

Paper Number: 5503

The potential use of aeolian sands in roads in Limpopo

Paige-Green, P.¹ and Brink, G.²

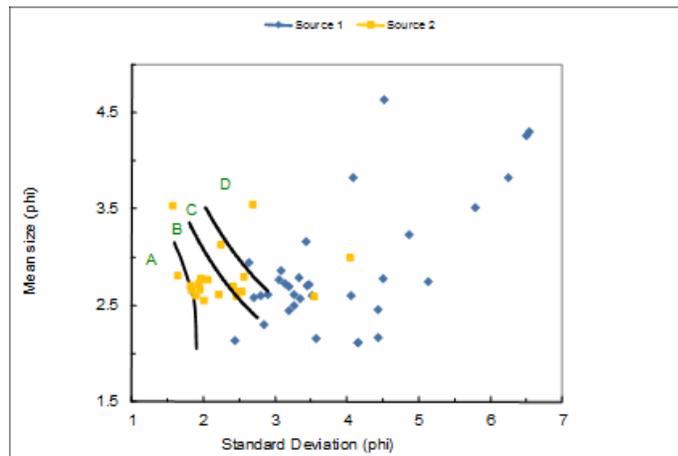
¹Tshwane University of Technology, Staatsartillery Road, Pretoria, South Africa. Paigegreenconsult@gmail.com

²Exxaro Resources, Roger Dyason Road, Pretoria, South Africa. george.brink@exxaro.com

It has recently been recorded that neat aeolian sand can be effectively used in structural layers in roads [1,2,3,4]. A simple screening test, based on work done in Australia in the early 1980s [5] has been applied to determine whether such sands may have potential for use in roads. The method is based on a plot of the mean particle size versus the standard deviation of grading when calculated using the phi scale ($-\log_2(\text{particle size in mm})$).

As a part of ongoing research and development in the Lephalale Area of Limpopo Province, South Africa, about 60 grading analyses (sieve and hydrometer) have been carried out on a number of sands from two different adjacent sources. Evaluation of the statistics shows a wide range of fine and very fine sands with an average particle size of 3.07 phi (0.12 mm) ranging between 2.11 and 7.95 phi (0.23 and 0.004 mm). There is a wide standard deviation indicating poor sorting of the materials. The skewness value of up to 0.9 indicates a relatively symmetric distribution (on a log scale, i.e. log normal) while the average kurtosis is slightly higher than 3 indicating a slightly steep normal distribution (leptokurtic).

Figure 1 shows the results plotted on the Metcalf and Wylde Chart [5], separated by source. Materials falling into Zone B of Figure 1 have a strong likelihood of being useful for construction of road pavement layers [1]. It is interesting to note that the materials from the two adjacent sources appear to have significant differences in their gradings. Of



the sand tested from Source 1 (north of the Daarby fault), only 1 (3%) classifies in Zone B, whereas 52% of those from Source 2 (south of the Daarby fault) classify as potentially useful as structural layers in roads.

Baillieul [6] studied the sands in Botswana and identified 4 material zones related to underlying material and their origin based on differences in their different particle size distributions.

Figure 1: Plot of mean particle size statistics (phi scale)

The materials tested are from an area in South Africa adjacent to Baillieul's Area 4. His findings from these sands were that they are mostly fluvial and depend on the underlying source material. The samples tested in this project had results indicating a slightly finer material on average but with a similar standard deviation, although the range was considerably wider. Source 1 is underlain by the Clarens sandstones while source 2 is underlain by Karoo basalts.

References:

- [1] Roads Department (2010) The use of Kgalagadi sands in road construction
- [2] AFCAP (2013) Guideline on the use of sand in road construction in the SADC region
- [3] Netterberg F and Elsmere D (2015) J. S. Afr Inst Civ Eng 57(2)
- [4] Paige-Green P et al (2015) Transportation Research Record 2474(3):56-64
- [5] Metcalf JB and Wylde LJ (1984) Bull Int Ass Engng Geol 30:435-437
- [6] Baillieul TA (1975) J Sedi Petrology 45(2):494-503.

