Calculations of Cost of Excavating and Concreting

Length of Sec. Taken	Capacity Required	Proposed Sewer	Capacity	Crown	Exc. Lin. Ft.	Conc. Lin. Ft.	Total Exc.	Total Concrete	Exc. Cost $2.50 c.y.	Concrete Cost $10. c.y.	Total
654 ft.	164.5	Special shape, 4′ 3″ x 4′ 9″	173 c.f.s.	6″	0.954	0.385	614 c.y.	252 c.y.	$1537.	$2520.	$ 4057.
654 ft.	164.5	Special shape, 4′ 3″ x 4′ 9″	173 c.f.s.	7½″	0.983	0.414	633 c.y.	271 c.y.	1584.	2710.	4294.
654 ft.	164.5	Special shape, 4′ 3″ x 4′ 9″	173 c.f.s.	9″	1.012	0.443	652 c.y.	290 c.y.	1630.	2900.	4530.
654 ft.	164.5	Egg shape, 3′ 8″ x 5′ 6″	179 c.f.s.	9″	1.042	0.470	682 c.y.	308 c.y.	1705.	3080.	4785.
1,680 ft.	123	Special shape, 3′ 9½″ x 4′ 3″	129 c.f.s.	5½″	0.777	0.320	1305 c.y.	537 c.y.	3262.	5370.	8632.
1,680 ft.	123	Special shape, 3′ 9½″ x 4′ 3″	129 c.f.s.	7¼″	0.843	0.360	1416 c.y.	604 c.y.	3540.	6040.	9580.
1,680 ft.	123	Special shape, 3′ 9½″ x 4′ 3″	129 c.f.s.	9″	0.908	0.399	1525 c.y.	670 c.y.	3813.	6700.	10513.
1,680 ft.	123	Egg shape, 3′ 4″ x 5′ 0″	139 c.f.s.	9″	0.906	0.433	1520 c.y.	727 c.y.	3800.	7270.	11070.

From these calculations, it was decided to build the special shape, 4 ft. 3 in. by 4 ft. 9 in., with a nine-inch crown and a seven-inch invert. Later, it was decided to build the sewer all one size, 4 ft. 3 in. by 4 ft. 9 in. and at a grade throughout of 1 in 110, or 0.91%. This gave a capacity of 181.7 c.f.s.

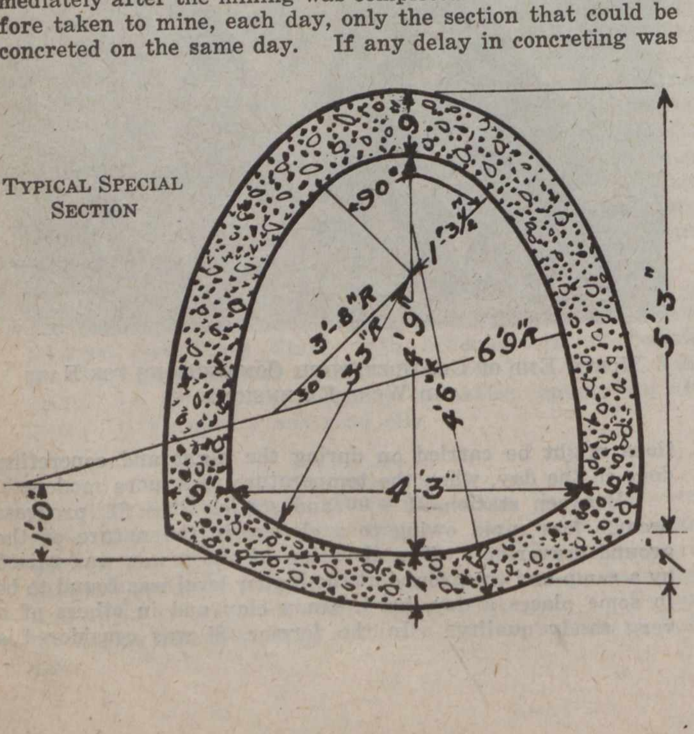
good day's achievement for the miners, while in the latter their operations were further retarded by the necessity of using timber sheeting all round the tunnel. In the case of the sandy clay ground just mentioned and the blue clay encountered in the earlier stages of the work, it was seldom that any timbering was required beyond two or three crown planks. Indeed, in some places, no timber at all was placed. In one stretch of the tunnel, fortunately of no great extent, small pockets of water were encountered by the miners, with the result that progress was slower, and that timber sheeting was required throughout. If tables of costs Nos. 3 and 5 are contrasted, the differences in the costs of mining operations in the three different types of ground will be readily seen. Table 5 represents the cost of mining of the last two classes of ground.

