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SURFACE OILING OF CITY STREETS

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THE TECHNICAL SERVICE BUREAU.

The Technical Service Bureau is maintained jointly by the Engineering Extension Department and the Engineering Experiment Station for the purpose of making more widely available the services of these departments to the industrial interests of Iowa.

In order to present technical information so that it will be of value to those who are not engineers, yet deal with technical problems, there are issued from time to time bulletins of special interest to the municipalities, industries and trades of the state. These bulletins are the result of investigations and tests; lectures or papers given during conventions or Extension Department short courses; or valuable information from other sources.

The Bureau also furnishes to the municipalities and industries special information and preliminary expert advice.

SURFACE OILING OF CITY STREETS

INTRODUCTION.

The earlier attempts to use asphaltic oils and petroleum residues for laying the dust and preserving the surface of roads and streets were made in California. On account of the somewhat sandy nature of the soil and the excellent quality of the oils available, the California experiments were generally successful and the results obtained attracted wide attention. Similar attempts in other portions of the United States and with oils of a different kind and under other soil and climatic conditions have not been so uniformly successful. This is particularly true of those attempts that have been made to secure permanent results with mixtures of heavy asphaltic oils and earth. In most cases the results have been of little value and have almost universally failed if the roads carried heavy traffic.

Where oils of a more fluid nature have been used to suppress the dust on earth roads, the results have been somewhat more satisfactory and there has been a gradual increase in the use of such oils for dust prevention. Many towns in Iowa are now regularly oiling their streets each year and the number is increasing rapidly.

SCOPE AND PURPOSE OF THIS CIRCULAR.

Reports which have been received from officials who have used oils for dust suppression, indicate a rather wide diversity in results. In some instances excellent results are reported, in others the results have been unsatisfactory in some respects. A number of oiled streets and roads have been inspected at various times during the past few years; some were in fine condition and others were little if any better than ordinary earth roads. Assuming that the oils used were of equal quality, and in general they were substantially the same, it is probable that the difference

A street in Ames, Iowa, looking from the part not oiled onto the part that was oiled in July for the first time. Photographed in October after a week of wet weather.

in the condition of the streets was due principally to differences in the care with which the street was prepared and the oil applied.

It is the purpose of this circular to describe what experience shows to be the best method of preparing the street and applying the oil.

KIND OF OIL TO USE.

The oils commonly offered for street work are obtained from petroleum, but oils from some other sources are available at somewhat higher prices than is paid for petroleum products. The petroleum oils are supposed to contain "asphalt" but whether any particular sample does or does not depends upon the source of the oil and what is meant by the term "asphalt." As a matter of fact few of the road oils do contain "asphalt" if we use the term in the strict sense, but it is not important what we call the black sticky portion of a road oil. If the oil contains good "body" and possesses some stickiness, while being fluid enough to penetrate the road slightly it will serve to lay the dust. For ordinary conditions the oils containing from 40 per cent to 50 per cent of so-called "asphalt" are best. In general, the oils are fluid and greasy and have little binding value so that they cannot be expected to give a dense, closely knit surface. Some of the oils, however, do contain a sticky constituent which has some binding value and probably adds to the stability of the road surface as well as serving to suppress the dust. There has not been enough experience with these materials on earth roads to show that they are worth any more than the more greasy oils for dust laying.

If the street be very sandy or is of gravel or crushed stone macadam, there can be no question as to the advisability of using an oil that is sticky and free from the greasy characteristics of the ordinary petroleum oil, nevertheless fair results can be obtained with many of the petroleum oils if they are handled properly.

PREPARATION OF THE STREET.

If a street is to be oiled for the first time, preparations should be started some weeks before the oil is actually applied.

This is how an oiled street looks after several days of rain. Note that only a small amount of mud has resulted. This street is well rounded up, which is essential for proper drainage.

