

COST OF ONTARIO HYDRO-ELECTRIC SYSTEM.

The total estimate of cost of construction of the Ontario Hydro-Electric system, made in 1908, was \$4,006,927, according to a statement issued by Hon. Adam Beck, chairman of the commission. Of this \$3,515,751 has been spent. Before the line is completed it will cost \$405,416 more. The estimate for the right-of-way was \$227,375, while the sum expended totalled \$456,067, with an additional \$40,495 necessary to complete this, which makes the total to complete the right-of-way \$496,562.

The amount asked for transmission lines was \$1,842,964. The amount already spent is \$1,623,172, and to complete their construction a further expenditure of \$75,926 will be required. This brings up the total estimate to \$1,699,098.

The sum of \$1,377,176 was asked for the erection of transfer stations, \$1,023,258 has been spent and their completion will involve the further expenditure of \$137,099, which brings the total estimate to \$1,160,351.

For testing instruments and all tools the cost was scheduled at \$31,970. So far, all spent on this work totals \$14,954.

Not included in the estimates of 1908 was \$106,800 for protective relay and \$51,485 for spare transformers. There has been actually spent under these two heads \$91,628 for protective relay and \$46,336 for spare transformers, and \$15,171 and \$5,148 respectively is needed to complete the work.

The total estimated cost to complete the Port Credit station is \$96,986, and \$42,033 is needed to complete the work on which \$54,953 has already been spent.

For new lines to Port Credit, Brampton, Weston, Seaforth, Mitchell, London and Hamilton asylums, Agricultural College at Guelph, and the two London lines, with the Springbank and Dundas loop, the estimate was \$240,000. The commission will complete the work with this sum, of which \$199,477.95 has already been spent.

Step-down equipment for the Watertown and Port Stanley lines will cost \$37,914.

Receipts from municipalities to September 30 last totalled \$134,422. Estimated receipts to October 1 total \$33,807. Payments to the Ontario Power Company for September and October for power and for charges to maintenance and operation will total by the end of this month, \$142,991. For September the payment for power to the Ontario Power Company was \$74,642. The estimated excess receipts over and above expenditures to October 31 are \$25,438.

The estimated expenditures and revenue for the fiscal year of 1911-12, which begins on November 1, are given by Hon. Mr. Beck with the sinking fund out. The total capital cost of the Niagara system to July 31, including all new stations and transmission lines constructed or under construction at that date is \$3,921,167.

An income of \$473,828 from municipalities based on estimated load of January, 1912, gives a revenue which ends the next fiscal year with a surplus of \$828.

This estimated surplus is reached after an allowance of \$18,539 has been made for power lost in transmission. The experience of the month of September, however, leaves the commission to believe that such an allowance was unnecessary. In that month, while 11,850 horse-power was purchased from the Ontario Power Company, yet by overlapping it was possible to supply the municipalities with the equivalent of 13,370 horse-power. If this can be continued during the coming year, instead of a loss of \$18,000 there should be a profit of about \$20,000 to the credit of the municipalities, making the surplus on the year's operations about \$40,000.

The statement of the Nipissing Mines Company shows the operating company, the Nipissing Mining Company, to have had on hand in cash on October 2, \$999,894; ore in transit and at smelters, \$131,782; ore sacked at mine, ready for shipment, \$197,653, or a total of ready assets of \$1,329,330. The dividend of 5 per cent. and bonus of 2½ per cent. requires \$450,000.

HUDSON RIVER TUNNELS.*

By J. Vipond Davies, Chief Engineer Hudson & Manhattan Railroad.

The Hudson & Manhattan Railroad, which comprises only 19 miles of single track, probably represents some of the most difficult conditions and also the most expensive construction of any similar railroad, and the total cost per mile of road was probably as high, or even higher, than any other rapid transit railroad in existence.

The difficulties in the construction of any such rapid transit railroad as this, practically the whole of which exists below the level of the sea, involved obviously an extremely large cost. But while the total cost of the undertaking is great and involves for the complete railroad and necessary real estate, power stations and equipment, a sum equivalent to approximately two and one-half millions of dollars per mile of railroad, the railroad is peculiar in the concentration of its business, and the short haul over which it operates its traffic permits a low operating cost per passenger to offset the high original capital cost of construction.

The system as a whole, including its connection with the Pennsylvania Railroad, has been in operation only since the first of October of this year. Nevertheless, the growth of traffic month by month for the current year has shown an increase of practically 20 per cent. over the traffic of the same months last year, and as the suburban district of New Jersey develops and the education of the travelling public increases, it appears certain that a growth such as this may reasonably be expected to continue.

Determining Factors.

The determining factors in arriving at the capacity of a railroad such as this were: (1) The carrying capacity of a train, determined by the dimensions of the cars and the cars per train. Physical conditions of construction at terminals limited the possible train length to approximately 400 ft., suitably divided into eight-car trains. The cars are about 50 ft. long by 9 ft. wide. (2) The headway which it would be feasible to obtain with the best possible equipment of brakes on the cars and by a satisfactory signal system, operating an automatic block system equipped with automatic stops, permitted operation of trains on an actual headway of 90 seconds.

Track Construction.

For the most part the track in these tunnels is designed with ballast foundation, but at certain points, such as on curves and at junctions, the track is on a concrete foundation, but as a general proposition we have found the ballasted track more satisfactory through the ability of the maintenance department to more easily maintain the surface and to renew ties and rails. For the most part the running rail is open hearth steel with carbon between .75 and .90. The steel is entirely satisfactory in these tunnels where the changes in temperature are extremely slight. The principal trouble which has arisen in the maintenance of track is the rapid corrugation of rail at points where power is usually applied or where brakes are applied. In such locations it has been found desirable to renew the rail without any regard whatever to the fact that the wear of the rail may not be sufficient to justify renewal, but the renewal is made solely to obviate the unpleasant "chatter" due to the corrugations in the rail.

*Abstract of paper read before the American Electric Railway Association, Atlantic City, N.J., Oct. 9-13, 1911.