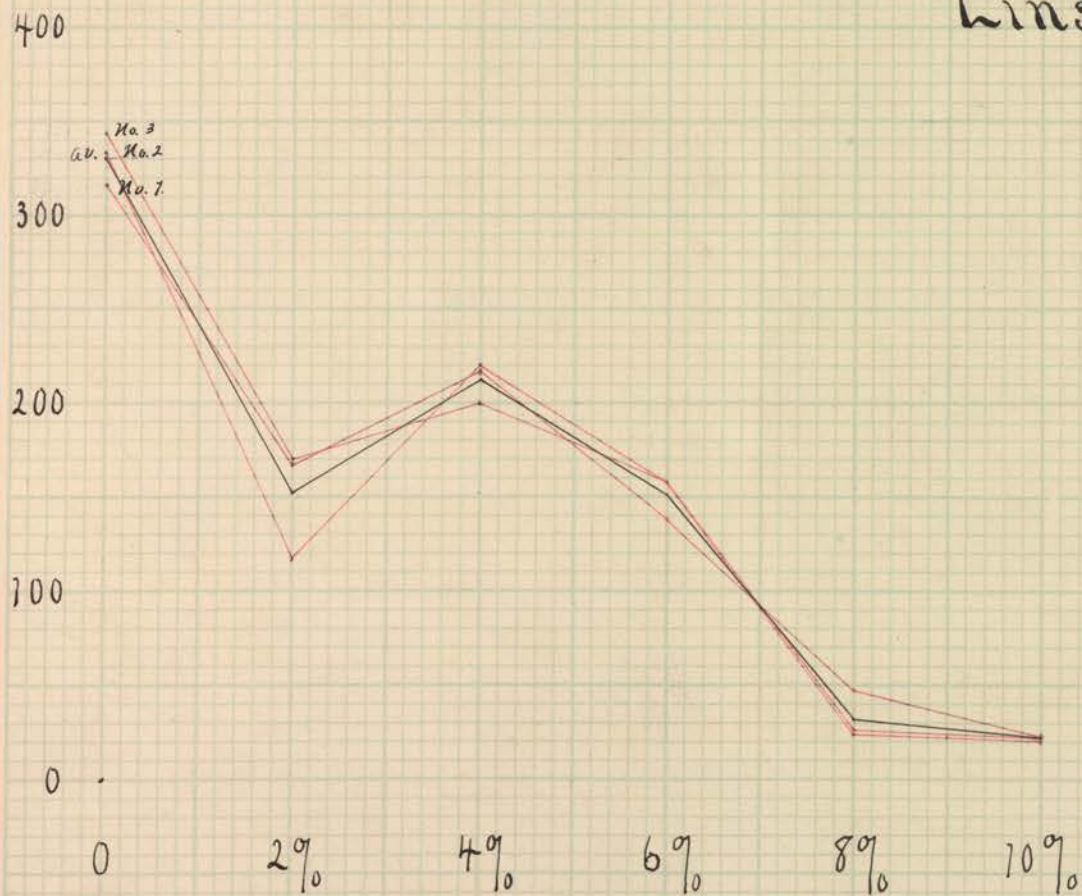
Briquettes	No.1	No.2	No.3	Av.		
Portland Cement	364	420	406	$396\frac{2}{3}$		
Kerosene Oil	29%	289	284	243	272	
"	"	49%	270	280	244	$264\frac{2}{3}$
"	"	6%	248	416	332	332
"	"	8%	346	356	336	346
"	"	10%	226	266	236	$242\frac{1}{2}$

Table 6.

Briquettes	No.1	No.2	No.3	Av.		
Portland Cement	364	420	406	$396\frac{2}{3}$		
Sperm Oil	29%	267	324	330	307	
"	"	4%				
"	"	6%	150	120	140	$136\frac{2}{3}$
"	"	8%	44	32	40	$38\frac{2}{3}$
"	"	10%	30	35	31	32

Plate 1

Louisville Cement Linseed Oil



No. & V. lines should be drawn in each table, 1/4" at each half inch.