The effect of the oiling is to render the earth partially impervious to moisture and if the surface of the road be uneven when treated or becomes uneven afterward, the depressions will become basins for holding water. Traffic will gradually work the soil and the water thus retained into mud to the serious detriment of the street. If the street be smooth and well crowned the water will run to the gutters so quickly that only in long continued wet weather will the street be softened to any great extent and therefore traffic will not make any considerable amount of mud on the surface.

The principal object in oiling a street is to prevent dust, therefore there should be no dust on the street when the oil is applied. If dust has formed, it must be removed, which costs something. It would be better to treat the suface before the dust has formed if possible.

For the best results the street oiling should be planned ahead and the preparation of the street be carried out in the early summer so that the oiling can be done before a layer of dust forms on the street.

GRADING.

Good results with oil cannot be expected on a flat and poorly drained street. Early in the summer the street should be carefully rounded up with even slope from the middle to the gutter. The gutter or ditch should be deep enough to readily carry the water and to permit a slope of about an inch to the foot from the middle of the street to the gutter. Generally, the bottom of the gutter should be about eighteen inches below the middle of the street where the width of the street is not over 35 feet between gutters. This is about right on a residence street. On a business street having a width of 50 feet, the bottom of the gutter should be at least two feet below the middle of the street.

After the street has been shaped with a grader, it will undergo a period of settling during which some depressions and uneven places will appear. These should be filled with earth and the entire roadway be kept dragged until it finally becomes hard and smooth and free from depressions.

It is very important to secure a firm, smooth surface for the oil and the small expense incurred will be more than made up by the increased effectiveness of the oil treatment.

A street must be well drained before it is oiled. The street shown here would be little benefited by oiling.

When the street has been brought to this stage it is ready for oiling and usually the best time is during the latter part of May and during June. If the oiling is delayed until a layer of dust has formed on the street it is best to scrape off most of it before oiling.

The decision to oil a street may sometimes be reached after the summer is well along and the streets have become hard and dry. In that event, it is not advisable to do any extensive earth work because at this time of year newly placed earth will not compact readily and if oiled before well packed, the results are unsatisfactory. Such a condition is not ideal and only poor results can be expected.

APPLYING OIL.

After the street has been prepared as described the oil should be applied, the quantity being one-third gallon to one-half gallon per square yard of surface. If the street has never been oiled before or if more than a season has elapsed since a previous oiling, the quantity used should be about one-half gallon per square yard, but if the street is being oiled regularly each season, about one-third gallon per square yard is sufficient after the first year. If the oil is being applied on a busy street in the business district, then it is necessary to oil every year, using about one-half gallon per square yard of surface for each oiling. In many towns the business streets are oiled twice a year.

An ordinary street sprinkler may be used for distributing the oil and after a few trials the operator can get his spray adjusted so as to deliver about the proper amount of oil and to spread it evenly. Care must be taken to secure a nice even distribution of the oil and to avoid forming pools or covering sidewalks and crossings. Many of the disagreeable features of street oiling can be avoided if care be taken to keep sidewalks and crossings clean. The crossings may be covered with dust or sand before the oil is spread so as to keep them clean. After the street has been under traffic the crossing may be cleaned and from that time no trouble will be experienced.

If a street sprinkler be not available for delivering the oil, a thresher or any similar tank can be used by attaching a pipe at the back for distributing the oil. The best pipe distributor

consists of an 8-foot length of two-inch pipe, made up with a tee at the middle and caps at the end. Along this pipe, tee included, should be drilled two rows of one-eighth inch holes one inch center to center in the rows. This pipe is connected at the rear of the tank so that it will hang about one foot from the ground, and parallel to it, the connection to the tank being made with 2-inch pipe in which there is an ordinary blow-off cock or a gate valve. A little better distribution will be secured if a "spatter" board is suspended just under the spray pipe so that the oil will strike the board and break up into spray before striking the ground. This will make it possible to cover the surface fairly uniformly instead of in streaks as will be the case if no board is used.

