tunately, hard frozen sides and there must have been a loss of heat to the frozen ground.

After being flooded with water at 32° F. for 70 days till 25th June, when the water was 55° F., the concrete was still soft enough to penetrate easily with a steel bar or pick. In 30 days, however, the mass was hard enough to resist repeated blows of a pick and only a few inches of the surface required to be removed.

The following gives an idea of the weather during one cold period in February, 1910:—

Record of Temperature.

1910	Day		Night	
	Maximum	Minimum	Maximum	Minimum
February 5	0°	-16°	-10°	-23°
" 6	-13°	-16°	-10°	-26°
" 7	19°	-10°	12°	26°
" 8	32°	26°	28°	- 3°
" 9	5°	- 3°	2°	-18°
" 10	- 3°	-18°	- 8°	-30°
" 11	17°	-24°	6°	2°
" 12	18°	4°	12°	-14°
" 13	21°	-10°	20°	13°
" 14	31°	17°	18°	-18°
" 15	1°	-14°	2°	- 7°
16	9°	0°	2°	-22°

The chemical and physical action of setting is illustrated by the following temperature records of concrete built by the Department of Public Works at St. Andrews dam, north of Winnipeg in 1907.

A pipe with closed bottom and a screw top was placed low in the concrete, a thermometer being suspended inside from the screw top. As the wall or structure came up, additional lengths of pipe were added. For the sake of comparison the results in the accompanying table are given for three different parts of the work showing considerable range of condition of laying. In this table (A) is the pivot pier of lock, a heavy mass of concrete 35 ft. high and built in summer, during August, 1907; (B) is submerged dam, Span No. 1, winter work, January, 1908, working 11 hours a day, and (C) is submerged dam, Span No. 4, winter work, January, 1909, working night and day.

Table Showing Varying Temperatures of Setting Concrete.
(Fahrenheit Degrees Above Zero.)

(A) Pivot Pier, built Aug. 1907			(B) Span 1 of Dam, winterwork, 11-hour day.			(C) Span 4 of Dam, winterwork, working night and day.		
Date 1907	Temperatures		Date 1908	Temperatures		Date 1909	Temperatures	
	In pipes	In Air		In pipes	In Air		In pipes	In Air
Aug. 28	Pipe set	65	Jan. 18	Pipe set	50	Jan. 20	Pipe set	53
Aug. 29	82.5	64	" 19	65	50	" 21	72	53
	84	69	" 20	75	50	" 22	80	......
	86.5	64	" 21	77	......	" 22	83	......
Aug. 30	82.5	68	" 24	76	......	" 23	86	......
	86	76	" 27	78	......	" 23	87	......
	91.5	66	Feb. 5	78	......	" 24	88	......
Aug. 31	96	74	" 8	78	......	" 24	110	......
	98	77	" 9	76	......	" 25	111	......
Sept. 2	99	60	" 10	76	......	" 26	110	......
" 3	104	64	" 12	75	......	" 26	110	......
" 9	103	......	" 18	70	......	" 27	108	......
" 11	103	......	" 22	65	......	" 30	80	......
" 12	105	......	" 26	65	......	Feb. 2	80	......
" 19	110	......	" 29	63	......	" 3	80	......
Oct. 11	102	......	Mar. 2	62	......			
Nov. 5	82	......	" 4	61	......			
1908		......	" 6	60	......			
Aug. 16	49	65	" 9	57	......			
" 29	51	......	" 13	54	......			
Sept. 25	52	43	" 17	50	......			
			" 24	45	......			
			" 31	42	......			
			April 3	42	......			
			" 6	40	......			
			" 8	39	......			
			" 9	38	......			
			Reading stopped by flood. Aug. 16 Pipes 62; Air 65; Water 67.					

No doubt, the Timiskaming concrete rose in temperature at some stage in setting.

For winter work, a new practice is to use very quick setting cement that hardens before it is cooled below chemical action temperatures. Work of this kind was done on the power plant near St. Timothee, Que., during this same cold winter of 1910. By mistake, a car of the quick setting cement, made at the International Works, Hull, Que., came to Timiskaming. Its hardening was so rapid that its surface could scarcely be smoothed over. The first batches being especially troublesome, because nothing of the kind was expected. The result was apparently as good concrete as any laid, however.

Designs of Sluiceways.—Plans and views of these sluiceways are shown in Fig. 5. The sill platform is at elevation 570, or 19 feet below standard level of reservoir. It would have been preferable to have the sill 5 feet lower, but the excavation necessary to cut down the approach channel would have doubled the cost.

Between the island and Ontario shore, the width was about 400 feet, so the design was made for 16 sluiceways each 20 feet wide with a pier 5 feet wide between. The piers have recesses to hold a movable curtain wall formed of horizontal timbers, 18 inches square, that can be hoisted out one by one. This is a removable dam and during spring floods all the timbers will be lifted out, leaving a larger exit than under natural conditions, because the Ontario channel has been deepened. To draw off the lower layer of storage during March, however, requires deeper sluice openings, and so advantage of the depth in the deep Quebec Channel was taken to place those sills at elevation 565, or 5 feet lower.

Minimum Discharge at Timiskaming Sluices.—The minimum through Timiskaming should be about 20,000 c.f.s. and lake surface must be 573.95 to discharge the total amount as shown by the following calculation made by H. H. Donnelly, assistant engineer:

Taking 572.1 as elevation of water below Timiskaming dam for a discharge of 20,000 c.f.s., then:—

16 Ontario sluices, each discharging with 0.95 feet head and 2 feet submergence at the rate of 20.5 c.f.s. per foot of crest, total 16 x 20.5 x 20 .... 6,560 c.f.s.

13 Quebec sluices, each discharging with 0.95 feet head and submergence at the rate of 52.5 c.f.s. per foot of crest; total 13 x 52.5 x 20 .... 13,650 c.f.s.

20,210 c.f.s.

If the Ontario sills were as low as the Quebec side, then, with Timiskaming lake surface elevation 573.05 and the surface below dam elevation 572.1, the discharge would be:—

16 Ontario sluices, each discharging with 0.95 feet head, and 7 feet submergence at rate of 35 c.f.s., total .... 11,200 c.f.s.

13 Quebec sluices, each discharging with 0.95 feet head, and 7 feet submergence at rate of 35 c.f.s., total .... 9,100 c.f.s.

20,300 c.f.s.

As designed, the lake surface can only be drawn down to elevation 573.95, instead of elevation 573.05, so a layer 0.9 feet thick is rendered unavailable.

As before stated, however, lowering the Ontario channel would double the cost which is not warranted at present.

Foundations.—The foundation of the sluices is shown in Fig. 5. It consists of a concrete platform, 3 feet thick, strong enough to support a pier, if undermined during a flood, till repairs could be made. To prevent under scour,