MUNICIPAL DEPARTMENT

DANGEROUS SCOUR CAUSED BY BRIDGE PIERS.

The Gatineau river bridge, Ottawa, Canada, is about 900 feet long and consists of four spans and a draw, supported on five channel piers, which together interpose an obstruction about 75 feet long against the direction of the current and disturbed the equilibrium of the river's regimen to such an extent as to cause a serious modification of the channel. When the bridge was built it was supposed that the width of the river was so great and the character of its banks and current such that no material effect would be produced by the presence of its piers, but the event demonstrated the changes which are always likely to attend the construction of a channel, the danger of scour when the river bottom is yielding, and the peril that may be developed for supposedly secure bridge piers if they have only surface foundations on soft or loose soil which may become exposed to the action of a current. It also demonstrated the necessity and efficiency of proper protection against erosion, and that the wise provision of additional security for the piers besides that which was requisite for the simple bearing strength, abundantly paid for itself and resulted in the salvation of the whole structure when it was in a critical condition.

The fixed span piers have bottomless timber cribs 9×22 feet on top and battered one in twelve to low water. The tops of the cribs are 30 feet above low water and they were sunk on the smooth level surface of the shallow bottom, which is composed of sand and sawdust compactly filled in to a depth of about 16 feet above the solid clay. After the cribs were landed in position sixty 12-inch piles about 40 feet long were driven in each to a penetration of about 10 feet in the clay, and their tops left projecting at irregular heights above the bottom. The spaces around the tops of the piles were filled with broken stone packed in to the tops of the cribs.

The winter floods attained a height of 25 feet above low water and produced a scour in the bottom of the river which dug away the loose material at both sides of the piers and excavated holes 20 feet deep, penetrating some distance into the solid clay and leaving the piers seated on the tops of mounds with steep sloping sides. Some of the sand and sawdust under the cribs was undermined and allowed a considerable amount of loose stone filling to escape through the open crib bottoms at the corners. In the interior of the cribs the piles retained the filling and it was not disturbed. Fortunately the clay stratum was tough and solid, and afforded sufficient support to the piles to enable them to hold the pier against the force of the six-mile current. Without them it is probable the whole bridge would have been wrecked, but with them it resisted the flood and after its subsidence was found in undisturbed level and alignment. No repairs were made to the piers except to replace the stone filling which had escaped at the corners, partly refill the holes around the bases of the cribs, and protect their slopes against further scour by rip-rap. Since these repairs the bridge has shown no signs of further damage from scour and is considered satisfactory by the engineer, Mr. Frank A. Hibbard, Ottawa, who constructed it and executed the protection works described.—Engineering Record.

A SEVERE TEST OF BRIDGE MASONRY.

The highway bridge across the St. Francis river at Richmond, P.Q., Canada, consists of five 150-foot steel spans with trusses 20 feet deep and 18 feet apart in the clear. These are supported on stone piers founded on the shallow bottom of the river and rise to a height of about 25 feet above ordinary stages of the river. The bridge was built, according to the Engineering Record, twelve or fifteen years ago by the Toronto Bridge Company, of which the late Job Abbott was then chief engineer, and it remained in service in good condition until the winter of 1898-9, when an unusually high flood swept great masses of thick ice down against the bridge and finally swept away one span and damaged one of its piers without overthrowing it or injuring the remainder of the superstructure.

The pressure was so great that the whole of the top and the lower part of the down stream end of the pier was moved bodily down stream four or five feet, sliding on the pier foundation and splitting the pier vertically from the bottom to the fifth course from the coping. The masonry was composed of large blocks of hammered stone laid in good cement mortar and moved as a whole without destroying its integrity. The upstream end opened in the joints so as to form an arch with one end resting on that part of the footing which was not displaced, and the structure preserved its stability until after the flood had receded. The span was then temporarily supported on falsework, the pier taken down and rebuilt with most of the old stone, and a new span built by the Dominion Bridge Company, Montreal, Mr. Phelps Johnson, M. Am. Soc. C.E., manager, and Mr. G. H. Duggan, M. Am. Soc. C.E., chief engineer.

COST OF PAVEMENTS.

The following is an approximate estimate of the cost of different kinds of pavements:

Wooden blocks (concrete 6 in.), per square yard	$2 25
Brick, sand 1 in, concrete 6 in.	2 84
Gravel 8 in., brick laid flat, sand 2 in., brick on edge	2 23
Bituminous rock 2 in., concrete 6 in.	2 70
Bituminous rock (Salt Lake)	3 00
Stone blocks (Denver), $3.30 to $3.47.	3 38
Asphalt (Denver), $2.85 to $3.13	2 99
Cedar block, pine plank foundation (St. Paul)	1 15
Asphalt (St. Paul)	2 65
Brick, concrete foundation (Detroit)	2 75
Asphalt, concrete foundation (Detroit)	3 37
Brick on edge, sand 1 in., brick flat 3 in. (Bloomington, Ill.)	1 25

According to the report of Mr. P. W. St. George, city surveyor of Montreal, the area of permanent pavements in that city on December 31st, 1898, was 659,698 square yards, or 145.750 lineal feet. The materials used include granite, rock asphalt, scoria, tamarac, syenite, porphyry, round cedar blocks, Massillon blocks and Trinidad asphalt. The first permanent pavement was constructed in 1875.