

useless. In spite of the fact that we were almost unanimous that the things should be done, difficulties arose when the type of pavement was to be determined. To date, we have plans for concrete, Kentucky rock asphalt on concrete, Kentucky rock asphalt on macadam, sheet asphalt on concrete, and sheet asphalt on macadam.

We have received assistance from the Engineering Extension Service of Purdue University and the State Highway Commission and present indications are that our plans will be carried out successfully in the near future.

TABLE I.—HUNTINGTON COUNTY ROAD DATA DEC. 31, 1922.

Township	Total Road Tax Levy	* (1) * (2) * (3) * (4)	County Road Mileage	State Road Mileage	Township Road Mileage	Bonds	Debt	Valuation
Jackson	.832	(.03-.132-.12-.55)	26.71	7	35.88	\$174,109.80	\$103,728.64	\$4,174,920.00
Clear Creek	.302	(.03-.132-.17-.07)	44.54		26	76,471.70	8,025.36	3,621,870.00
Warren	.482	(.03-.132-.05-.27)	40.24		14	111,556.00	27,550.00	2,958,290.00
Dallas	.642	(.03-.132-.10-.38)	23.68	5	15	123,220.00	54,026.96	2,822,290.00
Huntington	.262	(.03-.132-.10)	40.03	7.75	21	121,576.00	5,754.00	24,475,610.00
Union	.382	(.03-.132-.13-.09)	40.84	2.5	24	68,125.00	15,595.50	4,463,400.00
Rock Creek	.802	(.03-.132-.15-.49)	44.44		26.5	133,737.00	64,188.50	3,733,430.00
Lancaster	.622	(.03-.132-.16-.30)	45.02	4.75	16.5	75,910.00	53,663.90	3,119,110.00
Polk	.672	(.03-.132-.16-.35)	27.16	1.75	17	56,903.40	21,980.90	1,621,410.00
Wayne	.532	(.03-.132- -.37)	36.99	5.75	7.25	94,178.00	37,274.00	2,023,950.00
Jefferson	.680	(.03-.132-.22-.30)	46.80	.50	18.50	113,389.00	42,342.00	2,957,730.00
Salamonie	.672	(.03-.132-.08-.43)	56.58		8.50	201,334.00	98,645.60	4,824,600.00

* NOTE: In the above table (1) went to the State Highway Commission, (2) to turnpike repair, (3) was the township road levy and (4) was for bond retirement.

GRAVEL ROAD MAINTENANCE

By J. T. DONAGHEY,
State Highway Engineer of Wisconsin.

Wisconsin is blessed by nature with a goodly supply of road materials of various kinds and quality, none of which are so valuable as its gravel deposits, especially those throughout the glacial district, covering the eastern and southern portion of the state.

We have over 25,000 miles of gravel roads in Wisconsin. About 5,000 miles of which are what is termed full depth gravel, or from eight to twelve inches. The majority of this mileage is

found on the ten thousand mile State Trunk Highway System.

The balance is what is termed light surfacing, from five to eight inches in depth. This latter mileage in the majority of cases has been built by the local units of government.

Our experience has taught us that gravel road maintenance must begin the moment the material is in place on the sub-grade. To maintain the surface adequately, the following rules must be followed:

First. Be sure the road enters the winter season in the best of condition. Ditches and culverts must be free and open and the road surface must be smooth and free from holes and depressions that will hold water. Add gravel where needed at this time.

Second. Go over the entire road (surface and ditches) with a twelve-foot blade grader just as soon as conditions will permit in the spring. Move the top inch of gravel back and forth at least twice. This insures removing all holes and depressions permitting the patrolman to begin the season's maintenance work with no handicap.

Third. Add new material at all places where the original material has been pounded into the sub-grade by traffic. Add new material to the entire surface as fast as the original is ground up and blown away. This will be about one-half inch per year for each 200 vehicles per day of traffic.

Fourth. Keep a light mulch of fine gravel covering the surface at all times. The patrolman must move this mulch of gravel entirely across the surface once for each 800 vehicles of travel. As traffic increases, the patrol section must be shortened accordingly and the maintenance equipment increased in weight correspondingly.

Time to Do Work

We begin maintenance work very early in the spring just after the frost has left the ground or as soon as the surface is thawed to a depth that will permit working a blade grader.

