GRAVEL ROADS IN WISCONSIN.


J. T. Donaghey.

The subject of gravel roads has become very important for many of the towns in Wisconsin. There has been built under the provisions of the State Aid Highway Law during 1912, 1913 and 1914, 440 miles of such roads. Previous to that time, hundreds of miles had been built throughout the State with varying results. Some were built fairly well, but the majority were built by simply hauling the gravel from the pit as it came and dumping it on the surface of the road, without any preparation of the subgrade, no attention being paid to alignment, and in many instances not taking time to spread it, thereby causing the traffic to take to the ditches until the elements had assisted in leveling the surface to a point where it was safe to attempt traveling it.

This manner of construction had prejudiced people against gravel roads and it has taken some time to convince them that it is possible to build a good road with almost any kind of gravel if properly handled.

We firmly believe in using gravel for surfaced at least ninety per cent of the roads in the counties of Wisconsin having gravel available, and there are several good reasons why we advocate its use whenever possible.

Why We Recommend Gravel Surfacing

(1) The construction cost is less; therefore, more miles can be obtained for the money expended.
(2) Repair and maintenance cost is less.
(3) No other type of road will return as great a percentage of its cost to the local unit that pay the tax.
(4) More satisfactory results are obtained for the traveling public.
(5) When the increased traffic demands a higher type of road, the gravel may be used for shoulder material.

Construction Cost Less

The principal reason for the cost of construction being less than for other types of roads is due to the fact that where gravel is available it can be delivered to the road at a much less cost.
than can any other material, on account of shorter haul and ease of handling. The cost of grading, culverts and preparation of the subgrade should be just the same for a gravel road as for any other type if you expect to have a high-class road when completed. Our nine-foot gravel roads are costing on an average about $2,200.00 per mile, and the cost per cubic yard of material in place is $1.15. The average cost of our nine-foot macadam is $3,200.00 per

mile, or $1.75 per cubic yard of material in place.

The cost per mile in both cases includes grading, culverts and guard rail. This shows a difference of $1,000.00 per mile in favor of the gravel road, which is nearly all chargeable to the difference in first cost of material, and getting it to the job. However, a small portion is chargeable to the extra rolling that stone requires over gravel.

In the early stages of road improvement in any locality, the greatest problem is to educate the people to a point where they demand better roads and are willing to produce the money necessary to build them. The first road built in any community along modern ideas is severely criticized, and mostly on account of its high cost. If gravel is used, more miles will be improved, therefore giving better satisfaction to the tax payer and creating a sentiment for better roads in the community.

After the people have seen the benefits of the improvement, a higher type of road may be built in the same locality and receive less criticism than the cheaper road did to begin with. This matter is worthy of consideration, for if at first the tax levy is very materially increased due to the improvement, there is apt to be some change in sentiment.

Repair and Maintenance Cost Less

It is a fact beyond dispute that the repair and maintenance cost is less on a gravel road than on any other type of road. Where the building of gravel

Nine-foot Gravel Road, town of Summit, Waukesha County, built in 1914 at a cost of $2,200 per mile, including grading and culverts.
roads is recommended, the material must be available at a reasonable cost; therefore, it will be available for repair and maintenance at nearly the same cost. If a hole or rut appears in a gravel road, or if the surface becomes worn flat, it can be repaired very satisfactorily without the use of expensive machinery, necessary for the repair of a stone macadam or other type of road. When you consider the interest on the difference in the investment between a

Money Returns to Tax-Payers Pockets.

