

the tunnel to be attacked at once, and ensures a maximum of operating-room for the workmen. To obtain the best advantage of the system, mechanical loaders or "scrapers" are necessary for loading excavated materials into trucks, but the bottom heading was adopted until suitable loaders could be secured.

In lining the larger tunnels the concrete is pumped into position behind steel form-work by means of electrically driven concrete pumps.

Waikoura Tunnel (1,555 lineal yards) North End: 264 lineal feet of bottom heading has been driven and 169 ft. of tunnel excavated to full size. Concrete lining has been completed for 117 ft., together with the tunnel portal. An 800-cubic-foot electrically driven air-compressor, 30 in. ventilating fan, aggregate bins, and concrete-mixing plant have been installed and are in operation.

Waikoura Tunnel, South End: A jigway 600 ft. long at an average slope of 28° has been constructed to serve the tunnel. A 600 cubic foot Diesel air-compressor is in course of erection. Driving will commence as soon as the approach cutting is completed.

Tunnel at 18 m. 70 ch. (101 lineal yards): The bottom and top headings have been completed and 200 ft. of tunnel lined with concrete. An additional 17 ft. has been excavated to full size ready for concreting.

Tunnel at 20 m. 10 ch. (131 lineal yards): The bottom heading has been completed through comparatively soft ground, which will require extra lining.

Coast Tunnel (1,024 lineal yards): Owing to the inaccessibility of the north face and the fact that tunnel spoil is required for the 90 ft. filling at 20 m. 27 ch., a bottom heading is being driven right through this tunnel. Lining will then be started at the south portal, enlargement spoil being trucked through the bottom heading to the filling at 20 m. 27 ch.

283 lineal feet of bottom heading has been completed from the north end and 316 ft. from the south end, making a total of 599 ft. A 600-cubic-foot Diesel-driven air-compressor has been installed for this tunnel.

Tunnels at 35 m. 58 ch., 35 m. 46 ch., and 35 m. 40 ch.: The bottom headings of these three tunnels have been completed, aggregating 956 lineal feet.

Tikiwhata Tunnel (3,267½ yards): The north portal of this tunnel is most difficult of access, and practically no working-space is available at the tunnel-level, owing to the next tunnel being only 1¼ ch. distant. A jigline 920 ft. long and with an average slope of 35° has been installed from the end of the service road to the portal for the transport of timber and machinery. Concreting-materials will be conveyed to bins by a chute erected close to the jigline.

An 800 cubic feet electrically driven air-compressor has been installed to the foot of the jigway; 15 ft. of the arch section of the tunnel has been driven and a further 30 ft. of the top heading completed.

An up-to-date machine shop has been erected at the north end of the Waikoura Tunnel to serve the whole of the section. This shop is working at high pressure.

A sawmill has been erected at Bartletts, where timber for all tunnels and other works is cut to requirements.

An 11,000-volt power-line was completed from Waikokopu to Bartletts for the purpose of driving tunnelling and other machinery. Transforming-stations have been erected at the various tunnels, and camps and workmen's accommodation, tunnels, cuttings, &c., reticulated for lighting.

In addition to accommodation for workmen, three Y.M.C.A.'s, one school, two cookhouses, and various bathhouses and drying-rooms have been erected.

*Gisborne Section* (Length, 14 m. 7 ch.).—With the exception of bridges and platelaying, most of the work on this section has been completed.

Formation has been completed from 0 m. to 5 m., except for light trimming and the approach bank to the Waipaoa Bridge, upon which a mechanical loader and bulldozer have been employed.

A Diesel drag-line has completed the embankment across swampy ground from 5 m. 10 ch. to 7 m.

7 m. to 14 m.: Major cuttings on this section are completed, with the exception of short lengths left for forming banks to bridge abutments.

A creek-diversion is finished at 13 m. 57 ch., and a concrete retaining-wall to protect formation from the Maraetaha Stream is in course of erection.

139,663 cubic yards of earthwork have been moved, equal to 70 per cent. of the estimated total quantity.

The formation of 40 ch. of main-highway deviation to eliminate two level crossings at 8 m. 35 ch. and 8 m. 67 ch. is well advanced.

A total of 454 ch. of fencing has been erected on the railway-reserve boundaries during the period.

Bridge-work has been delayed to some extent owing to the difficulty in procuring reinforcing steel.

Bridges at 0 m. 62 ch. (three 20 ft. spans) and 2 m. 27 ch. (five 20 ft. spans) have been completed.

Concrete piles for bridges at 2 m. 55 ch. and 3 m. 4 ch. are all driven.

Waipaoa Bridge (six 30 ft. and nine 60 ft. spans): Good progress has been made on this bridge. Abutment A and pier B are completed, and all piles driven for piers C, D, E, and F, totalling sixty-two piles. An additional thirty-eight piles have been cast. The temporary staging has been erected for three-quarters of the total length. The north bank of the river at the bridge-site has been protected against erosion for a length of 10 ch., with tetrahedral concrete blocks set close together on a 6 in. crushed metal base, sloping at 18° to the horizontal. The blocks weigh 32 lb. each, and are made on a vibrating table at the rate of one per minute, 40,000 having already been placed. This method of protection is similar to that adopted on the Mississippi River, and is proving very successful.

The casting of concrete piles for the bridge at 11 m. 27 ch. has been started.

A Diesel-driven stone-crushing plant has been erected at 13 m. 66 ch.

The maximum number of men employed during the period on this section was forty-seven.