

100 ton locomotives, to meet the requirements of intercommunication with steam lines. Plate girder bridges on concrete abutments would be used in most cases, but some steel viaducts would be required. Following the practice of the steam lines in the district, all overhead railway crossings were estimated on crossing two tracks. Half interlocking plants would be used for the protection of all grade crossings, to be operated by such employees as would have other duties in the vicinity. These plants would consist of a small central tower with interlocking machine controlling home and distant signals on the steam lines, and derails and home signals on the electric line. The electric line signals would be located close to the crossing, to be conveniently operated by conductors when the regular attendants were not on duty.

The estimates include the cost of brick

fic may be properly handled without the capital cost being raised to an amount that would cause unusually heavy expenses for normal operation. These systems have also been chosen so that the line may be able to take care of freight traffic and be extended short distances without installing additional sub station equipment and trolley feeders. Should it be decided to construct only a short portion of the complete line, it would be possible to use the low voltage d. c. until such time as extensions warrant the system figured on. The single catenary bracket arm type of construction has been the basis of computation, with 35 ft. wooden poles spaced at 150 ft. intervals, with 7-16 in. steel messenger, and 4-0 grooved copper trolley wires.

Heavy double truck cars would be used for the through service, with lighter cars on the suburban traffic. The car equipment

motors with multiple control would be the probable equipment. Standard steam line freight cars would be required for freight and express business, and it is planned to have sidings between stations, so locating the loading and unloading points as to reduce team haulage on large shipments.

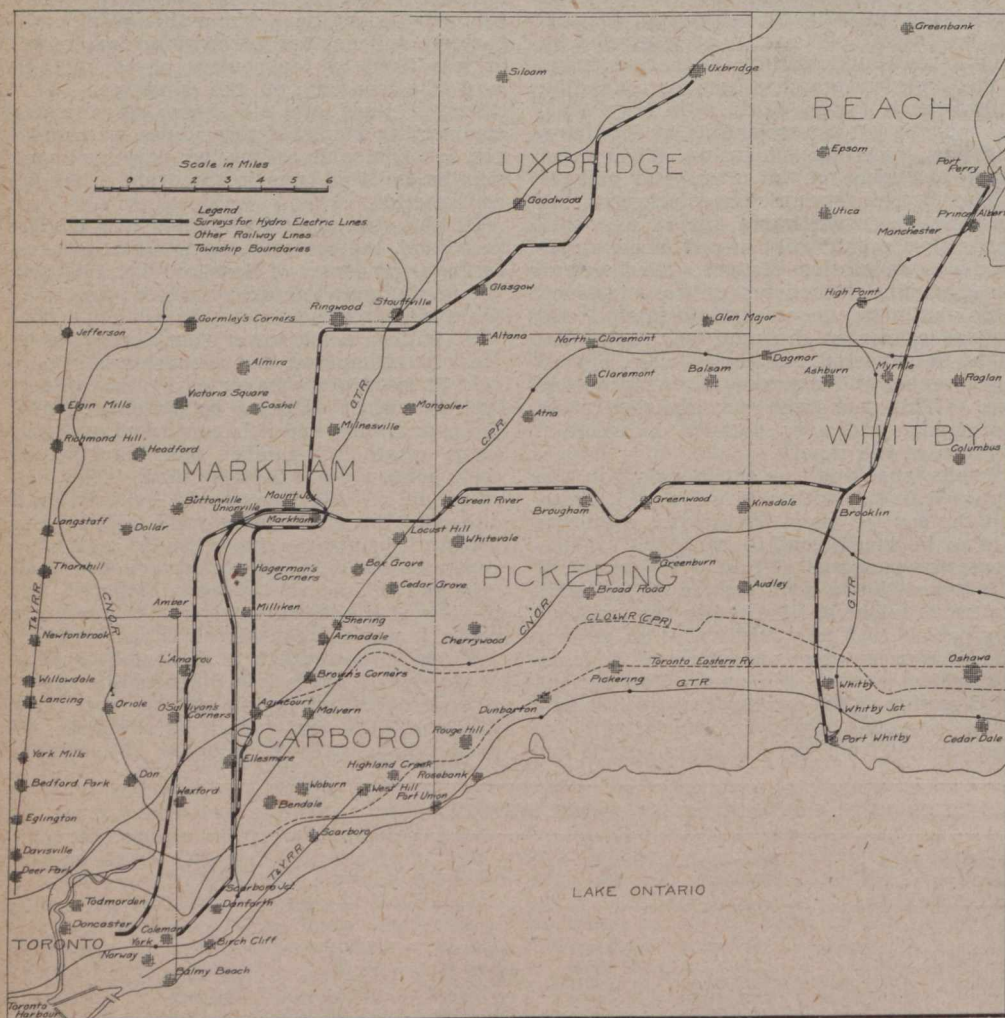
In estimating the probable capital costs, the cost of the right of way was obtained from information obtained in the field. It is said that the costs will probably be less than estimated, as several owners have expressed a willingness to give a free right of way through their property. Information on the cost of bridges over grade and level railway crossings, signalling, interlocking plants, etc., was obtained from the present railways in the district. Sufficient data and costs were also obtained from manufacturers of bridges, rails and track fittings, interlocking plants, cars, electrical equipment for rolling stock and sub stations, etc., to enable accurate figures to be prepared on the capital cost of the line. Plans and profiles have been prepared of the lines surveyed, and the quantities of grading, draining, etc., figured for the different sections. To all this has been added an overhead charge of 7% to cover engineering, interest during construction, and bond discount.

