PAGES

MISSING

The Canadian Engineer

A weekly paper for civil engineers and contractors

Moore Park Drainage System, Toronto

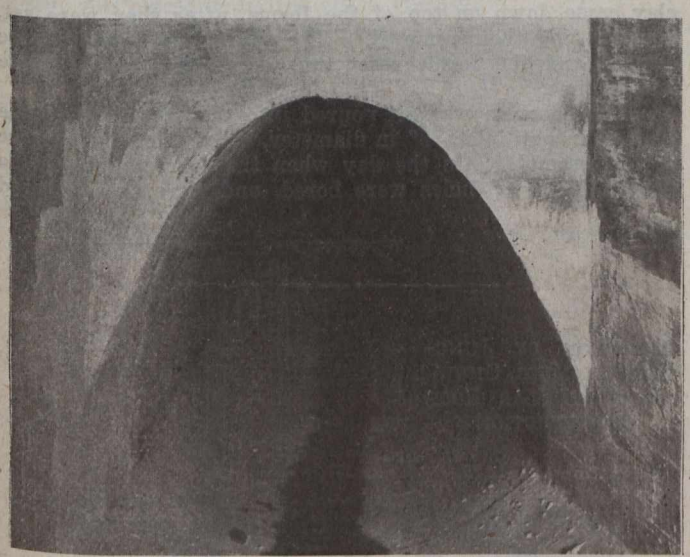
Special Culvert-Type Design Used in Toronto for the First Time—Comparisons With Other Sections—4 ft. 3 in. by 4 ft. 9½ in. Special Section in Tunnel Required 13½ cu. ft. of Concrete and 30 cu. ft. of Excavation per Lineal Foot

By W. G. CAMERON

Construction and Maintenance Engineer, Sewer Section, Works Department, Toronto

WHEN the main part of the Moore Park drainage system was completed in 1916, provision was made for a storm-water outlet. The need for it, however, at that time, was not pressing and the construction was postponed until a later date to make way for other work more urgently required. Construction was started on this sewer in the latter part of 1917 and is now completed.

The district in Moore Park to be drained, comprised an area of 233.5 acres. After the usual calculations were made for the maximum run-off, etc., it was decided that a sewer with 173 c.f.s. would be required. It had to be considered that this sewer was to be built in tunnel and head room for the miners, etc., was a very important consideration.



SOUTH END OF JUNCTION CHAMBER, LOOKING INTO COMPLETED SEWER

The most economical shape to construct had then to be decided upon, and was arrived at by a consideration of circular, egg and special designs.

	Special Shape 4′ 3″ x 4′ 9″	Equivalent Egg Shape 3′ 8″ x 5′ 6″	Equivalent Circular 4′ 5″
Excavation per lin. ft.	27.2 c.f.	30.02 c.f.	27.49 c.f.
Concrete per lin. ft.	11.68 c.f.	13.15 c.f.	12.17 c.f.
Excavation per lin. ft.	3′ 9½″ x 4′ 3″ 22.88 c.f.	3′ 4″ x 5′ 0″ 24.46 c.f.	3′ 11″ 23.04 c.f.
Concrete per lin. ft.	10.6 c.f.	11.69 c.f.	10.99 c.f.
Excavation per lin. ft.	3′ 7″ x 4′ 0″ 21.36 c.f.	3′ 2″ x 4′ 9″ 22.68 c.f.	3′ 9″ 21.65 c.f.
Concrete per lin. ft.	10.24 c.f.	11.15 c.f.	10.61 c.f.

The circular shape was eliminated. The two remaining shapes are considered in detail in the table at the top of the next page.

The sewer was built from Beaumont Rd. to Summerhill Ave. along Glen Rd. in tunnel throughout its entire course. The material used was 1:3:5 concrete, and the shape was of the culvert type as shown on the next page, which is a design adopted for the first time in Toronto.

The ground, through which the tunnel passes, is mostly (or to speak exactly, from station 3 + 01 to station 21 +00) a soft, dry blue clay. Through this, good progress was made, 10 lin. ft. per day being mined with ease. The advance accomplished daily was between 8′ and 12′, depending entirely on the amount of time required for concreting.

The amount of concreting, in its turn, was determined to a great extent by the conditions of the weather which, it will be remembered, was of an unprecedented inclemency during the winter of 1917-1918, when part of this work was under construction. During the nights, which is the time usually chosen for concreting, the cold was frequently so intense that materials could not, for any long period, be kept sufficiently warm. It accordingly became necessary to construct in short lengths, or to alter the shifts so that mining operations might be carried on during the night and concreting done in the day, when the temperature was more moderate.

NORTH END OF CHAMBER, WITH CONNECTIONS FOR EAST AND WEST EXTENSIONS

Between station 21 + 00 and station 23 + 31, progress became less rapid owing to a change in the nature of the ground traversed. The elevation of the sewer was raised by a ramp and the ground at the higher level was found to be in some places a dry, hard, sandy clay and in others of a very sandy quality. In the former, 8′ was considered a

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.

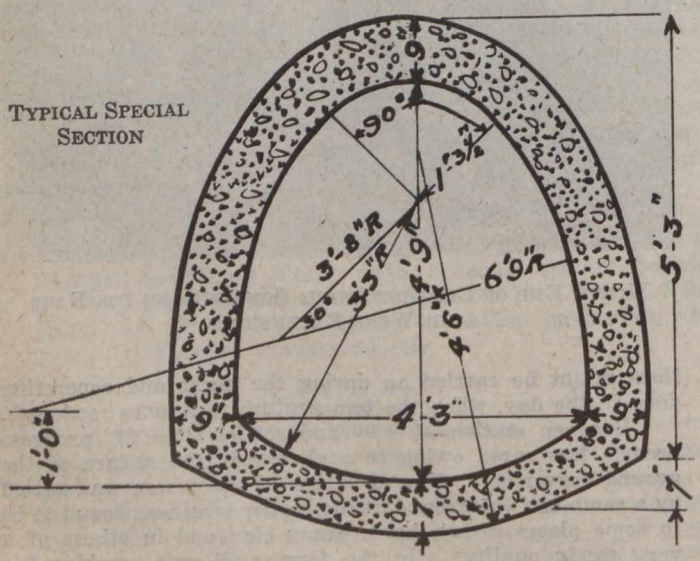
good day's achievement for the miners, while in the latter their operations were further retarded by the necessity of using timber sheeting all round the tunnel. In the case of the sandy clay ground just mentioned and the blue clay encountered in the earlier stages of the work, it was seldom that any 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

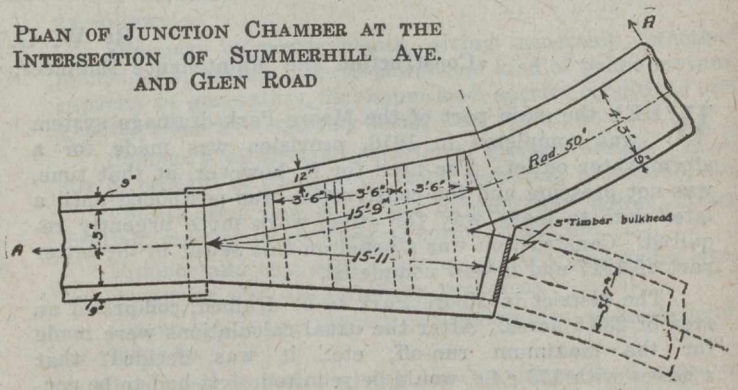
Area for 4 ft. 3 in. x 4 ft. 9 in.	= 15.52 sq. ft.
Perimeter	= 14.33 lin. ft.
R	= 1.08304
$\sqrt{R}$	= 1.04
n = coefficient of friction	= .013 for concrete.
C = coeff. for mean radius in ft.	= 118.1
Therefore $AC\sqrt{R}$	= 1906
S = slope = 1/110.	
Therefore capacity = $1906\sqrt{S}$	= 181.7 c.f.s.

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

TYPICAL SPECIAL SECTION



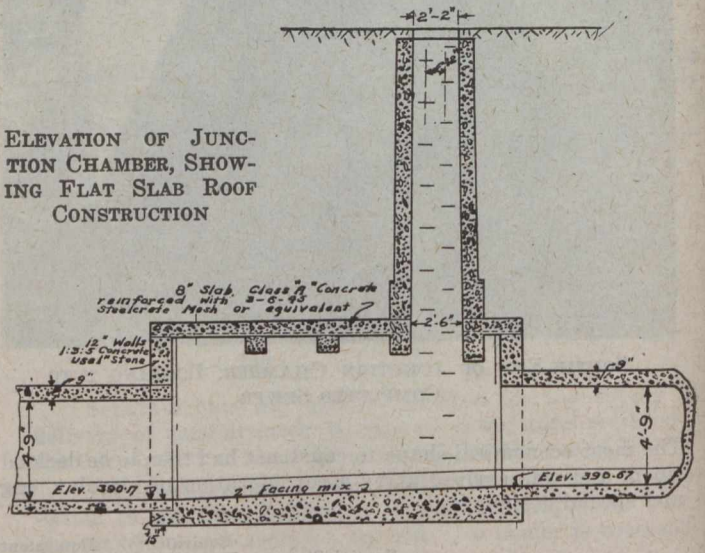
PLAN OF JUNCTION CHAMBER AT THE INTERSECTION OF SUMMERHILL AVE. AND GLEN ROAD



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.

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-

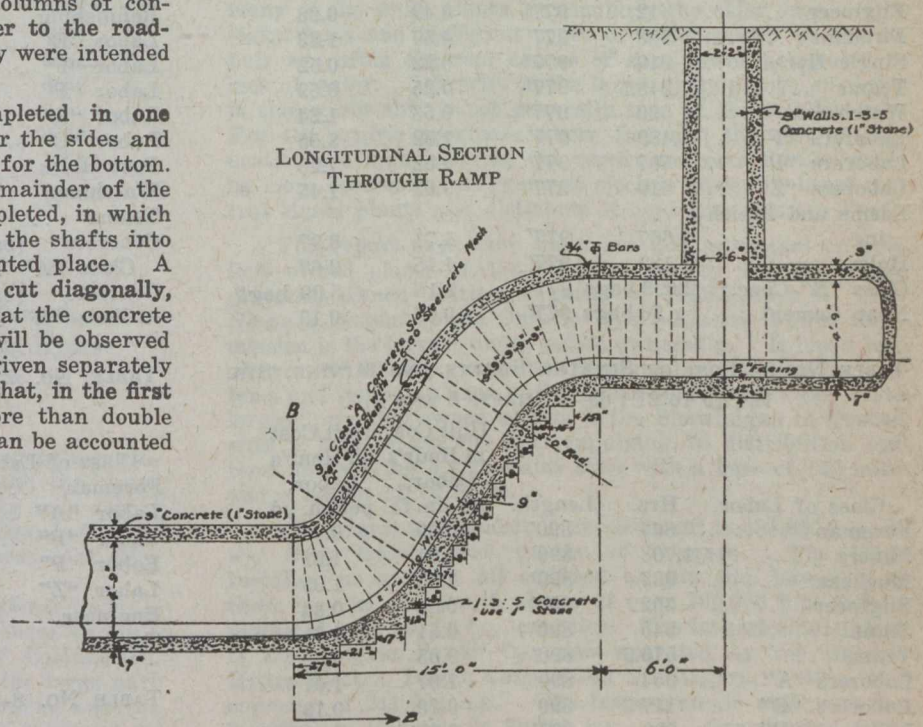
tinuing, section by section, as the filling of the form progressed, until the last section was put in place. Pouring was continued until the 8" hole was completely filled to the surface of the ground. After the concrete was set, and the bulkhead removed, it was found that the weight of green concrete, pressing towards the form had filled every space. Perhaps in a future age, some antiquarian, in the course of his excavations, may come across these 8" columns of concrete extending from the crown of the sewer to the roadway and may come to the conclusion that they were intended as some sort of support for the pavement.

The mining for each section was completed in one operation, but the pouring of the concrete for the sides and walls was not done at the same time as that for the bottom. Usually, the bottom was placed after the remainder of the section of sewer between two shafts was completed, in which case the concrete was poured down chutes in the shafts into waiting cars which conveyed it to its appointed place. A key 2" deep, formed by a 4" x 4" scantling cut diagonally, was left near the bottom of the walls so that the concrete of the bottom would key into the walls. It will be observed that the costs of this part of the work are given separately in tables 9, 10 and 11. It will also be noted that, in the first table, the cost of the labor amounts to more than double what it does in the other two tables. This can be accounted for by the fact that the work, referred to in the first table, was carried on in the middle of the winter, when all material required heating and rehandling and that, in the later stages of the work, during the spring, the men were more experienced and, consequently, more skilful.