At this time the gravel surface is somewhat loosened from the frost action and it is possible to cut off the high places and move them to the low places with more ease and more lasting results than at any other time during the season.

The ridge of gravel thrown outside the wheel tracks by traffic is moved in towards the center of the road with the blade grader and naturally fills the ruts, holes and low places.

All large projecting stones are removed from the surface before adding new material.

Material

If additional material is needed, it must be made available along the roadside during the winter months and added during this spring work as it will bond much better and more easily than at any other time during the season.

Where new material is needed to fill the holes and low places, use gravel that has passed through a screen having round perforations not to exceed one inch in diameter and containing but a small amount of binder.

When the holes and low places have been filled, the entire surface is gone over thoroughly with a grader having the blade set nearly at right angles, until a uniform and even surface is obtained. The blade is then set at the proper angle to shape up the surface to the proper cross section, which should not permit more than a three inch crown for a twenty-four foot surface. The blade grader or planer is used frequently to keep the ruts filled, assist in compacting the gravel, and smoothing up the whole surface.

Piles of fine gravel for use in maintenance are placed along the road at convenient points outside the ditch line where patrolmen can easily get the material necessary to fill the small holes and defects that may appear from time to time.

The material is delivered to the road by motor truck or on sleighs during the winter months, provided the haul exceeds one mile.

If the patrol man has material available along the roadside he can fill the holes immediately in the spring or after a rain and water standing in the low places will show him better than can be shown in any other way, the exact depth of new material necessary to bring the low places to the proper crown. The best time to add new material is when the holes or low places are filled with water.

Time to Use Grader or Planer

The best results are obtained with the blade grader or planer early in the season, just when the frost is leaving the surface, or after a rainy period of several days, at which time the entire surface has become so thoroughly soaked and softened up that material moved from the high places will bond readily where it drops into the low places.

Motor trucks are used to good advantage for pulling the grader or planer. An ordinary three ton motor truck will pull a blade grader or heavy planer very satisfactorily. This requires an extra man to handle the grader, but the extra expense is offset by this type of equipment being suitable for delivering material to the road.

Motor graders do excellent surface maintenance work, but are not satisfactory for cleaning out ditches.

We find a good team patrol will cover a six mile section. A motor grader thirteen miles, and a motor truck twenty miles. The team patrol generally being the best and cheapest.

Do not be afraid to use the grader or planer during dry weather on a gravel surface. The material thrown out by traffic should be moved in to assist in filling the depressions caused by heavy traffic in dry weather. All of the material will not remain in the depressions, but enough of it will to warrant the work. We find on those gravel sections where the patrolman keeps moving the surplus fine material back and forth across the surface, even though the weather is dry, that he invariably has the best riding section.

Scarifying and Reshaping

Hundreds of miles of uneven gravel roads built in the past have been converted into excellent roads for travel by scarifying and reshaping. A roller scarifier or an ordinary heavy grader scarifier pulled by a heavy tractor is used. It is generally advisable to scarify to the entire depth of the gravel or at least to the depth of the deepest holes. Harrow thoroughly with a heavy peg tooth harrow and shape up the surface with the blade grader. The blade should be set nearly at right angles in order to remove the waves and depressions. Remove loose stones from the surface and use the grader or planer daily until the surface is well compacted. Add fine gravel where needed to strengthen the weak places and fill all depressions.

Untreated gravel surfaces that carry an average traffic of 400 or more vehicles per day should be scarified and reshaped twice during the maintenance season. The first time as early in the season as the work can be done and the second time about September 1st. We generally have rains about this season, which will assist in bonding the gravel that has been loosened up with the scarifier. The surface will be in much better condition to go through the fall and spring wet seasons than if the holes and wash boarding are allowed to remain.

Surface Treatments

When traffic reaches an average of 300 vehicles or more per day some form of surface treatment should be applied in order to protect the surface of the road from grinding up and blowing away. Up to this traffic limit there is probably no question but what the addition of the required amount of new material from time to time will keep the surface of the road in very good condition at a lower cost per mile per year than can be done by any form of surface treatment. However, we must consider the

material lost annually, which is not less than 300 cubic yards per mile for an average daily traffic of 300 vehicles and the danger and nuisance existing from the prevalence of dust.

