THE EFFECTS OF SAND QUALITY ON THE STRUCTURAL PERFORMANCE OF CONCRETE BLOCK PAVING

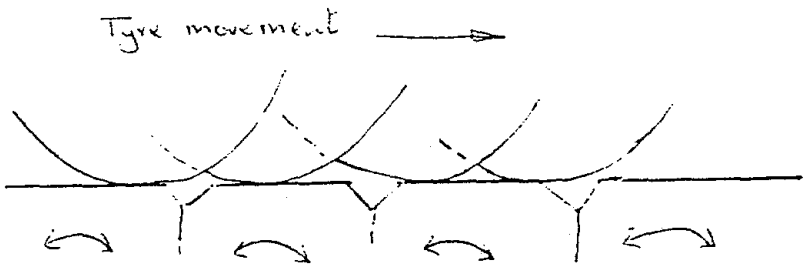
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SAND INVESTIGATION

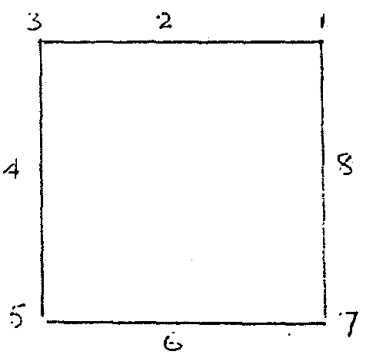
In an evaluation of a pavement using the NUROLF method, it was observed at one failure point that the sand had lost much of the surface f ines at the centre of the unit and it appeared to have a greater proportion of fines at the edge.

From this, I would conclude that due to the load applied to the edge of the unit, it is causing the fines to move forward and as the load moved forward it moves a certain size particle. This movement of the particles, in the presence of water moves forward until it reaches a point where the build up is so great that it is forced up through the joints and is deposited on the surface. The theory is such that as a tyre passes over one unit the load is applied to the edge and as the type progresses along the unit the load pattern changes. The diagram illustrates this.



Sampling Details

After removal of all the flags, areas of sand bedding layer were selected especially around the area where a depression occurred. At a position 32 the sand thickness was measured.



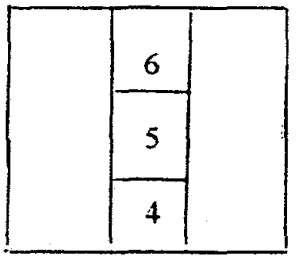
Thickness Results

Position	Thickness (mm)
1	50
2	42
3	46
4	20
5	0
6	26
7	38
8	51

At position 33, where there was obvious loss of fines on the surface, sections through the sand bedding layer were taken for sieve analysis at the following depths. The area sampled was 130x130mm.

Ref. No.	Sand Thickness Sample (mm)
51	20
52	10
53	20

To examine if there was any other changes in grading of the layer a sample of the sand was taken from a sensibly untrafficked area reference 32. The sand thickness was measured from the centre of the flag position and three samples were taken as shown below.



In all cases, the sand thickness was 50mm

Where the sand had obviously been effected as the photograph illustrates samples of the upper part of the sand approximately 20mm thick were taken.

The sampling plan is illustrated below.

75mm	10	11	12
150m	7	8	9
125m	4	5	6
75m	1	2	3
	75		75

A further sample was taken from the lower part of location 5 to use a control check on the grading.

Using the Bottle Rolling Test and the Sieve Shaker Test on the same sample, the results are as shown.

From the foregoing results, this has led us to make the following assumption or theory.

For sand to degrade under traffic conditions causing the surface to depress as:-

The destabilization of sand due to mechanical breakdown of particles caused by the instantaneous rolling loads approximately 10 times the tyre pressure. This will change the volume of sand and destroying some of the water resistance of the jointing sand allowing small amounts of water to enter into the bedding layer mobilising the fine particles to the intersection of the blocks. When the pressure is to great the very fines and some water is forced upwards and deposited on the surface of the block, this is a continues process.

LABORATORY TEST - DEGRADATION OF BEDDING SAND

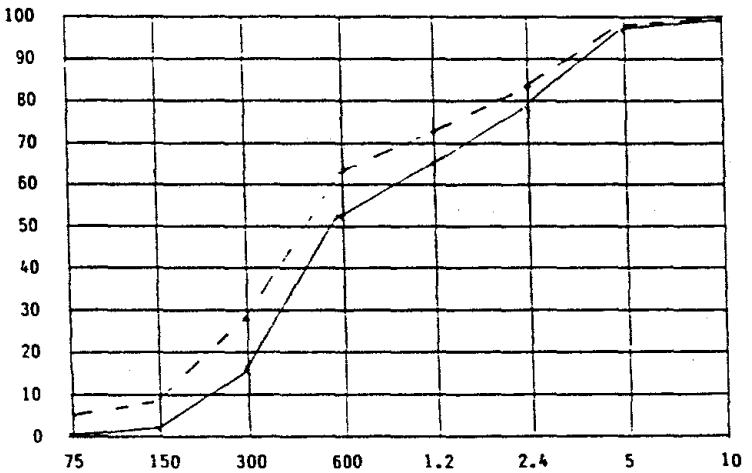
LABORATORY TEST NO: C50304 DATE OF TEST: 9.3.94

MATERIAL IDENTIFICATION: GATESHEAD MARINE AGGREGATE PLANT HUMBER ESTUARY.

RESULTS

SIEVE SIZE	*% PASSING	*INCREASE AFTER BOTTLE ROLLING
10mm	100	—
5mm	98	—
2.4mm	79	3
1.2mm	65	6
600 µm	51	10
300 µm	16	12
150 µm	1	8
75 µm	—	4

* Grading in accordance with BS 812:Part 103:1985 - Average of 3 samples



Original Grade _____ After Bottle Rolling -------

Additional Information: _____

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