Where local gravel is used, which is the case on practically all of Wisconsin’s gravel roads, at least eighty-five per cent of the cost of the work is for labor. This money is usually spent in the locality where the road is built, and eventually gets back through the different trade channels, to the pockets of the tax-payers. This argument may

Nine-foot Gravel Road, town of Delafield, Waukesha County, built in 1913, at a cost of $1,800 per mile, including grading and culverts, and surface treated in 1915.

fifteen-foot gravel road at $3,700.00 per mile and a fifteen-foot concrete road at $12,000.00 per mile, which interest is about $450.00, you will readily see that you can maintain the gravel road from year to year for that amount and have at the end of almost any period of years a road as good or better than when built, providing that amount is expended each year in the addition of necessary material and a surface treatment of some good asphaltic oil or tar product. sometimes apply to a stone macadam road, but never to a concrete, brick or asphalt road. When you demonstrate to the tax-payer that he is getting the road he travels improved, and that the money spent for the improvement is returning to his pocket, he naturally wants more of that kind of road, and less of the kind that sends his hard-earned cash out of the county, and, in many instances, out of the State.
More Satisfactory to the Traveling Public.

There is no question but that a well-built gravel road with a proper surface treatment is easier on both horses' feet and automobile tires than any other type of medium-priced surfaced road. This is a very important feature, and one that does not receive enough consideration. In localities where both gravel and stone macadam roads have been properly built in the past and not surface treated, the gravel surfaces stand out plainly as being far superior for both horse and automobile travel.

May Use for Years and Still Have Nearly Original Value.

The last reason to be considered is a business one entirely. The argument is often advanced that in building gravel roads, we are wasting money for the reason that very soon traffic will demand a higher-type of road, therefore causing the loss of a great portion of the cost of the gravel road. When that time comes, and it will come sooner or later, for our main roads at least, the gravel can be rooted up and pushed to the outer edge of the grade and used for shoulders to the concrete, brick or other type of road that may be best suited to meet the traffic conditions.

This "used gravel" will make excellent shoulders and in many instances by using it the width of the higher type of surface may be reduced, thereby reducing the cost of the new road an amount nearly if not fully equal to the first cost of the gravel road.

Characteristics of Good Road Gravel

Very few of our gravel pits contain material that conforms to our ideas of a good road gravel. In some cases, it does not contain binder enough and clay must be added. Again, it may contain too much of either clay or sand or both and some must be removed.
by screening. Where the pit contains many stones larger than two and one-half inches in their longest dimensions, we believe in crushing the gravel, as it is just as cheap in the end and gives us a much more uniform and valuable product.

If we could have gravel pits made to order, our specifications would provide for stone from one-quarter of an inch to an inch and a half in size, with just enough clay and good sharp sand evenly mixed to fill the voids. This would mean about eighty-five per cent stone from one-quarter of an inch to an inch and a half and fifteen per cent binder material. However, we have come to the conclusion that a good road can be built of any kind of gravel, if properly handled.

Construction.

The surveys, plans and cross sections for gravel roads should be the same as for other types of surfacing and standard concrete culverts should be built. Where necessary, provide under-drainage and insist upon just as good a foundation for a gravel road as for any other type; it is impossible to get a good surface on a poor foundation. The subgrade is prepared in the usual manner, by cutting out a trench the full depth and width that the finished surface is to be, having the same crown the completed surface should have.

Pit-run Gravel.

In building a pit-run gravel road, remove the large stones, if any, at the

Nine-foot Creek Gravel Road in the town of Jamestown, Grant County, built in 1915. This is one of the largest jobs completed under the State Aid Law in 1915. It consisted of 25,000 cubic yards of dirt; 10,000 feet of guard fence and 155 cubic yards of concrete culverts, in a distance of 9,800 feet. This work was done by one of County Commissioner Henry Mink's crew under the direct supervision of foreman Fred Skem, a local man.
pit, preferably by the use of an elevator and screen, delivering the gravel to the elevator by the use of wheel or slip scrapers. If extreme care is used, they may be removed at the time of loading by the use of five-or six-tine forks. On small jobs, this method is very satisfactory.

Haul loads of exactly the same size in length, width and depth, and be sure they are dumped so as to cover the same length, insuring an even depth of material. Uneven loads as a rule mean an uneven surface.

