ing table, abstracted from the journal of the Association, and added to with respect to data on Canadian plants. The following information regarding construction experiences in the United States is a summary of the discussion referred to above:—

Mr. H. B. Andrews, engineer of the Simpson Bros. Corporation, stated that his company has built 17 reinforced concrete standpipes in New England. In some cases difficulties have arisen, in others no trouble has been experienced. We quote from Mr. Andrews' discussion as follows:—

Waltham, Mass.—We commenced our work by building the Waltham reservoir in 1904 (see Table I. for dimensions). We had nothing to say in regard to the design of this reservoir. It was designed by the city engineer of Waltham, and the plans were gone over by Mr. Worcester, consulting engineer. There was not very much precedent at that time for the design of reinforced concrete standpipes. The proportion of concrete was 1:2:4, and the aggregate was especially selected to make it waterproof. The reservoir was built in successive lifts of about 3 ft. We anticipated some trouble at the joints if special precautions were not taken to prevent it. The joints were cleaned as we went up, and recesses were made in the preceding day's work by putting in strips of wood entirely round the tank to form a slot to engage the next day's work. The reservoir was plastered on the inside with ½ or ¾-in. plaster, and in the top half was painted with a neat cement wash. We found after the water was turned into the reservoir that the concrete in itself was not entirely waterproof and that the joints leaked to a certain extent. We decided to make some changes in the next reservoir we built.

Manchester, Mass.—This reservoir was 50 ft. in diameter and 72 ft. in height. We increased the richness of the mix to 1:1.5:3; we also increased the amount of the reinforcement between base and walls. We plastered this reservoir also on the inside, and when it was filled there was but very little leakage. Subsequently two or three cracks developed on the south side of the reservoir, caused by the unequal expansion due to the rigidity of the base and the expansion of its circular shell above, which caused a shear in the concrete and opened up a joint perhaps 30 ft. in length. That was repaired by putting a lead lining over that joint. But the continued change in expansion, due to the filling and the refilling of the tank and the change in the temperature, caused that joint to open again and some water to get in it, so that the leakage reappeared. This reservoir has been repaired by lining it with asphalt and felt over a certain extent of it, so that no leakage appears there now. But it was found necessary to increase the amount and length of vertical reinforcement as cracks appeared at the end of the rod which joined the floor to the wall.

Lisbon Falls, Me.—This we did in the succeeding tank which we built at Lisbon Falls. That tank also was built with 1:1:2 mix, and plastered, and it has not shown any leakage. That was built in 1909. I saw it last summer, and there was no water that leaked out through the tank and reached the ground. There was but one little spot half an inch in depth and the size of the hand where the frost had scaled off the surface. We found some vertical cracks in the reservoir at Manchester in the plastering and decided that the concrete was not thick enough. That is, there must be thickness enough of concrete to resist the tension in the tank, or else the tank will crack.

Rockland, Mass.—In the one we built at Rockland we built the tank with concrete walls thick enough and strong enough to resist all tension. We did not plaster the tank. The forms used consisted of movable wooden sections connected by a bolt extending to 1½ ins. from surface fitted with threaded sleeves. Into these threaded sleeves were screwed tap bolts fastening the forms together, and these tap bolts were later removed and the holes plugged for the 1½ ins. depth. We found that after the pressure had exceeded some 60 or 70 ft. of water there was enough pressure to force the water through at the plugs that we put in. There was a little channel under the bolts caused by settlement of concrete, and the water filtered through there to the outside plug and caused some trouble through the freezing of water near the surface, causing the scaling off of quite an area. We took out some of those bolts and replugged the holes, and had no further trouble in that respect. We had had some trouble with the joints in the first reservoir built. The Rockland reservoir was 104 ft. in height, and the Lexington reservoir was the same.

The later reservoirs that we have built have not exceeded 50 or 60 ft. in height. In those we used a 1:1:2 mix of cement, and we find that is impervious to water. We have had no leakage through the concrete whatever, and we have found that that proportion of cement is as good waterproofing material as we can put in concrete. We find that it also increases the strength of the concrete against cracking. The only trouble we have now—and we have had very little of that—is in the joints. Since we built our first reservoirs we have made some experiments on the protection of joints that have worked out very well.

I do not think we have had any leakage whatever in the standpipe at Winchester, Mass. On the one at West Falmouth, Mass., there has been no leakage. On the one at Woonsocket, R.I., there was a little efflorescence that showed around the joints when the tank was first built; it has now disappeared, and I do not think there is any there now. The one that was built at Jamestown, R.I., shows some seepage. There is a peculiar thing about that. I was down there three months after the tank was filled this winter. The superintendent of the waterworks, Mr. Kent, said there was no leakage of water whatever. I went over there, and as I approached I could see absolutely no seepage on that side of the tank, but there was a little seepage on the other side. Mr. Kent says these spots show more prominently on days when the humidity is high.

In these reservoirs up to 50 or 60 ft. in height we have had no trouble with surface damage by the frost—only in three reservoirs that I know of. That is the Rockland reservoir, the one that was built in Manchester, and the one that was built at Lexington—for the first 30 or 35 ft. in height, above that no trouble.

Mr. Bertram Brewer, city engineer of Waltham, Mass., made the following statement relative to the performance and present condition of the Waltham standpipe:—

The first year or two there was very little seepage; some at the joints, and a good deal of efflorescence and some stalactite formation on the outside of the wall. After being in use for a year or two the seepage began to increase considerably, so that when the tank was full (it is 35 ft. high) a considerable portion of it has been and is quite wet. It never has leaked or seeped sufficiently to cause the water to run down the sides to any extent. It has mostly evaporated before it got to the bottom. After the first two years this seepage has continued about the same every year.