THE HOMER TUNNEL

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Details of an unusual construction job, and some of the special problems encountered.

5 per cent. of the shot rock passed a 100 sieve.

Though sound for the most part, the rock was traversed by faults through which water percolated. This was a surprise as the depth of the tunnel below the surface at the major inflow was 1,500 ft. The rate of flow through this fault varied widely, but one measure of it was 6,000 gal./hr.

In some cases the rock had to be timbered. In these cases the joint planes were horizontal, and slabs were likely to fall from the roof. The rock was sometimes under stress, and spalling of the rock took place with a crack like a rifle shot, and fragments were shot across the tunnel at considerable velocity. This was only in freshly excavated rock.

The Homer portal was located to reduce the length of tunnel through scree. This scree contains huge boulders of hard rock and excavation and timbering is difficult.

History

Work on the approach cutting started in 1935 and the men went underground late in that year. The lined portion through the scree was completed in July, 1936. Early in this month an avalanche at the portal killed Mr. P. L. Overton, a tunneller, and injured other men.

Progress during August, September, and October was slow. Snowfalls were heavy and avalanches buried the portal on three separate occasions. The tunnel was advanced 470 ft. from the portal by May, 1937, when Mr. D. F. Hulse, engineer-in-charge, and Mr. T. W. Smith, the tunnel overseer, were killed by an avalanche at the portal. Several others were caught by the avalanche blast, but were not seriously injured.

Work at the tunnel was stopped, and the men employed elsewhere. It was decided to let a contract for the driving of a 12 ft. wide by 9 ft. high centre bottom heading, and for an avalanche protection of reinforced concrete from the Homer portal. The contract was let to Downer & Co. The Department maintained power, lights, pumps, did all plant maintenance and drill sharpening, and provided all materials.

The tunnel portal was cleared of a towering mass of avalanche snow and the tunnel dewatered and work at the face commenced in November, 1937. By June, 1938, when work closed for the winter, the heading had been driven 1,022 ft. To enable the passing of 2 cu. yd. trucks it was found necessary to make the heading 14 ft. wide. Downer & Co. also built 190 ft. of the avalanche protection.

Tunnelling recommenced in November, 1938. Better progress was made during the season and to make certain of the holing through during the following season, it was decided to work during the winter. The length of drive which would have to be dewatered and the replacing of services made this desirable. The following preparatory steps were made:

(i) The access track from the Homer camp to the tunnel was made as far as avalanche area and as well protected as possible.

(ii) A covered way was made from the fitting shops to the avalanche protection and the drill sharpening shop was safely sheltered in the avalanche protection.

(iii) Lengths of underground cable were placed across avalanche paths on the transmission line from the power station, and a 50 kW. standby set which could supply lights and power for pumps was installed at the fitting shops.

(iv) To permit the disposal of muck from shelter a double drum winch was installed under the ava-
The scree was reached and a shaft was driven to reach the Cleddau Valley in March, 1940. Three hundred feet of avalanche protection was also built during the 1939-40 season. After this some work was done on an avalanche protection at the Cleddau portal, and a start was made on the enlargement of the tunnel, but the project was then abandoned owing to the war. Since then 300 ft. of the avalanche protection at the Homer has been demolished and the fitting shop flattened by what must have been a huge avalanche.

A graphic wattmeter in the fitting shop recorded the history of the Homer Tunnel in a most revealing form. The predilection of certain shifts for drawing out their crib hours was unaccountably recorded.

**Cycle of Operations**

After firing the face was cleared in about 8 hours. The tunnellers then sealed the roof while the air, water and light leads were brought to the face. The bar was then rigged and three holes drilled in the face for the anchor pins to which the tail block of the scraper was attached.

The scraper slide was then lowered down to its working position and scraping was commenced. The trucks were coupled in pairs both for loading and hauling. The number of trucks in a round was approximately 30.

When the face was cleared and the tail block was hoisted to a point in the side of the drive and the muck left at the sides was cleaned up. The drills connected up hoes and started drilling.

The top half of the round was drilled from the first position of the bar. The bar was then dropped to the lower position and the round completed. Two drills were used, and about 40 holes were drilled to a depth of 7 ft. About 130 steel were used in an average round.

While the drills were at the face, the muckers completed the scraping, hauling and tipping, brought down sharp steel and took back blunts, retired the scraper to 150 ft. from the face, laid fired, instantaneous cut, and seven delays, from the power line, by a switch in the drill sharpening shop outside the tunnel.