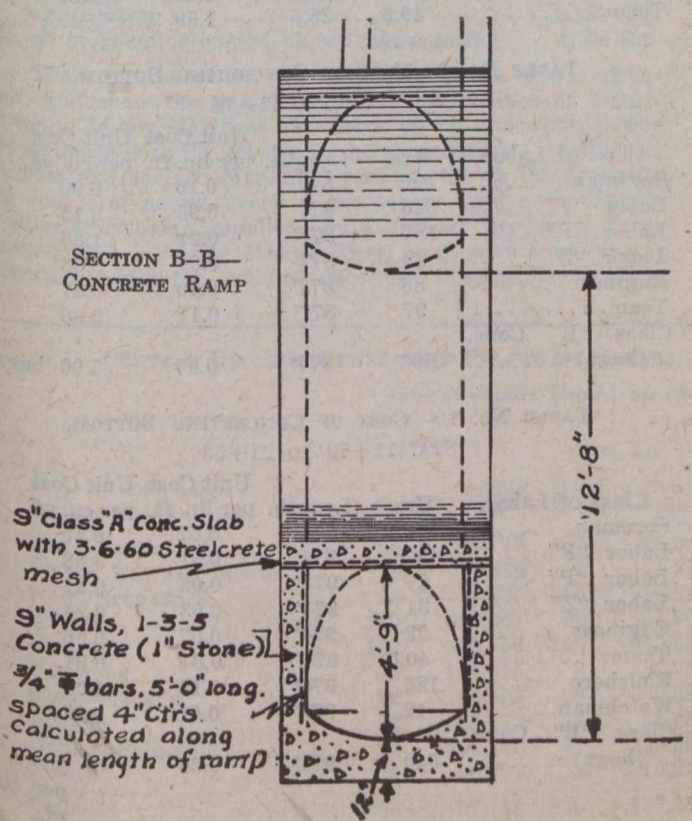
For the concrete in this work, 1" stones, screened from gravel, was used exclusively—both it and the sand being kept warm by steam coils placed under the piles. The face of the invert was worked to a smooth finish. This was so well done that the co-efficient of friction may be expected to be very low, possibly not more than $n = 0.012$. On the ramp and in the junction chamber, the inverts were coated with a 2" facing mixture, consisting of one part cement to two parts ⅜" crushed granite. All slabs and beams were built of class A mix, one part cement to two parts sand to four parts 1" stone.

The intention is that this contract will complete the sewer to Summerhill Ave. and Glen Rd., where a junction chamber was constructed with branches east and west for future extensions, for the construction of which the contract is now nearing completion. Meanwhile, the ends of the branches were temporarily sealed by 3" timber bulkheads.

It will be noted that in the calculations of costs, 11.68 cu. ft. of concrete per lineal ft. of sewer is assumed. In the actual construction, however, allowance has to be made for overbreak in mining, for shaling, small slides, and spaces between supports etc. According, it is estimated that 13½ cu. ft. of concrete per lin. ft. of sewer must be allowed. 10½ cu. ft. for the crown and sides and 3 cu. ft. for the invert. Similarly, the excavation per lin. ft. amounted to somewhat over 1 cu. yd. or, approximately, 30 cu. ft. The shafts, which were timbered from top to bottom, were about 25 ft. deep and were 8 ft. by 10 ft. in area. The shafts for manholes were seven in number, but, owing to the difficulty of keeping the costs separately, costs are given for the sinking of only two of them. Only costs are given here which are known to be absolutely accurate.



LONGITUDINAL SECTION THROUGH RAMP



SECTION B–B— CONCRETE RAMP

The contractor was A. W. Godson Contracting Co. Ltd., and the resident engineer for the city was R. W. Dickie.

Following is the key to letters used in the cost tables: A, excavation; B, timbering; C, backfilling; D, moving surplus; E, forms; F, concrete; G, pipe-laying; P, rehandling material; Q, moving plant; Z, miscellaneous.

TABLE NO. 1—COST OF SINKING SHAFTS AND MINING, STA. 3+01 TO 12+79—(SHAFTS 3 AND 4)

Class of Labor.	Hrs.	Length.	Unit Cost in Hour's Labor, per lin. ft.	Unit Cost in Hour's Labor, per cu. yd.
Foreman	577	978′	0.59	0.59
Miners	2,183	978′	2.23	2.23
Muckers	1,270.5	978′	1.29	1.29
Engineers	553	978′	1.57	1.57
Signalmen	710.5	978′	0.73	0.73
Teams	1,107	978′	1.13	1.13
Laborers "A" ..	1,189	978′	1.22	1.22
Laborers "B" ..	254	978′	0.26	0.26
Laborers "P" ...	389	978′	0.39	0.39
Laborers "Z" ...	494	978′	0.51	0.51

TABLE No. 2—COST OF CONCRETING WALLS AND CROWN, STA. 3+01 TO 12+78

Class of Labor.	Hrs.	Length.	Unit Cost in Hour's Labor, per lin. ft.	Unit Cost in Hour's Labor, per cu. yd.
Foreman	563	977'	0.58	1.34
Engineer	412	977'	0.42	0.98
Fireman	558	977'	0.57	1.33
Single Horse ...	219	977'	0.22	0.52
Teams	248.5	977'	0.25	0.59
Watchman	520	977'	0.53	1.24
Laborers "F" ..	1,489	977'	1.52	3.55
Laborers "P" ..	507	977'	0.52	1.20
Laborers "Z" ..	610	977'	0.62	1.45
Forms and Finishing	1,667	977'	1.71	3.97
Holes	1,122	977'	1.15	2.67
Class "B" Conc. .	2,099 bags	977'	2.15	5.00 bags
Neat Cement ..	56 bags	977'	0.06	0.13

TABLE No. 3—COST OF SINKING SHAFTS AND MINING, STA. 12+79 TO 21+69—(SHAFTS 5 AND 6)

Class of Labor.	Hrs.	Length.	Unit Cost in Hour's Labor, per lin. ft.	Unit Cost in Hour's Labor, per cu. yd.
Foreman	347	890'	0.39	0.39
Miners	1,703	890'	1.91	1.91
Muckers	937	890'	1.05	1.05
Engineer	302	890'	0.34	0.34
Signal	545	890'	0.61	0.61
Teams	576.5	890'	0.65	0.65
Laborers "A" ...	954	890'	1.07	1.07
Laborers "B" ..	117	890'	0.13	0.13
Laborers "P" ...	599	890'	0.67	0.67
Laborers "Z" ...	408	890'	0.46	0.46
Watchman	162	890'	0.18	0.18

TABLE No. 4—COST OF CONCRETING WALLS AND CROWN, STA. 12+78 TO 21+68

Class of Labor.	Hrs.	Length.	Unit Cost per lin. ft.	Unit Cost per cu. yd.
Foreman	276	890'	0.31	0.66
Engineer	283	890'	0.32	0.67
Finishers	216	890'	0.24	0.51
Bricklayer	4	890'	...	...
Teams	126	890'	0.14	0.30
Watchman	118	890'	0.13	0.28
Laborers "F" ...	1,302.5	890'	1.44	3.10
Laborers "P" ...	45	890'	0.05	0.11
Laborers "Z" ...	83	890'	0.09	0.20
Laborers "E" ...	1,026.5	890'	1.15	2.45
Holes	1,061	890'	1.19	2.53
Class "B" Concrete (bags)	2,098.5	890'	2.36	5.00
Neat Cement (bags)	45	890'	0.05	0.11

TABLE No. 5—COST OF SINKING SHAFTS AND MINING, STA. 21+69 TO 28+05.1—(SHAFTS 7 AND 8)

Class of Labor.	Hrs.	Length.	Unit Cost per lin. ft.	Unit Cost per cu. yd.
Foreman	283	611'	0.46	0.46
Labor "A"	866	611'	1.42	1.42
Labor "B"	248	611'	0.40	0.40
Labor "P"	229	611'	0.37	0.37
Labor "Q"	99	611'	0.16	0.16
Labor "Z"	225	611'	0.37	0.37
Miners	1,473	611'	2.41	2.41
Muckers	768	611'	1.25	1.25
Signalmen	640	611'	1.05	1.05
Watchman	270	611'	0.44	0.44
Engineer	379	611'	0.62	0.62
Teams	584	611'	0.95	0.95

TABLE No. 6—COST OF CONCRETING WALLS AND CROWN, STA. 21+68 TO 23+31 AND 23+46 TO 28+05

Class of Labor.	Hrs.	Length.	Unit Cost per lin. ft.	Unit Cost per cu. yd.
Foreman	417	622'	0.67	1.27
Engineer	317	622'	0.50	0.97
Finisher	548	622'	0.88	1.67
Refinishing	97	622'	0.15	0.29
Labor "E"	762	622'	1.22	2.32
Labor "F"	1,343	622'	2.15	4.08
Labor "P"	47	622'	0.07	0.14
Labor "Z"	139	622'	0.22	0.42
Labor "C"	74	622'	0.12	0.23
Post Holes	720	622'	1.15	2.19
Watchman	318	622'	0.51	0.97
Teams	112	622'	0.18	0.34
Concrete (bags) Class "A"	63	622'	0.10	0.19
Concrete (bags) Class "B"	1,644	622'	2.64	5.00

TABLE No. 7—COST OF EXCAVATING SHAFT No. 5—SIZE 8' x 10' x 25'.4 = 75.26 CU. YDS.

Class of Labor.	Hrs.	Depth.	Unit Cost per lin. ft.	Unit Cost per cu. yd.
Foreman	40.5	25.4	1.60	0.54
Labor "A"	315	25.4	12.37	4.19
Labor "B"	54	25.4	2.13	0.71
Labor "P"	18	25.4	0.70	0.24
Labor "Z"	13.5	25.4	0.53	0.18
Engineer	9	25.4	0.04	0.01
Team	40	25.4	1.58	0.53

TABLE No. 8—COST OF EXCAVATING SHAFT No. 6—SIZE 8' x 10' x 25'.5 = 75.6 CU. YDS.

Class of Labor.	Hrs.	Depth.	Unit Cost per lin. ft.	Unit Cost per cu. yd.
Foreman	36	25.5	1.41	0.48
Labor "A"	279	25.5	10.94	3.69
Labor "B"	63	25.5	2.47	0.83
Labor "P"	27	25.5	1.06	0.36
Labor "Z"	4.5	25.5	0.02	0.06
Engineer	9	25.5	0.04	0.01
Team	40.5	25.5	1.59	...

TABLE No. 9—COST OF CONCRETING BOTTOM, STA. 3+01 TO 11+78

Class of Labor.	Hrs.	Length.	Unit Cost per lin. ft.	Unit Cost per cu. yd.
Foreman	90	877'	0.10	0.90
Labor "F"	820	877'	0.93	8.15
Labor "P"	187	877'	0.21	1.86
Labor "Z"	83	877'	0.09	0.83
Engineer	88	877'	0.10	0.87
Team	97	877'	0.11	0.96
Class "B" Conc. (bags)	503	877'	0.57	5.00 bags.

TABLE No. 10—COST OF CONCRETING BOTTOM, STA. 11+79 TO 21+53

Class of Labor.	Hrs.	Length.	Unit Cost per lin. ft.	Unit Cost per cu. yd.
Foreman	72	974'	0.07	0.56
Labor "F"	497	974'	0.51	3.88
Labor "P"	27	974'	0.03	0.21
Labor "Z"	31	974'	0.03	0.24
Engineer	72	974'	0.07	0.56
Teams	40.5	974'	0.04	0.31
Finishers	126	974'	0.13	0.98
Watchman	12	974'	0.01	0.93
Class "B" Conc. (bags)	640	974'	0.66	5 bags per. cu. yd.

TABLE NO. 11—COST OF CONCRETING BOTTOM, STA. 21+50 TO 23+31 AND 23+46 TO 28+05

Class of Labor.	Hrs.	Length.	Unit Cost in hrs. per lin. ft.	Unit Cost in hrs. per cu. yd.
Foreman	63	640′	0.09	0.88
Labor "F"	239	640′	0.37	3.32
Labor "Z"	53	640′	0.08	0.74
Engineer	58	640′	0.09	0.81
Finisher	78	640′	0.12	1.08
Team	..	....	....	....
Class "B"	360	640′	0.56	5.00
Watchman	54	640′	0.08	0.75

ELECTRIC GENERATION IN CANADA

Directory of Central Stations Issued by the Commission of Conservation Gives Complete Data Regarding Hydro-Electric, Steam-Driven and Producer Gas Plants

INSTALLED capacity of central electric generating stations in Canada is 2,107,743 h.p., although the total maximum load is only 1,078,298 k.w., according to a report on "Electric Generation and Distribution in Canada," written by Leo G. Denis and issued by the Commission of Conservation.

"The investigation into this subject has extended over a number of years and has been a most comprehensive one." says "Conservation," the official organ of the Commission. "Two of the principal points to bring out are the large part water-power plays in the production of electricity and the fact that over three times as much power is produced by privately owned plants as by those publicly owned."

There are, according to the report, 565 electric generating plants in Canada, supplying 752 distributing systems, which serve 973 localities. Classified according to the prime-movers used, these plants are divided as follows:—

270 hydro-electric, aggregating ..... 1,806,618 h.p.
201 steam plants, aggregating ..... 288,202 h.p.
49 gas plants (nearly all producer-gas), aggregating ..... 8,157 h.p.
45 oil or gasoline engine plants, aggregating 4,766 h.p.

These figures give a very fair idea of the power situation, and show the unquestionable predominance of water-power. In the Maritime Provinces, steam and water-power predominate with the former in the ascendancy. In Quebec, Ontario and eastern Manitoba, water-power is the dominating source of power, every large centre and most of the smaller ones being supplied by electricity produced from water-power. In the Middle West, large plants are steam operated, while the smaller ones use internal combustion engines. In British Columbia and western Alberta, water-power again predominates, but the generous coal supply in certain districts also permits considerable steam operation.

