MUNICIPAL DEPARTMENT

HIGHWAY CULVERTS AND BRIDGES*

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(Concluded.)

DESIGN OF IRON BRIDGES.

The design of iron or steel bridges commonly erected may be classified under: The plain beam or girder, the beam truss, the suspension truss, and the bowstring or arch truss. The first of these is well understood; the second comprises those trusses in which both bottom and top chords are essential; the third includes those in which the upper chord only is necessary, in which the horizontal tie takes the place of fixed abutments. The style chosen should be governed by circumstances and economy, but apart from this any design is good as long as it can be accurately analyzed as to the character and amount of strain in all its parts. On the other hand, any design which cannot be so analyzed should not for a moment receive consideration.

The course pursued by some, indeed most municipalities, in erecting iron bridges is likely, however, to result disastrously 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 the councils accept the lowest tender without obtaining the advice of an experienced builder of iron bridges as to the plans and specifications submitted. Cases have occurred in which a difference of five dollars has influenced a council to accept a tender for a bridge which manifestly, to a man of experience, was 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 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.

PAINTING IRON BRIDGES.

The prevention of rust is a matter of first importance in the care of iron and steel bridge work. The first principle in so doing is the exclusion of air and moisture. Galvanizing and painting are the two most commonly adopted means for accomplishing this end. If the coating could in all cases be made continuous the result would be reached, but it is impossible to prevent slight breaks, no larger than pin-points, perhaps, but which admit air and moisture. With these as a point of commencement, corrosion goes on beneath the coating, and is all the more dangerous because concealed. The durability of painted iron work depends largely upon the surface of the metal being properly cleaned and prepared to receive the paint or zinc coating. An ideal paint should have a toughness that does not depend upon a perishable ingredient; its elasticity should not be diminished by cold; it should not soften, but rather harden, by heat; and it should contain nothing which would act as a carrier of oxygen to the metal. Most engineers have a pet compound, that recommended by the chief engineer of the Bay of Quinte Railway being composed of one pound of lamp black, eight pounds of red lead, and one gallon of raw linseed oil, the color being a rich chocolate brown.

PAINTING WOODEN BRIDGES.

The painting of timber in bridges is a matter of some importance. The effect of paint on wet timber is to retain moisture and cause the so-called "dry-rot". If the timber is dry and well seasoned, the better practice is to apply a coating of paint at once. It is, however, a mistake to paint unseasoned timber in a bridge until it has stood a year; and the work should be done at the end of the summer when the wood is thoroughly dry.

Because the tendency of paint to retain moisture, there has been some dispute as to the advisability of painting very large timbers in a bridge, the tendency of the paint being to increase the "dry-rot". Nevertheless, the timber reaches a certain stage, after sufficient seasoning, when to exclude the atmosphere by painting tends to its preservation.

It is not considered good practice, however, in wooden bridge construction, to use any timber more than 6 inches in thickness. Where greater strength is required, in caps, beams, cords, braces, etc., a sufficient number of pieces of this or less thickness should be built together by keys, packing pieces and bolts, thus allowing a free circulation of air. Over members thus composed should be placed a covering of galvanized iron, extending a half or three quarters of an inch down on the timber, and secured by galvanized tacks, preventing the rain from entering the spaces or resting in or around the packed joints.

The bridge thus built should be given one thorough coat of paint the summer following its construction, and a second one should be applied the third year. The ends of all timbers, all seats, joints and bearings, should be well coated with white lead at the time of construction.

THE ECONOMY OF IRON AND STEEL.

The economy of iron and steel bridges for replacing wooden structures is a matter in which definite statistics are not available. The steel superstructure should last half a century, while the masonry piers and abutments, with first class material and workmanship and careful attention to repairs, should be good for at least twice that period. The life of a wooden bridge may be placed at fifteen years, and during that period expensive repairs will be required. If the cost of the iron and masonry bridge is twice that of the wooden structure, there is still a wide margin for profit. The price of concrete, masonry and steel is constantly decreasing; that of timber is becoming greater, while the quantity available is degenerating; and it is not difficult to foretell that, in future, culverts and bridges will necessarily be built of permanent and durable materials.

* Paper read before the Association of Ontario Land Surveyors.

A municipal street railway is operated in Port Arthur, Ont., under the direction of a commission, which is also in charge of the public lighting plant. Mr. Geo. T. Marks, mayor of the city, states that Port Arthur was being left behind the times for the reason that the Canadian Pacific Railway deserted it for Fort William, leaving it to either go backward or to work out its own salvation. So the road was built to Fort William with the understanding that the latter city could buy a half interest within a certain time, but if she does not do so within this period, she must wait twenty years. The road and equipment cost $130,000, which was raised on 5 per cent. bonds. This was seven years ago. At first the line hardly paid expenses, but is now yielding about 2½ per cent., leaving the city an equal annual loss on account of the interest on bonds. The haul is 7.6 miles, and the business is almost wholly of a suburban nature. School children can buy 10 tickets for 25 cents, and there are special workmen's tickets, available only between certain hours, which are sold at the rate of eight for 25 cents.