Practically all gravel roads should be built in two courses, plus the binder necessary. Spread the first course evenly to a loose depth of not to exceed six inches. It is generally best to begin at the end nearest the pit and haul over the material as the work progresses. This method saves some rolling.

Go over the first course several times with a small road grader, with blade set nearly at right angles, to even up the surface before rolling. After proper rolling of the first course, start the second course at the opposite end and work towards the pit, spreading to a loose depth of about five inches. Harrow thoroughly with a heavy peg-tooth harrow before rolling. Most pits run uneven; the harrow will tend to mix the material and will also bring the coarse stone, if any, to the surface, where they can be raked off. Sometimes it is necessary in clay to help in bonding, which can be done at the same operation. Use the light grader again a sufficient number of times to insure the removal of all wavy appearance, and to give the surface the proper crown.

It is often necessary to use the grader a second time after the rolling has been started to remove all of the wavy appearance. Fill the voids in the surface if there are any with fine gravel; then roll thoroughly and flush. Occasionally better results may be obtained by thoroughly wetting the material and allowing it to dry to such an

Fifteen-foot Limestone Macadam Road in the town of Metomen, Fond du Lac County built in 1914 and Surface-treated in 1915.
extent that the binder will not pick up on the roller, before attempting to roll. This method insures the proper bond from the bottom up. It is difficult to advise the proper amount of water for a gravel road, as no two sections can be treated alike. If possible, throw the road open to travel while the roller is yet on the job and if ruts appear fill them at once by use of the light grader or road drag and roll again.

Crushed and Screened Gravel.

In many of the eastern and southern counties we have numerous gravel pits of excellent quality, but usually containing a rather high percentage of large stone, and many of them contain an excess of binder. To handle this particular kind of gravel economically and to get the very best results it becomes necessary to crush and screen the material. Use the ordinary portable rock crusher, screen and bins, with a capacity of from 80 to 120 cubic yards per day.

Deliver the material to the crusher by teams with slip scrapers and block and tackle, or one of the various gravel conveyors that are on sale. The past season, one of our progressive counties purchased three improved gravel outfits, consisting of crusher, screen, bins and a conveyor that permits of deliver-

A First-class Earth Road, town of Shullsburg, Lafayette County, built in 1915.
ing the material to the conveyor with wheel scrapers from where it is elevated to the crusher, with no additional labor cost.

Each outfit costs complete about $1,800.00 and will easily save to the county its entire cost in one season’s work. The crushers should be equipped with two section screens, each section thirty inches in diameter and four feet long, the first, or lead section, having one-half inch perforations and 1 material spread to an even loose depth of about five inches, and well rolled, the voids having been filled with the necessary amount of No. 3 material. This course should be laid for a distance of 400 feet before starting with the second course.

The same care should be taken in having uniform loads evenly spread. The second course should consist of from four to five inches of No. 2 material evenly spread and rolled, the voids

the second two-inch perforations, which separate the material into three sizes. The No. 1 size consists of material refusing the two-inch ring; the No. 2 size the material refusing the one-half inch ring and passing through the two-inch ring; the No. 3 size, the material passing through the one-half inch ring.

Prepare the subgrade the same as described for pit-run gravel, but start construction at the end of the road opposite the gravel supply, in the same manner as for a stone macadam road. The first course should consist of No. well filled with No. 3 material, the surface brought to the proper crown with the small grader, then thoroughly rolled and flushed in the same manner as a stone macadam road. Some pits contain quite a percentage of clay and in this case a harrow should be used to work in the No. 3 material, thereby greatly benefiting the job. In some cases there is a surplus of No. 3 material, which should be distributed at convenient points along the road for maintenance purposes, or used for surfacing private entrances or road inter-

Nine-foot Limestone Macadam Road, town of Jamestown, Grant County. Note Standard Guard Fence.
sections. In many pits better results may be obtained by crushing fine enough for practically all the material to pass through the No. 2 ring, and carry over into the No. 2 material just enough of the No. 3 for binding material to fill the voids. The latter is done by placing a sheet iron jacket around the inner portion of the first section of screen, which does not permit the finer material to pass through the one-half inch perforations, but carries it over with the No. 2 material. This must be regulated so as to just fill the voids in the No. 2 material and no more.

