

TO LIMIT THE PERSONAL EQUATION IN CEMENT TESTS.*

At the convention of the society held two years ago, the writer outlined in a general way the work inaugurated at the cement testing laboratory of the NewYork Rapid Transit Railroad Commissioners. In mentioning the efforts to minimize as far as possible the baneful influence of the "personal equation" of the tester, reference was made to some special experiments just then commenced which it was hoped would lead up to some interesting results. It is the data collated from these experiments which have now crystallized into a regular part of the work, although so far only for comparison, which are the subject of the present paper. For two years the laboratory has been regularly making up every tenth lot of cement submitted for use on the work, under what the writer calls the "dry" process of briquette making, in addition to the usual method practiced in laboratories generally. After much experimenting and numberless trials, the method now rigidly followed was adopted.

The gang moulds are filled with dry cement in three layers, the lower two being tamped by three blows of a wooden mallet and a tamping iron exactly fitting the moulds, the top layer being simply put into place, pressed in and smoothed off with a small trowel, after the moulds had been filled. Three blows of the mallet were adopted because repeated experiments demonstrated that this number gave results, when the briquettes were broken, approximating the strength desired in what was considered the most acceptable cement at the 7-day period; fewer blows not giving such satisfactory results in every way, more blows developing abnormal strength at that period as well as at later stages.

After the briquettes are finished, as far as filling the moulds is concerned, the whole is put into storage tanks and there left to take up as much water as required. At the expiration of 24 hours, all the briquettes are ready to be taken from the moulds, when those for the first period are immediately broken and the others stored in tanks. By careful weighing of a great many sets of briquettes it has been ascertained that 22 per cent. of water by weight is taken up during the first immersion. This is just 1 per cent. more than is generally used in ordinary practice in this laboratory, though therein when tempering the aim is to obtain the same paste constituency always, irrespective of the percentage of gauge water. While this does occasionally vary from 20½ to 22 per cent. working as the writer does with the output of one company's mills, this variation occurs so seldom that it may be ignored in calling the average gauge water 21 per cent.

The variation in weight of individual briquettes (the average results always being obtained from ten breaks) as well as the variation in tensile strength of these ten briquettes is markedly less than with the ordinary briquettes. The pronounced feature of the Rapid Transit specifications, viz.: the percentage of gain in strength

between 7 days and 28 days, which requirement to a greater or less extent is finding its way into other specifications, is readily met in practically every instance under this "dry" method of manipulation, and while this is not applicable to sand mortar tests and does not approximate actual field conditions, even to the extent of briquettes ordinarily made, still as cement is not practically used neat and laboratory results are only for comparison at best, any method giving such regular results should claim attention.

Here follow some comparative results, the figures given for each period being averages of 300 briquettes representing over 50,000 barrels of cement, irrespective of its acceptance or rejection.

Ordinary Wet Briquettes—

7 days, 711 pounds.

28 days, 791 pounds.

3 months, 779 pounds.

6 months, 774 pounds.

1 year, 821 pounds.

Gain, 11.1 per cent. 7 days to 28 days.

Dry Method Briquettes—

7 days, 739 pounds.

28 days, 888 pounds.

3 months, 903 pounds.

6 months, 863 pounds.

1 year, 871 pounds.

Gain, 20.1 per cent. 7 days to 28 days.

Of the lots of above total, which were accepted as approximating the gain requirement, the marked showing was as follows:

Ordinary Wet Briquettes—

7 days, 705 pounds.

28 days, 797 pounds.

3 months, 788 pounds.

6 months, 779 pounds.

1 year, 863 pounds.

Gain, 13.0 per cent., 7 days to 28 days.

Dry Method Briquettes—

7 days, 710 pounds.

28 days, 887 pounds.

3 months, 912 pounds.

6 months, 878 pounds.

1 year, 897 pounds.

Gain 24.9 per cent., 7 days to 28 days.

Of the lots of first total rejected for marked failure to comply with the 15 per cent. increase requirement, the results are as follows:

Ordinary Wet Briquettes—

7 days, 764 pounds.

28 days, 809 pounds.

3 months, 785 pounds.

6 months, 804 pounds.

1 year, 695 pounds.

Gain 5.9 per cent., 7 days to 28 days.

Dry Method Briquettes—

7 days, 816 pounds.

28 days, 937 pounds.

3 months, 903 pounds.

6 months, 880 pounds.

1 year, 792 pounds.

Gain 14.3 per cent., 7 days to 28 days.

The last results would have assured the acceptance of all the rejected cement, if the failure to show proper increase had been the only reason for adverse action.

Examination will show that in every instance the "dry" method briquettes show the greater strength at every period, and while the above are averages, the uniformity of results in individual lots, as referred to before, is very marked. In most instances the lowest dry break is as good as the best wet break. These results are very surprising and are incontrovertible evidence that the manipulation of the cement by the tester surely works detrimentally as far as obtaining most regular laboratory results.

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* Abstract of a paper presented to the American Society for Testing Materials, by W. A. Aiken.