In the large hydro-electric installations, the report says, the type of plant is of the most up-to-date and substantial construction, but the same, unfortunately, cannot be said of many of the small plants, particularly the older ones. Old, leaky dams and inefficient types of water-wheels in bad repair are often the real causes of shut-downs attributed to lack of water. Likewise in the large steam plants, efficiency is shown but this is not generally true of the smaller ones. For the prairie provinces where fuel and the cost of generation are high in price, the report suggests that it would be more economical to generate electric power in large central steam plants and distribute it over transmission lines.

The report says that there are 207 municipal or publicly owned plants of 452,508 h.p. capacity and 358 plants privately owned with a capacity of 1,655,235 h.p. The Niagara system of the Ontario Hydro-Electric Power Commission is the largest under public ownership. It has a load of over 201,000 h.p., supplies 120 municipal distributing systems and serves an area of 210 miles long by 85 wide. The largest privately owned system is the Shawinigan in Quebec, with a load of 205,000 h.p., supplying 76 distribution systems and serving a triangular area with a base of 140 miles and a height of 75 miles.

The largest hydro-electric development is 488,800 h.p., in the three large power plants at Niagara. The large installations are not all confined to this site, however, as there are, in addition, 5 plants of over 100,000 h.p. and 36 plants of over 10,000 h.p. capacity. The largest single plant is the Ontario Power Co., now operated by the Ontario Hydro-Electric Power Commission at Niagara, with a total capacity of 211,300 h.p. The largest single unit thus far installed in Canada is 20,000 h.p., at Grand'mere, Que., though the Ontario Hydro-Electric Chippawa plant will contain units of 50,000 h.p., while future plans are said to contemplate use of 100,000 h.p. units.

The average head of water utilized is not exceedingly high, but many large hydro-electric plants operate under fairly high heads, such as 140 to 180 ft. at Niagara, 145 ft. at Shawinigan, 83 ft. at Grand'mere and 400 ft. at the Coquitlam-Buntzen plants near Vancouver. The highest head in eastern Canada is 540 ft., at the 8,000 h.p. plant at Eugenia Falls, Ont., while, in the West, a head of 1,820 ft. is utilized at Britannia Beach, B.C., where the development also provides a total head of 3,530 ft. in two steps of 1,450 ft. and 2,080 ft. for the direct operation of other machinery. On the other hand, one of the largest plants, recently installed, at Cedars, Que., operates under a head of 30 feet.

The 26,667-horse-power plant at Hamilton, Ont., is the largest steam-power plant in Canada and is used as an auxiliary. The 14,234-h.p. plant at Edmonton, Alta., is the largest steam plant operated continuously, says the report.

CENTRAL ELECTRIC GENERATING PLANTS IN CANADA, SHOWING CAPACITY, OWNERSHIP AND PRIME MOVERS

(From report issued by the Commission of Conservation)

Province	Plants		Ownership: Private		Ownership: Public		Kind of prime mover: Hydraulic		Kind of prime mover: Steam		Kind of prime mover: Internal Combustion	
	No.	Capacity h.p.	No. of Plants	Total capacity h. p.	No. of Plants	Total capacity h. p.	No. of Plants	Total capacity h.p.	No. of Plants	Total capacity h.p.	No. of Plants	Total capacity h.p.
Nova Scotia	38	27,177	24	23,064	14	4,113	12	3,474	23	23,478	3	225
Prince Edward Island	9	1,314	9	1,314	..	.....	5	207	2	475	2	632
New Brunswick	23	18,607	16	16,212	7	2,395	8	7,462	12	10,014	3	1,130
Quebec	119	625,061	99	604,903	20	20,158	92	585,911	20	38,791	7	359
Ontario	173	899,856	105	609,658	68	290,198	113	831,004	50	66,519	10	2,333
Manitoba	23	103,015	8	53,706	15	49,309	4	78,550	13	23,841	6	624
Saskatchewan	62	30,593	26	2,682	36	27,911	..	.....	15	26,585	47	4,008
Alberta	52	85,117	27	43,235	25	41,882	4	31,980	42	51,805	6	1,332
British Columbia	63	306,776	41	290,234	22	16,542	31	258,029	22	46,467	10	2,280
Yukon	3	10,227	3	10,227	..	.....	1	10,000	2	227	..	.....
Canada	565	2,107,743	358	1,655,235	207	452,508	270	1,806,618	201	288,202	94	12,923

No less than 59 plants report the successful operation of storage facilities to provide for increased flow at low-water periods. Among government undertakings of this nature may be mentioned the three large reservoirs at Lakes Timiskaming, Kipawa and Quinze to regulate the flow of the Ottawa River; La Loutre reservoir on the St. Maurice River; Lake St. Francis dam for the St. Francis River, Que.; the extensive system of smaller conservation reservoirs on the Trent River, Ont.; Lake Minnewanka, on the upper waters of Bow River, Alta.; and the reservoirs on Jordan River and Goldstream, near Victoria, B.C. Most satisfactory results have been obtained from storage undertakings, the capacity of plants being frequently doubled or more than doubled.

Generating Data

"Practically all energy for distribution is generated as alternating current," says the report. "The types of generators comprise various phases, frequencies and voltages. All large plants and a great many of the smaller plants operate at three-phase; a number of the older plants, some of a fair size, still use two-phase, while the single-phase systems are confined to small plants which have also been installed for some time.

"The principal frequencies used are 60, 30 and 25 cycles, while frequencies of over 100 cycles are still found in the older plants of small size. There is naturally a great variety of generator voltages, these being adapted to suit the most economic power plant design. In plants supplying distribution systems direct at the generator voltage, we find 2,200 volts predominates; also 550 volts where a large amount of motive power is supplied near the plant; also 12,000 volts in plants where all or a portion of the energy is transmitted a certain distance at this voltage.

"With the exception of electric railway service and, in a few places for a portion of the industrial power service, direct current generation is practically confined to very small plants. Such plants sometimes use storage batteries to provide continuous service, while the generating units operate only a portion of the time. In this connection, storage batteries are very convenient, but often too little attention is given to the batteries. Such lack of care results in rapid deterioration and the batteries soon become very inefficient if not almost useless, whereas, if proper attention had been given, satisfactory service could have been expected.

"The aggregate maximum demand on the plants included in this report is 1,078,298 k.w., of which 1,003,955 k.w. is on hydro-electric, 69,924 k.w. on steam, and 4,419 k.w. on internal combustion engine plants. The division between the various services, such as lighting and power, could not be obtained from all plants and systems, but available data indicate that 31% is used for lighting, 59% for power and 10% for miscellaneous. The load factor on the larger plants is stated in the report, but, in some instances, such information respecting the smaller plants was unobtainable. For the larger hydro-electric plants, the load factor usually varies from 50 to 80%, while in plants supplying large blocks for metallurgical or chemical purposes, it may reach from 90 to 100%. On steam plants of fairly large size, 30 to 40% power factor is usually recorded, but 60% may be reached in exceptional cases where the load comprises mainly mining or other industrial operations requiring 24-hour power.

274 Continuous Service Plants

"Of the various plants, 274 give a continuous service, night and day, while 220 give only a night service, but, as the latter only comprise small installations, their total capacity is relatively unimportant. The remaining 71 plants are used as auxiliaries.

"It is very difficult to obtain accurate data on cost of generation which could be used to compare conditions at various plants. An attempt to keep a record of this information is made in most plants, but the manner of arriving at it varies greatly. The chief difficulty lies in the inclusion for certain plants and omission in others of various items which are comprised in the total cost given. In some cases, the overhead charges are left out, which leads to most erroneous figures, especially in hydro-electric plants; in certain steam plants, only fuel and oil costs are considered.

"On the other hand, some plants keep this information in a very accurate and detailed manner. Such plants include all chargeable items, sub-dividing the total cost into various parts and extend it to the transmission and distribution costs. The cost of generation for hydro-electric plants is usually given in dollars per h.p.-year, and among the lowest reported is a cost of $8.50 per h.p.-year, the plant being only some 10,000 h.p. capacity, but operating under a 90-foot head; for very large plants, the cost should be even substantially lower, while for plants of the same order it varies from $8.50 to $15 per h.p.-year; in smaller hydro-electric plants, $30 to $40 per h.p.-year may be reached.

"Steam plant costs are more often expressed in cents per k.w.h. and they vary greatly with the service, size of plant and with its geographic situation, as affecting the price of fuel; in steam plants of over 500 h.p. capacity, the reported generation cost varies generally from 0.7 cents to 5 cents per k.w.h., while in smaller plants it varies from 3 to 15 cents per k.w.h."

O.L.S. ANNUAL MEETING

IN the lecture room of the Engineers' Club, Toronto, last Tuesday, Wednesday and Thursday, there was held the twenty-seventh annual meeting of the Association of Ontario Land Surveyors, H. J. Beatty, Pembroke, presiding.

Several standing and special committees met Tuesday morning and discussed their reports. In the afternoon the president's address was delivered, and also the reports of the secretary-treasurer, and the committee on topographical surveys. E. T. Wilkie, Toronto, read a paper on right-of-way surveys and descriptions; W. E. Taylor, Toronto, on the design of concrete arches; and Lt. J. H. McKnight, C.E.F., on the operation of light railways in France. Lt. McKnight's paper appears in full on page 264 of this issue

A. R. Davis, Toronto, delivered an address on "Surveys and Reconstruction" Tuesday evening, in which he discussed the soldier-settlement problem. This was followed by an address on the "History of the Madoc Gold Excitement in 1866-67," by C. Fraser Aylsworth.

Various committees reported Wednesday morning, and there were discussions on permanent survey monuments, legislation, governing lines and surveyor's tariffs, following which Nolan Cauchon, Ottawa, gave an illustrated address on town planning.

Drainage matters and construction of roads and pavements were the subjects of discussion Wednesday afternoon, following a paper by H. T. Routly on road work in Coleman Township, Ont., and on "Drainage Matters," by G. A. McCubbin.

The usual informal dinner was held Wednesday evening at the Engineers' Club, with representatives from other technical societies as the guests of honor.

The meeting was concluded Thursday morning by the election of C. Fraser Aylsworth, Madoc, as president; T. D. Lemay, Toronto, vice-president; L. V. Rorke, Toronto, secretary-treasurer; D. D. James, Toronto, and John VanNostrand, Toronto, auditors.

There are six nominations for executive council, two of which are to be elected by letter ballot before April 1st. The nominations are: E. N. Rutherford, St. Catharines; E. T. Wilkie, Toronto; J. J. Newman, Windsor; R. R. Grant, Toronto; J. M. Watson, Orillia; and G. A. McCubbin, Chatham.

The annual luncheon for surveyors who received their final certificates prior to 1887 was held Thursday noon at the Engineers' Club, and was attended by nineteen veterans, who much enjoyed reminiscences of their early adventures.

Queen's University intends to establish a highways engineering course under the direction of Prof. Thos. Scott, who has been in Halifax for the past year in connection with reconstruction work, but who is now returning to the university.

Standard Bill for Licensing of Engineers

Proposed by the American Association of Engineers—A Combination of Fourteen Existing and Proposed License Laws—Complies With Fundamentals Formulated by the United States Joint Committee, Says Secretary Drayer—State Examiners

REGISTRATION and licensing of engineers is the subject in which many members of the profession are the most interested at present. In Canada, bills are about to be introduced in Saskatchewan and other legislatures, and the Engineering Institute of Canada has appointed a special committee that has been asked to report on May 1st whether it is advisable to ask for legislation, and, if so, to submit a standard bill that can be introduced in all the provinces so as to secure uniform legislation.

In the United States, similar bills are about to be introduced in the legislatures of California, Ohio, Colorado, Michigan, Montana, Iowa, Oregon and Indiana.

May Apply to Canada

The following draft copy of a standard bill just prepared by the American Association of Engineers will be of general interest, and may be of assistance to the committee of the Engineering Institute in bringing forth suggestions and criticisms from Canadian engineers, stating whether the Canadian standard bill should be similar to that adopted by the American Association of Engineers or whether the Canadian bill should be along different lines.

The draft is the work of the American Association's committee on legislation, the chairman of which is L. K. Sherman, director of the Housing and Transportation Bureau, United States Department of Labor.

In commenting upon the draft bill, C. A. Drayer, secretary of the American Association of Engineers, says:—

"The bill to a great extent is a combination of bills that have gone before. It has been done with painstaking and careful thought. Some fourteen existing and proposed license laws have been examined. The bill is drafted, embodying the essential features recognized in all of the existing laws. It complies with the fundamentals formulated in the proposed standard law of the Joint Committee of six national societies. It might be said that the act proposed by the Joint Committee was formulated at a time when opinion was against license laws (February 4th, 1915). Consequently, that bill is too innocuous in many respects to be effective. One important feature to be considered is the reciprocity arrangement for interstate use of licenses."

Following is the text of the standard bill proposed by the American Association of Engineers:—

Text of the Bill

A bill, to be entitled: "*An Act Providing for the Creation and Establishment of a State Board of Engineering Examiners, Granting Certain Powers to and Prescribing the Duties of Said Board; Providing for the Examination and Registration of Land Surveyors and Professional Engineers, Regulating the Practice of Engineering in the State of———— and Providing Penalties for the Violation of This Act.*"

Be it enacted by the legislature of the state of————:

Section 1. After one year from the date of passage of this act, unless otherwise permitted by the provisions of this Act, no person shall practice professional engineering or land surveying in the State of———, except he be a registered professional engineer or a registered land surveyor, as provided by this act.

