"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 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 reduced 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 farm should not be overlooked, and whenever a change in the road allowance means the change from a bad to a good road, or a change from a steep to a gentle grade, the slight inconvenience created by the alteration of boundry lines 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 severest 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 anunal 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 a short time amount almost to renewal of 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 the most temporary and expensive. No sooner have they all been rebuilt than we must again commence the reconstruction of the first, in this way the expenditure becomes perpetual, and fixes a large percentage of our annual tax. If these 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 vitrified pipe. If properly laid the latter will withstand the frost and is durable. These pipes may be used up to 18 inches in diameter; and the capacity may be increased by laying two or more 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 arches, 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 then be thoroughly mixed again, spread out, the stone or gravel added, and the whole thoroughly mixed until every stone is coated with the mortar, then put it 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 wood. The substructure of stone or concrete is more expensive than pile or crib work, but as in other structures a firm foundation is most serviceable and economical. Wooden foundations from decay and other causes settle and the least settlement in the foundation twists the timber causing a disarrangement of the strains and frequently transferring the greatest load to the weakest point. Wherever timbers have a seat or bearing exposed, decay soon commences, and when least expected, collapses under a heavy load.

Wherever 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, properly breaking joints, and coating each bearing with lead. A further protection is to cover these built timbers with galvanized iron to protect the numerous joints and bearings from moisture. All caps, corbles, chords, braces and floor beams should be made in this way so that the thickness of no timber will be more than six inches. A wooden bridge should be painted one year after erection; iron bridge at time of erection, and care should be taken to see that they are kept painted and that all nuts are kept tightened so that each member may carry its fair share of the load.

The cost of renewing a wooden bridge in which a man has to be sent to put in a new timber from time to time, will amount to twice the initial cost of the bridge. In this way the ultimate cost of a timber structure becomes very great.

The course pursued by some, indeed most municipalities in erecting iron bridges is likely, however, to result disasterously, and throw iron and steel into disrepute. A council advertises for tenders. The companies responding supply their own plans and specifications. Thus far the procedure is entirely satisfactory. The difficulty arises when councils accept the lowest tender without obtaining the advice of an experienced builder of iron bridges as to the plans and specifications submitted. This is a matter in which few township engineers and surveyors are qualified to decide, and certainly the wisdom of councillors, entirely without professional training in such matters, is not to be trusted. Cases have occurred in which a difference of five dollars have influenced a council to accept a tender for a bridge which was manifestly, to a man of experience, worth less than the other by several hundred dollars; and which was indeed unsafe offering every likelihood of failure with attendant loss of life and great expense for reconstruction. It is difficult to understand the action of some councillors shrewd in other matters, in the construction of bridges and other public works proceeding with such apparent disregard for the true interests of those whom they represent. A small sum spent in securing reliable advice is as much a matter of economy in public as in private affairs.

RECENT ROAD LEGISLATION.

The State of Massachusetts is one of those which has taken advanced steps in road improvement. On petition of a county, the state road commission may, with the ass nt of the Legislature, adopt any road within the county as a state highway. Except that the grading and bridging is done by the county, the work thereafter, both construction and maintenance, is under the authority of the state commission. Also on petition of two or more cities or towns, a road between them may be made a state highway. The "state commission" is composed of three commissioners who compile statistics, make investigations, advise regarding road construction and maintenance, and hold public meetings for the discussion of road matters. One-fourth the cost of construction is paid by the county the remaining three-fourths being paid by the state. In 1894 the state spent $300,000, in this way; in 1895 $400,000; and in 1896 $600,000. It is intended that ultimately about one-tenth of the entire road mileage will be built as state highways.

In Michigan, upon a majority vote of the rate payers in any county, a county road system may be adopted. A board of commissioners five in number, are elected by the people to lay out, and construct certain of the leading roads, to be paid for and thereafter maintained by a county rate.

A bill has just passed the New York may be adopted as state roads. The petition of a county council, certain roads ma ybe adopted as state roads. The petition is first presented to the State Engineer. If he approves of the section of road thus sought to be improved, he prepares plans, sepcifications and estimates. These are presented to the legislature and, if approved by that body, 50 per cent. of the cost of construction is paid by the state.

The New Jersey Highway law provides that on the petition of the owners of two-thirds of the land bordering on a road, the state Commissioner of Public Roads will cause the road to be improved in accordance with plans and specifications prepared by him, subject to the approval of the Legislature. The owners of the land affected by the improvement pay one-tenth of the cost; the county pays six-tenths; and the state three-tenths.

Connecticut has introduced a plan of highway improvement providing for the appointment of three state commissioners. When a township votes in favor of constructing a road under the provisions of the State Highway Act, specifications are prepared and submitted to the state commissioners. If the commission approves, the township council lets contracts for the work, to be performed under the supervision of the state commissioners. One-third of the cost is paid by the state; one-third by the county; and one-third by the township. The expenditure by the state in this way is limited to $75,000 annually.

The State of Rhode Island has appointed a commissioner of highways. When a council represents to the commissioner the need for improving a certain road, an examination is made by him. If he considers the work necessary, he prepares plans, specifications and estimates; and reports to the municipalities affected, also to the state legislature as to the proportion in which 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 Indianna, 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 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 beats 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-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, 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 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.

