sion. It is proposed to build a dam of sufficient height to back the water up to Ben Millar bridge and to further increase the head by diverting the flow across the neck of a sharp bend in the river. The additional head obtained by this diversion will be at 5 to 15 feet, depending upon the relative locations of the dam and power-house, and the total average head available would be about 80 feet.

The largest item of capital cost in connection with this development is the dam construction, and before the flow characteristics of the river had been investigated it was thought that earth fill construction could be used for the main dam, but the abnormal flood flow conditions evidenced by this spring's measurements demonstrated the practical impossibility of utilizing this type of construction at the Black Hole. It was therefore necessary to largely increase such preliminary estimates as had been made to provide for a masonry dam, and the hollow reinforced type of construction was adopted as being the cheapest and most economical after giving proper consideration to safe and efficient handling of ice and flood-water.

In a general way it may be said that the conditions relative to development at the Black Hole could not well be more unfavorable, as the low water power conditions are such as to make the revenue-producing power capacities very small, while the flood conditions are such as to call for an abnormally heavy capital expenditure for dam construction and permanent works. The annual cost of generated power is therefore affected by reason of the fact that the revenue from power generated at low stages of flow must be sufficient to cover the heavy capital charges and maintenance costs arising out of the necessity for handling an abnormal flood discharge.

Two estimates of the cost of development at the Black Hole have been made, one for 2,000 h.p., and one for 6,000 h.p. installed capacity. The 2,000 h.p. estimate represents the cost of developing the Black Hole site, as an independent source of power, to the limit of dependable 10-hour capacity. The 6,000 h.p. estimate provides surplus installed capacity for the purpose of using the higher stages of flow to supply auxiliary power to the Niagara system.

The 2,000 h.p. estimate shows a capital cost of $587,000, and a total annual charge of $45,500. The 6,000 h.p. estimate shows a capital cost of $637,000 and a total annual charge of $51,500. Considering these figures in connection with the statements made above as to the effect of a low power capacity, combined with a heavy flood discharge, upon cost, it is interesting to note:—

1. In the 2,000 h.p. estimate, the dam construction amounts to 63 per cent. of the total capital cost, and the annual charges against dam construction alone amount to 51 per cent. of the total annual charges.

2. In the 2,000 h.p. estimate, the interest and sinking fund charges amount to 75 per cent. of the total annual charges.

3. In the 6,000 h.p. estimate, the dam construction amounts to 58 per cent. of the total capital cost, and the annual charges against dam construction alone amount to 45 per cent. of the total annual charges.

4. In the 6,000 h.p. estimate, the interest and sinking fund charges amount to 71 per cent. of the total annual charges.

It is evident from the above figures that the annual cost of generated power at the Black Hole will be high as long as the interest and sink fund continues to be an annual liability, the more so because the revenue from such continuous power as can be generated under conditions of minimum flow will always have to carry the bulk of the annual charge against the development.

FREIGHT RATES BY WATER

The plans of the department of railways and canals for ascertaining the average rate per ton per mile on the inland waters of Canada involved the recording of the freight rates on each ship's report filed at the various canal offices. As an alternative those operators who wished to do so were permitted to send a monthly statement to Ottawa of tonnage, mileage and gross freight earnings. Ship owners were also required to send in at the close of the season a report showing:—Total tons carried, total ton mileage of loaded vessels, gross receipts from freight. On the whole, and having regard to the difficulties which are inseparable from the inauguration of new undertakings of that character, the results obtained during the past year the first of the operations of the plans were satisfactory. For example, out of a net Canadian tonnage of 6,942,278, definite information was received with regard to the mileage and freight earnings on 6,292,661 tons. St. Peters and St. Andrews canals were left out of the scheme for the year 1912, and they accounted for 170,358 tons; so that the actual net Canadian tonnage affected was 6,771,920. Returns were thus received in relation to 93 per cent. of Canadian business. These returns covered all classes of traffic, and it might reasonably be assumed that had every ton been accounted for, the result would not have been altered.

The Canadian returns applied to 6,292,661 tons of freight, to 3,286,187,160 ton miles, and to gross freight earnings amounting to $6,378,893.43.

From United States shipping companies reports were received covering 26,030,661 tons, out of a total net tonnage of 36,840,812. These reports had reference to all classes of commodities, and were thoroughly typical of the whole business on inland waters of Canada. It may be confidently asserted that absolutely complete returns would not have materially affected the final calculation of the average rate per ton per mile. The number of ton miles accounted for amounted to 21,799,392,809, and the gross earnings on United States freight to $14,617,368.60.

Using the factors which have been indicated—the ton mileage and the gross earnings from freight—the results are as follows:—

Canadian traffic:—

Average rate per ton .....91. 04 cents.
" " per mile ..... 0.194 "

United States traffic:—

Average rate per ton .....50. 62 cents.
" " per mile ..... 0.067 "

Without an explanation, the difference between the Canadian and United States rate per ton per mile will not be understood. Of the 36,840,812 tons of United States traffic through the canals of Canada in 1912, no less than 31,134,251 tons, or nearly 85 per cent., consisted of iron ore. Upbound coal accounted for a further 2,945,441 tons, or 8 per cent. In fact, if iron and coal were eliminated from the total account, the volume of Canadian traffic would exceed that of the United States.

The transportation of iron ore and coal is a special feature of the trade of the Great Lakes. Most of the ore is carried by the vessels of the Pittsburg Steamship Company, and the rate in 1912 was 55 cents per ton from the head of Lake Superior to ports on Lake Erie. These vessels are owned and operated by the iron interests of Pittsburg, and do not carry other commodities than ore and coal—ore down and coal up. For this upbound coal, without regard to ownership of the vessels, the rate last year was 30 cents per ton. Thus, while wheat was being carried to Buffalo at as high a rate as 2.616 cents per ton per mile, iron ore was passing over the same route at .063. Coal was being moved upward at the still lower rate