ON THE PERFORMANCE OF PERMEABLE PAVERS

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Urban stormwater runoff is a transport medium for many contaminants from anthropogenic sources. This stormwater borne contamination originates from a variety of sources inclusive of the rainfall itself, and the pervious and impervious surfaces within the catchment. Many frequent storm events, however, result in generation of surface runoff only from the impervious surfaces within the catchment. As a result, a number of studies have investigated the availability or transport of pollutant constituents from impervious surfaces. As a result of these studies, many contaminants have been shown to exhibit a strong association with particulates in stormwater runoff.

There are many alternative management strategies available to treat these contaminants. One of the technologies suggested for this purpose is the use of permeable pavements to minimise the quantity of surface runoff generated by impervious surfaces within an urban catchment. The basis of this management approach is that by reducing the quantity of surface runoff generated, the quantity of contaminant transported to the surface drainage system will be reduced.

To test the effectiveness of this approach, a section of Smith Street, Manly was reconstructed with permeable pavement. This section of road was monitored over an eleven month period for both the quantity and quality of stormwater runoff. The gauging station installed as part of the monitoring program reported herein comprised

- Rain Gauge;
- Water Level Measurements;
- Automated Grab Sampler; and
- Data Logger.

To extract pertinent details from the collected data, the following information was determined for each event

- Volumetric Runoff Coefficients for both the total event and for the supply period of the event;
- Event Mean Concentrations for contaminants sampled.

Monitoring of the Smith Street site was undertaken between June 2002 and April 2003. The results from this monitoring have been analysed in terms of the quantity and the quality of runoff from the permeable pavement. Throughout the monitoring period a total of 22 rainfall events that resulted in runoff from the permeable pavement were recorded. Water quality samples were collected for 9 of these events.

From analysis of this data, it was concluded that the monitored Smith Street catchment was acting in a manner analogous to a pervious surface. This was shown through determination of the supply period runoff coefficients for each recorded event. These coefficients ranged from 0.04% to 7.33%. When compared with the representative range for pervious catchments (5% to 35%) it is apparent that the values of the supply period runoff coefficients are similar to those expected for a pervious catchment and hence the hydrologic behaviour of the street is as a pervious surface.

Further to this, the effective imperviousness of the catchment seems to have been reduced from around 45% prior to the installation of the pavement to about 3%. This suggests that the installation of the permeable pavement has been effective in restoring permeability to this urban catchment.

Both the quantity of rainfall and sudden increases in rainfall intensity were found to influence the initiation of runoff. Analysis of the data suggests that about 4mm of rain is required before any runoff occurs. Furthermore, approximately a rainfall intensity of approximately $20mmh^{-1}$ was required prior to development of surface runoff.

In relation to the quality of the runoff from Smith Street, it was found that the range of values found for the constituents monitored at the site was not significantly different to values typically found for urban road runoff. However, the EMC values for total phosphorous were closer to typical values than the heavy metals which were found to be at the lower end of the range of typical values. While the EMC values found in the runoff may not appear to show that the runoff quality from the permeable pavement surface is an improvement over a typical road surface, the total load of pollutants leaving the catchment has been reduced since the quantity of runoff has been shown to have been reduced.

In summary, the permeable pavement in Smith Street was effective in reducing the quantity of runoff and hence in reducing the total load of pollutants leaving the catchment with stormwater runoff.