Section 2. *Payment of Expenses.* Under no circumstances shall the total amount of warrants issued by the state auditor in payment of the expenses and compensations provided in this act exceed the amount of the examination and registration fees collected as herein provided.

Section 3. *Definitions.* As used in this act:

(a) The "Board" means the state board of engineering examiners provided for by this act.

(b) "Surveyor." Any person who shall be engaged in locating, establishing or relocating any land boundary line between two or more landowners, or who shall be engaged in locating any United States government, state, county, township, or municipal land survey lines, or the lines of any public streets or roads, is hereby declared to be a surveyor and as practicing land surveying within the provisions of this act.

(c) "Professional Engineering." Any person who shall be engaged in the designing or supervising of the construction, enlargement or alteration of any engineering structure, or utilities, as hereinafter defined, or any part thereof for others and to be constructed by persons other than himself, shall be regarded as practicing professional engineering within the meaning of this act.

The practice of professional engineering within the meaning of this act embraces the design and the supervision of the construction of public and private utilities, such as railroads, bridges, highways, roads, canals, harbors, river improvements, lighthouses, wet docks, dry docks, ships, barges, dredges, cranes, floating docks and other floating property, the design and the supervision of the construction of steam engines, turbines, internal combustion engines and other mechanical structures, electrical machinery and apparatus, and of works for the development, transmission or application of power, the design and the supervision of mining operations and of processes and apparatus for carrying out such operations, and the design and the supervision of the construction of municipal works, irrigation works, water supply works, sewerage works, drainage works, industrial works, sanitary works, hydraulic works and structural works and other public or private utilities or works which require for their design or supervision of their construction such experience and technical knowledge as are required in section 8 of this act. The execution as a contractor of work designed by a professional engineer or the supervision of the construction of such work as a foreman or superintendent for such a contractor shall not be deemed to be the practice of professional engineering within the meaning of this act.

(d) "Professional Engineer" means any person who practices professional engineering.

State Board of Engineering Examiners

Section 4. There is hereby created a state board of engineering examiners consisting of five members to be appointed by the Governor within sixty (60) days after the passage of this act. Three members of the board shall be civil engineers, one a mining or electrical engineer, and the other one a mechanical engineer or naval architect. One of said members of the board shall be a professor of engineering at the state university of———— (or the state engineer in such states as the office exists). Of the members of the board first appointed hereunder two shall hold office for a term of two years, two shall hold office for a term of three years, and one shall hold office for a term of four years, each term of office ending the first day of July. Upon the expiration of each of such terms the term of office of each member thereafter appointed shall be four years. Each member shall hold over the expiration of his term until his successor shall be duly appointed and qualified. The Governor may remove any member of the board for misconduct, incapacity or neglect of duty. Vacancies in the board caused by death, resignation or removal from office shall be filled by appointment by the Governor for the unexpired term. Each member of the board shall be a professional engineer of at least ten years' active experience and of recognized good standing in his profession and shall be at least thirty-five years of age and shall have been a resident of this

state for at least three years immediately preceding this appointment. Each member of said board, except the members first appointed hereunder, shall also be registered as a professional engineer under this act. The members of the board shall receive as compensation, the sum of ten dollars ($10) per day for the time actually spent in traveling to and from and in attending sessions of the board and its committees, and each member shall receive all necessary expenses incident to the performance of his duties under this act.

Certificate of Appointment, Oath, Powers

Section 5. Every member of the board shall receive a certificate of his appointment from the Governor and before beginning his term of office shall file with the secretary of state his written oath for the faithful discharge of his official duty. Each member of the board first appointed hereunder shall receive a certificate of registration under this act from said board. The board shall adopt and have an official seal. The board may make all by-laws and rules not inconsistent with law needed in performing its duties; but no by-law or rule by which more than a majority vote is required for any specified action by the board shall be amended, suspended or repealed by a smaller vote than that required for action thereunder.

Officers, Meetings, Quorum, Finances, Report

Section 6. The board shall annually elect from its members a chairman, a vice-chairman and a secretary. The secretary shall give a surety bond in the sum of three thousand dollars ($3,000) conditioned for the faithful performance of his duties and for the accounting and paying over of all moneys received by him. The premium on said bond shall be paid from the fund of the board hereinafter provided. The secretary shall keep on file a record of all certificates of registration granted. He shall receive and account for all fees derived from the operation of this act, and shall pay them to the state treasurer, who shall keep such moneys in a separate fund, to be known as the fund of the board of engineering examiners, continued from year to year to be drawn against only for the expenses of the board. Warrants for the payment of the expenses incurred shall be issued by the auditor of state and paid by the state treasurer upon presentation of vouchers regularly drawn by the chairman and the secretary of the board, provided, however, that at no time shall the total amount of warrants exceed the total amount of fees paid under this act.

On or before the 30th day of June in each year the board shall submit to the Governor a written report of its transactions for the preceding year, and shall file with the secretary of state a copy of said report, together with a complete statement of the receipts and expenditures of the board, attested by the affidavits of the chairman and secretary, and a complete list of those registered under this act, with their addresses and the dates of their certificates of registration.

The board shall hold at least two regular meetings in each year. Special meetings may be called in such manner as the by-laws of the board may provide. Notice of all meeting shall be given in such manner as the by-laws of the board may provide. At all meetings a majority of the board shall constitute a quorum.

Section 7. The board shall have power to employ, during its pleasure, such clerks and other employees and to rent such offices as may be necessary for the proper performance by it of its duties as in this act prescribed.

Admission to Examination

Section 8. The board shall admit to examination any candidate who pays a fee of fifteen dollars ($15) and submits evidence, verified by oath and satisfactory to the board, that he

(a) Is more than twenty-five years of age.

(b) Is of good character, and

(c) Has been engaged in the practice of professional engineering or land surveying for at least six years and during that period has had charge of said work, as principal or assistant, for at least one year.

(d) Or, in lieu of requirement (c) specified above, is a graduate from an engineering school of recognized standing and has been engaged in the practice of professional engineering or land surveying for at least two years and during that period has had charge of engineering work, as principal or assistant, for at least one year; that he is qualified in the knowledge and practical application of the principles of physics, strength of materials and mathematics, including trigonometry.

Examinations

Section 9. Examinations for registration shall be held at regular or special meetings of the board at such times and at such places within the state in each year as the board shall determine. The scope of the examinations and the methods of procedure shall be prescribed by the board. Examinations shall be held to determine the qualifications of applicants for registration separately in surveying or in any one of the branches of professional engineering, embracing civil, mechanical and electrical, mining or naval architecture. The examination may be either oral or partly oral and partly written. As soon as practicable after the close of each examination the members of the board who shall have conducted such examination shall make and sign and file with the secretary a certificate stating the action of the board upon the application of each candidate, whereupon the secretary of the board shall notify each candidate of the result of his examination. A candidate failing on examination may, after an interval of not less than one year, be examined again.

Certificate of Registration

Section 10. In the case of examination as professional engineer, upon receipt of an additional fee of ten dollars ($10), the board shall issue to any applicant who has been reported to have passed the examination conducted by the board, a certificate of registration as a professional engineer in the branch or branches in which he is qualified, signed by the chairman and secretary of the board under the seal of the board, whereupon such applicant shall be authorized to practice professional engineering as defined by this act. In the case of examination as land surveyor, upon receipt of an additional fee of ten dollars ($10), the board shall issue to any applicant who has been reported to have passed the examination conducted by the board, a certificate of registration as a land surveyor, signed by the chairman and secretary of the board under the seal of the board, whereupon such applicant shall be authorized to practice land surveying as defined by this act. A certificate of registration as a professional engineer shall not carry with it the right to practice land surveying unless it is specifically permitted by said certificate, which permission shall be granted by the board without additional fee in the case of any applicant duly qualified as prescribed by the rules of the board.

Registration Without Examination

Section 11. At any time within one year after this act becomes effective, upon due application thereof and the payment of a fee of twenty-five dollars ($25), the board shall issue a certificate of registration, as provided by section 10, to any professional engineer or land surveyor who shall submit evidence under oath and satisfactory to the board, that he is of good character, has been a resident of the state of ——— for at least one year immediately preceding the date of his application, and has practiced professional engineering or land surveying for at least ten years preceding the date of his application; and during that period has had charge of engineering work or land surveying as principal or assistant for at least two years. Graduation from an engineering school of recognized standing shall count as four years of practice. After this act shall have been in effect one year, the board shall issue certificates of registration only as provided in sections 5, 10 or 11 hereof.

Section 12. The board shall from time to time examine the requirements for the registration of professional engineers in other states, territories and countries and shall record those in which, in the judgment of the board, standards not lower than those provided by this act are maintained.

(Concluded on page 263)

SOME ENGINEERS*

By an Ottawa Engineer

Who is the man that designs our pumps with judgment, skill and care?
Who is the man that builds 'em and who keeps them in repair?
Who has to shut them down because the valve seats disappear?
The bearing-wearing, gearing-tearing Mechanical Engineer.

Who buys his juice for half-a-cent and wants to charge a dime?
Who, when we've signed the contract, can't deliver half the time?
Who thinks a loss of twenty-six per cent. is nothing queer?
The volt-inducing, load-reducing Electric Engineer.

Who is it takes a transit out to find a sew'r to tap?
Who then with care extreme, locates the junction on the map?
Who is it goes to dig it up and finds it nowhere near?
The mud-bespattered, torn and tattered Municipal Engineer.

With compressed air and dynamite, who toils in dark and wet?
The copper, iron, coal and gold for all the world to get?
Who sinks his shafts, and drives his slopes and makes the wealth appear?
The drilling, blasting, pumping, hoisting, Mining Engineer.

Who thinks without his products we would all be in the lurch?
Who has a heathen idol which he designates Research?
Who tints the creeks, perfumes the air, and makes the landscapes drear?
The stink-evolving, grass-dissolving Chemical Engineer.

Who is the man who'll draw a plan for everything you desire?
From a trans-atlantic liner to a hairpin made of wire?
With "ifs" and "ands," "howe'ers" and "buts" would make his meaning clear?
The work-disdaining, fee-retaining Consulting Engineer.

Who builds a road for fifty years, that disappears in three?
Then begs another subsidy to change its quality?
Who covers all the travelled roads with filthy, oily smear?
The dust-providing, rough-on-riding Highway Engineer.

Who is that youth who scales yon height and swims that torrent black?
To find a grade point four per cent. across the mountain's back?
Who lays his rails of shining steel to bring far places near?
The booze-absorbing, girls-adoring Railroad Engineer.

Who is the man who lays out docks whence steamers ply their trade?
Who overcomes all obstacles when others are afraid?
Who builds canals, hydraulic plants, to help our daily cheer?
The ne'er dismayed, yet underpaid Civil Engineer.

*Read at the "Smoker" held February 11th at Ottawa by the Engineering Institute of Canada.

Standard plans and specifications for inexpensive houses have been prepared by the Ontario Housing Committee in order to assist builders who wish to borrow from the Federal Housing Fund. The smallest house planned has four rooms and requires 16 ft. frontage.

On page 199 of the February 6th issue of *The Canadian Engineer* there appeared an article on "Town Planning in Canada" by James White, deputy head of the Commission of Conservation. Mr. White writes that this article had been prepared by Thomas Adams, town planning adviser to the Commission, and that its authorship should have been credited to Mr. Adams.

CANADA'S PROSPECTS AS A STEEL PRODUCER

IN the course of an address last month before the Canadian Manufacturers' Association, Toronto, Colonel David Carnegie, of the Imperial Munitions Board, in speaking of the prospects for selling Canadian iron and steel products to Great Britain, France and Belgium, said:—

"We have fine deposits of magnesite in Canada, developed during the war, which is of excellent value for our furnaces, making it unnecessary to import as hitherto; our carbon electrodes are second to none and cheaper than are produced in England; we have nickel in abundance; everything, in fact, calls for Canada to rise to the first rank as a producer of high quality steels. She has the opportunity by sustained and wise propaganda of displacing much of the heavy, cumbersome, short-lived, common carbon steels used in our rolling stock, ships, dredges, docks, mines and general machinery, and of becoming one of the principal exporting countries in the world. The things I have named—power, electrodes, magnesites and nickel—enter so much into the vital cost of producing high grade steels that Canada stands out almost alone in its great opportunities in this direction."

Believe Belgium Will Buy

Discussing prospects of trade with France, Colonel Carnegie said that the resourcefulness of that country, especially with the restoration to her of Alsace and Lorraine, would enable her to repair her own waste places without calling upon other countries; indeed some believe that France will not only be able to reconstruct her own country, but will be a formidable competitor of Britain and other industrial nations in the export of her surplus productions to foreign markets.

As for Belgium, it is believed that she will buy iron and steel products for one or two years while she is rebuilding, but after that she will return to her former place as an exporter, particularly of rolled steel and cast steel products.

"Regarding Britain, the amount of work likely to be secured through Government channels for public works will no doubt exceed the pre-war annual requirements, owing to most of the ordinary Government contracts during the war having been suspended," said Colonel Carnegie.

