

Resurfacing runways on military airfields

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Would the Author expand on his comments in § 29 concerning the standardization, by the PSA, of 3 mm × 3 mm × 25 mm grooving as being a compromise between imparting good macrotexture without unduly shortening the life of the surface. Would he consider there to be a risk of a shorter pavement life for BAA's pavements? They suggest using a 4 mm × 5 mm × 25 mm grooving pattern to satisfy the CAA and ICAO requirement of a total texture depth of not less than 0.1 mm (see reference 1, § 56). Has there been any research to determine the effect of depth of grooves on pavement life?

34. I would also refer to the Author's comment in § 16 that interlocking concrete block paving is not felt to be suitable for front line military runways on the grounds that jet efflux from those aircraft whose exhausts are angled slightly downwards, e.g. the Phantom, might dislodge blocks after eroding the jointing sand. This would be the case if the jointing sand was not stabilized. A low viscosity liquid prepolymer is now available which binds jointing sand particles together and to the sides of the blocks, thus avoiding problems of sand loss by jet blast, use of vacuum sweepers and flooding. An additional benefit is that the polymer greatly reduces the ingress of water and fuels etc. into the laying course sand and underlying pavement structure.

35. A series of tests was made recently by British Aerospace PLC and the writer to investigate the effectiveness of the polymer in stabilizing jointing sand in block paving subject to VSTOL operations. It was found that considerable erosion resistance was provided by the polymer, in conditions considered to be more severe than those imposed by Phantom aircraft.

36. The investigations were made by British Aerospace (Military Aircraft) Ltd at their Hot Gas Laboratory using their ground erosion rig (see Fig. 1). This facility enabled tests to be carried out at full scale jet pressure and temperature values to determine the effects of direct jet impingement on block paving treated with the polymer. Sample trays measuring 600 mm × 600 mm containing 80 mm thick rectangular blocks laid in the modified herringbone pattern, shown in Fig. 2, were mounted on the ground erosion rig and subjected to a range

of jet pressure ratios (JPRs) and temperatures to simulate VSTOL aircraft efflux values during vertical lift operations. For present VSTOL aircraft typical values would be JPRs between 1.5 and 2.0 and temperatures, at ground level, of up to 500°C.

37. Analysis of the test results concluded the following.

- For a JPR of 2.12 the onset of erosion of treated blocks would occur after 9 s residence time at a temperature of 500°C.
- At ambient temperatures, even at a JPR of 4, no sand erosion was noted.
- The jointing sand in untreated panels of block paving was easily removed at JPRs well below present VSTOL operating conditions.

38. Also of interest was the fact that a sample panel filled with asphalt, binder erosion was noted at JPR 2.0, nozzle temperature 300°C and residence time 3 s. Further details of these tests are available from the writer of this discussion.

39. In reply to J. Emery the PSA view on size of grooves, although no research data are available to support it, is that the deeper

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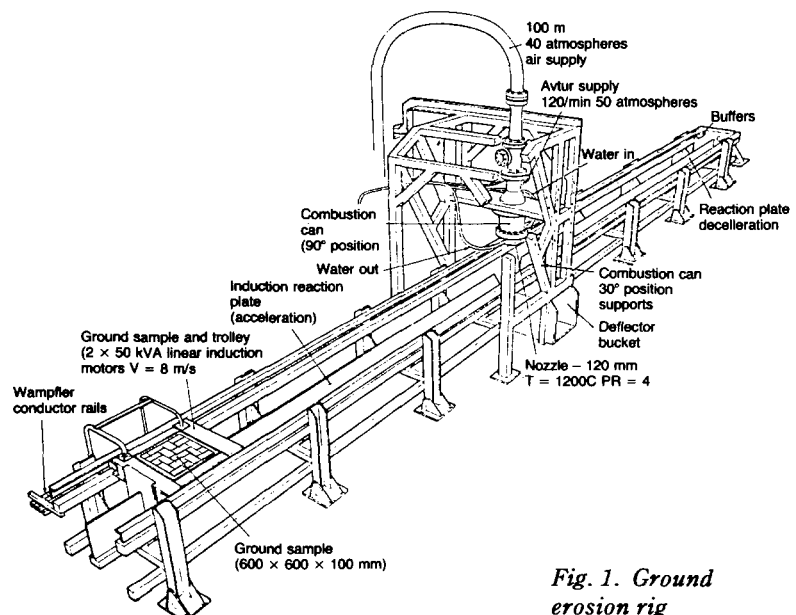


