cious investment of a few thousand dollars had resulted in the reclamation of waste lands, the value of which had amounted to several times the amount of the sum expended H J. Bowman read a paper entitled Arbitrators and Witnesses, dealing with the respective attitude which should be taken by each. In the absence of W. M. Davis, his paper on "The use of Field Tile for Large Drains," was read by A. S Code The writer showed the superiority of tile drains for several reasons The following table gives approximately the comparative cost of open and tile drains of various depths.—

COST PER ROD.

Depth.	Open Drain.	Tile'd Tile 6 in.	8 in.	10 in.	12 in	14 in.	18 in.
3 feet	$1 08	0 90	1.20				
4 "	1 80	0 96	1 26	1.86	2.19	3 00	
5 "	2 52	1 27	1.60	2.00	2 40	3 60	5.00

It would appear from the above that for depths up to 5 feet, and for sizes of tile up to 12 inches, the tile drain has the advantage, considering only first cost, and taking all things into account field tile of any size capable of carrying off the water, and for any depth, are cheaper than an open drain. In deciding on the size of tile it is not necessary to provide a capacity that would be ample for a culvert, neither is it safe to calculate on a drain having twelve months in which to dispose of the annual rainfall In this latitude a rainfall exceeding one inch in twenty-four hours is exceptional, so that this quantity may reasonably be taken as a basis for our calculations. Not more than one-half the rainfall can be depended on to reach the trunk drain, a proportion which decreases as the area of the watershed increases. If the water can be removed within forty-eight hours, as a rule, no damage to the crops will result, therefore a trunk drain that will convey about 900 cubic feet of water per acre in twenty-four hours will be ample for ordinary drainage; lateral drains will require a greater capacity depending on the facility with which the rainfall reaches the tile.

Tile over twelve inches in diameter should not be less than two feet in length, as they can be laid more evenly; they should be particularly well burned, and moulded from the toughest clay; many qualities of clay, which make fair tile of small size, are totally unfit for hose of large diameter The thickness should increase from one inch for 12-in. tile to 1¾ inch for 18 in. tile Two factors of vital importance in drainage are perfect alignment and grade, the curves should not have a less radius than 60 feet An accurate grade can best be obtained by means of "boning rods;" that is, by placing two bridges across the trench about 300 feet apart, the tops being adjusted so that a line joining the top of one with the top of the other will be parallel with the grade line. A rod equal in length to the distance of this line from the grade line is then used to obtain the exact elevation of each tile; this method is especially advantageous when working in quicksand. Catch basins or manholes should be placed about 1,000 feet apart to admit of easy inspection of the drain; they should have a pit 18 inches below the grade line for the purpose of intercepting sand; they also provide a convenient means of connecting lateral drains Wherever possible, these catch basins should be placed at crossings of fences.

In accordance with the usual practice, the report of the committee on entertainment was taken as read, and ordered to be printed in the annual report. Professor McLeod addressed the association on the subject of proposed incorporation of civil engineers in Ontario, and explained its objects and its relation to the position occupied by land surveyors The discussion on the report of council was begun, and lasted the remainder of the session. In the afternoon the discussion on the report of council was continued, and by-laws numbers 45 and 46 were ratified. Under motions; the papers on "Unrecorded Original Field Notes," by J J. Murphy, and "Lake Erie Survey," by Otto J. Klotz, also the report of the committee on drainage, were taken as read, and ordered to be printed in the report.

Since the date of the meeting the balloting for the election of officers for the ensuing year has resulted as follows:—

President—P. S. Gibson, elected by acclamation.
Vice-President—H. J. Bowman "
Sec.-Treas.—T. G. Van Nostrand "
For Council of Management—F. L. Foster and J. L. Morris.

The report of the committee appointed to confer with representatives of the Can. Soc. C.E., was presented by Major Sankey. A cordial vote of thanks was tendered the retiring president for the manner in which the duties of that office had been fulfilled by him, after which the meeting adjourned.

The Hess Metallic Furniture Company, Niagara Falls, Ont., has begun building and will probably be the first company to use electric power developed on the Canadian side of the river for manufacturing purposes.

MANUFACTURE AND USE OF SAND CEMENT.

