

from shaft to shaft, or with land tunnel and contingencies a total sum of £2,252,500—\$11,262,500.

I would recommend that before inviting tenders for the chain work, a shaft so placed at Carlton Point as approximately shown on appendix F, as to be afterwards available for permanent pumping and ventilating purposes, should be sunk well into the red clay shale, which lies above the grey carboniferous sandstone, care being, however, taken not to approach closely to such sandstone. This shaft might be either at once lined with local brickwork upon hardwood cribs, or temporarily with timber. If any large feeder were met with a portion of the shaft might require cast iron tubing. A pumping plant of sufficient power to deal with any ordinary feeder should be provided before commencing to sink.

Borings similar to those taken at the Sarnia tunnel (viz., from a vessel or platform through 6" wrought iron pipes, so as to ensure cores of sufficient size and undamaged being brought to the surface) should be made at intervals of, say, not more than 500 yards, right across the straits and down to the carboniferous bed rock, but this line of borings should be at some distance, say 300 yards from the centre line of the tunnel. This work should be carried out in the presence of an experienced engineer who should carefully note the sample taken.

With this information obtained much closer tenders may be expected for the construction of the tunnel, whilst the cost of these temporary works will be comparatively insignificant.

When the work is resolved upon immediate steps should be taken :

1st. To connect the existing railways either permanently or by temporary "overland routes" to the shafts with the tunnel works.

2. To establish brickyards at the nearest available site where good clay free from lime is to be found. The quantity of bricks required will vary from 30 to 60 millions according to the size of the tunnel.

3. To erect dwellings, stores, &c., for the staff and workmen.

4. To put down the permanent pumps and provide the necessary plant for temporary purposes.

5. To install the necessary electric plant and motors.

6. To provide and fix the compressed air machinery. The tunnel when ready for traffic would require mechanical ventilation, but by the adoption of a door at one end to be locked and worked automatically with the signals, the necessary machinery would be reduced to great simplicity, and might consist of a fan of probably thirty feet diameter with the necessary engines and boilers similar to those erected under my supervision and which have now worked most successfully and economically for several years on the Mersey railway at Liverpool.

The traffic through the tunnel could be advantageously conducted either by cable or by electric motor, somewhat similar in general principle though not in detail to those now in regular work in London, and about to be introduced by Mr. Greathead and myself in Liverpool.

Arrangements would have to be made for protecting the approaches at either end from snow and for clearing them of water which would otherwise find its way to the tunnel.

I have been greatly assisted in the preparation of the necessary data for this report by the Honourable Senator Howlan, who has given much time and attention to the matter, and whose local knowledge has enabled me to arrive at a close estimation of the requirements.

I am, sir, yours faithfully,

DOUGLAS FOX.