VOLUME 1

ABRASION RESISTANCE

AND RELATED

STRENGTH CHARACTERISTICS

IN

CONCRETE BLOCK PAVING

Abstract – Volume 1

Volume 1 of this thesis is based on experimental testing done in 1987 on factory made paving blocks, and the measurement of abrasion-wear in companion blocks after 6-years of traffic.

Forty-eight different mixes were made in a typical paving factory. The variables were water content, binder content, and binder type. At age 28 days these mixes were subjected to ten different laboratory tests, including compression testing, tensile splitting testing, absorption testing, density determinations, and three different abrasion tests. The results demonstrate that the abrasion resistance (and other properties) of cbp is greatly improved when the water content is maximised and the binder content is increased.

The three abrasion tests used to test the pavers (MA20, Wirebrush, ASTM C418) are critically assessed, and in particular their ability to simulate wear is discussed. The MA20 test appears to be the best of the three, but it also has the highest variability, and has therefore not been adopted by the manufacturing fraternity.

The distinctive characteristics associated with abrasion-wear are a colour shift in the direction of the aggregate, increased surface roughness, and increased depth of abrasion. These trends are visually observable from photographs, and may be qualitatively related to the mvd ('mean visible depth'), which is generally related to roughness and depth of abrasion-wear. Using these various terms, abrasion wear is categorised into five 'degrees of abrasion'. A classification is also proposed stating what degrees of abrasion are acceptable in the various applications of cbp.

Blocks from the same mixes as those tested in the laboratory at 28-days were installed in the access road of a busy bus terminus and a busy pedestrian sidewalk. Six years later, the actual wear in these blocks was measured (i.e. mvd). On the one hand it was *not* possible to establish *meaningful* 28-day limits for the abrasion tests, because of the different rates of strength development of the various cement replacement materials used. Whereas silica fume acted as an accelerator at 28-days, it had little advantage over the control mix at 6 years. Conversely fly ash (ex Matla) appears to retard abrasion resistance at 28-days, but clearly has the least wear after six years. On the other hand it *was* possible to relate the 6-year wear results to the experimental mix designs, and based on this an expanded 'mix design selection chart' classifies 21 mixes in terms of expected long-term wear.

Based on the difficulties experienced and the lessons learned, a method of establishing limiting criteria for an abrasion test is proposed. This method takes cognisance of variations that are likely to occur from one local manufacturing environment (lme) to another, such as aggregate type, binder type, water dosage, curing methods, and production machines/processes. These various locality sensitive criteria are linked to yet-to-be-determined national 90-day limits.

Summary of some useful findings arising out of the volume 1 research: As a result of this work a clearer understanding now exists of how water content, binder content and binder type influence abrasion resistance. A suitable abrasion test has been identified, although doubts relating to its inherently high variability have precluded its formal adoption into the national standard for the manufacturing of pavers. Wear has been classified, both quantitatively and visually. A mix design chart makes it possible to select a mix with a predictable long-term wear performance. A model/method is proposed for establishing local 28-day abrasion limits that correlate to national 90-day limits.