The total revenue of the proposed line has been divided between passenger, freight, milk, express and mail business, and the sum deduced under each of these headings has been checked with statistics obtained from electric lines operating through a somewhat similar territory. The similarly situated electric lines of which data are given are the Brantford and Hamilton Electric Ry., Chatham, Wallaceburg and Lake Erie Ry., Hamilton Radial Electric Ry., Niagara, St. Catharines and Toronto Ry., Toronto and York Radial Ry., and Windsor, Essex and Lake Shore Rapid Ry. Of these several lines, statistics for 1912 are tabulated: Showing length, passenger number and revenue, freight tonnage and revenue, express revenue, advertising revenue, and operating expenses. From these figures, some interesting comparisons can be drawn.

As a further comparison of probable revenue, the estimated revenue obtained by the steam lines operating in the Toronto northeastern territory from the centres of population along the lines has been obtained from reliable sources, for the different classes of traffic that are to be handled. The places considered are Agincourt, Milliken, Unionville, Markham, Stouffville, Uxbridge, Locust Hill, Brooklin, Myrtle and Port Perry, and where the place is served by more than the one line, separate estimates are tabulated. From these several centres, the estimated total passenger revenue is \$92,500; milk, \$16,390; freight, \$340,000; express, \$21,000; with a total combined revenue obtained by the steam lines from this territory of \$469,800. Basing the estimated revenue on the conditions existing in similarly situated electric railway territory, using the estimated revenue of the steam lines to obtain a detailed analysis of the probable revenue, the following table has been compiled:

Passenger revenue—900,000 at 4 cts.	\$36,000	
Passenger revenue—600,000 at 40 cts.	240,000	
		\$276,000
Freight revenue—60,000 tons at \$2.25..	135,000	
Milk Revenue—150,000 cans at 20 cts....	30,000	
Express and mail revenue	8,000	
Advertising revenue	1,500	
Total revenue from operation		\$450,000

Further checks on the estimated traffic that might be expected from the district were made. For the passenger traffic, a study of interurban lines, on the basis of a return per head, shows that this varies un-



Routes of Proposed Municipal Hydro Electric Lines from Toronto.

passenger and freight stations at important towns, and shelters, with small loading platforms, at the most important road crossings. It is proposed to have a car barn and shops of brick construction located near Markham, at the junction of the Uxbridge and Port Perry lines, and galvanized iron shelters on steel frames and concrete footings at termini, for housing cars over night. Sub stations would be provided by fireproof station additions at Markham and Brooklin.

The 2,400 volt d. c. system has been used in figuring the cost of the electrical equipment, but the layout and traffic would give very similar results with single phase a. c., or 1,200 volt d. c. These systems, while more expensive in first cost and operating expenses than the lower voltage d. c. systems, for short lines, are necessary for a line of this type, in order that holiday traf-

would be quadruple 100 or 125 h. p. motors, hot water heaters, automatic air brakes, pantograph trolleys and double end multiple control. The cars would have smoking and baggage compartments in addition to the passenger section. Main line cars would be capable of operating up to 60 m. p. h., with schedule speeds of from 25 to 35 m. p. h., the stops varying from 4 per mile to one every 2 miles. Trailer cars would be operated on holidays and during the rush hours on a reduced schedule. Express cars for milk and light freight traffic would be equipped with large motors, capable of shifting or hauling freight cars short distances. The locomotives considered would weigh up to 60 tons, and would be capable of hauling from 6 to 20 freight cars, or 3 or 4 passenger trailer cars for excursion business. Quadruple 100 or 150 h. p.