REINFORCED CONCRETE ELEVATED WATER TANK AT BERLIN, ONTARIO.

Although elevated water tanks were the first important reinforced concrete structures built in Europe and although there are some railroad tanks made of this material still in existence which were built over fifty years ago, the construction of large elevated water tanks for municipal use is still something of a novelty in this country. The following description and illustrations of reinforced concrete tank recently completed at Berlin, Ontario, are taken from a recent issue of "Engineering-Contracting," to whom acknowledgement is here made:—

The capacities and heights of elevated tanks are increasing each year. With increase in size, economical design of the bottom and supports of elevated concrete tanks becomes highly important, since the cost of these parts of such structures is by far the greatest item of expense in building a tank of this character. The ordinary girder and slab construction for the bottom of large tanks is a very expensive feature in concrete tank construction. Loads of from 1,000 to 3,000 lbs. per sq. ft. require very heavy beams and slabs and a great many supports. There is no more ideal design for tank bottoms than the dome and frustum shape bottom as shown in the illustrations here given.

Concrete, being an ideal building material for compression, is strained to its best advantage in this type. The inner dome is under compression in every direction, and the frustum or outer dome is in compression in one direction and in tension from water pressure in the other direction. At the junction of the inverted dome and the inner dome, the thrust from these two domes may be balanced by the adoption of proper inclinations and sizes of the domes, or there may exist a tension in the ring by the thrust of the inner dome being greater than the thrust of the outer dome, or there may exist a compression caused by the thrust of the outer dome being greater than that of the inner dome. In most cases there is at this region a very massive ring of concrete to take care of eventual changing conditions, for the tank empty, for the tank half full, or for the tank filled to its top. This ring may be supported by four or more columns according to the size of the tank, in which case the ring must serve also as a girder and must be designed accordingly. On account of the comparatively small spans and great loads, these girders are designed mostly for shear and less for bending, and it thereby lends itself readily to architectural treatment, as the rational form of such a grider is really an arch on top of the support. Where only four columns are used, this grider is subjected to a considerable torsional moment, and must be designed accordingly.

Another way of supporting the ring at the junction of the two domes is to support it on a shell of concrete, or, as it is preferred in Europe, of brick or stone. If the shell is built of brick or stone, it is rarely made less than 18 to 24 ins. thick, and, although offering opportunity for elegant architectural treatment, it is very much more expensive than reinforced concrete shells, which can be made very much thinner.

A very cuch larger tank of the second type was recently designed and built by Mr. Mensch for the city of Berlin, Ontario. The construction of this tank was begun in August and completed in November of this year. The tank has a capacity of 600,000 U.S. gals. The details of design of the tank are shown in Figs. 1 and 2.

As will be seen from Fig. 1, the tank is supported by a reinfored concrete shell 75 ft. 11ins. high and 12 ins. thick. This supporting shell rests upon a circular beveled ring foundation 13 ft. wide on its base and 18 ins. wide on its upper face. The two main parts of the tank bottom are referred to as the inner and outer domes. The inner dome is a portion of the surface of a sphere of 27 ft. radius. The outer dome is the frustum of a right circular cone. The inner and outer domes intersect at the top of the supporting cylindrical shell. The tank proper is 50 ft. in inside diameter. The depth of water in the tank when full is 39 ft., measured from the median plane of the base to the elevation of the overflow. The tank shell is a cylinder 41 ft. high with 12-in. walls. The roof is a portion of a spherical surface 4 ins. thick. The total height of the structure from the top of the foundation ring to the top of the roof is 127 ft. 4 ins.

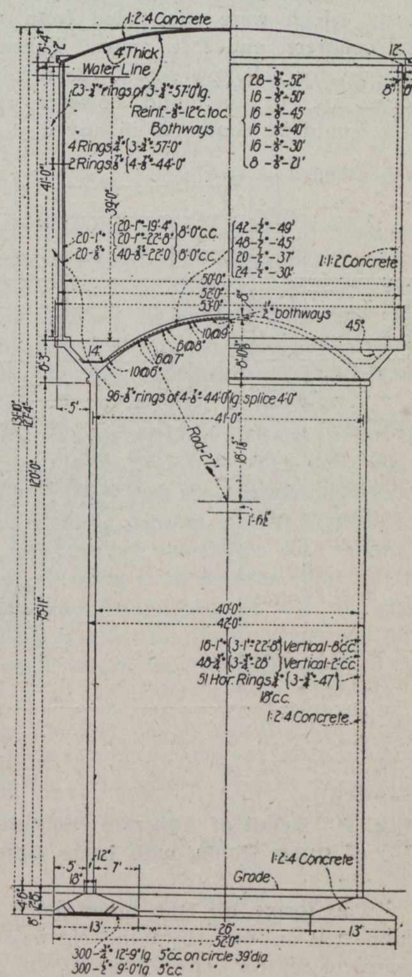

Fig. 1. Sectional Elevation of Concrete Water Tank for Berlin, Ont.

The supporting shell is made incidentally to house a booster pumping unit composed of a turbine pump direct connected to an electric motor. This pump is held in reserve for use in case of very heavy water consumption when the pressure on the mains produced by the head of water in the tank may become insufficient in the higher zones of the distribution system. This pump is placed in operation by automatic electric control from a remote point. In addition to the pumping unit the supporting shell houses the regulating device which controls the admission of water to the tank.

The lower shell is provided with a door and several windows. The ladder to the tank rises from the floor of the pump-room and extends, inside the supporting shell, to an opening 2 ft. 6 ins. by 5 ft., which is made in the shell just below the tank bottom. Outside the shell at the level of the bottom of this opening there is a platform 2 ft. 6 ins. by 7 ft., which is supported on brackets from the shell. An outside ladder extends from this platform to a manhole opening in the roof of the tank.

The inner dome varies in thickness from 14 ins. to 8 ins. The outer dome varies from 12 ins. to 10 ins. A large scale detail drawing of the intersection of the two domes is shown herewith in Fig. 2. These two domes are so proportioned that their thrusts nearly balance. At the junction of the outer dome and shell of the tank there exists a great outward thrust from the weight of the shell of the tank and of the roof, which necessitated the placing of a large amount of steel, and in order to secure the co-operation of the steel and the concrete there was provided a section of concrete at this junction of 18 ins. by 30 ins.

The reinforcing of the tank consisted of ⅞-in. and ¾-in. square bars of high carbon steel. They are placed in two