"Canada has increased her steel production per annum from one million tons before the war to two and a quarter million tons at present. United States steel production has increased from thirty-two million tons to forty-five million tons, and Britain's from seven and a half million to twelve million tons per annum."

Canadian Export Competition

Touching on Britain's high cost of production compared with pre-war costs, Colonel Carnegie said that while Britain has a capacity to supply her domestic requirements, she will have a struggle to maintain both her home and export trade against United States and Canadian competition.

"Facts show that Britain has a capacity for steel production exceeding her pre-war capacity of 62 per cent., while Canada's capacity has increased 125 per cent.," said Colonel Carnegie. "If Canadian manufacturers will follow Britain's example by determining to supply her domestic trade more fully than in the past, Canada will go a considerable distance in using her surplus steel capacity.

"Canada should have at least one structural mill for rolling heavy structures.

"The home demands alone of the electrical industry for higher quality steel sheets is not by any means insignificant, and should be supplied by our manufacturers who have finishing mills.

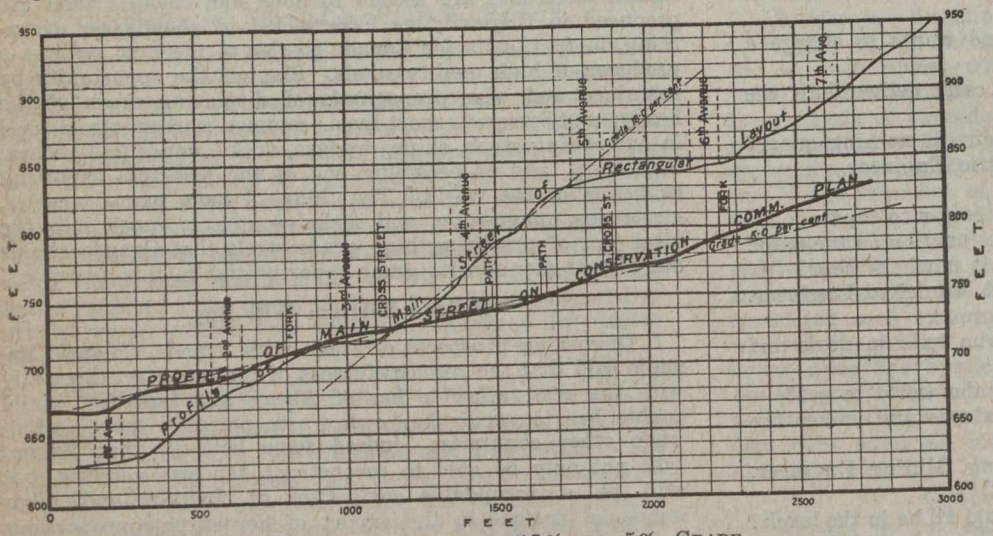
"The growing demands for alloy steels for motor cars, tractors and all kinds of engines and high-class machinery where excessive wear calls for a better and more enduring steel, should arouse the most earnest attention of the makers of electric and crucible steel.

"The importation into Canada of tool steel, file steel and files, spring steel and springs should be reviewed by the makers of high-class steel. There is no doubt that a much larger volume of that business should be undertaken by the manufacturers of Canada."

THE TOWN OF KIPAWA*

By Thomas Adams
Town Planning Adviser, Commission of Conservation

KIPAWA is being established by a large industrial corporation which has acquired sufficient land not only to erect their works but also to house their employees. The Riordon Pulp and Paper Co. decided to develop a new mill for production of pulp, and apparently came to the conclusion that the most economical situation for such a mill was near the raw materials used in their industry.



COMPARATIVE PROFILES—18% VS. 5% GRADE

They selected the site of Kipawa, because of its proximity to the timber-limits and also because of the available water-powers derived from Kipawa Lake. The interests of John Lumsden, owner of Lumsden's Mills, and of other owners were purchased, and a compact area of about 10 square miles was brought under control for the purpose of erecting the mill and town. The consent and approval of the Quebec Government had to be obtained, and those who acted for the government showed every desire to co-operate in helping the Riordon Co. to build up a model community.

Limited in Location

As will be seen from the accompanying plan, the site overlooks Lake Timiskaming, which is part of the Ottawa River. The waters of Kipawa Lake drain into Lake Timiskaming by Gordon Creek, which is between the town and the railway. The site of the mill is to the south of the town, on the opposite side of Gordon Creek.

The first step taken by the Riordon Co. in connection with the selection of the site for the town was to invite the Commission of Conservation to advise as to the best situation. When the inspection of the area was made, there were certain governing factors which made the choice very limited. The millsite had been selected and took up nearly all the level land that was available. On one side there was Lake Timiskaming, and there were other physical features, such as the Gordon Creek and two tracks of the Canadian Pacific Railway. At a point to the east of the area shown on the plan, there was an existing mill and village known as Lumsden's Mills, and on this side also the whole of the level land was taken up by lumber yards.

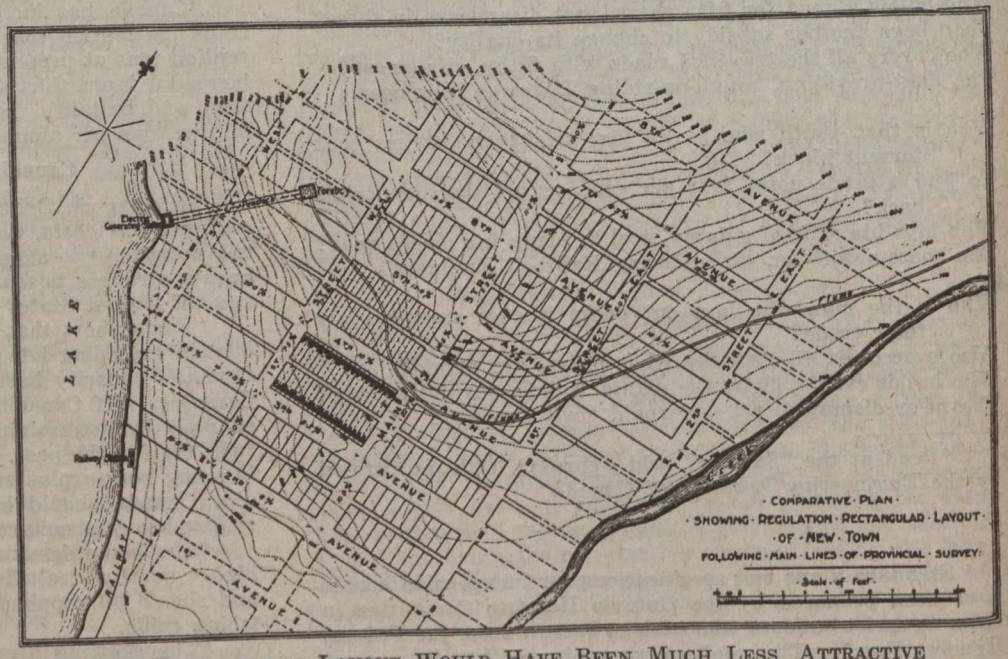
The only land available for the town was hilly land to the north and south of the mill site, overlooking the lake and river. Large parts of this land were covered with huge boulders and with timber or shrub of various sizes and densities. After careful inspection, it was finally decided to build the town to the north of the mill site, on what appeared to be, from the view that was obtained from the mill site, a steep hill, which would be very difficult and expensive to develop. It was found, however, on investigation that there were considerable fairly level areas on the site, and that, in order to obtain easy grades and economical development of lots, all that was necessary was the preparation of a proper plan.

Lines Through Virgin Forest

The first step in preparing a town plan was to have a contour map of the site prepared, and Ewing, Lovelace & Tremblay, of Montreal, were instructed to make a topographical survey. While this survey was being carried out by Mr. Lovelace, the site was visited by the writer and a preliminary sketch plan prepared.

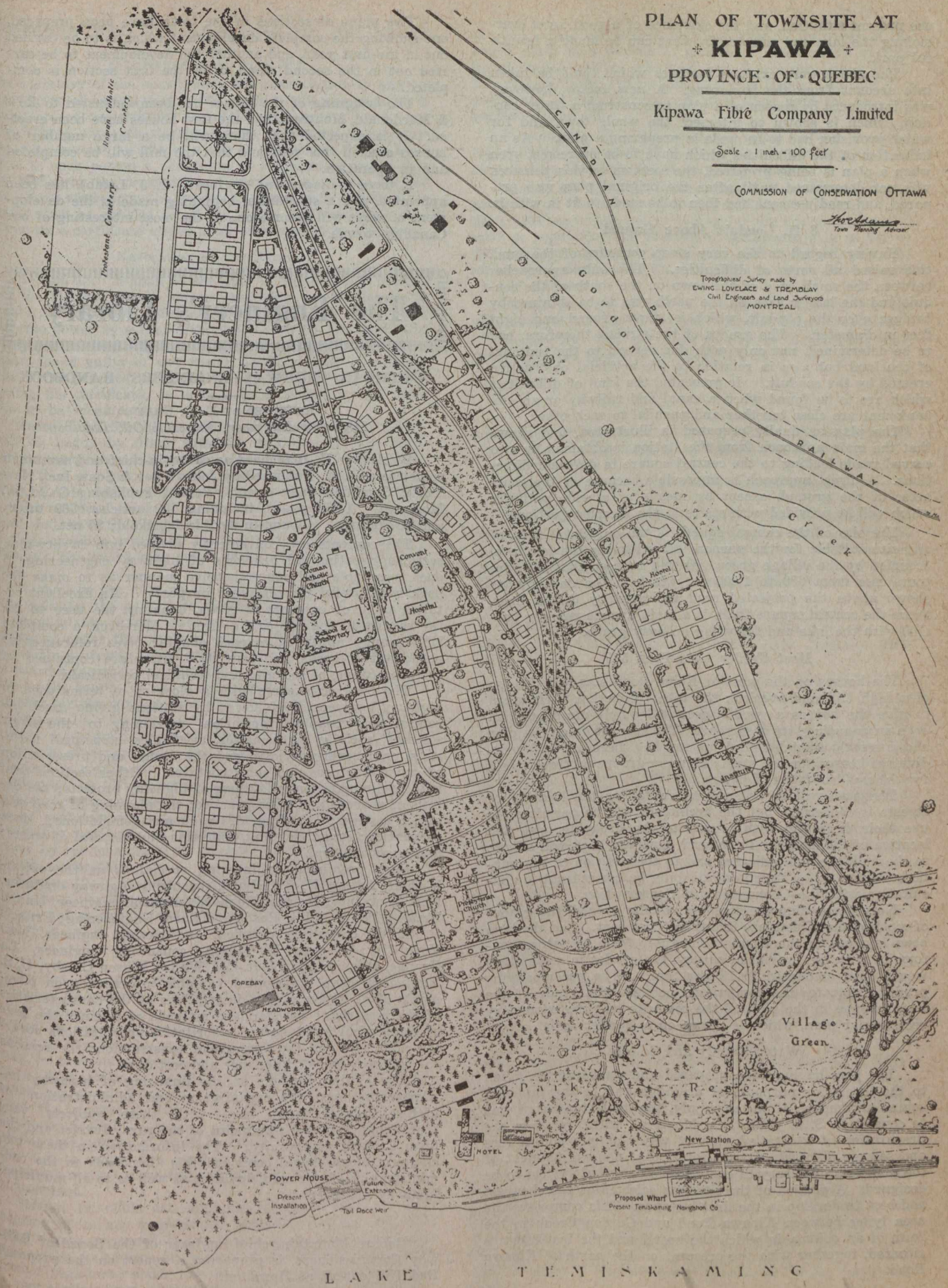
After sundry alternatives were considered, the main lines of the plan shown in the illustration were determined, and the surveyors were instructed to locate the roads on the ground. For this purpose, paths had to be blazed through the forest and the plotting carried out under peculiar difficulties. Very creditable work was done, with the result that the whole of the lines of the plan were laid down on the ground through virgin forests. A large part of this work was carried out in the heart of winter.

Considerable care had to be taken to select sites for the churches and other institutions. One of the arrangements that had to be made was that of providing a site for the Catholic church in exchange for one which had to be abandoned where the mill is being erected, and a small cemetery had also to be changed in location. Other existing features which had an influence on the plan were the position of the station, which could not be moved very far from



THE RECTANGULAR LAYOUT WOULD HAVE BEEN MUCH LESS ATTRACTIVE

*From "Conservation of Life."


PLAN OF TOWNSITE AT
KIPAWA
PROVINCE · OF · QUEBEC
Kipawa Fibre Company Limited
Scale - 1 inch = 100 feet
COMMISSION OF CONSERVATION OTTAWA
Thos Adams
Town Planning Adviser
Topographical Survey made by
EWING LOVELACE & TREMBLAY
Civil Engineers and Land Surveyors
MONTREAL
Roman Catholic Cemetery
Protestant Cemetery
CANADIAN PACIFIC RAILWAY
Gordon Creek
KIPAWA ROAD
WILLSON ROAD
Convent
Roman Catholic Church
Hospital
School & Presbytery
Hostel
Hospital
CENTRE SQUARE
AVENUE
Club
Presbyterian Church
Library
ROAD
RIDGE
FOREBAY
HEADWORKS
Village Green
Park Reserve
Pavilion
HOTEL
New Station
CANADIAN PACIFIC RAILWAY
POWER HOUSE
Present Installation
Future Extension
Tail Race Weir
Proposed Wharf
Present Temiskaming Navigation Co
LAKE TEMISKAMING

the present situation, and the existence of a good hotel overlooking the lake and situated in what can be made a beautiful park.

