CORRESPONDENCE

on a Paper published in Proceedings, Part I, March 1954

Paper No. 5971

" The Construction of Two Concrete-Lined Tunnels for the Machkund Hydro-Electric Project, South India " †

by

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Mr A. B. Harman observed with regard to the concreting of the arch and walls of the tunnels by means of the pneumatic placer, he had witnessed lining defects such as those described by the Authors in two tunnels similar to those of the Machkund Project. In the instances in question the concrete was mixed outside the tunnels in two 1-cubic-yard mixers and transported in transit mixers each holding nearly 3 cubic yards. With three pairs of transit mixers and three Diesel locomotives, the supply of concrete to the pneumatic placer enabled rates of placing exceeding 40 cubic yards per hour to be achieved. A mix having 3-inch to 3¼-inch slump was found to be satisfactory and occasional mixes of 2-inch slump did not cause blockages. That was for a shutter length of up to 80 feet and he was surprised to learn that the Authors had found it necessary to use a mix of 4-inch to 5-inch slump to avoid blockages with a shutter length of only 40 feet. The adequacy of the air supply was probably important in that respect, but the Authors might have been handicapped by having largely to use crushed stone sand.

The main objection to the pneumatic placer as used in the Machkund and other similar projects appeared to be that a triangular area of porous concrete was commonly found at the starting end of each pour, indicating that segregation occurred until the concrete had built up to crown level. The Authors, in commenting on that, had said that little trouble was experienced once the discharge pipe was buried. Whilst Mr Harman

† Proc. Instn Civ. Engrs, Part I, vol. 3, p. 111 (March 1954).

agreed on the desirability to keep the pipe buried, he thought the emphasis should be on the fact that once the concrete had built up to crown level, the discharge was into freshly placed concrete, whether the end of the pipe was buried or not, instead of against the hard construction joint of the previous pour.

Good compaction in the tunnel arch appeared to be provided by the discharge of the placer, and in the walls by hand punning with, or without, vibration; but, in Mr Harman's experience, honeycombed patches were liable to occur in the region of springing level and adequate access for some form of compaction in that area was most important. As the Authors had pointed out, delays during concreting appeared to have been a contributory factor of some importance. He thought they might have found the best solution in the form of closely supervised hand punning in conjunction with external vibration, the former being the more important, particularly with the rate of placing which they quoted, and the latter being mainly a means of improving the surface finish. It should be borne in mind that the mix workability suitable for the pneumatic placer was not normally associated with compaction by vibration and Mr Harman had found that when internal vibrators were used, their main function appeared to be to keep the concrete moving along the shutter; that helped to prevent the formation of pour planes, and the occurrence of " tear shears " when concrete which had built up too steeply towards the point of discharge slumped along the shutter.

In spite of certain difficulties, Mr Harman thought there would be an increasing tendency in the future to use the pneumatic placer in favour of the concrete pump for the concrete lining of tunnels. Its main advantages were the much higher rate of placing which it achieved and its freedom from mechanical breakdown; but other factors might be important in some circumstances, such as the fact that it was not nearly so sensitive as the pump to mix workability and aggregate grading, and appreciably less head-room was required for its operation.

The Authors thanked Mr Harman for his contribution but did not feel called upon to make a reply.