choice of line. At the west end a long strip of property was offered reaching nearly to the Back River. It so happened that on this property was the best point at which to cross the C.P.R.'s Atlantic and North Western line, so this end was promptly and satisfactorily settled.

The east end was the subject of longer debate and some warmth of argument. Most English-speaking people think of Montreal as extending from the mountain to Dorchester St., and from Park Ave. to the confines of Westmount, with an addition for business purposes extending east and south for half a mile from the Place d'Armes, and of St. Catherine St. as being the main and only important artery.

This is only a small part of Montreal in reality, but the conviction in the Anglo-Saxon mind that this is Montreal, the whole of Montreal, and nothing but Montreal, is almost as fixed and ineradicable as the Englishman's idea that the whole world is centred about his own tight little island.

As a result of this obsession, it was difficult to get any site off St. Catherine St. even seriously considered. A line near University Ave. was actually adopted, and abandoned only when it was shown that this was of no use except for purely passenger business; that there was no chance for extension eastward, and that it must for all time to come remain a dead end branch six miles long, and worse in this respect than either the C.P.R. or the G.T.R.

Finally, the present line was adopted mainly for the reasons that it gave a continuous line from the mountain to to the water front, with opportunity to connect with the Harbor Commissioners' tracks, and through them with the system extending to Quebec and Chicoutimi; that in doing this it passed through some of the best freight-producing districts in Montreal, and that it did all this with a minimum of property damage and with an absolute avoidance of grade crossings or even distortion of street grades.

There is further, an avowed intention on the part of the Harbor Commission to build a dam across the river to St. Helen's Island and a bridge from it to the east shore, which will furnish a route for such roadways and railways as care to avail themselves of it.

It is more than probable that the Quebec, Montreal & Southern and the Intercolonial will avail themselves of the chance, for the Grand Trunk's great bridge is already congested and overcrowded; but this is a matter for the future.

Grades Through Tunnel

Closely allied to the question of alignment, and in some respects even more important, is that of grades. I have already alluded to the increasing length and weight of passenger trains. The C.N.R.'s standard transcontinental train averages eleven cars, and with this its Pacific type locomotives get over the 1% grades of the Lake Superior Division with reasonable ease.

On the other hand, if the grade is flattened too much, on a long tunnel and approach such as this, trouble with drainage is apt to occur, especially in winter. The grade through the tunnel is 6/10 of 1%, or 32 ft. per mile, and is continuous from end to end; the west portal being thus 100 ft. higher than the east. From the west portal the same rate of grade carries us down through the Model City for nearly the same distance. The long cutting on the west approach, was introduced with a purpose, viz.: to allow the civic expansion to go on overhead without too much distortion of street grades.

In consideration of the electrical operation, the headroom required under the bridges was reduced from the regulation 22½ ft. to 16½ ft., and the problem of grade separation rendered so much the easier of accomplishment. Near Cartierville the Montreal Park & Island Ry., and a main road alongside it, have been carried underneath. Absolute grade separation is thus secured, not only through the city itself and its transmontane annex, but for the entire length of the electric zone, nearly nine miles; and Cartierville, a promising suburban settlement on the bank of the Riviere des Prairies, is now brought within eighteen or twenty minutes of the heart of the city.

The tunnel itself is a very interesting one and ranks among the great tunnels of the world, being-3.25 miles long. Only the three great Alpine tunnels, the Mount Cenis, the St. Gothard and the Simplon, completely eclipse it in length, and there is only one in Canada which is longer, the C.P.R. Rogers Pass tunnel.

It was predicted beforehand that the difficulties would be comparatively few, and so it turned out. Very little water was met with, and this where it was expected, near the west portal, at the contact between the limestone and the older rocks on which it rests uncomformably. The core of the mountain was almost exclusively Essexite, a basaltic volcanic rock, somewhat hard to drill, but otherwise quite unobjectionable.

Concrete Lining

It was at first thought that most of it would not require lining, and had it been a steam operated road in the open country, it is quite probable that very little lining would have been put in, but its nearness to the terminal, and the adoption of the trolley system, which meant support from the roof, made even a small fall a very serious matter, as it would both delay and endanger the traffic. Some little seaminess and disintegration showed itself after exposure to the air, and in the end all of it except about 1,000 ft. was lined with a thin sheeting of concrete. This applies to the rock section.

For something over half a mile at the city, or east, end, the roof ran into clay, although the bottom and most of the wall remained in limestone. This clay was known beforehand to exist, and it is of a very plastic and semi-fluid formation and contains numerous shells such as now exist in northern seas. On account of its semi-fluid nature, and because this section led under streets and close to the foundations of buildings, it was decided to take this out under a shield protection, the shield being followed up with an arch of concrete blocks pre-cast in voussoir shape.

Practically no leakage, even of water, was ever visible during the progress of the work, and yet considerable settlement of the street overhead took place. Probably the moisture evaporated and escaped as invisible vapor. A great many of the houses had been set down on this soft clay and had suffered from settlement before the work was started; the further settlement was therefore of less consequence than it would otherwise have been. Throu, 't this section the individual tracks are carried in separate tunnels with a thin wall between them. The same is true of a few hundred feet at the west portal, but the body of the tube is a single opening.

The heading was a "bottom" one, 8×12 ft., and was put through with very good speed. For a time, in fact, the American record for hard rock tunnelling was broken by an average advance of 26 ft. a day for a whole month. As soon as a sufficient advance had been made, the enlargement to full section was commenced, the arch being taken out first, and the two "benches" afterwards.

As the east end is in the city and there was no means of getting rid of large quantities of material except by teaming for several miles, this work had to be done from the west end, and for this reason the heading was driven faster from this end, and this meant working down hill. Under these circumstances the small flow of water was particularly fortunate, as the amount of pumping was small.

Shafts

In order to expedite the work, a 250-ft. shaft was sunk one mile from the west end. This made it possible to follow up with the enlargement on the westerly mile without interference from the heading from the shaft, but as a matter of fact the rapid progress of the heading was to a large extent wasted, because the war intervened, and work on the enlargement was impeded by the difficulty in finding the necessary capital to carry it on.

The shaft was, however, designed to carry an elevator in the future to a substation at its foot, and with this in view, was sunk to one side the centre line of the tunnel. This, as may be imagined, greatly increased the difficulty of alignment of the tunnel. To offset a line on the surface, to two plumb lines, only some 12 ft. apart and 250 ft. long, and then offset this line again at the bottom of the