The above were existing features which could be taken into account from the beginning. A new factor, however, was introduced by reason of a plan to construct a water conduit, which is shown to intersect the whole town and for which provision had to be made in preparing a plan. As an indication of the difficulties which have to be overcome, even when a plan is being prepared, the location of this penstock was not determined until after the original plan was prepared, and readjustment had then to be made to fit in with it.

8 ft. Conduit Above Ground

Having regard to the very steep contours of the land, this raised all sorts of difficulties. The only approaches between the small area of the town on the south of the conduit and the larger area on the north was to be obtained by bridges over the conduit, which is above ground and eight feet in diameter. The grades of the streets, therefore, had to be determined, not only with due regard to the contours of the land but also in relation to the artificial obstruction created by the conduit. It presented the kind of difficulties which are to be found when a canal and railway or an embankment are close together and parallel to each other.

The plan as finally prepared is illustrated, and shows that the main approach from the station is obtained by two curved roads leading to the central square in different directions. A direct approach is impossible because of the character of the ground, except by means of a wide pathway which will be provided with stairs in the steepest portions.

The site of the central square is the only level area of any size suitable for the purpose after leaving the low level occupied by the village green. It will be seen that the contours rise from 650 to 1,000 ft., which is the datum level shown above the projected road indicated by dotted lines. From the central square there is a main avenue runnnig parallel with the lake and following an easy grade.

Most Grades Less Than 5%

The houses on the west of Ridge Road stand at the top of a high cliff and overlook the lake. Care has been taken to give the houses a good aspect and ample air space and open surroundings to each house. The suggestion on the plan shows mostly semi-detached houses, but there are a few individual houses for the staff and some groups of three to six for the smallest types of houses.

The plan will be adhered to so far as the location of streets is concerned, but the architects will be permitted to use their discretion with regard to the grouping, size and location of the houses. In general, however, they will adhere to the building line indicated and to the position of the public buildings. Any variation will only be carried out in consultation with the Commission of Conservation.

Notwithstanding the steepness of the ground, the grades of most of the streets are less than 5 per cent. Had the land been laid out in the usual rectangular form to secure conformity with the provincial survey, the grades in some cases would have amounted to 18 per cent. The accompanying profile illustrates the comparison between the grade of the main avenue in the plan of the townsite and the customary rectangular plan, which is shown on a smaller scale.

Water Supply and Sewers

The plan having been prepared and consideration given to the levels for purposes of drainage and to the probable source and means of water supply, the next step taken was to consult R. S. & W. S. Lea, Montreal, with regard to the preparation of a detailed plan of water supply and sewers and sewage disposal. It was found that no readjustment of the plan was necessary to enable an economical system to be designed. A portion of the site was selected as the cheapest and best to develop in the first instance. This comprises the area lying between Kipawa Road and Gordon Creek in the form of an oblong, in which the hostel and the institute are situated, together with the crescent on the north of Kipawa Road.

Two plans of sections of the town have been prepared, one showing the complete development which is to be carried out in the first year, and another the development to be carried out in the second stage, after the first section is completed.

The designing of the houses has been entrusted to Ross & Macdonald, Montreal, and the first houses have been erected. It is expected that there will be a large number of houses erected this year and that the mill will be completed and in operation.

A town manager and engineer (G. J. Lamb) has been appointed, and a substantial beginning made in the development of what will become one of the most interesting of our Canadian towns.

The Engineer's Library

AMERICAN HIGHWAY ENGINEERS' HANDBOOK

REVIEWED BY E. D. GRAY
Highway Engineer, Imperial Oil, Ltd.

By **Arthur H. Blanchard** as editor-in-chief and seventeen associate editors. Published by John Wiley & Sons, Inc., New York; Canadian Sales agents, Renouf Publishing Co., Ltd., Montreal 1,658 pages, including 559 articles, 369 tables and 607 figures. Bound in flexible fabrikoid; $5 net.

The contents are conveniently divided into twenty-nine sections, treating all branches of highway engineering in such a reliable and comprehensive manner as to make the book most useful for reference purposes. An excellent detailed table of contents is given, enabling the user to refer readily to the subjects desired. Moreover, a complete bibliography appended to each chapter gives references to authoritative books and important literature contained in the proceedings of societies and technical periodicals.

The book commences with a glossary of terms used in highway engineering, followed by sections giving much essential and usable information pertaining to the sister sciences, such as mathematics, mechanics, structural materials, engineering geology, and the design and preservation of superstructures and sub-structures. Other sections deal with preliminary investigations of highway projects; the details of surveys and office practice; the planning of road and street systems; grading, drainage and foundations; dust prevention; street cleaning, collection and disposal of waste; and snow removal.

Such prominent engineering specialists as the editor-in-chief, Arthur H. Blanchard, consulting highway engineer, New York City; Prevost Hubbard, chemical engineer, United States Office of Public Roads and Rural Engineering; Francis P. Smith, consulting chemical and paving engineer, New York City; George W. Tillson, consulting engineer, La Grange, Illinois; and Lieut.-Col. Walter Wilson Crosby, U. S. Engineers, have contributed valuable information on pavements of all types, giving descriptions of the characteristics of the materials; the standard methods of testing; the uses of mechanical appliances; authoritative specifications covering materials and the methods of construction; the reasons for failures; and maintenance and cost data.

The closing sections on the financing of highway improvements and the organization and administration of highway departments, deal with these subjects very thoroughly from the standpoint of the rural district and the town as well as the city. The information in these two chapters alone should commend this handbook to the administrators of our municipalities as well as to all municipal highway engineers.

George Mountain, chief engineer of the Board of Railway Commissioners, is preparing a report on the proposed Red Hill cut-off at Hamilton.

STANDARD BILL FOR LICENSING OF ENGINEERS

(Continued from page 258)

The secretary of the board, upon the presentation to him by any person of satisfactory evidence that such person holds a certificate of registration issued to such person by proper authority in any such state, territory or country so recorded and upon receipt by him of a fee of ten dollars ($10), shall issue to such person a certificate of registration under this act, signed by the president and secretary under the seal of the board, whereupon the person to whom such certificate is issued shall be entitled to all the rights and privileges conferred by a certificate issued after examination by the board.

Revocation of Certificate

Section 13. It shall be the duty of the board to inquire into the identity of any person practicing or claiming to be a land surveyor, or professional engineer. The board shall have the power by a four-fifths vote to revoke the certificate of any professional engineer or land surveyor registered hereunder, found guilty of any fraud, deceit or gross incompetency in his practice, or guilty of any fraud or deceit in obtaining his certificate, or in case he is found by the same vote to be incompetent.

Proceedings for the revocation of license of registration shall be begun by filing with the secretary of the board written charges against the accused. The board shall designate a time and place for a hearing and shall notify the accused of this action and furnish him a copy of all charges at least ten days prior to the date of the hearing. The accused shall have the right to appear personally or by counsel, to cross-examine witnesses or to produce witnesses in his defence. The board may summon witnesses and administer oaths.

It shall be the duty of the board to prosecute any persons violating the provisions of this act.

Section 14. Every certified professional engineer so registered under this act who desires to continue the practice of his profession shall annually pay to the secretary of the board a fee of five dollars ($5), on or before a date to be fixed by the board, for which fee a renewal certificate of registration for the current year shall be issued.

Section 15. An unrevoked certificate and endorsement of registry made as provided in this act shall be presumptive evidence in all courts and places that the person named therein is legally registered.

Section 16. The provisions of this act shall apply to every corporation, domestic or foreign, engaged in the business of professional engineering within the state of ———, except that certificate of registration issued hereunder shall be held by one or more of its officers or employees instead of by such corporation.

Section 17. The board shall, during the month of April in each year, certify and publish a complete list of registered professional engineers and land surveyors with their business addresses in a newspaper published in the state of ——.

Penalties

Section 18. Any person who, not being then legally authorized to practice professional engineering or land surveying within this state according to the provisions of this act and so registered according to law, shall practice, or attempt or advertise to practice, or hold himself out as authorized to practice professional engineering or land surveying, or shall use in connection with his name, or otherwise assume, use or advertise any title or designation tending to convey the impression that he is a professional engineer or land surveyor shall be deemed guilty of a misdemeanor and shall for each offence of which he is convicted be punished by a fine not to exceed five hundred dollars ($500), or by imprisonment not to exceed three months, or both such fine and imprisonment.

Section 19. This act shall not apply to military engineering or to any professional engineer working for the United States government; nor to any professional engineer employed as an advisor or as an assistant to a professional engineer registered under this act; nor to any professional engineer coming from without this state and employed therein until a reasonable time, as prescribed by the rules of the board, shall have elapsed to permit the registration of such person under this act, provided that before practicing within this state he shall have applied for the issuance to him of a certificate of registration and shall have paid the fee prescribed in this act.

Section 20. This act shall not apply to any architect registered by the state of —— under the provisions of the act creating the state board of architecture.

Section 21. Persons licensed to practice professional engineering in this state under this act shall be exempt from the provisions of any act providing for the licensing of architects or regulating the practice of architecture in so far as the definition of "buildings" in any said architect's act may include or be included in the structures enumerated in section —— of this act.

Section 22. All laws or parts of laws in conflict with the provisions of this act be and the same are hereby repealed.

Section 23. This act shall take effect immediately upon its passage and approval by the governor.

$13,000,000 PAPER MILL AND POWER DEVELOPMENT FOR THREE RIVERS, P.Q.?

(Special despatch to The Canadian Engineer)

New York, N.Y., February 24th.—The directors of the International Paper Co., of this city, at a regular meeting of the board decided to go ahead immediately with the construction of a paper mill at Three Rivers, P.Q., and of a dam for hydro-electric power development at Les Forges Rapid.

The following information regarding the proposed work appeared in *The Canadian Engineer* for January 23rd, 1919:—

"The proposed pulp mill of the St. Maurice Mill will be located on the company's property at Three Rivers, P.Q., at the outlet of the St. Maurice River. It has not been fully decided whether the company will construct only a sulphite mill, or also a paper mill. The company's shareholders are divided upon this point. The sulphite mill will involve an expenditure of about $500,000, but a paper mill such as is planned, containing ten units, will cost about $6,000,000, it is said.

"The company has been working upon the plan since 1913. The scheme involves the development of Les Forges Rapids on the St. Maurice River, nine miles north of Three Rivers. A monolithic concrete dam, 30 ft. high and 1,900 ft. long, will be built. The foundations will be carried 60 ft. below low-water level. The power station will be equipped with seven water turbines, each 9,500 h.p. It is stated that the power development portion of the scheme will cost about $7,000,000.

"The company was incorporated in 1916 under the laws of Quebec province, with an authorized capital of $600,000. It is a subsidiary of the International Paper Co., 30 Broad St., New York. The parent company will finance the work.

"The president of the International Paper Co. is P. T. Dodge, New York. A. H. White, 30 Broad St., New York, is chief engineer, and H. S. Ferguson, 200 Fifth Ave., New York, is consulting engineer. The president of the St. Maurice River Lumber Co. is Geo. F. Underwood, New York."

The city of Toronto has reached an agreement with the Toronto and York Radial Railway for the purchase of that portion of the "Metropolitan Railway" which is within the city limits. The purchase price will be about $590,000, the city acquiring all rolling stock, right-of-way and franchise privileges; the company acquiring the right to send freight cars at night through the city streets to the St. Lawrence market.

LIGHT RAILWAY WORK IN FRANCE*

By Lieut. J. H. McKnight

DURING the Somme offensive in 1916, the advantages and importance of light railways were realized, and later in the year the Canadian Railway Corps was organized. At the cessation of hostilities, over 12,000 Canadian troops were engaged on railway work, besides 10,000 men from labor units.

Light railways act as arteries or distributors from the standard gauge railheads and bases of supply, which were from 6 to 15 miles behind the front lines. These railways are 60 cms., or nearly 2 ft., gauge. At first, rails 5 ms. long and 9 lbs. to the metre, were used and made in sections at the factory, the steel ties being riveted to the rail. These could be laid rapidly but were unsatisfactory, and a heavier rail of the same length, 15 lbs. to the metre, also made in sections, was used. The sections were connected by fish plates and bolts, and while satisfactory, took so much space in transportation that some other design had to be adopted.

Surveys Under Trying Conditions

A steel tie was designed 8 ins. wide, 4 ft. long, with edges flanged downward, and two pair of small rectangular holes were punched so that the base of rail would lie between each pair at nearly the required gauge. The ties were fastened to the rail by means of a bolt and clip which gripped the base of rail. The ties were shipped in bundles of ten, weighing approximately 100 lbs., and the material was assembled at any desired place. A still heavier rail, 20 lbs. to the metre, and of the same length, was used.

It was soon found that for satisfactory work a survey had to be made and levels taken. Conditions under which this work was done were at times most trying, but as fair a degree of accuracy was obtained as the work warranted. The work was plotted and maps blueprinted showing location of all lines, ammunition dumps, railheads, material yards, important roads and other information. This work naturally fell to the lot of the surveyor, as also did the supervision of grading.

