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.

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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 reforest. 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
first macadam in the county was broken by hand and placed on the streets around the square in Bloomington about fifty years ago. The first pike roads were built in the face of the greatest opposition, about thirty years ago. And some of the original kickers are still kicking. We now have about fifty miles of improved streets and four hundred miles of pike roads in the county, and the number of kickers is gradually but slowly diminishing. Only a very few would care to return to the primitive conditions, and strangely enough they all live on roads already improved.

There are about sixty locations of quarry sites for macadam, fairly well distributed over the county, and about the same number of quarries and mills operating for building stone. The average haul for delivery of stone on the roads is between two and three miles, the longest haul for some roads being four to five miles. The average cost of stone delivered on the roads now is about $2.25 per yard. The cost of repair work on our three hundred miles of county roads in 1924 was $73,000 or about $265.00 per mile. This does not mean that all of the roads were repaired. Only the most traveled roads and those in the worst need of repair received attention. Many of the roads which have been improved are not repaired at all for the simple reason that repair funds are inadequate. This curtailing of repair funds is due to an honest effort on the part of taxing officials to keep taxes down. It results in half of our roads getting in such a condition in a few years that they must be practically rebuilt at a much greater cost than the cost of repair would have been, if it had been done at the proper time. On the whole, we pay more taxes by having tried to lower taxes at the wrong place, and besides we get much poorer service from our roads in this deteriorated condition.

Many of our citizens make use of the fact that we do not keep our roads in the proper repair in advocating that we should cease the building of new roads. They say, "Why build new roads when we can not repair the ones we have already built?" The error lies in assuming that the repairs can not be made. The tax levy for repairs should be pushed to the limit as a measure of economy. This is true now more than ever before, because of the much more damaging character of the present traffic. If the tax levy for repairs can not be made to meet the requirements then some other means should speedily be found whereby the work can be carried on.

There are really only a few people in the county of a disposition mean enough to want to discontinue the construction of new roads in the outer parts of the county. These rural citizens have been paying loyally for the last thirty years of their hard-earned savings at the same rate as every other citizen of
the county toward the whole county road repair program, and in that time they have paid in more than the cost of what they are now asking in return.

To complete these roads as proposed and petitioned for will require about sixty miles in addition to what is under contract. The cost will be about four hundred and fifty thousand dollars. Our bonding limit for county unit roads is about two hundred seventy-five thousand dollars, of which about one hundred thousand dollars remains unappropriated. After the limit is reached there will be enough paid off each year to build four miles of average road. From this it appears that it will require from twelve to fifteen years to build the roads now petitioned for. In view of the fact that we have built four hundred miles of fairly decent roads in the last thirty years it would seem that the program of building sixty miles of road in the next fifteen years is not unreasonable, and should not cause a very deep gloom to settle over our good people who already have their pike roads. I am quite certain the people who live way out in the mud will not worry much about it.

Some of our first pike roads were built at a cost of $850.00 to $1,000.00 per mile. Of course, they had fords then in place of bridges and culverts. Most of these roads have been rebuilt two or three times since. The average cost per mile, taking into consideration the fact that many miles have been built two or three times, is probably close to five thousand dollars, making the total cost about $2,000,000.00. Another million dollars cost for new roads, spread out over a period of twenty years, will solve our problem of roads in new territory. Then we can settle down to a cost of maintenance and occasional rebuilding of old roads with new and improved materials and feel that our heaviest burdens of road building are beginning to lighten.

The property within the corporate limits of the city of Bloomington pays over half of the cost of new roads and maintenance. The citizens generally are strongly in favor of going ahead with our program of connecting our improved roads with the improved roads of our adjoining counties. The business men of Bloomington believe in extending the territory served by them and are willing to invest their money in the rural roads as the best means of bringing about this result. As is usually the case, what is best for the rural communities in a county is best for the county seat and vice versa.

In the construction of county unit roads now under contract we are expending from fifteen hundred to three thousand dollars per mile on bridges less than twenty foot span, culverts, clearing and grade twenty-two feet wide with maximum gradient of ten per cent. In two instances so far we have been forced to
a maximum of eleven per cent in our plans. This maximum will
doubtless seem rather high to many of you, but I may say that
we have a number of hills in the county, on roads improved years
ago, with gradients running up to eighteen and twenty per cent.
One of these, Tabor Hill near Gosport, which for many years
was used for advertising tests of automobiles, is eighteen and
one-half per cent.

The state highway engineers are now making surveys for
the purpose of getting away from a lot of these steep hills in our
county on state road No. 22. It looks as though they might have
to relocate the road for almost the entire distance through the
county if they are to secure as low a maximum gradient as roads
with such heavy traffic should have.

**Construction Methods**

We do not find it necessary to roll the subgrade. The stone
is hauled to the road in five-yard trucks weighing twelve tons
loaded. The wheel treads are fourteen inches and drivers are
bound to distribute the bearing well over the subgrade to pre­
vent it from rutting. The subgrade is crowned an inch and a
half to two inches on the center twelve feet and six to seven
inches from the center line to the ditch.

On the subgrade we place a nine-inch layer of stone twelve
feet wide of sizes to pass a three-inch ring, from which enough
screenings have been removed to make a top layer of four inches.
The character of the stone has very much to do with the amount
of screenings made. The fineness of the crushing should be such
that will yield strong four inches of screenings rather than scant
four inches. The cost of the stone is close to a dollar a lineal
foot.

We use thirteen-inch boards with thirteen-inch pins in the
center, the pins being set after the nine-inch layer is placed so
the trucks will pass over them. The screenings' course is kept
up close to the first course, neither course being rolled. We do
not bank the boards at all, and when they are removed the edges
of the stone are raked outward one foot on each side. This bev­
eling makes it easier for traffic to get on and off the stone and
the traffic helps in widening the stone, which in time comes to
be about sixteen feet.

Three or four times during construction the wheel ruts in
the stone are filled by using the grader and during the first year
after completion the county road superintendent frequently runs
the grader over them to smooth them up. In a year's time the
traffic will have found the road in fairly good condition. The
people in most localities where we are building them seem very
much pleased to get them without the expense of rolling and
water-binding. We are convinced that we are getting some very
good roads at a minimum cost.

In cases of rebuilding roads carrying very heavy traffic,
where the width required is eighteen to twenty feet, we have
built water-bound roads, perhaps fifty miles in the county. It is
only a very short time until the process of traffic binding has to
start and be kept up the same as on the roads that have been
traffic bound from the first and without the added cost. If the
traffic on a road justifies water-binding, then it justifies the addi­
tional expense of putting on some wearing surface to take the
wear of traffic.

We believe that the methods of maintenance followed in
our county by the State Highway Commission's maintenance de­
partment are the best for our roads and we are following their
plan as far as possible to do so on our old roads in repairing
them. We have a most excellent road superintendent and one
who is very skillful in making the funds hold out and spread out
over the 300 miles of roads, but he should have at his disposal
twice as much as he has.

The greatest damage to our roads is brought about by ero­
sion, owing to the high gradients so frequent throughout the
county. This condition is always accompanied by very low tax
values and the two do not make a very happy union.

We are much inclined to the belief that the state should in­
crease the road mileage in the state system to ten thousand miles
and help the poorer localities in the state get better roads.