

The instructions next deal with the capacities of machines, rate of construction that can be attained and quality of work that should result. Such matter serves admirably as a yard-stick by which the engineer may measure his efficiency. Here, again, a man's personality will often enable him to do much better than the average set down in the instructions.

And finally, the instructions deal with reports, cost data and records of progress that are required. In this respect the instructions will be specific and lay down exact requirements.

Instructions to engineers are not, nor can they be, a series of exact rules that must be followed because no one can foresee all phases of the multitude of detail that enters into the prosecution of construction work and competent engineers would be hampered by instructions that attempted to prescribe exactly how each machine should be utilized.

Instruction to Operators.—In the widespread use of costly machinery there always lies the danger of loss through incompetent operation. Delays due to breakdowns are costly and often avoidable. Here, again, many states and municipal organizations seek to avoid trouble by furnishing to machine operators complete instructions.

These instructions deal first of all with the operation of the machine and since the work is largely mechanical though skilled, the instructions can say in detail just how the machine is to be handled. Here minute instructions are justifiable and they should include besides suggestions on operations, others on the care of the machine, the making of repairs, methods for adjustments and renewals of working parts.

The matter of personal conduct should also be dealt with in these instructions since the public often obtains its impressions of a department by the conduct of some irresponsible subordinate.

The construction of highways involves the handling of much bulky material and consideration of efficiency and economy requires that the machinery shall be well adapted to the work for which it is used, that the operations be systematized so that each machine will produce to capacity, that the machinery shall be handled in an intelligent manner so as to have normal life, and that the problem of transportation be studied in all its relations before a system is adopted.

MORE RAPID TUNNELLING AT ROGER'S PASS.

A footage of 852 ft. in the 31 days of December is reported by Mr. A. C. Dennis, superintendent for Foley Bros., Welch and Stewart, contractors for the Roger's Pass tunnel of the Canadian Pacific Railway. Readers will recollect the announcement in December 10th issue of this journal to the effect that previous records had been broken during the month of November, where an average of 27.23 ft. per day was made in the west end pioneer heading through slate with small quartzite bands. The record for one week was 220 ft. in a heading the size of which was 10 x 7½ ft.

In December the following record was made:—

East end pioneer heading, 544 ft quartzite with some schist. East end centre heading, 523 ft. schist with some quartzite. West end pioneer heading, 852 ft. slate with small quartzite bands. West end centre heading, 686 ft. slate with small quartzite bands.

This shows an average of 27.5 ft. per day in the west end pioneer heading.

HAMILTON HARBOR DEVELOPMENT.

An excellent summary of the harbor improvements for the city of Hamilton, Ont., is contained in the recently issued annual report of the Harbor Commissioners. The work laid out for last year included the construction of a warehouse on the city dock property at the foot of Catharine St.; the reclamation of about 12 acres of land between Ferguson Ave. and Wellington St.; the dredging of the harbor front and approaches to a depth of 18 ft.; the construction of extensive water shipping facilities. The establishment of an industrial district at Stipes' Inlet. All these works were accomplished or nearly completed during the year, with the exception of the Stipes' Inlet proposition.

The city's concrete dock at the foot of Catharine St. was completed in 1912. The warehouse that has recently been constructed upon it is a fireproof building of structural steel with corrugated iron roof and sheeting, and with concrete floor. It is 300 ft. in length, 34 ft. wide on the dock and 111 ft. wide on the ground fill at the rear. It cost approximately \$37,000.

The revetment wall now under construction will, when completed, extend 450 ft. easterly from the old revetment wall, and thence 1,150 ft. into the shore, making a total of 1,600 ft. of wall. Of this length about 870 ft. of steel-faced wall has been completed and about 500 ft. more has been completed under water and partially so above. The pile foundations have been driven for the remainder, and about 300,000 cu. yds. of dredge-fill have been placed behind the completed portion of the wall, so that about 7 acres of the area that is being reclaimed has been filled up to grade level and the remaining 5 acres up to water level. This will provide the city with 12 acres of centrally located water front property, available for commercial purposes and easy of access for rail connection. The total cost of the work is estimated at \$200,000.

The expenditure involved by last year's dredging operations has amounted to practically \$100,000. To secure a depth of 18 ft. along the harbor front and approaches, 212,383 cu. yds. of material were removed, and the work is to be continued next year. It is of interest to note in this connection that dredging to the extent of about 10,000 cu. yds. will be done in 1915 at Wabassa Park, owned by the city, north shore of the harbor. This work will consist in deepening the approaches to the dock to a depth of 17 ft. and will cost about \$2,500.

The reclamation of Stipes' Inlet includes the construction of a channel between Gage Ave. and Ottawa St. to extend from the shore for a distance of 2,500 ft. and to be 300 ft. in width, with a turning basin at the inner end 800 ft. in diameter. A depth of 25 ft. in this channel will be secured, the object being, in the design of the scheme, to accommodate boats up to the 600-ft. class. This development will involve an expenditure of \$2,000,000.

In all, the works completed in 1914, those still in progress, and those approved, amount to \$2,339,500.

Lathe tools are now made which surpass in hardness those made of the finest special steels, and which outlast them many times in cutting metals. They are composed of an alloy of cobalt, chromium, and tungsten, invented by Elwood Haynes, of Kokomo, Ind., president of the Haynes Automobile Company. These alloys are also used for cutlery, and take an edge equal to good steel and yet are very non-corrosive.