and examined after three and a half months immersion in the solutions. The actions of the alkali solution is shown in the accompanying photographs of the steamed series; this set being more disintegrated than the set cured in the moist closet. Referring to the density curves in Figure 5, note the order of densities of the mortars, disintegration taking place in general, according to the density of the mortar, and in this case also according to the strength of the mortar.

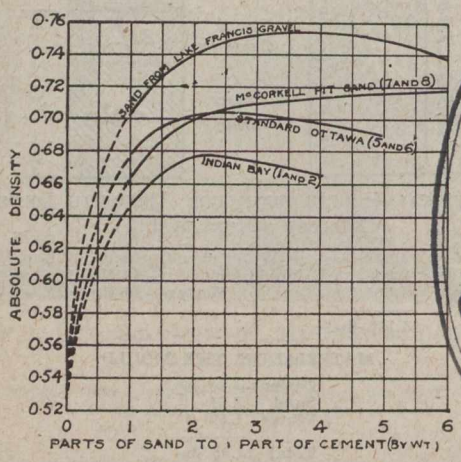

FIG. 5—COMPARISON OF ABSOLUTE DENSITIES OF MORTARS FROM SANDS OF DIFFERENT GRADING

All sands screened through ⅛-in. screen.

Lake Francis Sand.		McCorkel Pit Sand.		Standard Ottawa.		Indian Bay Sand.	
Sieve No.	Per Cent. Ret'd.	Sieve No.	Per Cent. Ret'd.	Sieve No.	Per Cent. Ret'd.	Sieve No.	Per Cent. Ret'd.
10	24	10	15	20	0	10	4
20	40	20	18	30	100	20	18
40	25	40	26			40	46
75	9	75	27			75	30
100	1	100	3			100	1½
Passg 100	1 pas'g	100	11		passing	100	½
	100		100				100

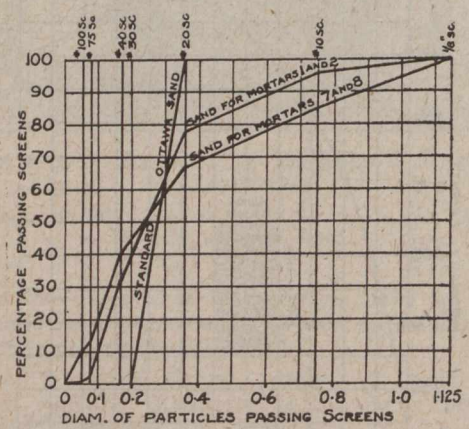

FIG. 6—MECHANICAL ANALYSIS DIAGRAM FOR SANDS USED IN TESTING AFFECTS OF ALKALI SOLUTIONS UPON VARIOUS MORTARS

To prevent the alkali water from coming into contact with the lime of the cement it was suggested by the Montana Agricultural College in circular No. 8, published in 1911, that soap and aluminum sulphate be added to the concrete mixture with the idea of coating the cement grains with a non-absorbent film.

The theory of the action of these chemicals is as follows: When Al_2SO_4 comes in contact with calcium hydroxide of the cement, calcium sulphate and aluminum hydroxide are formed. The aluminum sulphate, which is a gelatinous precipitate, not acted upon by alkali, coats the remaining calcium hydroxide and protects it from further action of the alkali. Soap, when added to cement, reacts with the lime liberated during the process of setting, forming an insoluble calcium soap. The soap will not be acted upon by alkali and will coat the remaining lime or calcium hydroxide.

On the recommendation of the work described in this pamphlet it was thought advisable to use soap and aluminum sulphate in a portion of a concrete structure being built by the Greater Winnipeg Water District, the attack of alkali waters being feared on this portion of the work. Aluminum

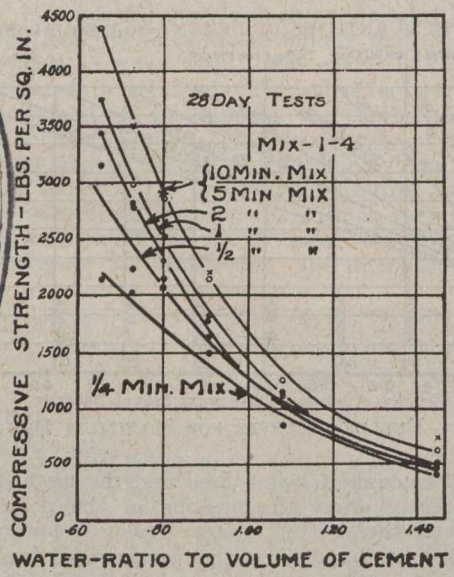

FIG. 7—INFLUENCE OF WATER ON THE STRENGTH OF CONCRETE

Water-strength curves for each time of mixing. Each value is the average of 4 tests from the same batch. Water content calculated as a ratio of the volume of cement. From paper by Prof. D. A. Abrams previously published in The Canadian Engineer.

sulphate and soap were added to the concrete mixers in equal proportions, the weight of these chemical substances being each one per cent. by weight of the mixing water used. To be certain of the thorough incorporation of the chemicals, the soap solution was first placed in the

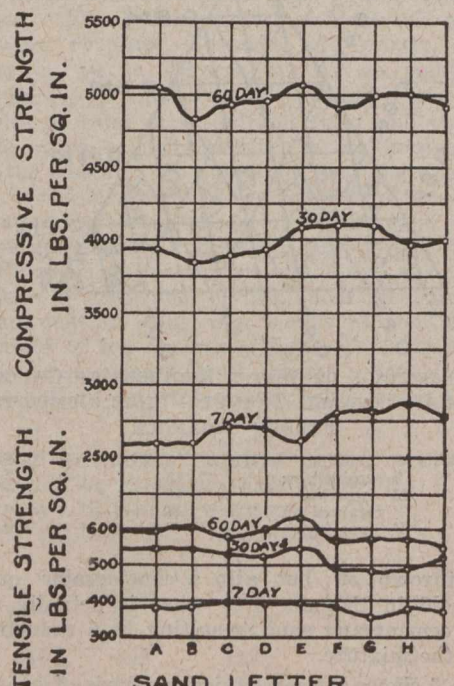

FIG. 8—STRENGTH TEST OF MORTARS OF SAME CEMENT-SURFACE AREA RATIO BUT DIFFERENT VOLUMETRIC PROPORTIONS—FROM PAPER BY CAPT. L. N. EDWARDS

mixer and the cement and aggregate then added and the whole thoroughly mixed. The aluminum sulphate solution was then added and the mixer given a few more turns be-