

bidder. The advertisements for all bids specify the road or roads upon which the work is to be done, the kind or character, and the extent of the same, so as to plainly indicate to the bidders the work to be paid for, and when necessary a county surveyor furnishes profiles and specifications for the work. When completed the work is inspected by a committee of the county council, and no payment is made until it has been inspected by them, except that thirty per cent. of the amount of the contract may be advanced after the work is at least one-half completed.

The road commissioners are not allowed to have any interest directly or indirectly in any contract under their control. This system is adopted for all work in the construction and maintenance of highways.

INDIANA

In Indiana a county council, upon petition of fifty freeholders of any township, may submit the question of road improvement to the electors. The petitioners are required to pay all costs of election, and the construction of the roads is let to the lowest bidder. Debentures are issued to cover the cost, running from one to five years. These debentures and interest are paid by special tax upon the property of the townships, towns and cities along the road in proportion to the cost of the road in each. Improved roads may be built on main lines, and their cost assessed upon the lands within two miles on each side. They are in charge of a superintendent appointed by the council, who is paid \$1.50 per day for time actually employed, and are kept in repair by the county in which they are located, the money for this purpose being raised in the towns, cities and townships interested. The rate for this purpose is limited to one mill on the dollar.

MASSACHUSETTS

In Massachusetts, which is rather a small State, a highway commission of 3 members appointed by the Governor has charge of all State roads, and upon petition of a county council may adopt any road as a State highway if the Legislature makes appropriation therefore, except that the grading and bridging is required to be done by the county council. These highways are afterwards maintained by the State under the supervision of the commissioners.

NEW HAMPSHIRE

In New Hampshire each township is a highway district, and all subdivisions have been abolished. The construction and repair of the highways is in charge of a township commissioner, the expenses are paid by a rate of not less than two and one-half mills on the dollar, and not more than \$50 per mile of road per year.

NEW JERSEY

In New Jersey the township roads are under the management of the township council, and debentures are issued for grading, macadamizing and improving the same. The county council may designate certain roads as county roads, and improve the same, the expense of which is paid—one-third by the county, one-third by the State, and one-third by the local municipalities through which the roads run. When the owners of two-thirds of the land bounding on any public road undertake to pay one-tenth of the cost of improving such road, it is the duty of the county council to cause such improvements to be made. The appointing of overseers of highways has been abolished, the township council appointing a competent person to superintend all the making and repairing of roads.

An interesting experiment was made in building good roads by the people of Union and Essex counties, N. J. The pecuniary benefits resulting from this work are summed up in a report from the board of freeholders of the former county, which states that the total outlay has been nearly \$350,000, and there are now nearly forty miles of Telford and Macadam road in the country.

The beneficial effect of the roads is seen in the fact that property in Union county alone has appreciated in value far more than the cost of the roads, as the assessment shows. The county issued \$350,000 worth of road bonds, the interest on which must be met annually; yet there has been no increase in the county tax rate, because the increased assessment easily produces enough revenue to meet this charge. Very few of these roads have been built more than a year, and most of them only a few months; but already the people appreciate the advantages flowing from them.

Such practical evidence as this will certainly encourage roadbuilding.

NEW YORK

In New York the county council may adopt the county road system, and designate as county roads highways not within an incorporated village or town. These roads are required, as far as practicable, to be leading market roads of the county. A county engineer is appointed, and these roads are then maintained at the expense of the county. The engineer and council have full supervision of the construction and maintenance. In all counties adopting the county road system, statute labor is abolished and the money tax system adopted for the repair of the township roads.

WISCONSIN

In Wisconsin the township councils have full supervision and control of the highways, which are constructed and maintained under the supervision of a competent superintendent, who, when appointed, holds his office for three years unless sooner removed for cause. This superintendent has the same charge over the highways as local overseers formerly had. All taxes assessed for making and repairing roads are paid in money, and collected at the same time and in the same manner as other taxes. This law may be changed at any time that the electors' vote decides that the highway taxes shall be paid in labor instead of money for the ensuing year. Statute labor is then performed under the supervision of a superintendent appointed by the council. Under the act, unless a vote is taken every year to provide for working out the tax, the repair of all public roads is provided for by general tax throughout the township.

