

remain loose and open for days, despite continued applications of screenings and repeated sprinkling. Opening both outlets of the sprinkler full force would fail to flush the road, the water going straight through as if the road surface were a sieve. Then quite suddenly this condition would cease, and the road refuse to absorb any more water, which would run off the sides in floods. We then knew that the road was finished, but it was some time before the process was thoroughly understood.

The explanation, of course, was that the water and fines continued to run down into the coarse rock foundation until all voids were filled. In some cases, where there was three or four feet of rock fill, this took days, whereas adjoining sections, where the fill was lighter, filled more quickly. The explanation was so obvious after once being determined, that it seemed inexcusable to have missed it for so long a time.

Methods were adopted to deal with heavy fills by adding an earth cushion over the coarse rock before applying a macadam, or by using suitable loam or gravelly clay as a first application on the crushed rock, which had a tendency to block up the voids instead of washing down to the bottom.

Again, it was found necessary to depart from standard practice and finish by adding a surface of from 1 to 2 ins. of screenings over the crushed rock, as a wearing surface. Otherwise the road ravelled quickly, because there is no cementing bond to hold the stones together.

Excellent—In Wet Weather

In dry, hot, windy weather the roads suffered greatly, the winds loosening this matting, which rolled or blew away. Quick showers also washed the loosened particles off at first, but once the surface became well wetted, the deterioration ceased, and as long as wet weather continued the macadamized road remained in excellent condition. One could drive over the whole macadamized portion during or following a heavy rain and find no mud to soil a buggy.

While wet weather lasted, no other preservative was necessary.

These roads were well crowned so that no water was allowed to lie on the surface to form puddles. This absence of any mud would not apply to unmacadamized surfaces, though even there we kept the surface well rounded, and mud holes of any moment were practically unknown in the road after the second season's work.

A grant of \$2,000 was made annually for maintenance work. This amount was always more than sufficient, because the roads once constructed were never allowed to get into bad condition but were taken in hand as soon as a weakness developed. This is the very cheapest of maintenance and the most efficiently expended money ever put upon a road. This is one of the first great lessons for all road supervisors to recognize.

Of course, in time, the matting of screenings wore off and had to be renewed. Also a rapid development of automobile traffic brought new problems and aggravated old ones. Trap rock roads, bound with trap rock screenings, are ill-adapted to withstand the rubbing, sucking, tugging action of pneumatic tires, and some other binder had to be found. Experiments were quietly carried on with various grades and densities of oils, but with unsatisfactory results. The problem was finally met and fairly well cared for by surface treatment with Tarvia.

Bituminous Binder Needed

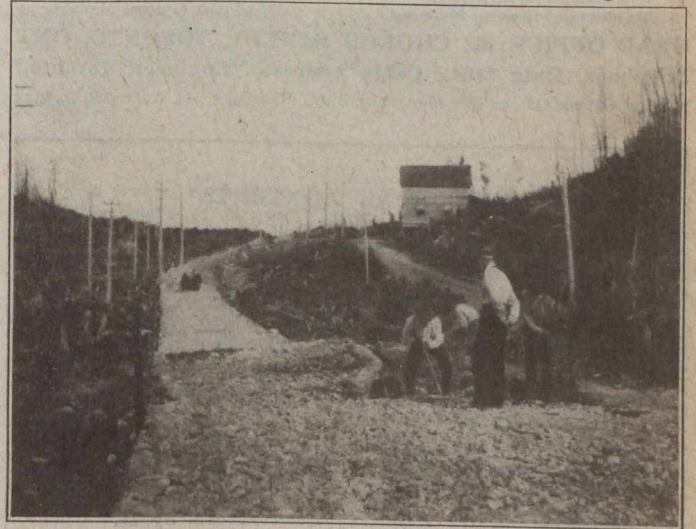
However, this material did not give entire satisfaction with the above type of construction, as it had a tendency to lift off this surface mat in large cakes, not being able to penetrate and bind the screenings to the coarser stone beneath. Special care was required to bring the Tarvia into direct contact with the coarse crushed rock after the same has been well set in place.

Where Tarvia surface treatment is contemplated, much less screenings should be applied as a wearing course, and these should be all removed just before application of the Tarvia.

The best results however, would be obtained by using bituminous binder, tar or asphalt, for the top layer of macadam.

My connection with the work terminated shortly after the application of the first tank of Tarvia, in June, 1913, and of the subsequent methods used and results obtained I have little personal knowledge. They must have been quite beneficial, as several tank cars have since been used.

You may have noted and criticized the lack of technical and statistical details given regarding this work. This is for two reasons: First, the conditions were so different from what is ordinarily met in road construction that methods and results, I felt, would be more interesting; conditions also varied so much in different parts of this small system, that one mile might cost quite double, or more, than the next mile



TYPICAL ROAD REVISION IN COLEMAN TOWNSHIP

built to the same width and standard. Approximate average costs, however, would run about as follows:—

Type 1—For opening the first narrow single track trail, per mile, \$500 to \$1,000.

Type 2—For widening to 10 or 12 ft., improving grade and surfacing the track with fine waste rock or other available material, about \$1,000.

Type 3—For widening for double track road, bringing to finished grade and making necessary rock cuts and dry rock retaining walls, varied largely in different locations but averaged about \$2,000.

Type 4—For macadamizing the surface, \$1,800 to \$2,000.

Type 5—For Tarvia surface treatment, per mile, \$350 to \$500.

Rock excavation in open country (very little of this) \$1 to \$1.25.

Rock excavation in restricted locations, \$1.25 to \$2.00.

Dry rock retaining walls with roughly hand-laid backing of 2 to 5 ft., per sq. yd. surface \$1.50 to \$1.65.

By June, 1913, we had in the system about 15 miles of trails,—15 miles of type 2, 5 miles of type 3, and 10 miles of macadamized road (of which about 3½ miles had been given a treatment of Tarvia B).

We also had laid in June, 1911, 990 sq. yds. of Rocmac on Cobalt Square at a cost of 93c. per sq. yd. Sample stretches of this material had been laid in Woodstock and Niagara Falls in the fall of 1910, but I believe Cobalt Square to have been about the first laid on a regular, commercial basis. It is also one of the best of the Rocmac roads and is still giving excellent satisfaction after carrying for 8 years the traffic of the busiest spot in Northern Ontario.

Personnel

Arthur Ferland, of Haileybury, was reeve of Coleman continuously from 1907 to 1918. During those years there was no election for reeve or councillors, the council changing somewhat in personnel but always being elected by acclamation.

Assistant engineers in direct charge of the road work were Thomas Strachan in 1909, A. E. Jupp in 1910, and G. C. Godard in 1911, 1912 and 1913.