

is remarkable how well this surfacing stands if constructed in a proper manner and regularly attended to as required in the way of patching, surface tarring, etc. What would our armies abroad have done without broken stone roads?

The author has already referred to the necessity of "imperviousness" and homogeneity, and that is the secret of the success of tar-macadam, which is the next step in the way of improved surfaces after water-bound granite. The three Sidcup sections, Nos. 9, 10 and 11, laid in July, 1911, are still in evidence and in good condition. They have been tarred annually and received some surface repairs. Their cost up to date, including construction and annual repairs, has been under 1s. per yard per annum, and over 10,000,000 tons-weight of traffic has passed over them.

Except for our wealthy municipalities, the initial cost of wood and granite paving on concrete is almost out of the question, but in many instances this is the most economical method of dealing with roads carrying intense traffic.

Having regard to all circumstances, including the difficulty of transporting road materials, the author is of opinion that bituminously coated or carpeted "double coat" road surfacing is the most suitable for all classes and volume of traffic. Except the binders, including pitch and tar and bitumen, all the materials can, generally speaking, be obtained locally, and so-called "inferior" materials, and even waste products, can be used as aggregates.

## Machinery and Plant

Special machinery and plant is required, and great care and skill necessitated for the preparation of the materials; but it is to be hoped that both these will be available in the near future.

For the under or base coat the author thinks that, generally speaking, comparatively soft stone, scarified macadam, or selected clinker mixed with pitch and tar and laid hot suffices, but all road engineers and contractors will not agree with this and prefer to use bitumen instead of pitch and tar.

For the carpet, which should be put on as soon as possible after the base coat is completed and not be less than 1¼ ins. in thickness, the necessary grading of the sand or clinker and the proper proportion of bitumen are the essential factors for success. This should be laid at a temperature of about 300 deg. F. and very carefully rolled, after which the traffic may be allowed over it in a few hours.

The author is of opinion that the waviness or corrugations caused by traffic are set up in the youth of the surfacing, and also owing to insufficient adhesion between the carpet and the base coat. He well knows some sections that are now somewhat wavy after being down about three years, but not more so than within three months of their birth.

He has under observation one section of this class of surfacing on the London-Folkestone road that was laid in 1913, and is still in fair condition, notwithstanding the fact that since August last about 13,000 demobilized lorries from France, on their way between Richborough and Slough, have been hauled over it by chassis. Many of these lorries have been tireless or improperly tired, and the towing chassis have, of course, during the same period made double journeys over it. In addition to this, there has been an enormous amount of government traffic over the road during the war as well as ordinary traffic, which is by no means light.

## Concrete Surfacing

The last type of surfacing to be referred to is concrete. In the discussion on this subject at the conference held at Olympia in November last, some speakers wandered from the subject and debated on concrete foundations. We are all agreed that, under certain conditions, concrete foundations are the most suitable, but not universally. The author prefers a bituminous foundation or base coat for a bituminous surface, and still adheres to the view that for quick, heavy traffic some resiliency (but not too much) is desirable both in the foundation and surface. We know that some elasticity is necessary in structures carrying heavy loads,

and especially live loads, hence the steel in reinforced concrete.

Just as a fine, rich mixture is necessary for good, strong reinforced concrete, so it is essential if the surfacing is to withstand the abrad ing and hammering action of quick, heavy traffic.

From observation of the trial sections of concrete surfacing laid on the London-Dover main road in the spring of 1915, the author has come to the conclusion that 6 ins. of 3 to 1 concrete is not adequate to stand the action of quick, heavy traffic, also that expansion joints are unnecessary when surface reinforcement is provided. It is satisfactory to note that the portion of the sections which were surfaced with 3 to 1 concrete show very little sign of wear or deterioration except at the expansion joints, which are admittedly *de trop*. He is of opinion that 8 ins. of concrete, the lower 6 ins. consisting of a 6 to 1 mixture topped with 2 ins. of 3 to 1 concrete, the reinforcement to be placed between the two layers and the upper one laid before the initial set has occurred in the lower one, will meet all the requirements of traffic, and should last with little if no repair for many years.

### Important Points

Important points to be observed are the putting in and proper tamping of the concrete to obviate all air or water holes, to keep the surface concrete moist, so that it does not dry out or mature more rapidly than the bulk below, and also to keep all traffic off the newly-laid surface for at least twenty-eight days.

The author would like to resurface the Gravesend sections with 5 ins. of reinforced concrete, the lower 2½ ins. to consist of a 6 to 1 mixture and the upper 1½ ins. 3 to 1, without expansion joints and laid during suitable weather, which was not the case when the first edition was constructed, also to close the road and divert all traffic during the execution and for one month after completion, and he is sufficiently optimistic to think that this will provide a good wearing surface for many years. He is not in favor of surface-tarring concrete as, in his opinion, the only benefit arising therefrom is to cause a cushion for horses' shoes and perhaps slightly minimize the jar. Tar is not a good friend to Portland cement.

The author ventures to think that road users and road makers are in closer touch, and are appreciating that their interests are entirely mutual. The road user has no desire in his own interest to cause undue damage to roads, and the latter wishes to encourage and facilitate all classes of transport which it is admitted is in the national interest.

## E. I. C. COMMITTEE OF POLICY

AT a recent regular meeting of the council of the Engineering Institute of Canada, the following Committee on Policy was appointed: J. B. Challies, Ottawa, chairman; A. R. Decarie, Quebec; Brig.-Gen. C. H. Mitchell, Toronto; Walter J. Francis, Montreal; K. H. Smith, Halifax; J. G. Sullivan, Winnipeg; and A. E. Foreman, Victoria. This committee was given power to add to its numbers, having regard to geographical location.

A. H. Harkness, consulting engineer, Toronto, was appointed chairman of the Committee on Remuneration. It is intended that the personnel of this committee, when selected, should include some of the junior members of the institute.

The council will submit to the vote of the members an amendment to the constitution, which, if carried, will permit juniors to vote at branch meetings and to be eligible for election as branch officials excepting only in respect to the office of branch chairman.

C. C. Inglis, executive engineer, Special Irrigation District, Poona, India, desires Canadian manufacturers to submit written quotations on 6-in. post-hole augers, and also on smaller sizes, f.o.b. boat.