The rules called for a maximum grade of 2%, but we tried to keep well below this limit. On all grading in the forward area, the work was done chiefly by men from labor units attached temporarily. On large cuts and fills, mules were used when possible. Bridge building and trestle work was done by a special party of our own men, and piles were driven by power from a petrol-electric tractor.

Filling old shell holes gave us the most work and trouble, as they were usually filled with water, and where they could not be drained they were often baled out by hand or with pumps. On main lines over shell-shattered ground, wooden ties were used, 4 and 6 ft. long, laid alternately. As soon as the steel was laid, it was immediately ballasted with sand, mine earth, poor gravel or brick from ruins.

Transferred by Carloads

Push cars hauled by mules were used on the first mentioned type of rail, but with the heavier rail the motive power was entirely steam and gasoline. At first a 20 h.p. gasoline tractor was used which was very satisfactory for small loads and could easily be replaced if derailed. A 40 h.p. gasoline tractor with splinter-proof covering was also very efficient, and also a 60 h.p. petrol-electric tractor for hauling heavy loads and furnishing light or power to small motors. Steam engines up to 15 tons in weight were used, but not on forward areas unless weather conditions were favorable or in cases of emergency.

Two standard types of cars were chiefly used, one a flat car 20 ft. long and 4 ft. 6 ins. wide; the other, the same size, but with sides and ends 26 ins. high. The sides were hinged and could be dropped down. The cars had hand brakes and were coupled with a link and pin. Their capacity was from 9½ to 10 tons, and as the average capacity of standard-gauge trucks was 10 tons, the loads could often be transferred directly, car for car.

The chief use of light railways was in delivering ammunition (especially to the larger guns), gravel and cement, and material for the engineers and tunnelers, besides carrying troops to the line and helping to bring back the wounded. Duck-boards, planks and facines were often brought directly from the mills and yards far in the rear.

Light Railways vs. Motor Lorries

The railways hauled nearly all the salvaged material of all kinds to points where it could be sorted. Many guns, especially the 6-in. guns, were carried on flat cars to positions where it would be almost impossible to take them otherwise. Even water tanks were hauled for supplying drinking water at forward points.

One illustration will show the saving of motor lorries. An average train of four cars, loaded with 300-lb. shells, would equal twelve 3-ton lorries, and the trip could be made as quickly by train, besides saving considerable labor in handling.

There were stations at suitable intervals, connected by telephone to a central control. The usual plan was for a train to get right-of-way from one station to the next and if the line was clear, it would be signalled to proceed. This method was used because of frequent blowouts and breaks, and consequent diversion of traffic.

Where possible, a single loop system was used on forward areas. The distance around this loop would be from 7 to 10 miles, with the greatest width, of about 1½ miles, nearest to the front line.

Spurs lead off to battery positions, engineers' dumps and support line of trenches. All the traffic was in one direction. Movement of ammunition and troop trains was usually done under cover of darkness.

Section gangs were kept on maintenance and repair work. All main lines were patrolled day and night. All breaks reported were repaired at once during the day, and a special party (with an engine and repair car) was used for work at night. This work was most trying on the men, partially because everything had to be done without a light and partly because of frequent gas attacks, alarms and shell fire, causing greater nervous strain in the dark. As many as 18 breaks have been repaired in one night, all ammunition trains reaching their destination and being unloaded.

Old Lines Used for Spurs

Except during a barrage, the enemy's shell fire was chiefly directed to battery positions, junction points, yards and points where the line would parallel or cross a highway or plank road. Material was always kept handy near these places for repairs. During an advance, new lines are laid very rapidly to help keep up the supply of ammunition and other material. Old lines not needed were torn up and used again as sidings or spurs.

The daily casualties in railway battalions was not large but was constant, and a good number have given their lives for their country. While not much has been said about the work done by the railway troops, I believe that they have a record which compares favorably with other branches of the Canadian service.

*Paper read last week at the annual meeting of the Association of Ontario Land Surveyors.

City Engineer Fellowes, of Vancouver, has reported to his Board of Works that the Connaught bridge is safe, and that the part destroyed by fire some years ago (which is now bridged by a temporary structure) should not be restored to its original condition until the prices of materials decrease.

The Board of Works of Vancouver has been advised by City Engineer Fellowes that they should not hand over the city's sewers to the Greater Vancouver Joint Sewerage Board. Mr. Fellowes objects to the surrender by the municipality of the control of maintenance and all other expenditures. He also states that it would be a great handicap to other city departments to have an outside board in control of the sewers, and that it would create confusion, overlapping and financial loss.

Letters to the Editor

RELATION OF THE RAILWAYS TO THE FEDERAL HOUSING SCHEME

Sir,—The Federal housing plan has in its intention a desire to benefit primarily two classes of the community: first, employees of manufacturing corporations who have located in parts of the country previously unsettled, and the employers of whom are willing to supervise the layout of model villages; and second, those of small means living under poor conditions in cities; and particularly the returned soldiers in these classes.

With the first class, the railways have no connection in the development of housing schemes, but with the second their influence may be paramount. The price of land within the cities is so high that in all probability the areas will be laid out in the suburbs, or beyond what we now consider as suburbs. Thus the greatest consideration is transportation, before even such important items as water supply and sewage disposal are considered.

It would be somewhat of a new idea for Canadians deliberately to set up habitations miles away from the centre of the city, although the reverse is often done. It is no unusual thing for the workers to travel for hours daily *from* the cities to their occupations, but consideration is seldom given to the other idea. An instance of this is the influx into Montreal every evening of the workers from the Longue Pointe district. In a small way, special transportation arrangements are made by the railways for the benefit of firms in outlying districts, but generally with the idea of bringing work people *into* the city after the day's work.

Those who have sufficient means live outside the cities in the summer, and in some cases the transportation facilities are good, but there is no evidence that the railways are convinced of the necessity of perfectly organized systems of rapid transit. Such systems are in evidence around London, Eng., where excellent service at very reasonable commuting rates exists as far as 50 miles out, and a great deal of this service is steam.

Previous to the war it was possible to commute on about 25 per cent. of the regular fare. The exact figures in one case were 50 cents return regular, and $11.25 for three months on a "season ticket," i.e., commuting, but not being restricted in any way as to how many trips a day.

The extension of street car lines cannot be recommended on account of the irksomeness of the many stops at very short intervals. The question of the electrification of steam lines around large cities is very urgent, but much can be done by the existing railroads if the companies will throw themselves with sufficient energy into the problem.

In Ontario it is certain that the "Hydro" can keep pace as regards supply with any demand made upon it by electrification of steam lines. The idea of rapidity cannot too strongly be impressed; with proper organization there is no reason why a speed of around 35 miles per hour could not be obtained even for such a short run as that to a village say ten miles out.

It is not an unusual arrangement for the railways to be interested in ventures not quite in their direct lines, as for example, the irrigation, drainage and general development of farm lands. Therefore, it is suggested that there is now an opportunity for part of the federal grant to be utilized by the companies in building houses, not only for their own employees but for city dwellers. The existing staff could in all probability supply all the organizing end of the business, and additional labor could be secured for the actual construction. The revenue from the number of commuters should seem attractive to the railroads.

A particular example which is brought to mind is the Gatineau River district near Ottawa and Hull, fed by the C.P.R. Quite a large scheme (or two separate schemes) are possible here for the industrial workers of Ottawa and Hull and for the civil servants, in an exceedingly beautiful district abounding in power for future electrification. At present, the rate at which this line is operated is roughly 18 miles per hour, but this might be increased if special non-stop trains were run from the suggested model villages.

Regarding the housing scheme in general, municipalities will be nervous of the question of the guarantee of repayment as demanded, for instance, in the Ontario scheme, and may not be inclined to be the first to move in the matter; and the question is very urgent. That is where a substantial lead may be given by the railroads around such cities as Toronto, Montreal and Ottawa, not to mention other cities and towns where the housing situation is just as acute.

EDMUND G. TIMBRELL,
Topographical Surveys Branch.

Ottawa, Ont., February 19th, 1919.

JAMES WHITE STATES CONSERVATION COMMISSION'S CASE IN REGARD TO THE TWO CENTRAL STATION DIRECTORIES

Sir,—I note in your issue of the 20th an editorial entitled "Two Central Station Directories."

The first summary statement re electric energy generated in Canada was contained in the January issue of "Conservation," issued January 2nd.

At the eighth annual meeting of the Commission of Conservation, January 16th-17th, 1917, it was announced that the Commission was compiling data respecting electric generation in Canada. The circulars requesting such data had been sent out in November, 1916, and many replies had been received prior to January 16th, 1917.

The preliminary draft of the Census circular was prepared March 26th, 1917, nearly five months after our circular was sent. The Census circular in its final form was not sent out till November, 1917, a year after ours. This settles the question of priority.

The Conservation Commission publication is *descriptive*, with some tabular matter as appendices, whereas the Census pamphlet is *statistical*.

The only duplication, thus far noticed, is in a portion of one table occupying one page out of the 296 pages contained in the Commission report, this table being only incidental to the other material.

The Conservation Act provides that it "shall be the duty of the Commission to take into consideration all questions which may be brought to its notice relating to the conservation and better utilization of the natural resources of Canada, to make such inventories, collect and disseminate such information."

The Census statement is up to December 15th, 1917, whereas the Commission's data are up to October, 1918, nearly one year later. Last autumn, our data were resubmitted to the various authorities for correction and revision.

JAMES WHITE,
Assistant to Chairman, Commission of Conservation.

Ottawa, Ont., February 25th, 1919.

Changes in details of the Hunter St. Bridge, Peterborough, Ont., that will mean a reduction of more than $50,000 in its estimated cost, have been suggested to the Board of Works by the consulting engineer, Frank Barber, Toronto.

Resolutions were passed by the Ontario Municipal Electrical Association, at its annual meeting this month, calling upon the provincial government to investigate the feasibility of a publicly owned telephone system, to secure the repeal of the federal act giving the Toronto-Niagara Power Co. certain rights, to secure additional payment for "the Hydro" for supply of power to munition plants, to secure provincial representation on the International Joint Commission, to petition the federal government against alienating the surplus water power of the province, and to advocate a senatorship for J. W. Lyon, president of the Hydro-Electric Railway Association.

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JUDGE MIGNAULT'S SUCCESSOR

NOW that parliament is again in session, it is most likely that the Cabinet will soon discuss the question of a successor to Judge Mignault as a member of the International Joint Commission. Despite rumours to the contrary, *The Canadian Engineer* is officially advised that the vacancy in the ranks of the Commission has not yet been filled.

The Engineering Institute of Canada and all other engineering and technical societies in Canada should grasp without delay the opportunity of making forcible representations to the government regarding the appointment of an engineer to this vacancy.

Attention has frequently been called in these columns to the fact that the work of the International Joint Commission is almost entirely of an engineering nature. Law and legal procedure have entered comparatively little into the discussions and decisions of the Commission. One lawyer on the Commission should be sufficient to give adequate legal advice. The present legal commissioner, Henry A. Powell, is quite capable of looking after that end of the Commission's responsibility.

Hon. Charles A. Magrath, chairman of the Canadian section of the Commission, is an experienced parliamentarian, but he is also a Dominion Topographical Surveyor, a Dominion Land Surveyor and a member of the Engineering Institute of Canada, and is therefore closely in touch with engineering problems and their solution. When Mr. Magrath was appointed to the Commission, one of the members of the government is said to have explained to the House of Commons that he was appointed because of his judicial mind. Apparently the government thought it necessary to apologize for appointing an engineer instead of a lawyer.

The appointment of a third member to fill the vacancy caused by the elevation of Judge Mignault to the Supreme Court bench, should be based solely and admittedly upon the appointee's engineering ability, and not upon his judicial or legal capability, because the services of another skilled engineer can be used to the greatest advantage in the work of the International Joint Commission.

As we have said before, it does not require a lawyer to decide how much water can be diverted from a stream for power purposes without interfering with navigation. The "K. C." hardly qualifies a man to decide the extent to which boundary streams can be polluted with sewage without endangering the health of communities which use those streams as water supply. Acquaintance with judicial procedure is no recommendation of one's ability in deciding the value of a lake as a storage pond for water power development. Blackstone is not the reference to whom one would turn in deciding the effect upon the great lakes of the water diversion through the Chicago Drainage Canal, or the effect upon the St. Lawrence River level of the construction of a submerged weir or of a dam.

The formal appointments to the International Joint Commission rest chiefly with the British authorities, we believe, but there would appear to be little doubt that Judge Mignault's successor will be named solely upon the recommendation of the Dominion Cabinet. The members of the Cabinet therefore, should be educated without delay to the necessity of appointing an engineer, so that Premier Borden, while he is in England, can discuss the matter with the Imperial government.

ELECTRIC GENERATION IN CANADA

ARE there 470 or 565 central electric generating stations in Canada? In a summary of central station statistics recently given out by the Dominion Water Power Branch, who co-operated with the Dominion Census and Statistics Office in taking a census of central electric stations throughout Canada, the number was stated to be 470. But the directory of central electric generating stations which has just been published by the Commission of Conservation as a report on "Electric Generation and Distribution in Canada," says that there are 565 such stations. The statistics in the latter directory also apparently "find" 263,172 more installed horse-power capacity than do the Census Offices' figures. Of this, 153,957 h.p. is additional hydro-electric power; 108,002 h.p. is developed by steam; and 1,213 h.p. by internal combustion engines.