Calcium Chloride:

The application of calcium chloride or any other dust layer that does not form a surface that will serve traffic without the patrolman's constant attention with grader or planer can hardly be classed as a surface treatment. However, on roads carrying not to exceed 400 vehicles per day quite satisfactory results can be obtained by the application of calcium chloride or similar dust layers. The surface must be shaped to the proper cross section and reasonably well compacted before application. It requires an application of from one-fourth to one and one-fourth pounds of calcium chloride per square yard for the first treatment. Generally a second application must be made about mid-summer, requiring from fifty to seventy-five per cent of the first application, making in all not to exceed two pounds per square yard per season. Calcium chloride is applied by the use of an ordinary lime spreader and one outfit can apply two miles or more per day. Calcium chloride does two things; first, it lays the dust quite satisfactorily, and, second, it conserves the material on the road surface, not so much as bituminous surface treatments, but enough to be recognized as a considerable saving per mile per year. It is, however, a dry weather treatment and works out much better during a dry season than it does if the season is especially rainy. During a rainy spell a surface treated with calcium chloride gets quite sloppy and pits easily. It also requires constant patrol maintenance.

There is no question but what this treatment is beneficial, especially upon those surfaces that are not bonded sufficiently to treat with light tar.

Light Asphaltic Oils:

There are certain gravel roads constructed of such material that the surface is always covered with a heavy mulch of fine material that stays bonded for only a short time after each rain. On such roads a light oil surface treatment works out very satisfactorily and at a reasonable cost. The surface must be shaped up properly and the oil applied at the rate of about one-half gallon per square yard. After the oil has penetrated the fine mulch, it should be moved back and forth with a blade grader the same as untreated gravel would be handled, and must be gone over often enough with the grader or planer to keep it from becoming solid or shiny at any point. If there is evidence of it becoming hard and shiny, it is well to apply a small amount of fine gravel and move it back and forth over this portion of the sur-

face which will prevent such condition. This treatment will conserve the material, prevent dust, and is generally a satisfactory surface for one season. Frequently, however, it is necessary to give a light second application about mid-summer. In this event the cost will be increased to whatever extent is required by the second application. It will not require quite as much material per square yard the second year as the first. However, if no application is made the second year, the surface soon gets in its original condition or worse. In other words, there is no permanent or lasting value in a light oil treatment. The total cost per mile per year, including new gravel but not including patrol maintenance, will range from \$400.00 to \$500.00 This form of surface treatment is generally satisfactory up to a daily average of 800 vehicles.

Light Tar:

Where traffic reaches an average of 800 or more vehicles per day, the loss is not less than one and one-half inches of surface annually, or not less than 450 cubic yards per mile. Very few localities have enough gravel available to construct and maintain their roads for a ten-year period unless such material is conserved to the maximum. A loss of 450 cubic yards per mile annually would in five years provide sufficient material for a mile of new road. No community can afford this loss.

We use no material in the top five inches of a gravel surface which exceeds a size that will pass a one-inch round opening. This material is not separated, but is all deposited in the same bin and loaded into trucks from a chute in the bottom of the bin. This insures a uniform gradation. The same specifications prevail on all resurfacing of old gravel roads. This costs somewhat more than pit run gravel or gravel crushed to a larger size, but it is worth much more than the difference in such cost, especially where the surface must be scarified frequently.

In preparing for the first surface treatment, the surface is thoroughly scarified to a width of twenty feet or more, and to a depth of the deepest holes appearing in the surface, which is generally not more than two inches. It is necessary to lap the scarifier one-half in order to get the surface completely scarified, as material of this kind becomes extremely solid under heavy traffic and a "once-over" with most scarifiers will not produce the desired results.

Immediately following the scarifier, the surface is shaped with a twelve-foot blade grader to a uniform cross-section. The material is sometimes loose and dusty on account of the fine content, and a sufficient amount of time is permitted to elapse for the surface to become well compacted. A good heavy rain will aid materially. The surface is now swept clean with a rotary

broom. The sweeper is hauled by a motor truck and leaves quite a windrow of dust and loose gravel, so that a light grader is used to push the windrow out of the way of the sweeper for its second trip. The surface is swept twice, and after the second sweeping the coarser gravel in the surface projects just a little above the rest of the surface, producing practically a mosaic surface. Should there be any dust pockets remaining, they must be cleaned out with hand brooms. Some gravel surfaces may not need scari-fying and are shaped up very satisfactorily with a heavy blade grader. This work should be done early in the spring, just as soon as the frost leaves the surface of the road.