Plate 2

Louisville Cement Kerosene Oil

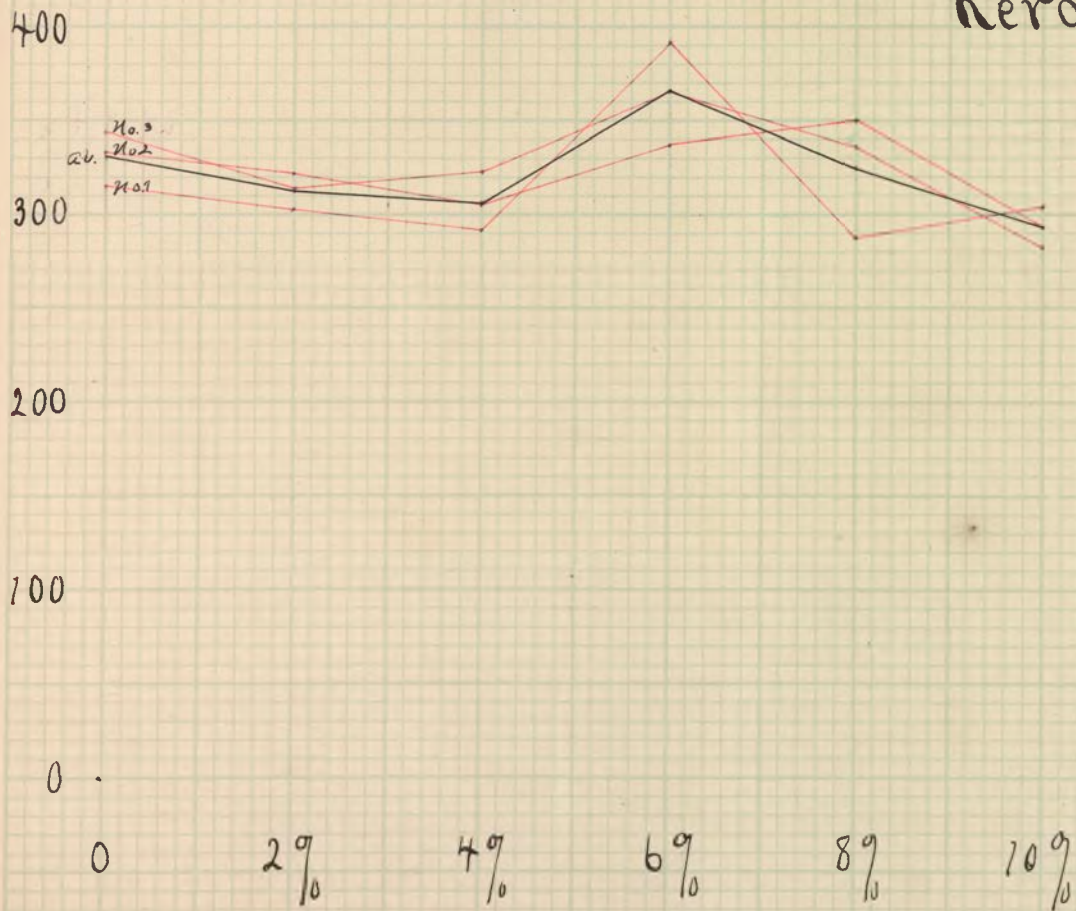


Plate 3.

Louisville Cement
Sperm Oil



Plate 4

Portland Cement
Linseed Oil

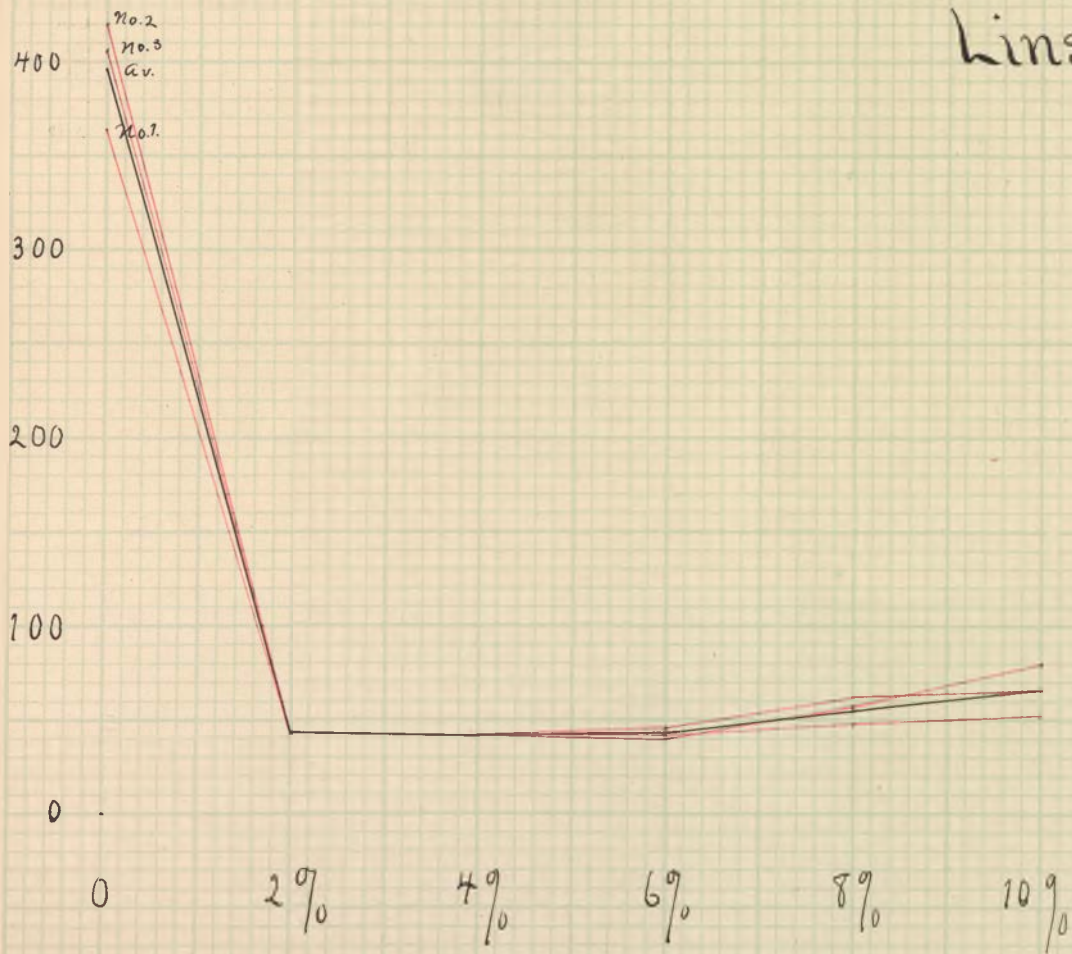


Plate 5

Portland Cement Kerosene Oil



Plate 6.

Portland Cement
Sperm Oil



Plate 7

Description of Cements used

Name	Kind	Fineness			Activity	
		Per cent No. 50	left on No. 80	on sieve No. 100	Began to set.	Fully set.
Germania	Portland	2.2	8.0	13.0	7 hrs. 30 min.	14 hrs. 15 min.
Louisville	Rosendale	16.5	24.5	28.0	1 "	15 " 1 " 40 "