

WELLINGTON.

At one of the forts a gun-emplacement is being converted to receive a more powerful weapon, and a magazine is also being constructed for this emplacement; also a submarine-mining observing-station has been nearly finished and equipped.

A tide-gauge in connection with the quick-firing battery has been set up.

The Point Halswell prison-yard has been asphalted, fences repaired, and the building repainted.

Some improvements were made at the electric-light station. A water-supply reservoir has been provided for Fort Ballance and Mahanga Bay. Some damage to concrete at one of the forts has been made good. An experimental range-indicator has been fixed at one fort. The boundary fence of the reserve has been repaired. Some concrete-work for the minefields has been done. An extension of Shelly Bay Wharf has been carried out by contract. The service tramway at Shelly Bay has been improved, and the site for a new paint-shed excavated. Various repairs to the roads to and around Point Halswell have been carried out during the year, and all necessary maintenance work done.

At another fort wooden gun-foundations have been replaced by concrete ones.

Some repairs to the Trentham rifle range water-supply have been done.

Alexandra Military Depot.—Some improvements in sanitation have been made. A hot-water heating system has been fitted up in the bath-rooms and offices. The billiard-room floor has been covered with linoleum, and various repairs done. The excavation of one parade-ground has been finished, other excavations are being made by brickmakers to obtain clay for bricks. The approach road to Buckle Street has been completed. Considerable trouble has arisen through the stoppage of drains; works are in progress to remedy this defect. Offices for the Commandant are being constructed in the basement. Various works and repairs have been done. Brick foundations for an 8 in. gun have been built in the parade-ground. An asphalt floor has been laid in the shed, built round the gun, and electric light fitted in the shed.

CANTERBURY.

Some alterations to the firing-butts at the Sumner rifle range have been made. The Lyttleton drill-shed roof has been overhauled and repaired. Some repairs have been done to a fire commandant's station, furniture supplied, and the drainage put right. The excavation and concrete work for a searchlight-installation have been carried out. At one of the forts alterations to the store and workshop have been done, an outhouse built, and drains laid.

OTAGO.

Works for a searchlight are in progress, and a magazine is being built. The roofs of some covered ways had to be re-asphalted to stop leaks. A six-roomed warder's cottage has been built. The roof of the prison was repaired. The Port Chalmers gun-shed was repaired and painted. A gun-shed for drill has been put up at one of the batteries.

I have, &c.,

W. H. HALES,

Engineer-in-Chief.

The Hon. the Minister for Public Works.

APPENDIX F.

MIDLAND RAILWAY.

SECOND SUPPLEMENTARY REPORT ON THE ARTHUR'S PASS PROBLEM,
BY MR. VIRGIL G. BOGUE, C.E.

[The diagrams, tables, and correspondence referred to in this report are omitted from the printed paper. These are in the hands of the Public Works Department.]

SIR,—

New York, U.S.A., 27th June, 1903.

Some of my recent letters to you mention additional data which I have received bearing on the Arthur's Pass problem, giving the latest statistics and information relative to the working-cost of heavy grades in this country and Canada.

WORKING COST.

I have combined these additional data with the data contained in my supplementary report, dated the 16th May, 1902, and with some statistics covering several large railway systems, and by the use of graphical diagrams, have obtained a general formula for the cost of the locomotive-mile. These new data are attached hereto, and form a part of this second supplementary report.

The average speed in miles per hour is an essential element of the cost per engine-mile, and is introduced in the formula. The speed that can be attained at any point of a line by a locomotive hauling a given load is determined by the method of virtual or velocity grades, which is explained below. I have calculated the working-costs of the several Arthur's Pass lines by this method, which I believe to be original, and more exact than any heretofore used (see tables of the Appendix).