Application of Priming Coat:

After the surface is swept clean, the tar is applied as follows:

Light tar equivalent to Tarvia B may be applied cold, but better results will be obtained if it is heated to 100° F. The distributor should be thoroughly cleaned before beginning operations and then kept clean. There should be a double strainer on the distributor tank intake in order to exclude all cinders that may be in the tank car as it is almost impossible to secure a tank car of tar which does not contain some cinders. It is also very necessary to have several extra nozzles so that if one becomes clogged it can be replaced immediately which will permit the distributor to operate evenly. Even distribution is very essential.

The priming coat is applied at the rate of one-sixth to one-fourth gallon per square yard on new surface treatments, and no sand or covering is spread over it. Forty-eight hours or more are permitted to elapse after the priming coat has been applied, during which time traffic irons out the surface in a fairly uniform manner. If the covering must be spread by hand and conditions will permit, immediately following the application of the priming coat the covering for the second coat should be deposited along the shoulder of the road. Be sure that the windrow of loose dust and gravel left by the sweeping has been pushed clear out over the shoulder with a grader before the covering is deposited along the shoulder as the covering material should be located on the shoulder outside of the edge of the surface treated portion and not be permitted to mix with the loose material swept off the surface.

Depositing the Covering Material:

Pea gravel, fine stone chips or clean, coarse, sharp sand is the best material to use for covering, and for a twenty foot surface it will require about fifty cubic yards per mile to cover the surface properly. The covering should be deposited in piles of about one-fourth cubic yard each, and twenty-five feet apart,

and care should be taken that the inside edge of the pile be entirely clear of the outer edge of the surface treated portion for, if a thin film of covering opposite the piles should be covered with the second application of tar it would pit out at that point and produce very unsatisfactory results.

The reason for depositing the covering in advance of the application of the second coat is that a certain amount of covering must be applied immediately after the second coat of tar touches the surface, which prevents the tar from running off and permits it to penetrate the surface, thereby forming a skin coat and not a mat. The covering if deposited along the shoulder is also available to add immediately in any amount desired to prevent picking up and to cure bleeding.

Application of Second Coat:

Should several days have elapsed before the second coat is applied and the surface has become slightly loosened or dirty, it should again be swept lightly to remove any loose material. The distributor is now set to spread about one-third gallon per square yard and care must be taken to have the tar spread uniformly.

Where the covering is spread by hand a number of men (from six to ten) are stationed along the sand piles from fifty to one hundred feet apart. When the distributor is started along the road, the man at the first pile spreads a little less than one-quarter of the covering in his first pile on the width covered by the distributor opposite the pile, doing the same with the next pile and so on, working rapidly. The second man does likewise when the distributor reaches a point opposite his first pile, and so on down the line of men. The first man, upon reaching the point where the second man started spreading, moves ahead of the line of men, beginning a new station the required distance from the last man in line. Handling the covering in this manner permits applying a small amount immediately after the tar touches the surface of the gravel, and, as stated before, prevents the tar from running off the road surface and assists it in penetrating the gravel, which is what is desired. To do this part of the work cheaply and rapidly, on a large mileage, there should be two or more distributors on each job, one being loaded while the other is distributing. There will naturally be a certain amount of elapsed time between the loads, which permits the sand spreaders to go back and add sand where needed to keep the tar from running off the surface or to prevent picking up. The distance of the job from the supply of tar will, of course, enter into the time question. The other side of the road is handled in just the same manner, and the distributor should be so equipped that two trips over the road will cover adequately the width of surface desired.

Extreme care must be taken to avoid spreading too much covering on the second coat until it has had time to penetrate the surface. If too heavy a covering is spread, or if the spreaders are careless and dump full shovels in a place, the result will be that the excessive amount of covering will absorb or blot the tar and prevent it from penetrating the surface and will result in a mat rather than a skin coat. The spreaders should use square point shovels and learn to throw the covering from the shovel in a manner that will produce an even application.

If the weather is reasonably warm penetration will immediately take place and after two hours have elapsed there is very little danger if more covering than is necessary is applied as the tar will then have penetrated sufficiently so that the excessive covering will not blot the tar. One or two extra men should be kept on each mile for at least a day or two following the second application to apply covering where the surface starts to pick up or bleed, and a small amount of material should be left in about every third pile for this purpose.

