TESTING CLINKER CONCRETE.*

John Charles Davis,
Dean of College of Applied Science and Engineering, Marquette University, Milwaukee, Wis.

For the last two months the writer, with the assistance of Messrs. Collins, Kurtz, Miller and Steigerwald, of the Junior Class, has been making some very interesting tests on concrete and reinforced concrete. The work has not been carried far enough to give scientific results but the practical points have been fully demonstrated.

The material for these tests was Huron Portland cement furnished by the Western Lime and Cement Co.; clinker from the Milwaukee Incinerator, furnished by Mr. S. E. Greeley and gravel from the J. C. James gravel pits. The cement has been tested in the regular laboratory and met all standard specifications. The gravel was fine and clean and for test purposes it was screened through a ⅛-inch screen; that passing through being called sand and the remainder called gravel. The clinker is the product from the furnaces at the new garage incinerator and results from the burnings of a

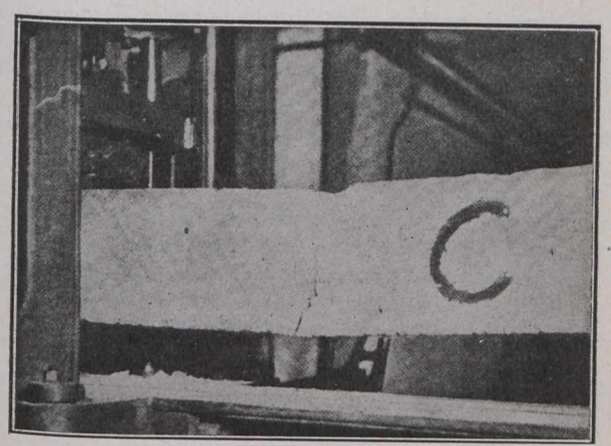

Fig. 1.

mixture of garbage, refuse and ashes. It is a surprisingly hard and strong product and very rough. It looks exactly like the clinker from any furnace but it is not mixed with ashes. This is due to the particular method employed in burning. Ordinarily cinder concrete is supposed to average about one-third the strength of gravel concrete, but this clinker concrete was better than the gravel concrete made in our laboratory.

When the tests were started it was the intention to investigate the strength of reinforced clinker concrete as compared with reinforced gravel concrete. Four clinker concrete beams, with a mixture of one part cement, two parts sand and four parts clinker, were made and tested in the 50,000-pound testing machine in the engineering laboratory. Three of these were reinforced with a ½-inch Kahn bar and one with four ⅜-inch plain round bars. Each one was 9½ inches high by 6 inches wide and the steel placed 1½ inches from the bottom. Two gravel concrete beams of a 1-2-4 mixture were made so as to compare the clinker beams with a standard material. Each of these was reinforced with one ½-inch Kahn bar and were 9½ inches deep. One was 6 inches and the other 7 inches in width. All the beams reinforced with a Kahn bar failed by compression of the concrete under a central load of about 4,000 pounds, the span in all cases being 10 feet. It was very noticeable during the application of the load that the deflection of the beam varied directly with the load up to the point of failure. Even after the beam showed failure the load remained equal to the breaking load for a deflection of about 2 inches. Figures 1 and 2 show a close picture of the ordinary crushing failure. The material in the top of the beam appeared to crumble away under the heavy compressive stress. Figure 3 shows a detail of the beam reinforced with plain round rods. This is the typical shearing of diagonal tension failure. During the application of the load the beam acted similar to the

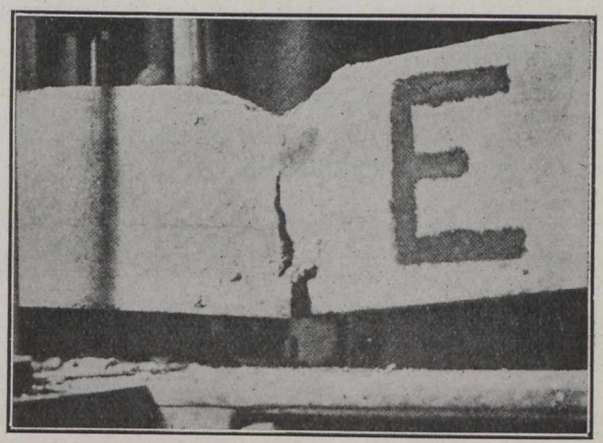

Fig. 2.

others up to a larger load of 5,000 pounds, when the large crack appeared suddenly.

The table shows a summary of the beam tests:

Material.	Maximum load.
No. 1 gravel	4370
No. 2 clinker	3500
No. 3 clinker	3480
No. 4 clinker	4200
No. 5 clinker	5100
No. 6 gravel	4000

To determine the actual strength of the concrete used in the beams sets of 4-in. cubes were made and tested at 7 and

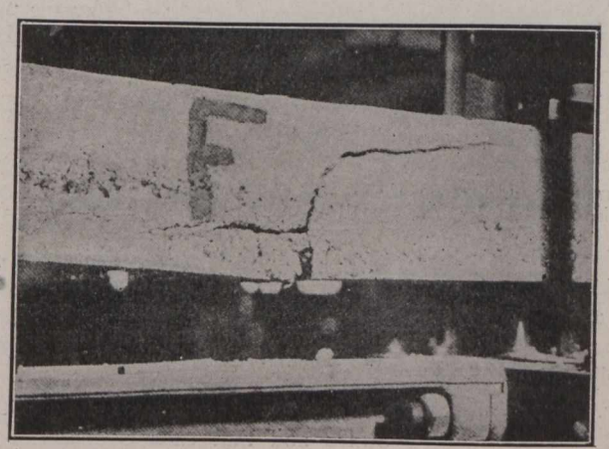

Fig. 3.

28 days. These tests show exact information which the beams do not.

One set of six 1-2-4 clinker cubes averaged 700 pounds per square at 7 days and 1120 at 28 days. Another set gave an average of 915 pounds at 7 days and a third set gave 760 pounds at 7 days and 1519 pounds at 28 days.

These results are by no means complete enough to give to the engineering profession absolute data for design, but they are complete enough to make the following assertions:

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