The average draw was about 61 ft. The explosive used averaged about 221 lb./ft. of heading, or about 4 lb./yd. of rock. The average cycle was about 24 hr. and the best time was 13 hr.

**Pumping**

When the tunnel had progressed sufficiently far past an inflow to allow a sump to be excavated below it, the worst of the trouble with water was over. It was then simply a matter of pumping the water out by the most economical means, i.e., electric centrifugal pumps, and keeping the pumps going continuously. Standby air operated pumps were provided at all pumping stations in case of power or pump failures.

Until a sump was excavated water flowed to the face. Pumping was interrupted by the necessity for taking all gear back from the face before firing. After firing the water flowed into the muck pile and the mucking was well advanced before a pump could be placed at the face. The water was then thick with abrasive rock dust which caused excessive wear and tear of pumps.

Continually shifting pumps to and from the face meant that only small portable pumps could be used. Breakdowns, meant floods and, when our largest inflow was struck, the water rose with alarming quickness. The consolidation of the muck pile by water has already been mentioned. All this meant that progress in the heading after striking an inflow of water was slow and uncertain.

**Hauling**

The in 10 grade made winching necessary. The winch hauled two loaded 2 cu. yd. trucks at a speed of
720 ft./min. Signals were given by lights on a special signal line, which also rang a bell at the winch. The winch also lowered the loaded trucks on a 1 in 10 grade to the tip about a block in the roof of the tunnel at the summit. The direction of the winch had to be reversed while the trucks were passing under the block. To prevent runaways a sprag attached to the rear axles of the truck was lowered when trucks were being hauled out of the tunnel. A derailing device was also installed above the spotting winch.

Spotting

The spotting equipment consisted of the spotting winch and a Californian lay-by.

The lay-by sat on the top of the centre track. The sleepers consisted of 40 lb. rails on their backs; the rails were also 40 lb. The lay-by held 10 trucks. Ramps at both ends brought the track back to ordinary rail level again.

The spotting winch was situated above the lay-by and to one side of the tunnel. Trucks were held on the lay-by by hardwood stops.

The lay-by was shifted forward in steps of about 100 ft. The scraper slide could not pass the lay-by so it had to be sufficiently far back to allow the slide to be retired to a safe distance from the face before firing.

Avalanches

The energy dissipated in an avalanche is enormous. If 1 in. of rain in the form of snow were to slide off an area of 10 acres over a cliff 1,000 ft. high, and the avalanche were to be completed in two minutes, the average horse-power generated would be 34,000 and the weight of snow would be 1,000 tons. This would be a small avalanche compared with those which occur in the tunnel vicinity.

Avalanches can be divided into two types, dry and wet snow. Snow between these two extremes is not so likely to avalanche.

The dry snow avalanche is likely to come down during or shortly after a period of heavy snow falls. The snow is powdery with little internal friction, and this type has a terrific wind blast. Both fatal avalanches at the Homer tunnel have been of this type.

The slope of the cliff above the tunnel is about 50°. This gives the impetus of the snow mass a large horizontal component. The snow and displaced air have a density many times greater than air, and a high velocity, and its effect is that of a wind of incredible violence. There is no pile of snow left at the bottom of the avalanche cliff and the path of the avalanche is often marked by a dark strip, where the wind has picked up the snow which previously covered the scrubby vegetation. The main part of the energy of this type is dissipated in atmospheric friction.

The wet snow avalanche is of tremendous size. It occurs generally after periods of hot sunshine or rain, and is very common in the spring. The mass of thawing snow and ice falls to the bottom of the cliff and advances across the scree floor, forming huge piles as the friction of the scree stops the bottom layer, and the top slides over it. There is a wind caused by the escape of displaced air, but this is not so laden with snow as in the dry snow type. In this type the energy is largely dissipated in friction with the rock and scree surfaces and in internal friction.

Avalanches usually follow well defined paths. There is a collecting ground above (usually a permanent snow field) and below either bare scree or stunted and contorted scrub. However, the tracks of avalanches through quite old trees prove that occasionally avalanches either of exceptional size or following unusual paths occur.

Three feet of the avalanche protection furthest from the portal at the Homer side was overthrown by an avalanche, presumably a wet snow one, and collapsed. The complete failure of the structure shows the magnitude of the forces which are encountered. This collapse took place between September 6 and 10, 1945.

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