Following is a comparison of the principle statistics quoted in the Commission's report with those given out recently by the Census Office:—

	Conservation Commission.	Census Office.
Number of central generating stations	565	470
Capacity, h.p.	2,107,743	1,844,571
Number of private plants	358	296
Capacity, h.p.	1,655,235	1,444,314
Number of public plants	207	174
Capacity, h.p.	452,508	400,257
Number of hydraulic plants	270	.....
Capacity, h.p.	1,806,618	1,652,661
Number of steam plants	201	.....
Capacity, h.p.	288,202	180,200
Number of internal combustion plants	94	.....
Capacity, h.p.	12,923	11,710
Installed electrical equipment, k.v.a.	1,684,615	1,387,521

Has the Census Office missed 95 generating stations and 263,172 h.p.? Or has the Conservation Commission's report been compiled upon a different basis? That seems to be the inevitable question.

Of course the manner in which the figures were gathered might make considerable difference in all of the totals, and even in the number of plants. For instance, the totals of hydraulically-developed horse-power installed might vary according to whether they represent the rated power of the turbines, the power at the generator couplings or the power measured at the switchboard; also according to the manner of listing plants that are central stations only in part. If

a pulp and paper mill, for example, develops 50,000 h.p. and uses 20,000 h.p. for its own manufacturing purposes, selling 30,000 h.p. to other firms, individuals or municipalities, the Conservation Commission lists that "central station" as hav- 50,000 h.p. capacity. Possibly the Census Office may list the station as having only 30,000 h.p. capacity, ignoring the 20,000 h.p. used for the firm's own requirements.

But even if this happens to be the explanation of the difference in horse-power totals, there still remains to be explained that apparent difference of 95 in the number of central generating electric stations. The Conservation Commission have not included in their list any stations excepting those that distribute electrical energy; and the name, location, horse-power capacity, etc., of every plant appears to be given in the directory. But it may be questioned whether the Conservation Commission's data really show quite 565 actually separate and distinct plants. For instance, the report lists two plants for Charlottetown, P.E.I., one steam driven and one gas-engine driven. But these two really form only one combined steam and gas-engine plant, owned by the Charlottetown Light & Power Co. Similarly the report lists two plants for Summerside, P.E.I., but there is only one combined gas and steam-power plant, owned by the Sun Electric Co.

Therefore there are really but 7 generating plants in Prince Edward Island instead of 9 as quoted by the Commission of Conservation. But the Census Office says there are only 6. Here are the 7 as named by the Commission:— Sun Electric Co.'s plant at Summerside; Tryon Roller Mills plant on the Tryon River; Montague Electric Co.'s plant on the Montague River; Kensington Electric Co.'s plant in Mill Valley; Charlottetown Light & Power Co.'s plant at Charlottetown; Leard Electric Light & Power Co.'s plant on the Huntley River; and Leard & Son's plant on the Crapaud River.

If such differences prevail throughout the two reports, they affect their accuracy, as to totals at least. Perhaps the Census Office and Dominion Water Power Branch were a little too conservative and the Commission of Conservation a bit too expansive in their totals. If so, it is certainly unfortunate that they did not combine their efforts into one joint report.

Pending some official announcement on the subject, the public can probably feel assured that there are probably more than 470 and less than 565 central stations in Canada, with a capacity of somewhere between 1,844,571 h.p. and 2,107,743 h.p.

Leaving all minor criticism aside, however, both of these government departments are to be congratulated upon their initiative and valuable work in compiling this data. The directory published by the Commission of Conservation is by far the best directory in that field ever issued, so far as Canadian statistics are concerned. It will be extremely useful to the whole electrical industry in Canada, and fill a long-felt want. It is timely and thorough and could have been compiled only by indefatigable labor, intelligent skill and most tactful correspondence.

When the Census Office's work is printed, which will be soon, we hope, it will no doubt be equally useful. It will contain some data that are not to be found in the Commission's volume,—such as wages, number of employees, revenues, capital invested, etc., and will also be a useful "check" on the accuracy of the Commission's report. It would be most unfortunate if the publication of the Conservation Commission's volume should jeopardize the printing by the government of the Census Office's work.

At the same time, it would seem to be most inadvisable to permit a second edition of the two separate directories to be issued. The Census Office should invite Mr. Denis, of the Commission of Conservation, and Mr. Johnston, of the Dominion Water Power Branch, to "get together" in their figures and to co-operate in compiling a 1920 or 1921 directory that might be even more complete and accurate than either of the present separate volumes.

(NOTE.—Just as this issue was going to press, a letter from James White was received. It appears on page 265 and has a bearing upon the points above discussed.—EDITOR.)

PERSONALS

W. H. FAIRCHILD, city engineer of Galt, Ont., has been appointed manager of the Galt Public Utilities Commission. Mr. Fairchild will manage both the hydro-electric and water works departments.

HERBERT THOMAS ROUTLY, who was recently appointed construction engineer of provincial highways, Ontario, was born in 1878 at Lindsay, Ont., where he graduated from the Collegiate Institute and the Model School. After two years' teaching experience, he went west for two years, living in various parts of Manitoba, Saskatchewan and British Columbia. Returning to Ontario in 1900, he secured an office position in connection with the Kirkfield section of the Trent Canal, resigning three years later to study civil engineering at the University of Toronto, where he graduated with honors in 1906. During the summer vacation in 1904, he was topographer on C.N.R. location surveys, and during the 1905 vacation was assistant on bridge construction, C.N.R. After graduation, he became an articled pupil under George Abrey. During 1906 and 1907 he was in charge of survey parties in Cobalt and Toronto. After receiving his O.L.S. in 1908, he practiced at Haileybury in partnership with the late Robert Laird. In 1909 he became a D.L.S., and was appointed town engineer of Haileybury, in charge of roads, water supply and sewers, and was also engineer of the township of Coleman. In 1910 he formed a partnership as Routly, Summers & Malcolmson, which was later changed to Routly & Summers. From 1910 to 1918 his firm had a large practice throughout the mining districts of Northern Ontario. In 1911 Mr. Routly formed the Routly Road Co. and undertook construction work for the York County Highway Commission. From 1913 to 1915 he was in charge of large road contracts in the County of Huntingdon, P.Q., where he had two plants. From 1916 to 1917 he built roads near Albany for the New York State Highway Commission, and last year returned to Ontario with his entire plant and undertook road maintenance contracts for the county of Dundas, Ont. In 1912 he was president of the Haileybury Board of Trade. As an engineer, he prepared data for that town that resulted in its choice as the Temiskaming county-seat. Mr. Routly is a member of the Engineers' Club of Toronto, and of the Engineering Institute of Canada. He will have charge of all the contracting work and also of day labor, under the direction of W. A. McLean, deputy minister of highways, Ontario. Mr. Routly has disposed of his road plants and has severed all previous business connections.

H. G. ACRES, hydraulic engineer of the Hydro-Electric Power Commission of Ontario, and L. V. RORKE, chief of the Ontario Survey Branch, have been appointed by the Ontario government to represent the province on the Lake of the Woods Control Board. As previously announced, the Dominion government's representatives are W. J. Stewart, consulting engineer to the Department of External Affairs, and J. B. Challies, superintendent of the Dominion Water Power Branch. Mr. Stewart will be the chairman of the board.

CONSTRUCTION NEWS SECTION

Readers will confer a great favor by sending in news items from time to time. We are particularly eager to get notes regarding engineering work in hand or proposed, contracts awarded, changes in staffs, etc.

▲—Denotes an item regarding work advertised in *The Canadian Engineer.*

●—Denotes contract awarded. The names of successful contractors are printed in CAPITALS.

ADDITIONAL TENDERS PENDING

Not Including Those Reported in This Issue

Further information may be had from the issues of *The Canadian Engineer* to which reference is made.

PLACE OF WORK	TENDERS CLOSE	ISSUE OF	PAGE
Belton, Ont., drain	Mar. 4.	Feb. 20.	44
Cornwallis, Man., bridge	Mar. 5.	Feb. 6.	208
Estevan, Sask., church	Mar. ...	Feb. 13.	50
Guelph, Ont., sewer pipe	Mar. 13.	Feb. 20.	250
Halifax, N.S., school	Mar. 1.	Feb. 20.	46
Halifax, N.S., school building	Mar. 1.	Jan. 23.	46
Hamilton, Ont., supplies	Mar. 3.	Feb. 13.	50
Hardisty, Alta., school	Mar. 1.	Feb. 13.	50
London, Ont., supplies	Mar. 6.	Feb. 20.	50
Ottawa, Ont., bridge	Apr. 16.	Feb. 6.	41
Paisley, Ont., bridge	Mar. 10.	Feb. 13.	42
Pembroke, Ont., waterworks pumping unit	Mar. 7.	Jan. 30.	44
Pembroke, Ont., waterworks pumping unit	Mar. 7.	Feb. 13.	48
Rapid City., Man., bridge	Mar. 1.	Feb. 13.	42
Sarnia, Ont., incinerator	Mar. 14.	Feb. 13.	50
Sherbrooke, Que., highway	May 5.	Jan. 23.	44
Sutherland, Sask., sewers	Apr. 9.	Feb. 20.	44
Toronto, Ont., office	Mar. 3.	Feb. 20.	48
Winnipeg, Man., Tuxedo buildings	Mar. 4.	Feb. 20.	50

BRIDGES, ROADS AND STREETS

Beauceville, Que.—Construction of roads is contemplated by the County Council. District engineer, Armand Dupries, Quebec.

Brandon, Man.—A. C. Emmett, Secretary of the Manitoba Good Roads Commission, at a recent meeting sketched a plan for the building of trunk roads across the province to be financed by sale of bonds to motorists.

Brantford, Ont.—See item under "Miscellaneous" heading on page 48.

Brantford, Ont.—Tenders will be received by the undersigned until March 1st for construction of culverts costing $4,500 for the Township Council. J. A. Smith, Court House, Brantford.

Brockville, Ont.—Repairs to road in the eighth concession of township will be made early in spring. Township clerk, John Mellafont.

Champlaine, Que.—Construction of roads is planned by the County Council. Clerk, D. G. Trudelle, St. Genevieve de Batiscan.

Chilliwack, B.C.—The Provincial Government will be asked to pay one-half the cost of surfacing the Canadian Highway through this city.

Compton, Que.—Tenders will be received until March 3rd for construction of eleven miles of roadway from Sherbrooke to Beauceville. Plans and specifications are with the secretary-treasurer, Arthur B. MacDonald, Gould, Que.

Fenelon Falls, Ont.—At a meeting of Victoria County Roads System Board, held at Lindsay, a communication from Ontario County re linking up its road system with Victoria was received favorably and the building of the connecting link will be discussed by the two counties. The board decided to commence actual work on construction this year and will spend not less than $70,000. The board also decided to buy a steam roller, stone crusher and several road drags.

Fort Fraser, B.C.—It is urged upon the government by the Good Roads League to extend the Fort Fraser Rd. in a north-westerly direction to connect with the road system of Bulkley Valley. Dr. King, Minister of Public Works, Victoria, B.C.

Fredericton, N.B.—Announcement has been made that the Department of Lands and Mines have arranged to loan to the Engineering Department of the Canadian National Railways the diamond drill which is owned by the province in order that borings may be made in the river here to ascertain information as to the conditions for foundations for piers for the new bridge. The drill will be operated under the direction of District Engineer Black, of Campbellton.

Galt, Ont.—It is said that a double-track bridge will be erected here by the C.P.R. Co.

Gould, Que.—Tenders will be received by the undersigned up till 2 p.m., March 3rd, for building the portion of the Sherbrooke-Beauceville road running through the Municipality of Lingwick from the town line of Bury to the town line of Winslow, a distance of over eleven miles. Plans and specifications, also form of tenders, may be seen at the secretary's office on Saturdays. Arthur B. Macdonald, secretary-treasurer, Gould, Que.

Halifax, N.S.—Bridges and roads will be constructed by the Department of Public Works. Engineer, W. G. Yorston, Halifax.

Hamilton, Ont.—City Engineer E. R. Gray has reported on street extensions up the mountain, east of Sherman Ave. The matter will come up for discussion at a special meeting of the City Council.

Hamilton, Ont.—Plans have been prepared by Engineer E. R. Gray for vehicle crossings and footpaths over the G.T.R. and T., H. and B. at a number of points between Wentworth St. and Kenilworth Ave. Application will be made to the Dominion Railway Board for approval.

TENDERS FOR BRIDGES

Sealed tenders, addressed to S. T. Anderson, Township Clerk, Comber, Ont., will be received up to 12 o'clock noon on Saturday, the 8th day of March, 1919, for the construction of two steel beam concrete bridges—one where the 12 and 13 Sideroad crosses the Big Creek Drain, and one where the 10th Con. road crosses the Big Creek Drain, both in the Township of Tilbury West.

Plans and Specifications may be seen at the office of S. T. Anderson, Comber, Ont., or at the office of the undersigned, Davis Block, Windsor, Ont.

The lowest or any tender not necessarily accepted.

J. J. NEWMAN,
Township Engineer.

Windsor, February 24th, 1919. 159