

"WE WANT GOOD ROADS."

By A. W. Campbell, C. E., Road Commissioner of Ontario.

The Great Need of This Country is Good Roads--How to Build Them Economically Explained by an Expert--Useful Hints and Diagrams to the Road Builders of this Country.

LOCATION OF ROADS.

There are very many instances where, by changing the course of a road slightly, municipalities would save a large sum in construction, and at the same time produce a better road. A slight deviation would frequently avoid a swampy or wet ground, or would do away with the necessity of expensive cuts and fills. A hill can sometimes be avoided or the grade very much improved by altering the location of the road. There is a prejudice against taking the roads from the lines laid down in the original survey, and property owners prefer to have their farms bounded by straight lines. At the same time the value of good roads to the farmer should not be overlooked, and whenever a change in the road allows for a better grade, the slight inconvenience created by the alteration of boundaries will be many times repaid.

CULVERTS.

In no branch of municipal work is so much money wasted as in the construction and maintenance of sluices and culverts. In most townships these are built of timber. Timber is perishable, culverts are subjected to repeated changes of wet and dry weather, the greatest test to which timber could be subjected. Each year a large number of these culverts are renewed at a cost of from \$5 to \$50 each, in some townships aggregating from \$500 to \$1,500, and this is an annual outlay. The life of these structures is so short that it is not more than five years before repairs are required and these repairs in short time amount almost to renewing the most expensive kind. A broken plank or stringer, a rotten log or any timber replaced with new at different periods, makes the maintenance very costly, and this class of structure is the most temporary and expensive. No owner has they all been rebuilt than must again commence the reconstruction of the first, in this way the expenditure becomes perpetual, and a large percentage of our annual budget is for culverts are in their proper locations, natural watercourses, and other fixed places, they will always be required and their construction in the most durable manner is the best and most economical plan.

For small culverts there is very little difference in the cost of timber and staved pipe. If properly laid the latter will withstand the frost and is durable. These pipes may be used up to 24 inches in diameter; and the capacity may be increased by laying two or three rows, but the pipes should have at least one foot of earth or other filling between them. Culverts of 5 or 10 feet span should be cement concrete culverts, which is permanent if the concrete is properly made. The concrete should be composed of first class cement, clean sharp, silicious sand, free from earthy particles and coarse enough to pass through a twenty mesh sieve, clean gravel screened through an inch and a half screen, the largest stones to be not more than two and one half inches in diameter; or in place of gravel broken stones that will pass through a two and one half inch ring. These materials should be mixed in the proportion of one cubic foot of cement, two cubic feet of sand and three cubic feet of gravel or broken stone, with just enough water to make the whole into a plastic mass. The sand and cement must first be mixed dry, then a sufficient quantity of water added to make it into a thick paste. It should be thoroughly mixed again, spread over the stone or gravel added, and the whole thoroughly mixed until every space is coated with the mortar, then rammed in place. The walls should extend well below the frost line and have a wing at the ends to protect the embankment from wash.

BRIDGES.

Wooden bridges, except where timber is very plentiful in the immediate locality, are not a good investment in view of the reduced cost of iron and steel, and the increasing cost of timber. Timber decays quickly, and while cheaper than steel in first cost, is more expensive after a term of years since the cost of repairs is very great. Generally speaking the cost of an iron superstructure is more than that of a wooden one. The substructure of stone or concrete is more expensive than pile or trestle work, but as in other structures a concrete foundation is most serviceable and economical. Wooden foundations from decay and other causes settle and the settlement of the timber causing a disarrangement of the strains and frequently transferring the greatest load to the weakest point. Wherever timbers have decayed or bearing exposed, decay soon follows under a heavy load. Whenever timber is used in bridges it should be used in members from four to six inches in thickness, the strength of the beam or chord being obtained by building several members together, and breaking joints, and coating with bearing with lead. A further protection is to cover these built timbers with galvanized iron to protect the wood. All caps, corbels, chords, and floor beams should be made in this way so that the thickness of no member will be more than six inches. After erection; iron bridge at time of erection, and care should be taken to see that they are kept painted and

the expense should be met by the state and the municipalities benefited. If the state legislature approves the work is performed by contract. Vermont and California also contribute largely in the form of state aid, while Indiana, Kentucky and others contribute to a less degree. Only the bare outlines of the systems have been stated, with the object of showing the prominence the question of road improvement has attained of recent years, adopted within the past five years. In all these systems, safeguards are placed to prevent the expenditure exceeding, for any state or any locality, certain reasonable limits, according to requirements, and ability to meet the payments. In most of these states the tax is so levied that the towns and cities pay the greater portion of the cost of state road construction; for example, in the State of New York it is estimated that the people outside of the towns and cities will pay only 10 per cent of the cost.

IN BRIEF.

Roads that "break up" are bad roads. Make road improvements in such a way that they will be permanent.

Whether by statute labor or other means undertake roadwork systematically.

Appoint a supervisor who will have charge of all the roadwork.

Make road beds five miles in length, choose the best men as pathmasters, and keep them in office.

Classify the roads according to the nature and extent of traffic over them.

Specify the width of grade, amount of crown, plan of drainage, kind, width and depth of material to be used, and see that these specifications are carried out.

Purchase gravel by the pit not by the load.

Use clean road material.

Strip the clay and earth from over the gravel pit, before the time of performing statute labor.

If screening or crushing is necessary, let this be done before the time of statute labor.

Do not scatter money in making trifling repairs on temporary structures.