The balance of the No. 3 material will naturally drop into the No. 3 bin and may be used in finishing the surface where additional binder is required, or for future maintenance and other purposes. If this method is pursued, both first and second courses are built of the same material and results in a better type of road, which is easier to build, cheaper to maintain and one which gives better satisfaction than any other type of gravel road.

Use just as much care in finishing a gravel road as one costing three times as much. Trim up the shoulders properly and clean out the ditches so the water can get away from the road immediately after each rain. The last fifty dollars spent in an intelligent manner shaping and trimming up any mile of road stands out more plainly than does any other one hundred dollars spent on the same road.

In any locality where there is gravel within a reasonable distance, by all means use it, unless traffic conditions demand a higher type of surface. If it is not of the right proportions, by proper methods of handling it can be made so. Should it run too fine and contain too much sand, do not give up. Apply the proper amount of clay for a binder and mix it thoroughly by use of a disc or peg-tooth harrow. It will no doubt rut some after opened up for travel. If it does, use a road drag after each rain and you may rest assured that it will be a first-class road in a short time.
DISCUSSION

This is the method followed by the Highway Commission in the construction of the many miles of high-class gravel road built during the past three years under the State Aid Law, and we believe the results obtained for the money expended on these 440 miles of gravel road has gone a long way towards creating the present great demand for road improvement in Wisconsin.

DISCUSSION

A Member—Will a gravel road be as satisfactory on a heavy clay soil as a road built of crushed stone?

Mr. Donaghey—Yes, I believe the gravel will be more satisfactory, providing the road bed is properly drained, the gravel crushed and screened and the same care taken in the construction of both roads.

A Member—Do you advise the use of pit-run gravel without crushing?

Mr. Donaghey—In some cases, yes, where gravel runs very fine, or when it is impossible to get a crusher on the job. If gravel in the pit contains quite a percentage of stone larger than two inches, it is very necessary to crush it.

A Member—How great a distance would you advise hauling gravel?

Mr. Donaghey—that would depend upon local conditions entirely. In Marinette county, gravel is frequently hauled a distance of six or seven miles during the winter months, and a road is secured at reasonable cost. In most cases, a haul of three or four miles, if hauled during the road building season.

A Member—is it advisable to break up field stone for building roads in Wisconsin?

Mr. Donaghey—This is also a question which local conditions must govern to a great extent. In many counties of Wisconsin, field stone is the only material to be secured for surfacing our highways, and in these counties it is advisable, but in any county where gravel can be found at a haul of not to exceed four miles we can usually build cheaper roads than by crushing field stone.

A Member—Does the concrete road meet the needs of both automobile and heavy team traffic?

Mr. Donaghey—I believe it does. Concrete is the very type of road to build where there is extremely heavy auto travel combined with heavy team traffic.

A Member—The concrete road built here last season is cracking to quite an extent. How can it be repaired?

Mr. Donaghey—During the past three years we have built 84 miles of concrete roads in the different counties of Wisconsin and cracks have appeared to some extent on all of this work. However, they are not serious and do not injure the surface materially. They can be repaired very cheaply by cleaning out the cracks and filling them with asphalt covered with good sharp sand. I know of other roads where cracks have appeared fully as frequently as in your road that have been treated in this manner, leaving the surface in practically as good condition as though no cracks had developed.

A Member—We had a few holes appear in our road. We cleaned them out and filled them with cement, leaving them as good as ever.

A Member—Would it not be better to reinforce concrete roads with wire?

Mr. Donaghey—We do not deem it necessary to reinforce a concrete pavement, except when built wider than the eighteen feet possible to build under our State Aid Law. Where village or city streets are paved with concrete, it is advisable to reinforce at least the center twenty feet of the pavement.

Adjourned to 7:30 P. M.