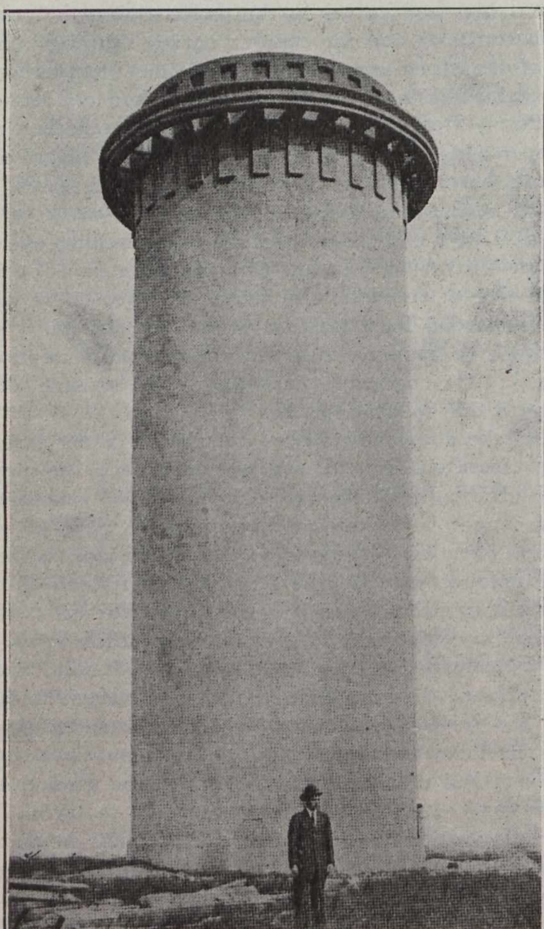
REINFORCED CONCRETE STANDPIPE.

A standpipe at Belton, Texas, constructed of reinforced concrete, is described by T. L. Fountain, a graduate of Engineering at Cornell University, in the March number of Cornell Civil Engineer.

For many years, the water supply of Belton has been obtained from deep wells, storage and pressure for domestic purposes being secured by use of a steel standpipe located on a hill in the northern part of the city. The pressure thus afforded not being sufficient for satisfactory service to Baylor Female College, located on one of the highest points in the city limits, the height of the standpipe was increased about 30 feet. Several years ago the upper half of this standpipe was torn off by the wind, probably due to the weakness of the plates, which originally were near the top. The pressure and storage afforded by the lower half of the standpipe were so unsatisfactory that a bond issue for extending the mains to the south side of the city and erecting a new standpipe on a hill located there carried without opposition.



Standpipe Complete, Showing Ornamental Cornice and Other Decorative Work at the Top.

The chemical contents of the well water at Belton is such that it rapidly corrodes steel, but has no delterious effect on concrete. The cement mortar coat on the interior of the storage basin at the pumping plant is as sound as when put on 20 years ago, whereas service pipes and fittings all over the city deteriorate rapidly. On this account, estimates for the proposed new standpipe were secured on the basis of using much thicker steel plates than would ordinarily be required. No bids were taken, but the lowest quotation received for a steel standpipe 24 feet in diameter and 75 feet high was over $7,000. At this juncture, the firm of which the writer is a member was employed to prepare plans for the proposed waterworks improvements. Believing that a reinforced concrete standpipe could be constructed at a lower first cost which would last indefinitely without any expense for maintenance or repairs, the design shown in Fig. 1 was submitted to the city, and, upon its approval, work was immediately commenced.

Design.—In the design of this standpipe, certain assumptions were made which resulted in securing its construction at a cost very much less than for a steel standpipe of the same dimensions. However, since its completion, important facts bearing upon the design of the concrete standpipes have been brought out by Mr. Hyram B. Andrews in a paper read by him at a meeting of the Boston Society of Civil Engineers. Had the design been carried out in accordance with his recommendations, the cost would have been nearly as great as for a steel standpipe. A wall thickness of 14 inches was decided upon, as a result of a study of concrete standpipe, previously constructed, this thickness being ample to transmit the stress to the reinforcing steel and to secure imperviousness with the concrete proportions used. The working stress assumed for the steel was 16,000 pounds per square inch. No mechanical bond was used to fasten the bars to each other. They were lapped 36 inches and bound in position with wire. Laps in adjacent rings were not allowed to come in the same vertical line.

When next designing a reinforced standpipe, it is the writer's intention to follow closely the lines laid down by Mr. Andrews in the paper mentioned above, the most important of which are briefly as follows: (1) The use of a very rich mixture of concrete; (2) a thickness of wall sufficient of itself to prevent the rupture of the concrete when the standpipe is full, (3) vertical reinforcement between the base and walls to distribute the bending moment and shearing stress, (4) a steel dam at each horizontal joint, in addition to the usual "keyings" to prevent seepage.

It is of fundamental importance that a standpipe designed and constructed on the assumption that the tensile stress is to be carried by the concrete alone with the reinforcing bars added as a guaranty of safety, should be allowed to stand at least 60 days after completion before being filled so that the concrete can secure its full tensile strength.

The ornamental cornice and other decorative work at the top and base of the standpipe were added to relieve the severe lines of the structure, as the standpipe occupies the crest of the highest hill in the vicinity and can be seen for many miles. As may be seen from the photograph, it has a much more dignified and interesting appearance than a plain cylinder of steel. No manhole is provided in the wall near the base as in a steel standpipe, as the construction difficulties of furnishing such an opening are hard to overcome for a concrete standpipe. The 8-inch inlet pipe is brought up through the bottom for the same reason.

Construction Equipment.—The steel forms for the outside of the standpipe were made from the drawing shown in Fig. 2. Two complete rings were used in order that one might be assembled on top of the other without waiting for the concrete to acquire a hard set and to secure a better bond at the joints by pouring fresh concrete on that still "green." The cost of these forms delivered at Belton was $423.

The concrete was mixed in a 3-cubic-foot batch Smith hand mixer, which discharged into a steel elevator bucket of the same capacity, arranged to run in vertical guides and to dump automatically into a combined bin and chute set above the working platform. The bucket was hoisted by a team, used for other purposes when the pouring was not in progress. The wheelbarrows used in placing the concrete were