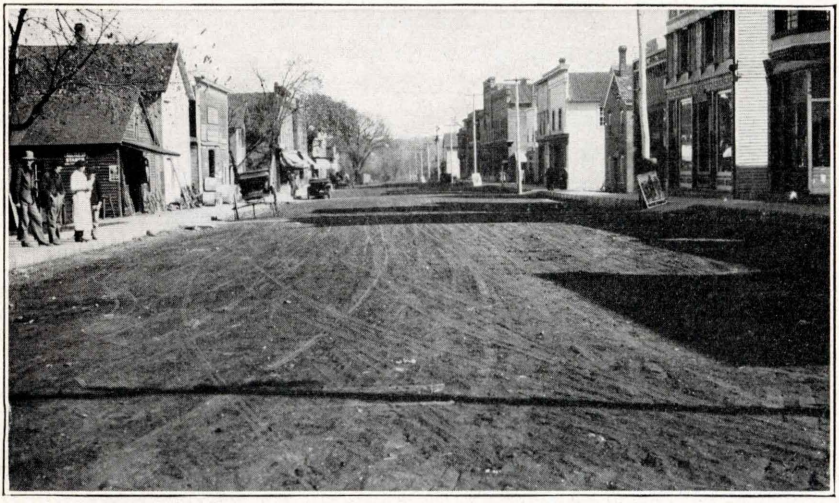
After the oil has been spread it should stand without being covered for about a day. Then it should be covered with just enough sand to keep the oil from picking up. Emphasis is placed on the importance of using sand for this purpose rather than dust from the old road surface. The amount of sand needed is only two or three loads per block and at any reasonable price the benefits derived from the use of sand justify its use, wherever it can be secured.

After the road has been put in service, it may be apparent that more sand is needed in spots and such places should be covered lightly; the covering being repeated two or three times if necessary. Use just enough sand to keep traffic from picking up patches of the surface.

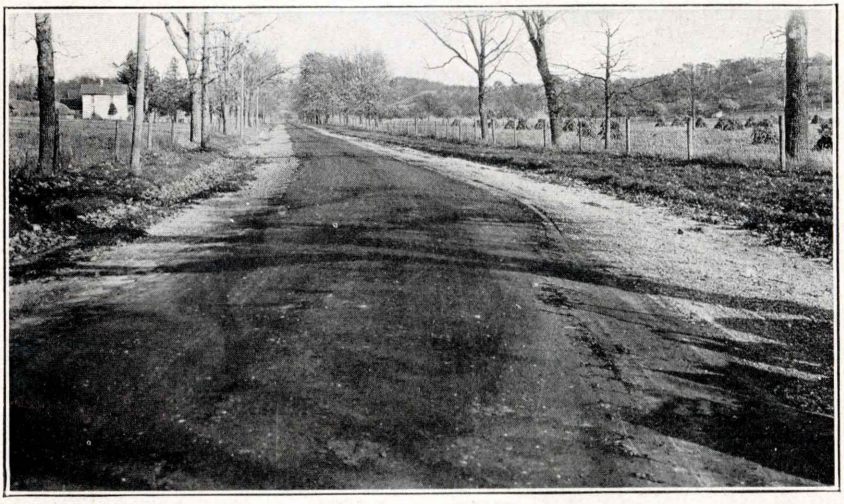
When a residence street is oiled the second time, the method to be followed is exactly the same as is followed the first time, except that the quantity of oil used may be reduced to about one-third gallon per square yard of surface. It is advisable to repeat the oiling the second year in any case and it may then be omitted the third year and resumed the fourth year. Better results would be obtained if the work were done every year, however.

RESULTS TO BE EXPECTED.

Surface oiling finally results in a street covered with a layer of granular soil which is oil saturated and consequently does not blow about readily. The suppression of dust is the principal benefit to be expected. Beneath the thin layer of loose oil soaked soil the firmer portion of the street is saturated with oil for a depth that varies from one inch to perhaps six inches.



A street in Elgin, Iowa, that has been oiled once a year for five years. Note the smooth surface and ample provisions for drainage.