SUMMARY OF STATE LAWS.

Here then we have the examples of different authorities controlling the construction and maintenance of highways.

In California, where the township system is optional, the county council constructs and maintains all roads.

In Indiana the roads are maintained by the townships; but the county council may assume control of particular roads when so authorized by vote of electors of municipality interested, the local municipalities paying all expenses.

In Massachusetts we find a combined system of county and State roads.

In New Hampshire the township councils control and maintain all roads.

In New Jersey, where it is said the greatest advance has been made in roadmaking, we find the townships in charge of the roads, while the county council may select certain roads for improvements, at the joint expense of the State, county and township.

In New York the county and township authorities maintain the roads, each providing for the expense of the roads under their control. Statute labor is abolished in all local municipalities when a road is assumed by the county.

In Wisconsin all roads are controlled by the township authorities. Statute labor is abolished, although it may be performed any year if a majority of the electors by vote so decide.

In all States the tendency is to abolish statute labor and divide the roads between county and township authorities.

Alignment.

In nearly every work on road construction, the author lays down two distinct rules; first make the lines as nearly straight as possible, and when changes of line occur connect them by regular curves of proper radius; second when the line is intended to be straight, let it be absolutely so. These rules are in a very large degree considered obligatory their violation does a great deal towards spoiling the beauty of any landscape through which it is necessary to make a road. A great many in following fixed rules and principles regard beauty as a thing unworthy of consideration, and fine trees of a century's growth are ruthlessly cut down, and hill sides marred by deep and ugly cuttings when by making a slight bend in the road, and following the contour of a hill with its natural and irregular curves the road would be given more beauty and expense could often be saved.

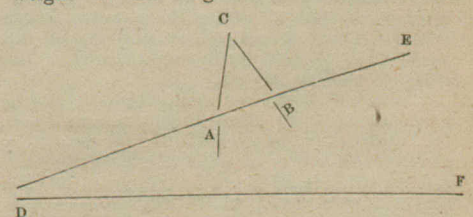
A consideration of the natural conditions ought to be among the determining elements of a line of road, the capability to seize upon and make the most of these natural conditions ought to be one point of decision. The aesthetic elements in the problem of making a road are not necessarily at variance with practical considerations.

Let road makers consider this question, consider how much beauty might be preserved, and added to our landscapes especially in suburban communities without the sacrifice of any reasonable utilitarian requirement. It is the want on disregard for beauty without any corresponding gain which should be protested against.

Grades.

In forming a road bed the grade should in all cases be reduced as far as practicable. The extra exertion a horse must put forth in overcoming a heavy grade is great. This can generally be lessened even in ascending steep hillsides by giving the centre line of the road a zig-zag direction, connecting the straight portion by circular arcs. The grades of the curved portions should be reduced, and the roadways also at these points widened for the safety of vehicles descending rapidly. The increased width of the road bed at the curves in the lines of the road should increase in proportion to the sharpness of the curve; the increase should be one half where the angle in the line is ninety degrees. The grade of the road should be regular between the changing points.

When a weight is drawn up an inclined plane the resistance of the force of gravity or the weight to be overcome is such a part of the whole weight as the height of the plane is to its length. If, then, a load rises one foot in every twenty of its length, a horse drawing a load of one ton is compelled actually to lift up one-twentieth of the whole weight, i. e., one hundred pounds, through the whole length of the ascent, besides overcoming the friction of the entire load. In the following diagram D E represents the inclined plane of the road, upon which rests a waggon, the centre of gravity of which is supposed to be C. Draw C A perpendicular to the horizon, and C B perpendicular to the surface of the hill. Let C A represent the force of gravity or the weight of the wagon and its load. It is



equivalent in magnitude and direction to its two rectangular component forces, C B, and