Roads, culverts and bridges will always be required, and their construction in the most durable manner, suitable to requirements, is most economical.

If statute labor is to be made successful the work must be systematically planned and some definite end kept in view.

Have the work properly laid out before the day appointed to commence work. Only call out a sufficient number of men and teams to properly carry out the work in hand and notify them of the implements each will be required to bring.

Let no pathmaster return a rate-payers' statute labor as performed, unless it has been done to his satisfaction.

In justice to others make the statute-

become accustomed to the work and give better service. Do not cover an old gravel road with sod and earth from the sides of the road. Turn this earth and sod outward and raise the centre with new gravel. Adopt every means to secure a hard, smooth, waterproof surface. Do not let stones roll loosely on the road. Do not let ruts remain. They make travelling difficult, and spoil the road by holding water. Make repairs as soon as the defect appears. Use wide tires. Improve the drainage of the hills. Make the crown of the roadway higher than on level ground. Change the location of the road if a steep hill can be avoided. Do not use wood for culverts. Use concrete, vitrified pipe or stone. Do not build wooden bridges. Use iron, stone or concrete. Build good roads. The End.

HOW NELSON HUNTED FLEETS.

Two Years Forcing a Trafalgar and Three Months Catching Bonaparte.

Lord Nelson was the greatest and most successful admiral the world produced, down to the days of steam power, yet on more than one occasion he let his enemy slip past and lead him a heart-rending chase for months before a blow could be struck. Bonaparte's expedition for the conquest of Egypt and the Orient had been organizing for many months at Toulon. On May 9, 1798, Nelson sailed with a flying squadron from Gibraltar to scout off the French port and ascertain the mission of the French fleet. But the enemy eluded him completely, left Toulon with Bonaparte's army and disappeared at sea with Nelson none the wiser for having appeared in the Gulf of Lyons.

Reinforced by ten ships of the line Nelson started in pursuit. But he kept missing the French fleet. He called at Alexandria in Egypt, but no French ship was there. Then he chased off to Syracuse, but still no enemy. Finally after about three months of vain pursuit he appeared on August 1 off Alexandria again, and there he beheld the object of his search anchored in Aboukir Bay. The army of Bonaparte had been safely landed. The complete destruction of the French fleet followed, however, and the ultimate ruin of the Egyptian campaign was assured.

The campaign of Trafalgar, perhaps the most memorable in naval history, was infinitely more trying to the patience of both Nelson and the English people than any before it. The British admiral blockaded Toulon, where the French fleet was fitting for sea, a full year and a half, and in all that time not once did he touch foot on the land. And how were his perseverance and vigilance rewarded? On January 18, 1805 the enemy broke away and swept off to sea. It effected a junction with the Spanish fleet at Cadiz, which Nelson had determined to prevent. Then the allied force sailed to the West Indies with Nelson in pursuit. The chase continued back to Europe again, without success, and Nelson thereupon left his ship and returned temporarily to England. It was not until October 5, 1805, over eight months after the French force had escaped from Toulon harbor that Nelson finally met it and the Spanish allies in battle off Cape Trafalgar.

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READY TO RECEIVE THE GRAVEL.—Cross-section. Showing earth shoulders as turned back by the grading machine.

labor returns clearly; show what work has not been done. See that the council collects the amount from the delinquent parties and have it expended the next year. The pathmaster should inspect the roads under his charge after every heavy rain-storm. A few minutes' work in freeing drains from obstructions, filling holes, diverting a current of water may save several days' work if neglected. It is impossible to do satisfactory work on clay roads which are very wet, or which have become baked and hardened by heat and drought. The operator of the grading machine should have instructions to commence work on clay roads as soon as the ground has become sufficiently settled in spring—and not to leave this work until the time of statute labor, usually in June.



COMPOSITION OF THE AVERAGE ROAD.—Cross-section.

Daily gravel is dropped on the roads without further treatment. The stones are forced down into the mud, and the mud comes to the surface.

when the ground is hard and dry. With the money which can be spent, build permanent culverts, permanent bridges, buy machinery, buy gravel pits, prepare gravel for hauling, construct drains, operate the machinery. Use the statute labor as far as possible in drawing gravel or broken stone. Do not leave the gravel or broken stone just as it drops from the wagon. Spread the metal. Crown the road with a rise of one inch to the foot from side to centre so as to shed water from the roadway to the drains. Give the open drains a good fall to a free outlet. Lay tile underdrains where needed. Drain thoroughly. Keep the road surface dry. Keep the earth underneath the surface dry. Use road machinery. Use graders, stone crushers and road rollers. Improved machinery is as necessary for good and economical work as are self-binders and steam-threshers. Employ one man to take charge of the machinery. He will become experienced and do better and cheaper work. The same teams should be always employed to operate the graders. They

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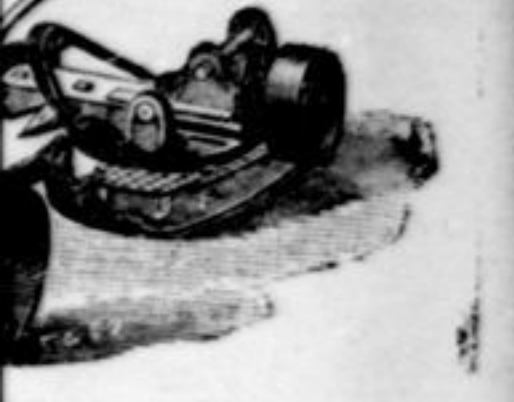
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