The following extract from a paper by C. B. Smith, McGill University, Montreal, was read by the author at the recent meeting of the Canadian Society of Civil Engineers in Montreal:

The use of sand cement has increased in Europe, and particularly in Denmark (where it was invented), during the past five years, and it has been tested by several American engineers, with satisfactory results, and has been used in the proportions (1 to 1) to 3, in the concrete for the foundations of St. John's Cathedral, New York, in which 3,000 yards were used, and in other places.

The advantages claimed for the material are, that where great strength is not required, mortars will be more dense, stronger, and will work more smoothly on the trowel, in which a portion of the sand has been ground together with the cement, before use in the mortar Another claim is that the cheaper grades will replace lime mortar in plastering, as it will set and dry quicker, and also, again, that in dock walls a very dense concrete can be produced which will prevent the destructive percolation of sea water.

Tests made at St. John's Cathedral foundations gave the following results:—

		Compression.
(1) Sand cement (1 to 1) Concrete. 2 sand 3 gravel		1 week—2,144 lbs. per sq. in. 2 weeks—2,312 lbs. per sq. in. 4 weeks—2,588 lbs. per sq. in.
(2) Sand cement Mortar.	(1 to 1) sand cement 3 sand.	1 week's tension 156 lbs. 2 weeks' tension 188 lbs. 4 weeks' tension 200 lbs.
(3) Portland cement. Mortar, 1,500 bbls.	1 cement. 3 sand.	1 week's tension 137 lbs. 2 weeks' tension 170 lbs. 4 weeks' tension 179 lbs.

The paper concluded with a description of the plant at Glen Falls, N Y., where tube mills and flint pebble balls are used in grinding, and a statement that the American sand-cement output is ground very fine (5 per cent. residue on 180 mesh sieve), the tests will show higher results than those in the table which is added, giving tests made in Europe on sand cement mortars of various proportions.

The usual proportions in America are (1 to 1) and (1 to 6), the former competing with Portland cement and the latter with lime.

(The manufacture of sand cement has been begun in Canada by the Rathbun Co., of Napanee Mills, and the St. Lawrence Cement Co., of Montreal)

EXTRACT FROM EUROPEAN TESTS IN GERMANY AND DENMARK.

TENSILE (WATER).

Mortar.	1 wk. lbs.	4 wks.	3 mos.	6 mos.	1 year.
(1 to 2) to 2.....	142	242	299	384	400
(1 to 3) to 2.....	114	185	228	271	326
(1 to 6) to 2.....	57	114	156	..	220
(1 to 12) to 2.....	43	114	128	157	142
(1 to 24) to 2.....	28	57	57	57	57

COMPRESSIVE (WATER).

Mortar.	1 wk. lbs.	4 wks.	3 mos.	6 mos.	1 year.
(1 to 2) to 2.....	1,080	1,795	2,148	2,578	3,365
(1 to 3) to 2.....	497	1,080	1,637	2,008	2,485
(1 to 6) to 2.....	200	384	667	....	1,050
(1 to 12) to 2.....	171	384	726	796	866
(1 to 24) to 2.....	128	270	370	370	383

TESTS ON SAND CEMENT.

MADE IN M'GILL COLLEGE LABORATORIES

(a) (1) Iron-clad brand Orlen Falls (1) Sand:—

Neat.	Tension. 1 wk.	4 wks.	Compression. 1 wk.	4 wks.
	475	602	3,380	4,650
(1 to 1) to 3....	73	105 pressed.		
(1 to 1) to 3....	..	185 rammed.	1,060	1,120 rammed.

Blowing test good residue 1.5 % on No. 100 sieve.

(b) (1) Aalborg, Denmark. 1 Sand (Cathedral brand).

(1 to 1) to 1	279	398	1375	2012
(1 to 1) to 3	44	66	..	300

This is from a barrel which was supposed to be damaged.
Residue 1.2% on No. 120 sieve. 0.7% on 100 sieve.
" 18.0 % " 180 "

(c) (1) Star (Rathbun). 1 Sand (Ensign brand).
4 months, 800 lbs.

Neat.	1 wk.	2 wks.	1 wk.	2 wks.
(1 to 1) to 3..	66	95 pressed	..	400 pressed.
(1 to 1) to 3..	183	192 rammed	..	880 rammed.

Residue 0.6% on 100 sieve.
" 1.0% on 120 "