improved except at a very great expense. No road should ever be graded to a perfect level, on account of drainage—this is not desirable—but the hills should be reduced to within two degrees, or about one to thirty, at least, where that is possible. A great advantage resulting from this is that in cutting away the hills and filling up the valleys, places that are liable to be quagmires and quicksand, are elevated, so as to free the road from this danger.

So much is now said, and very properly too, about the inferiority of the roads in this country compared with those of Europe that it may not be amiss to say a little on this subject. When we come to look fully into the causes which have produced this disparity, I do not think there is any cause for discouragement; for besides the advantages of cheap pauper labor there, it must be remembered that centuries of civilization have given those countries time to accomplish very much that there has not yet been time for here. And there are other things to be taken into account. Before railroads and steam navigation were invented, all the mails had to be carried by stage coach over the common roads, and there was no water communication; all merchandise traffic was by common roads. For centuries roadmaking has been a most important department of governmental care in those countries. For example, as early as 1816 there were, in England and Wales, about twenty-five thousand miles of turnpike roads, and this was just the commencement of scientific roadmaking. By that time the work of carrying the mails had become immense, and this required the constant oversight of the government, and a great deal of the time of parliament was devoted to the department of roads and the transportation of the mails. Before railroads were invented, all England become a network of good, artificial roads, and had been accustomed to them to such a degree that they were considered a necessity. This country, on the other hand, had scarcely immerged from a wilderness, when steam navigation and transportation by rail sprang into existence and soon claimed the bulk of all traffic in the conveyance of persons and merchandise of every description. The great evolution in the business of transportation thus created put a check for a time to the progress of roadmaking. Had steam navigation and railroading been deferred for half or even a quarter of a century we would have been vastly further advanced in the science of roadmaking. But it was not to be expected that in a country so vast, where the temptation is so great for the population to spread over an immense extent of territory that it would be possible to make all roads through it such as would be looked for in densely populated countries where they have had centuries to do the work. We need not be discouraged, and can, at least, make a good beginning, and when once the example is set and our people learn what a really good road is, they will not be satisfied without them, and lawmakers and supervisors and all concerned will have to give heed.

We have the material in abundance; we have learned something of what a good road should be, and we have those who possess the skill and ability to do the work, and there is no longer an excuse for the lack of means which should be forthcoming. For every other form of enterprise and public improvement capital is put forth in abundance, and it is universally admitted that here is no way in which money can be spent that would afford a better return than this in its beneficial influence to every member from the highest to the lowest of the community.

Influence of Good Roads on Country Life.

The improvement of country roads undertaken upon a large scale would decentralize labor while it was in pregress as well as afterward. There would be a large floating population of laborers in the country while the work was proceeding. With the improvement of the roads would come a great improvement in the conditions of country life; greater facilities for social gatherings, church and school attendance; the discussion of public questions; cheaper and easier transportation and improves access to the towns; less dependence upon the railways.

One defect of the railway system is its tendency to build up large cities at the expense of small towns and villages. Good roads help to build up thriving market towns and other small communities. Then they cannot be monopolized like railways. There can be no oppressive tariffs for carriage, nor discriminating rates, nor disputes about long and short hauls. They are the people's roads. There is no need of any movement to nationalize them. They are already nationalized, and all that is needed is for the nation to recognize the value and the splendid possibilities of its own property.

Fair and free, night and day,
Fair and free is the king's highway.

—*Toronto Globe.*

Broad Tires Improve Roads.

The introduction of broad tires upon all farm wagons and carts adapted for heavy draft purposes alone would do much to improve roads, since half the trouble seems to arise from heavy loads carting over country roads at seasons of the year when the ground is soft. At Tuxedo, where all draft wagons are prohibited an entry unless furnished with broad tired wheels, the tremendous advantage over the ordinary tires has been plainly proved, for there, even when the roads are softest and at their worst, they never cut up through the constant carting of heavy loads of brick or stone.—*Exchange.*

Bridges.

It is hardly too much to say that of late years more attention has been given to bridge superstructure than to the substructure. Bridge substructure is preeminently a branch of engineering which can be taught in the class room. At the present day the superstructure of bridges of magnitude are almost always made of iron or steel. Perhaps it would be more proper to say, are always of iron, since steel is only a third form of iron, intermediate between cast and wrought iron: or, more properly, iron manufactured in a peculiar way is called steel. A century ago iron was not available for bridge superstructures. The bridge was made entirely of masonry, or largely of timber. The best way to understand modern bridge superstructure is to study its development. This development has taken place simultaneously in Europe and America, but on very difierent lines in the two continents. The development of the European bridge was from a masonry structure to a metallic structure The development of the American bridge was from a wooden structure to a metallic structure. This was the real order of development, though there have been in Europe many noted wooden bridges, and there are in America, some old structures resembling those of Europe. In America for the first time in the history of the world, a people possessed of modern tools have had at their disposal ancient forests. The steam engine and the saw mill have made cheap timber from the forests, which, in the other part of the world, were removed and worked up in early times by slow manual labor. The American builder has at his disposal the most convienent building material ever known. It has, however, three very serious defects. It is very short lived; if exposed to both air and water it may become worthless in less than ten years. It is very combustible. No addition can ever be made to the original stick, and if it is to be used in tension there is a great waste in making proper connections. The price measured by the unit of strain was formerly hardly more than one-twentieth the cost of iron. The cost of frequent renewals of timber was less than the interest on the orignal cost of iron. A structure built of timber, after charging up the cost of renewals and allowing a liberal premium for insurance against fire, was still able to earn more money than an iron structure could, after deducting interest on the additional cost of iron. In other words, the wooden structure was the most profitable tool. Fifty years ago it was good engineering to build wooden superstructures, and it would have been bad engineering to build iron superstructures. Wooden superstructure were universally built. In many parts of the country, bridges were built almost entirely of wood; the piers which carried the wooden superstructure were timber cribs filled with rubble stone. In fact, wood was wisely used in ways which, at the present day, would seem absurd.