Calculation of Capacity

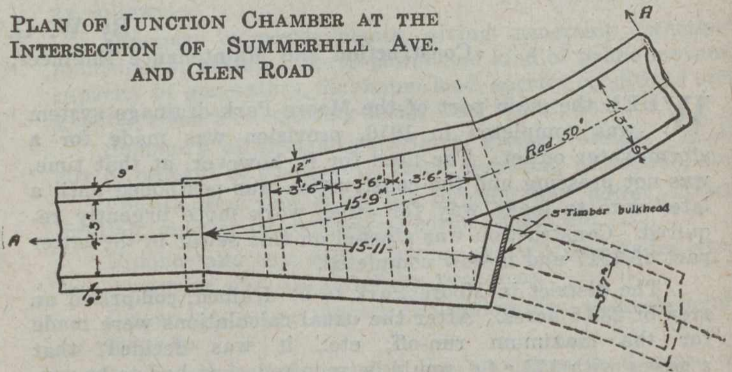
Area for 4 ft. 3 in. x 4 ft. 9 in. = 15.52 sq. ft.
Perimeter = 14.33 lin. ft.
R = 1.08304
$\sqrt{R}$ = 1.04
n = coefficient of friction = .013 for concrete.
C = coeff. for mean radius in ft. = 118.1
Therefore $AC\sqrt{R}$ = 1906
S = slope = 1/110.
Therefore capacity = $1906\sqrt{S}$ = 181.7 c.f.s.

In the concreting of this sewer, certain difficulties were overcome, and interesting features presented. Owing to the fact that the ground was flaky, and that sometimes large layers would shale off, the concreting had to be done immediately after the mining was completed. Care was therefore taken to mine, each day, only the section that could be concreted on the same day. If any delay in concreting was anticipated, the crown was well protected with planks. In a few instances, in spite of these precautions, large pieces of clay came down on top of the forms, after they were set, necessitating their removal. The space had again to be cleared and the forms reset thus entailing a considerable loss of time.

Typical Special Section

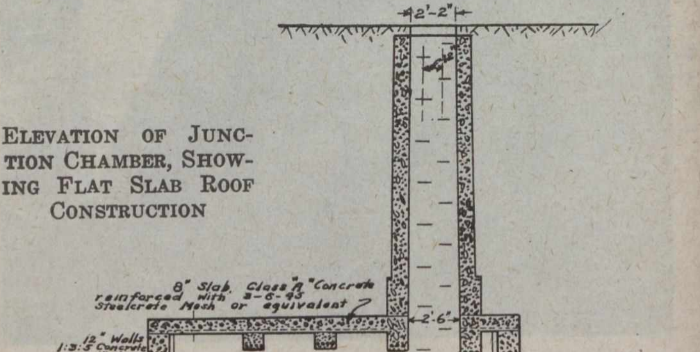


Plan of Junction Chamber at the Intersection of Summerhill Ave. and Glen Road



The concrete was all poured into the forms from the crown through inlets 8″ in diameter, bored from the surface of the ground. On the day when the concrete was to be poured, these 8″ holes were bored, and were then covered

Elevation of Junction Chamber, Showing Flat Slab Roof Construction



until required. In the severe weather, when there were several feet of frost in the ground, a passage through it was made for the auger by thawing the ground with steam. The holes were in a line so as to come exactly in the centre of the crown and, the concrete forms being in 8′ lengths, were always 8′ apart. The holes were arranged to come at the back or up-grade end of the 8′ length to be poured, because it was easier to pull the concrete forward, than to shove it back to be worked into place, and also because it would flow more freely with the grade. At the end of the form a bulkhead was put in, in sections, starting at the bottom and con-