crete raft, 5 ft. wide, and from 9 in. to 14 in. thick, which was designed to take the remainder of the total load. The raft was formed in situ on the puddled bank of the canal, which is known to have been constructed over 100 years back, and is thoroughly consolidated and sound. The calculated maximum load on the bottom is 0.8 per ton square foot, and the estimate formed of the safe load which the bank could carry has been fully borne out by the result of the test applied (which is described later), and the subsequent traffic over the bridge.

The abutments and wings are built up of ferro-concrete columns, curtain beams and curtains, thoroughly braced together and to the ferro-concrete raft, the wings being formed with a slight batter and finished off with a rectangular coping, also of ferro-concrete.

The superstructure consists of two pilastered main beams, which form the parapets; cross beams, spaced 4 ft. 6 in. apart; and a continuous decking, 5 in. thick, with cambered upper surface—all moulded in situ so as to form a monolithic whole. Holes are left in the parapets, two to each bay, to enable ferro-concrete brackets to be bolted on to carry future footpaths.



The roadway is formed of a hard core, 4 in. thick, of local sandstone, broken to 2½-in. gauge, and a surface coat of tar-macadam, 3 in. thick, a blue brick channel being laid on each side to carry off surface water. At the north end of the bridge self-adjusting unclimable iron railing and a pair of iron gates are fixed, the gate pillars being bolted down to the decking, and the standards of the railings similarly secured and attached to the ferro-concrete piers by means of ¾ in. diameter bolts passing through them and enclosed in lengths of galvanized iron tubing.

The approach road on the south side is carried on an embankment, with I to I batters, covered with sods obtained from the marsh; and on the north side, after the preliminary filling to counteract the outward thrust of the abutment during the process of testing, the surface was brought up to the required level by the tipping of town refuse, and a temporary sleeper road formed. Part of the "Back Cut" of the canal has been enclosed by 18-in. stoneware socket pipes, bedded on and surrounded with cement concrete, and the toes of the embankment are supported by retaining walls of rubble masonry.

In his article Mr. Jenkins points out that there were two special conditions governing the design of the bridge: (1) The superstructure had to be kept up so as to give a clear headway of 7 ft, 6 in, in accordance with the requirements of the Neath Canal Navigation, who have statutory powers, and whose consent had to be obtained in the first place for the crossing of the canal; and (2) the surface level had to be kept as low as possible so as to avoid excessive gradients on the approaches. To meet these opposite conditions, the arrangement was adopted of two main girders, carried up as parapets with cross beams spaced sufficiently close together to keep their depth within the required limits. Further, for a number of years only limited cart traffic will be required to pass over the bridge, but later on, when the marsh land has been developed, access for the general public will have to be provided. To meet this condition the bridge has been formed to the by-law width of carriageway -namely, 24 ft.-and provision made, as before mentioned, for adding when required a footpath to be carried on cantilevers outside each parapet. This is an economical arrangement, while at the same time it admitted of the distance between the road surface and the underside of the main beam being kept to a minimum-the alternative having been to space the main girders 36 ft. apart to increase their depth and strength, and incidentally the gradients of the approaches, and to incur practically the whole cost of the finished bridge long before it was necessary.

## MOTOR FUELS AND THEIR FUTURE PRICE.

Mr. G. S. Sayner, in a recent lecture to the members of the Harrogate and District Automobile Club, pointed out that benzol was one of the first products of the distillation of coal tar, and was obtained in very large quantities on the Continent, and to a limited extent (now increasing largely) from the recovery plants fitted to ovens in which metallurgical coke was produced. This hydrocarbon had the formula  $C_0H_0$ , and was only a little less volatile than petrol, I lb. giving 4.5 cubic feet of vapor at normal temperature and pressure. Like all the volatile hydrocarbons, there was a certain amount of variation in the determinations of its calorific value-from 18,188 B.th.u., according to Thompson, to 17,780 as determined by the bomb calorimeter. The commercial washed or rectified go per cent. benzol was the only kind really suitable for motors, though Mr. Sayner said he had run a car on the crude 60 per cent. unwashed. There was no difficulty in driving motor carriages of any description with 90 per cent. benzol as the principal fuel. With regard to napthalene, coming from various products of the distillation of coal, it contained 93.7 per cent. of carbon, and required melting or vaporizing, and special apparatus for obtaining the explosive mixture. One advantage was its low cost-0.32d per horse-power-hour in a recent test. Mr. Sayner added: "In looking into the future I see great possibilities for napthalene, as the source (coar tar). from which it is obtained is more likely to be equal to the demand. Those in the North of England especially are in a favored The position, as the tar of the coal is full of napthalene. quantity required for motor purposes could be easily provided."

## CANADIAN PULP AND PAPER MANUFACTURERS.

The Canadian Pulp and Paper Manufacturers' Association has been formed for the "object of gathering statistics on the possibility of the world's market, the collection of rainfall data, and to co-operate with the Dominion Government in the establishing of laboratories for forest products."