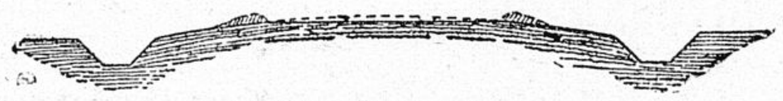
Improve the drainage of the hills. Make the crown of the roadway higher than on level ground.

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.

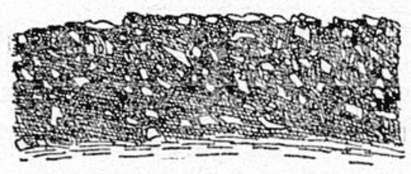
Do not build wooden bridges. Use iron, stone or concrete.

Build good roads.



READY TO RECEIVE THE GRAVEL.—Cross-section.

Showing earth shoulders as turned back by the grading machine.



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.

THE QUEEN'S HINDOO ATTENDANTS

In the days of Roman Empire the Caesars brought captive to the Eternal City, Princes and potentates of their conquered outposts. The lot of the captives are not always a happy

MUMTAZ HUSAIN,
The Queen's Indian Chef.

or contented one, though some of them, it is recorded, established relations in Rome, which advanced them to high positions of honor about the Caesars. Some such idea or a development would appear to apply to the Hindoo attendants of the Empress of India, and our Gracious Queen. She has at the present time three Indian attendants, who look to her personal comfort, and a chef over the Eastern kitchen, which is called into use when distinguished visitors from India go to London. The Oriental department of

MUNSHI ABDUL KARIM.
The Queen's Indian Secretary.

the Royal household is in charge of her private Indian secretary, Hafiz Habdul Karim, who belongs to a good family at Agra, and has been in Her Majesty's service since the jubilee year, 1887, discharging his duties faithfully and well. The Queen speaks and reads Hindustani with considerable proficiency, and she also shows devotion to Indian art. Nothing gave the Indian cavalry officers who formed a guard of honor to the Queen in the diamond jubilee procession last year more pleasure than the fact that they received their jubilee medals from her own hands.

FLOORS OF PAPER.

In Germany, it is said, paper floors are well liked because, having no joints, they are more easily kept clean they are poor conductors of heat and of sound, and they cost less than hard wood floors. They are put down in the form of a paste, which is smoothed with rollers, and after it has hardened, painted of any desired color or pattern.

SARTORIAL WIT.

Jack—Did you know that Jones, the tailor, asked Miss Swell to marry him?

Dick—So? And what did she say?

Jack—She gave him a fitting answer.

Dick—What was it?

Jack—She told him he was cut out.

Dick—And that ended it, I suppose?

Jack—Yes, he didn't press his suit further.

SANTIAGO'S CAPTURE IN 1662.

English and Americans Under Lord Winsor Did the Trick Effectively.

It was Diego Velasquez who founded Santiago de Cuba in 1515, thus making it the oldest town on the island. For a long time Santiago was the capital and the headquarters of the various murderous expeditions of the Spanish against the mainland. Cortez made it his rendezvous during his conquest of Mexico. De Soto started from Santiago in 1528 on his first expedition of exploration. By the middle of the century the place had grown to be rich and important. There was all kinds of wealth there, the accumulation, doubtless, of the plunder taken from the defenceless Aztecs and the countless other victims of Spanish lust and avarice.

In 1553, 400 French landed in the harbor and didn't have much trouble in capturing the city, not half as much trouble as Sampson and Schley are having now. This handful of French held the town till a ransom of some $80,000 was paid. After this there were frequent attacks by the numerous bands of buccaneers and pirates that infested the seas of that time.

But the real attack was in 1662, just 100 years before Havana was captured by the Americans and English, when Lord Winsor, with 15 vessels and less than 1,000 men, English and Americans succeeded without much opposition in effecting a landing at Aquadores, the very same town where Sampson was said to have landed men to effect a junction with the insurgents of to-day. These 1,000 men walked all the way from the sea to the city, and after a little brush with the inefficient force of Spanish sent to oppose them, wiped them off the face of the earth and took possession of the town.

It is not exactly known why Lord Winsor attacked Santiago rather than Havana, unless it was that he thought it easier and richer. The English were disappointed sorely to find that the inhabitants in leaving for other parts, had either hidden or taken all valuables with them, so there wasn't enough plunder to go around. The invaders, however, confiscated all the silver church bells and the guns from the fort, and, as if just to show their spite blew up the Morro Castle and destroyed the cathedral. The Morro was rebuilt in 1663, and remains to this day—or rather till the other day, when Yankee guns once more battered it. Philip I. was king of Spain at the time, and he was angry that the English should be so rough with his belongings. It always has been part of the Spanish nature to get angry about little things and rave in helpless rage.

In 1762 the English took Havana, and Santiago for a while was left out of consideration, but not for long. In 1766 along came an earthquake, wrecking half the city, and putting 100 people out of the misery of being Spanish subjects. Since that time the town has lived a pretty even existence up to the present time. Looking backward, we see that a full 100 years elapsed between the capture of Santiago and the capture of Havana.

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.