Sediment Retention Behaviour of Laboratory-based Permeable Pavements

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Overview
This paper investigates the sediment retention behaviour of laboratory-based permeable pavements using mono-sized sediments that were representative of the sizes typically found in urban stormwater. The sediments were applied in two cycles, namely in order of increasing and decreasing size. The results indicated that most of the sediment accumulation could be attributed to the depth of the pavement and the material used in the joint and bedding aggregates. Most of the sediment was retained in the bedding and surface layers, and little difference to the retention was made by the incorporation of a basecourse layer. When the mono-sized sediments were added in decreasing size order with the coarsest sediments applied first, the overall rate of retention increased.

Objectives
The main objective of the research was to address the question:
What are the effects of passing varying sediment sizes (small to large and large to small) through permeable pavements, in terms of overall sediment accumulation within the various pavement layers?

Method
The method used a series of permeable pavement units set up under laboratory conditions, consisting of 12 permeable pavement sections, 4 for each design. A schematic diagram of the experimental set up can be seen in Figure 1.

To examine the effect of sediment particle size on the clogging mechanisms in permeable
pavements a series of 'mono-sized' sediments were passed through the pavement system. In this paper the term 'mono-size' refers to sediments of a particular size within a range of ±5% of that sediment size. For example sediment size 9 is 530µm consisting of a range of particles between 504 µm and 556µm in diameter.

Results
The results suggest that the application of sediments in decreasing size order may have a greater impact on the accumulation of sediment. Further analysis showed that a large retention of sediments was visible in Design B when sediments were applied in both large to small, and small to large size order. A cyclical pattern of sediment transport through the pavement was suggested in this research, with three waves of build-up and release evident when sediments were applied from small to large. These waves were reduced when applied from large to small, suggesting that the build-up of sediments observed in pavement Design C may have caused a delay in the release of sediments into the second layer in Design B.

Conclusions

In conclusion the results indicated that most of the sediment accumulation could be attributed to the depth of the pavement and the material used in the joint and bedding aggregates. Most of the sediment was retained in the bedding and surface layers, and little difference to the retention was made by the incorporation of a basecourse layer. When the mono-sized sediments were added in decreasing size order with the coarsest sediments applied first, the overall rate of retention increased.