Oil applied at the proper time to a gravel or macadam road will preserve the surface and keep down the dust. This road was photographed about four months after it had been oiled for the first time.

Water penetrates this layer rather slowly. If the street has plenty of cross slope so that water does not stand on the surface, only a small amount of mud will form under light or moderate traffic. A street that is oiled systematically for a series of years gradually acquires an oil soaked crust which becomes more and more impervious as the oiling is repeated. An oiled street never gets to the place where it will not be muddy in those seasons of heavy rainfall nor will the surface be stable in ordinary wet weather if the road carries heavy traffic.

UNLOADING THE OIL FROM TANK CARS.

The oils used for dust suppression can be purchased so much more cheaply in tank car lots than in barrels that it is always advisable to purchase in such lots. If the town be so fortunate as to have a siding or an embankment 8 or 10 feet high, the car can be placed thereon and the oil allowed to run into the sprinkler wagon from the tap in the bottom of the tank car.

Usually such a siding is not available and in that case the oil must be pumped from car to wagon. For this purpose the ordinary tank pump used with traction engine tanks is as good as anything. It should be placed on top of the tank car with all connections made of pipe as hose does not last long in oil. If a small steam or gas engine driven pump be available it will of course be faster than a hand pump. It is not worth while to purchase one for a small amount of work.

COST OF SURFACE OILING.

The cost of preparing a street for the oil treatment may vary from $.25 to $1.00 per lot 60 ft. wide but it is hardly proper to charge extensive earth work against the oiling. The street ought to be kept well shaped up regardless of whether it be oiled or not.

Some cleaning is almost always necessary prior to the oil work, however, and the cost of it will usually range from $.30 to $.50 for each 60-foot lot where the street is oiled about 25 feet wide. The oil can be unloaded, hauled and distributed for about $2.00 per lot including the cost of covering the oil with sand. The cost of the oil will be about $1.00 per lot and the cost of sand about $.25 per lot. The total cost for each 60-foot lot on each side of the street is as follows:

Cleaning the Street	$ .40
Applying oil and covering with sand	2.00
Cost of oil	1.00
Cost of sand	.25
Total	$3.65

These prices are about an average and will serve as a guide in estimating the cost of work of this class. Oiling is often done considerably cheaper and in other instances has cost more. It is assumed that the application will consist of about one-half gallon per square yard of surface and that the oil cost $.04 per gallon.

OILING MACADAM ROADS.

When oil is used to prevent dust on a new broken stone or gravel macadam it should be applied after the road has been well seasoned, but before traffic has brushed off all the fine material from the surface. Usually a road will reach the proper condition within a year after it is built, but the time varies greatly. If allowed to go too long the surface will be a little rough after oiling. If oiled too soon a putty like mat will form which will scab off the surface under traffic.

If an old macadam road is to be oiled it should be repaired and thus be brought to a smooth even surface. It should then be placed under traffic just long enough to get a good texture to the surface before the oil is applied.

A macadam road is in the proper condition to oil when it has a true cross section and a uniform surface whose texture is close and compact but upon which there is very little loose binder, be it either sandy loam or stone screenings. If the surface be porous the oil will penetrate too deeply and will interfere with the bond of the surface. If the surface be covered with fine material, the oil will mix with it and form a mat covering which is not durable.

It should be noted that the general statements made above apply only in those cases where a light petroleum oil is used for dust laying and not to the construction of macadam by the penetration method.

TESTS OF ROAD OILS.

It is often desirable to secure complete tests of samples of oil that is to be purchased for street work. Such tests will show which one of a number of oils is best for a certain class of work. When oil of a certain asphalt content is purchased, it sometimes is desirable to check up the material to learn whether the proper grade has been furnished.

Tests such as the above will be made by the Engineering Experiment Station at Iowa State College, Ames, Iowa, if a sample of one quart of the oil be sent by prepaid express to the above address. Samples should invariably bear the name and address of the sender. No charge is made for testing materials submitted by public officials of Iowa.