

shovelled into the forms as required for puddling. Before each succeeding barrowful was taken out, the mixer drum was given two or more revolutions to overcome any segregation of the ingredients of the concrete remaining in the mixer due to the action of gravity.

No special provision was made to prevent evaporation losses in the mixer drum and in the barrow. The mixing and placing was carried on in the open air and the usual variations of temperature and humidity of atmosphere existed from day to day as the work progressed. The mixing of batches was done from 7.45 to 8.30 a.m. The maximum variation in temperature was therefore only 46° F. In this connection, the writer desires to mention the valuable information contained in Bulletin No. 81, "The Influence of Temperature on the Strength of Concrete," University of Illinois Engineering Experiment Station.

In the puddling of the concrete in the forms, a special effort was made to do the work with the greatest dispatch, consistent with the securing of uniform results, special attention being given to thorough compacting and the uniform distribution of the broken stone and mortar throughout each cylinder and beam.

Bars having a diameter of  $\frac{5}{16}$  to  $\frac{3}{8}$  in., flattened to form a comparatively thin blade-like end, were used for puddling. Compacting of the concrete and the exclusion of entrapped air was mainly accomplished by tapping the exterior surface of the forms with a hammer. In the consistency tests this latter method of compacting was used only in the preparation of cylinders and beams of the first and second consistencies. In the placing of concrete of the third, fourth and fifth consistencies the puddling bars were mainly used to uniformly distribute the stone aggregate.

All molds were filled at the mixing machine and were removed as soon as filled to the storage shed, a distance of about 100 ft. The top surfaces of cylinders and beams were here troweled slightly to remove irregularities.

*Time of Mixing.*—Information indicating the effect of varying the time of mixing was desired, and the specimens for this investigation were prepared as follows:—

The ingredients necessary for a 1½-bag batch of 1:2½:5 concrete were placed in the mixer drum and a sufficient quantity of water to produce concrete of first consistency. The mixing was timed from the completion of placing all concrete materials in the mixer drum. When the mixing had continued ¼ minute a sufficient quantity of concrete was removed to mold the ¼-minute group of cylinders. As soon as these cylinders had been puddled, the mixing was continued an additional ¼ minute to mix the concrete for the ½-minute group of cylinders. In a similar manner the concrete was mixed for the 1 and 2-minute groups of cylinders.

The uncontrollable conditions of temperature, humidity, evaporation, etc., above mentioned constituted the main factors of a foreign nature, tending to produce irregularities in the mixing and placing, the personal equation being reduced to a minimum by reason of the fact that the work was performed by the same men from day to day.

In a few cases it was found that the water content fixed upon in the first batch of each mix was insufficient to produce a plastic mortar. A greater amount of labor was required in such cases to produce a uniformly compacted mass.

Sands having little fine material, with a considerable proportion of coarse, were found to be unadapted to the production of a "sticky, semi-plastic mortar." The water

content of such mortar sinks by gravitation below the surface and doubtless takes with it some of the cement, thus producing an uneven distribution of that important element of the mix.

In relation to the volume of cement (assumed at 100 lbs. to produce 1 cu. ft. of cement paste), the quantity of sand used in each mix was greater than that used in common practice. As already shown, the shrinkage in volume due to thorough drying amounted to 18.7 per cent. per cubic foot of wet sand.

To eliminate possible irregularities throughout the work, two men prepared the ingredients of the specially graded sands and apportioned the concrete materials for each batch. These men with two others mixed and placed the concrete. In general, all placing of concrete in the forms was the work of three individuals. The troweling of the top surfaces of cylinders and beams was done by one of these. The main variables, namely, the gradings of the sands and the consistency of mix, were thus as clearly defined as practicable.

*Storage.*—The forms as soon as filled were placed in a corrugated-iron covered shed.

In general, the forms were removed from the test specimens 24 hours after filling. The few exceptions to this rule were due to slow setting of the concrete, resulting from cold or wet weather. As soon as removed from the forms the test specimens were marked for identification and placed in beds of moist sand, where they remained until required for the compression or bend test.

The reinforced-concrete beams were handled with special care in order not to produce incipient fractures.

Mixing of concrete was commenced on March 30th, 1916. It was, therefore, necessary to maintain artificial heat in the storage shed during the night and at times during the day for a period of from two to three weeks.

*(Continued in the next issue.)*

## Coast to Coast

**Barton Tp., Ont.**—Papers and reports that three years ago cost the township over \$3,000 have been lost. The missing articles include the reports, tracings and blue prints having to do with the proposed water and sewer system of Barton on the mountain.

**Beeton, Ont.**—The ratepayers voted on August 6 on the hydro enabling by-law and also on a by-law to raise \$15,000, which sum, it is estimated, will be necessary to put the transmission plant in good order.

**Edmonton, Alta.**—Building permits for the month of July amounted to \$44,400, as compared with \$2,800 for the same month last year.

**London, Ont.**—The annual convention of the Union of Canadian Municipalities will be held here on August 27th, 28th and 29th.

**Mimico, Ont.**—Three miles of new steel will be laid, in addition to that already laid, and other improvements made this year by the Toronto and York Radial Railway Co. along the Lake Shore Rd. Charles L. Wilson is assistant manager.

**Montreal, Que.**—A syndicate has been formed in Montreal and plans are about completed for the building of concrete steamships on the local water front. The Atlas Construction Co., of Montreal, are the prime movers in this enterprise, and the members of the syndicate which will provide the initial working capital are well known business men of Montreal. The cost of the first vessel to be constructed here will be well within \$100,000. The engines for this vessel have been contracted for, and it is expected that it will be launched before October 1st.