

gineers advocate to-day the placing of a transverse joint only at the end of each day's work. The difference in the kinds of soil over which the pavement is laid should not be overlooked. A good practice, when metal protection plates are used, is to finish the pavement at least six inches on each side of the joint with the steel trowel. Though considerable difference of opinion exists as to the use of such protection plates, it seems that the present practice has much tendency to do away with them.

Many of the unsightly longitudinal cracks will be done away with in concrete roads if precautions have been taken to ensure a thorough sub-drainage and a uniform subgrade. Longitudinal cracks are the worst enemy of concrete roads. It has not yet been proved by any plain concrete road that they can be eliminated altogether, but with the refinement of the present practice in the construction of such roads, they will be reduced to a minimum. The use of reinforcement will eliminate to quite an extent the formation of longitudinal cracks, or at least will render them less objectionable. Mesh reinforcement is much easier to place than bar reinforcement. Reinforcing depends on the condition of soils and loads, and it is a matter that certainly should be left to each engineer to determine on the spot the needs of the situation, after having well weighed all the circumstances. Some engineers are of the belief that the use of reinforcing will ensure stability to the road, scatter shrinkage cracks and eliminate joints.

Regarding the thin, bituminous wearing surface for concrete pavements, the results obtained to date do not economically justify its use just at present. Maintenance of concrete pavements will be greatly simplified so soon as a satisfactory method of coating their surface can be devised.

After the road is completed and opened to traffic, it has to be maintained, and this is a point that should be clearly demonstrated to the officials of all communities who are planning good roads. An efficient, systematic and intelligent system of maintenance should be devised and enforced. I do not need to show here the full economic value of such a system. No municipality, province or country will ever realize the benefit and merit of a good road unless it is properly maintained. While the cost of systematic maintenance of concrete pavements is small, if we neglect to maintain same the cost may be very high and the taxpayer will not have received the greatest value for his money.

When an engineer makes the statement that a concrete road represents the minimum outlay for maintenance cost, highway officials should not derive from these words that when a concrete road is finished no care or attention whatever need be given to it. This would be a very grave mistake. It is inherent to human nature that everything will wear away in the course of time, and it is so with all pavements, even though they be called "permanent."

In their ninth annual report, the Board of County Road Commissioners of Wayne County, Michigan, say:—

"Recognizing that durability and low cost of maintenance, as mentioned in preceding reports, largely determine the success of any type of road, our preference, based on our past seven years' experience, continues to be for concrete construction. We believe in constant and systematic maintenance of all roads under our jurisdiction. As in past years, our gravel and macadam mileage continue to absorb the bulk of our maintenance moneys and energies. We have repaired and oiled all gravel roads and in addition thereto dragged them systematically in both the spring and fall.

"The wisdom of building of concrete, in our judgment, stands out conspicuously when maintenance cost involved in

keeping all other types of roads under our jurisdiction in usable condition is compared with the actual cost of maintaining concrete. Yet, even the best concrete road will require some maintenance, consisting principally of cleaning out and refilling expansion joints, the repair of pockets which occasionally appear on the surface as a result of some foreign material such as clay getting into the concrete, some fragment of inferior pebble or stone, or defects in workmanship. Usually no maintenance is required on our concrete roads the first year of their life, but if we find that any is necessary, we do it promptly and thoroughly.

"Our concrete roads possess the special feature of presenting a surface that wears but slightly and uniformly; a surface that does not give away in any one spot and withstands traffic over its entire surface. This is made possible by careful selection of materials, careful methods of proportioning and mixing, and care in finishing and curing, resulting in a concrete having a uniform texture, which is a big factor in eliminating maintenance costs. We have over 125 miles of concrete road in Wayne County, some of it in its seventh year of service, all of it in good condition, and we have never taken up and replaced a 25-foot section since we have been building and developing this type of road, which, we think, speaks volumes for our low annual maintenance costs."

NEW TRAFFIC MAKES ROAD CONSTRUCTION AN EVER-CHANGING SUBJECT*

By W. A. McLean

Deputy Minister of Highways, Ontario

ROADS are as ancient as human history. I suppose that in the olden days the Greeks and the Romans must have had their congresses to create public feeling and interest in those organizations which were required by them to construct the ancient highways that are still so famous. And if roads are so old and highway conventions are so old, the question naturally occurs to us, why are we still talking about them? Haven't we reached the point when we should have good roads without talking about them? The answer is that history repeats itself, and that while roads are old, human nature is the same and we must all learn our own lesson painfully, slowly and patiently.

While roads are old and human nature is old, men are new. We are constantly in a new generation. Changes are constantly taking place. While there is nothing new under the sun, yet the combinations of the old things are infinite, and as we go on year by year, there are new combinations of vehicles and traffic which we all have to learn. If we could see three or four more thousand years into the future, we would still see road conventions and congresses just as we have them to-day, to create the organization which will be necessary to extend and build highways for a constantly changing state of circumstances.

We to-day have entered upon a situation of remarkable combinations. Until a short time ago we had to construct roads only for the horse-drawn traffic. We have suddenly sprung into an age when the gasoline engine is applied to traffic and transportation and only the highway engineer who has considered the problem of the new motor vehicle can understand and appreciate the intricacies of the question that is before us. We have not only had to construct for the present state of circumstances, but we have to see beyond the sky line and construct for the future. We have to create in our imagination that toward which we are tending, and if we are to leave a heritage for the future that will be for their good instead of for their injury, we

*Address delivered May 7th, 1918, at Canadian Good Roads Congress.