Mechanical spreaders may be used, but if used, not to exceed one-fourth of the total covering required should be spread immediately following the distributor, an additional fifty per cent in about two hours, and the balance as needed to cure picking up or bleeding.

The most practical and convenient mechanical device for spreading sand, pea gravel or stone chips that the writer has seen in operation is in Bane County, Wisconsin. It was designed by the county mechanic. It will spread evenly at the rate of twenty cubic yards per mile of twenty-foot width, or any desired thickness in excess of that. It is very simple, can be attached to any dump body truck and is not expensive to construct or attach.

Patching the Surface:

The patching material is composed of from fifteen to seventeen gallons of light tar equivalent to Tarvia B, mixed thoroughly with one cubic yard of coarse sharp sand. The material must be mixed thoroughly either by hand or in a mixer, and it will give better results if it stands several weeks after mixing prior to being used. The volatile oils evaporate and when thoroughly cured the mixture makes a better patch and will stay in place much better. Patching material mixed the previous year has been used with better results than when used fresh. No more than seventeen gallons of tar per cubic yard of sand should be used even though it is slow in mixing.

Those in charge of maintenance must watch the surface very carefully, especially the first ten days after the surface treatment is applied. If a hole or abrasion appears in the surface the loose material should be swept out clean and the hole filled with

patching material. If there are any places that appear loose and do not harden up under traffic, they should be dug out to a depth where solid material prevails, the hole filled and the material well tamped in and given an application of tar, and in a few days covered with a coat of patching material. The patch will soon iron out and become equal to the balance of the surface. The patrolman must be sure to fill every hole just as fast as it appears noticeable to the eye, even though it is not more than the size of a silver dollar.

The outstanding points to insure satisfactory results are:

First: Do not add more than one inch of new material during the season in which the treatment is given. In other words, if a gravel road is to be surface treated, any addition in material required in the line of resurfacing should be applied the previous season and permitted to compact during the late fall, winter and spring. However, light applications of one-half to one inch can be made early in the spring and get good results the same season. This material should be placed before scaring the surface.

Second: The surface must be well compacted and uniform.

Third: The surface must be swept clean.

Fourth: The primary coat must be applied immediately after sweeping.

Fifth: The tar must be uniformly spread.

Sixth: The covering must be spread evenly, and a little less than fifty per cent of the required amount spread immediately following the distributor, the balance being applied later as required.

Seventh: If possible, close the road to traffic for twenty-four hours after the second coat is applied.

Eighth: The surface treatment must be followed up promptly and carefully by the patrolman or maintenance gang and patching material must be added just as soon as the slightest hole is noticeable on the surface. A well-prepared surface should not require more than seven cubic yards of patching material per mile per year.

Ninth: **Unless plans are made to patch every hole the moment it appears, it is better not to attempt to maintain a gravel road with this type of treatment.**

Approximate Costs:

The first tar surface treatment of a gravel road twenty feet wide will cost from \$900.00 to \$1,200.00 per mile. This includes the necessary preparation of the surface, the follow-up maintenance, and the entire patching cost of the season.

Preparing the Surface for Retreatment:

Where a road has been previously treated by this method, preparations for retreatment are as follows:

Any portions of the surface that are in perfect condition, showing no holes, ridges or wrinkles, may be retreated without scarifying or breaking up with a blade grader. Under these conditions two to three-tenths gallons per square yard should be sufficient.

Those portions that are slightly uneven should be gone over with a heavy blade grader early in the spring when the tar skin coat is inclined to be loosened up a trifle from frost action and weather conditions, pushing the skin coat out of the shoulder of the road with the grader and following this up with a light blade grader such as is used in patrol work moving the material pushed to the side of the road back and forth across the surface of the road every other day for a week or two. The best results are obtained when the temperature is from 60 to 70 degrees F.

This breaks up the old tar crust and the grader operations smooth up the surface of the road to a point where it is practically a perfect cross-section. When the surface has become smooth and well compacted by these operations it is swept clean and the covering material placed in piles along the edge. The tar is applied in the same manner as outlined above and generally no priming coat is required. Should the surface require a priming coat it should not be in excess of one-sixth gallon per square yard. The coat required for the second year's surface treatment is approximately one-third gallon. The third year and thereafter a less amount is required unless additional width is treated.

