essential point in the preservation of a good surface is the vigilance on the part of road authorities. Should a depression appear in consequence of settlement, defective material, or other causes, it should be immediately eliminated. Best results are obtained and money is saved by immediate repairs on the road surface rather than leaving it until practically worn. Roads must be kept clean and, if possible, dustless.

When a road is finished and opened to traffic, it cannot be left to take care of itself; if so, it will soon deteriorate. The systems of maintenance in vogue are: (I) Contract; (2) personal supervision by rural population; (3) men employed by road authorities.

The author is in favor of the system of the work being done by men employed by the authorities, as in his opinion the men become familiar with the section under their supervision, and also seem to take an interest in the work, doing their very utmost to keep road clean and tidy. This is the system carried out in Scotland and other European countries, and it is to the thorough appreciation of this fact that the excellence of their roads is due.

The contract system is very unsatisfactory from the difficulty of getting a proper observance of the terms of the contract from contractor; this system has been tried in many places and has never given satisfaction.

The personal supervision by rural population or the statute labor system is not applicable to the upkeep of improved roads. It is unsound in principle, unjust in its operation, wasteful in its practice and entirely unsatisfactory in its results.

The rolling of a road in spring, after frost is out and before roadbed is dry, is one of the best means of keeping a macadam road in good condition. As before mentioned, great care must be exercised in watering and a road should not be watered unless it really needs it.

Macadamized Road with Tar Binder.—The tar binder has given good results, producing a road almost similar to an asphalt surface, almost noiseless, less wear and tear, less mud and dust than ordinary macadam.

Asphaltic oil has been used in many places as a binder for macadam roads and in very dry climates has given satisfactory results. The following method is employed: The existing surface of the road is covered with coarse sand of $\frac{1}{2}$ in. thick. The oil heated to a temperature of 175° F. is then applied and is allowed to remain for 24 hours. This surface is then covered with $\frac{1}{2}$ in. of sand, and oil again applied. This surface is immediately covered with sand sufficient to fill the liquid oil and remove stickiness. The surface is then rolled. Should surface lift under this treatment a little sand is applied again.

One of the first experiments tried by the author was treating of road surface with ordinary gas-works tar. This certainly kept down the dust and as a surface binder was fairly successful. But in hot weather it was continually running, and was more of a nuisance than otherwise.

Another method tried and highly successful as a dust preventative: calcium chloride was mixed in the proportion of 1 cwt. chloride to 100 gallons of water, and the mixture sprayed on to the road. This material served the purpose well, the absence of dust within a given period (almost three weeks) being the subject of favorable comment by residents. The cost worked out at 25 cents per mile for chemicals only.

A thin coat of tar of under-mentioned specification gives a fine surface in dry weather, but becomes dirty in wet weather under heavy traffic. During summer this method is very successful if used on streets under light traffic.

Specification: Specific Gravity—1.19 at 60° F.; Water—free; Fractionation—not more than 3% at 220° C., 15 to 20% at 300° C.; Free Carbon—15%; Viscosity —30 sec. at 70° F. The cost of this treatment was 5 cents per sq. yd. One gal. of tar covered 5 sq. yd. of surface.

A few years ago the author had a section of road treated with Tarvia "A," which was an exceptionally heavy tar. This road surface was in every way good, very regular in shape. The method was carried out in the following manner:

ist, Surface of road was thoroughly cleaned and swept free of dust; and, the tar was heated and spread on road by means of sprinkling cans; 3rd, chippings of same quality of stone used on existing surface, which was very gritty, 1/2 in. to 1/4 in. in size, free from dust, was spread on surface; 4th, the surface was then rolled with a 10-ton roller. The section treated was opened to traffic a few days after completion. The quantity of tar used was 34 gal. to I sq. yd. of surface. The following year a similar treatment was applied, with the exception that the quantity of tar used was 1/4 gal. to I sq. yd. of surface. This treatment gave excellent results, openings made in road a few months after second treatment showing that tar had really penetrated the surface to a depth of one inch, which greatly helped to bind the surface. It may be mentioned that this section did not get quite a fair trial as traffic conveyed upon it mud and dust from either end of the section, which caused a little more sweeping and watering than was necessary.

Before applying the tar the surface of road must be thoroughly cleaned, all dirt being removed so as to expose the stone surface. Should the surface not be cleaned in manner mentioned, or any cakes of dirt be allowed to remain, the tar will not penetrate into the macadam.

Surfacing with a substance called "Cormastik" is another method which has proved satisfactory. It is composed of ¹/₄ in. to ³/₈ in. granite chippings, sharp sand, powdered sicilian rock asphalt containing ¹⁰/₈ of pure bitumen and Portland cement. The binder employed is Cuban natural asphalt refined and suitably fluxed. The existing surface of road having been thoroughly swept and cleaned and painted with the bituminous solution. The "Cormastik" is then spread in a heated state to a thickness of one inch, a wooden straight edge being used for levelling, and finally rolled to a smooth surface by a 3-ton tandem roller.

This surfacing is also made up in brick form $9 \times 4^{\frac{1}{2}}$ x 2 in. thick laid on a concrete foundation and suitable for heavy traffic.

Pitch Grouted Macadam.—The size of stones used was $2\frac{1}{2}$ to $1\frac{1}{4}$ in. with chippings from $3\frac{1}{4}$ to $3\frac{6}{6}$ in., and finished thickness being 3 in. The stone, spread been levelled, is rolled dry until proper surface has been formed. The pitch, after being melted, is heated to a temperature of 300° F. Clean, sharp sand is added to this, mixed thoroughly in mixing vessels and transferred from these into cans, from which it is poured upon the road. On this surface a thin layer of chippings applied. The quantity of pitch used was 2 gal. to a sp yd. of surface. This method is fairly satisfactory in some districts. In the author's experience the pitch boiled the road became bare of pitch, the sides getting