Fig. 1. Ground erosion rig

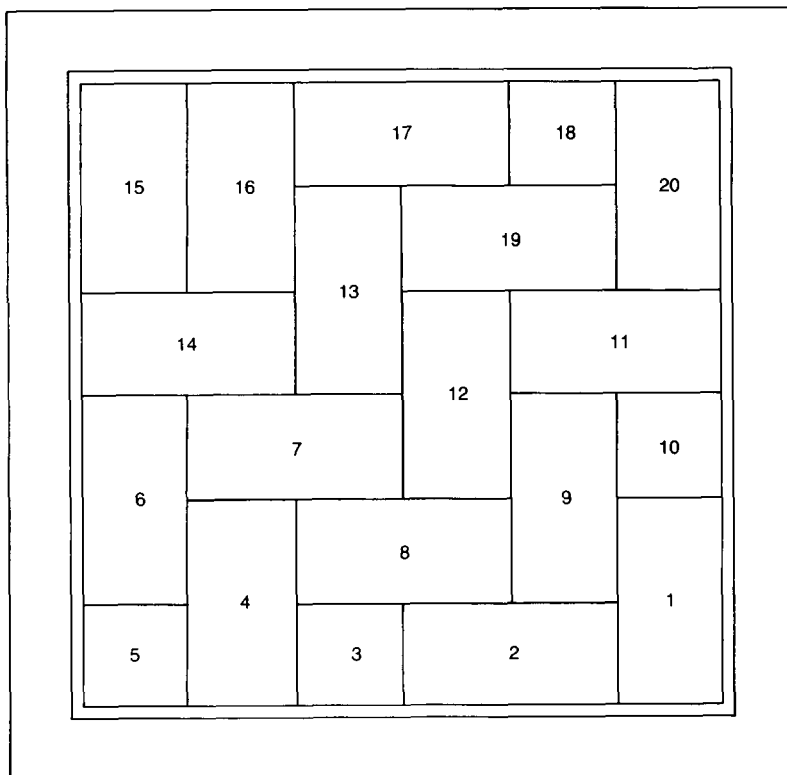


Fig. 2. Pattern of rectangular blocks in the sample trays

grooves in an asphalt surface are cut, the larger will be the particles likely to shear from the edges of the grooves; the wider the grooves are cut, the greater will be the load from aircraft tyres on the edges of the grooves encouraging the shear. Eventually, grooves can develop towards ill-defined corrugations. The larger these are, the less likely the surface is to satisfy the rideability and freedom from loose particles criteria which were set out in § 2 of Paper 9604 as being requirements on a runway. The dimensions selected for the grooves should therefore be the minimum consistent with the achievement of the required standard of wet weather braking.

40. PSA engineers have appreciated the benefits of the low viscosity liquid pre-polymer for stabilizing the sand in joints between blocks in interlocking concrete block paving and have already specified the use of this material in certain circumstances. One example of their use was on a helicopter apron adjacent to a hangar in which a servicing operation requiring particular cleanliness was to take place.

41. The PSA too has arranged trials using the ground erosion rig at the British Aerospace Hot Gas Laboratory. In 1984, a test was made on a sample of interlocking concrete blocks laid to the same pattern as that illustrated by Mr Emery but without the pre-polymer stabilizer. With a JPR of 1.4 and efflux temperature of 15°C the sand was removed and the blocks lifted from their bed after 10 s. Comparison of

this result with that quoted by Mr Emery in § 37(b) illustrates the benefits to be gained by using the polymer. It also illustrates the risks if the polymer should for any reason fail to keep the sand stabilized; loose blocks on a runway surface would be extremely hazardous.

42. We feel that there are several points on which further information needs to be gained before we would be prepared to use interlocking concrete blocks on a runway, even with the stabilizer. Among these are the following.

- (a) It is perhaps a little late to be discussing the characteristics of the Phantom as most have now been withdrawn from service. This aircraft does, however, provide a convenient example. Its exhaust axis is depressed below the horizontal so that it strikes the pavement only 10 m behind the exhaust nozzles. At this distance the exhaust gas temperature with afterburners lit exceeds 900°C, although gas at this temperature normally impinges on any point on the pavement for at most a few seconds as the aircraft begins to roll. During the anticipated life of a pavement surface, however, certain points on it could be exposed to this efflux on thousands of occasions. From the results quoted by Mr Emery, high temperature appears to promote early failure of the pre-polymer. Research information is needed to predict how the pre-polymer would stand up to a large number of brief exposures to high temperature.
- (b) Most compounds purpose-made for sealing joints in conventional concrete pavements can cope only with 25% extension or compression from their width in a joint at the time of sealing. Since the space between adjacent interlocking concrete blocks when laid is usually only approximately 2 mm, it seems likely that a proportion of these will open by more than 25% during the life of a pavement. Information is needed on whether the pre-polymer stabilizer continues to function satisfactorily after such movement.
- (c) Pavement quality concrete pavements are designed for a life of 30 or 40 years and this is the standard which block paving has to match. If for any reason and in particular those quoted at (a) or (b) the stabilizer has a shorter effective life than this, some practical means of renewing it have to be available.

Reference

1. AUSTIN G. E. Runway resurfacing experiences. *Proc. Instn Civ. Engrs*, Part 1, 1991, **90**, June, 575–586.