The application of tar, spreading the covering, the follow-up patching and everything connected with the work is done just the same as on a new surface treatment.

The Mixing Method

Where the gravel surface contains but little binder and the surface is not well bonded, very good results may be obtained by applying the tar without sweeping the surface. The surface is brought to the proper cross-section with a blade grader and immediately following this an application of one-third gallon per square yard is spread over the full width of the road.

About two hours is permitted to elapse after applying the tar to permit it to penetrate the loose surface. However, traffic can pass over the surface almost immediately following the distributor, splashing but little tar on the vehicle due to the fact that it immediately penetrates the loose gravel surface. Two twelve-foot blade graders are now used to move the top three-

fourths inch of surface over well beyond the center of the road. Immediately following the second grader the distributor applies one-third gallon of tar per square yard on the solid gravel. Immediately following this the graders push the loose material from the other side over to the opposite side of the road and the tar is spread on the other half of the solid gravel. The loose material is now moved back and forth across the road surface three or four times. The blade is set at about a 45-degree angle in order that it will roll the material along the blade, which assists materially in mixing the tar and gravel. When the loose material has been mixed until it is all coated with tar, it is then spread out with the blade grader to a uniform thickness over the surface. Traffic is permitted to use it immediately; in fact, traffic is never shut off on this type of treatment. A light grader or planer is used continuously until the surface is thoroughly ironed out and well compacted, which will take about two days where travel reaches a thousand vehicles or more daily. Where traffic is less than this amount it will take slightly longer to iron out and become well compacted.

After the surface is well ironed out a seal coat of about one-sixth gallon per square yard is applied, followed immediately with a very light covering of pea gravel. The planer is again put in operation and moves the surplus pea gravel from the high spots to any depression in the surface, resulting in a very uniform and smooth surface within a week or less.

This method requires about five-sixths gallon per square yard and, of course, necessarily costs more than the ordinary surface treatment heretofore described. However, it insures a penetration of approximately one inch and also insures the entire surface being well bonded with tar. We find this type requires much less patching and less attention than the ordinary surface treatment. We tried out a mile of this type in 1923 and it came through the 1924 season without a retreatment. Therefore, at the end of the two seasons it was cheaper than the ordinary surface treatment.

We are very much sold on this latter type and are satisfied that more of our treatments will be along this line from year to year.

Costs

We surface treated 200 miles of gravel road with light tar in 1924, and expect to treat 400 miles in 1925. Dane County alone will treat approximately 200 miles in 1925. After three years' experience in Dane County with tar surface treatments the county board appropriated \$150,000.000 as a special fund for the surface treatment of their main gravel roads in 1925.

It may be interesting to know that Dane County is one of the few wealthy counties in Wisconsin that has not bonded for concrete roads. While I am satisfied that their main roads should be of some high type of surface, nevertheless they are getting excellent results with the surface treated gravel and are satisfying the general public and especially the farming public. The maintenance cost is well under the interest on a high type surfacing and as long as it remains below that point it can be argued that there is no waste of public funds.

In Wisconsin we find it practically impossible to get appropriations sufficient to build all our main lines of travel with high type surfaces, and we do find that we can maintain our gravel surfaces in a very adequate manner with light tar surface treatments giving the public a safe and pleasant road to drive over and conserving our local materials by so doing until such time as funds can be provided for a higher type surface.

STONE ROADS OF MONROE COUNTY

By PROF. U. S. HANNA, Indiana University,
Monroe County Engineer.

Owing to the generally rough and rolling character of the land in Monroe County the roads in very many parts of the rough sections do not follow the section lines, but follow ridges and valleys instead. About one-third of the land is very good for farming purposes, one-third is only fairly good for tilling and pasturing and the remaining third is about as poor as any land in the state, and should be taken by the state and reforested. Thousands of acres in the county are what is called "trading land," and it changes ownership very frequently, when it has ownership at all.

These localities are the farthest removed from Bloomington, where none of the roads have been improved. The lack of wealth and the roughness of the land have made it altogether impossible for these out townships to build any roads under the three-mile road law. Since the passage of the county unit road law we have built and let contracts for about twenty-five miles of roads in these outer townships and there are petitions now on file for about fifty additional miles.

Distribution of Stone

The distribution of limestone suitable for stone roads is pretty general throughout the county, and this fact has made possible the very rapid development of our stone road system. The