**Experimental characterisations of green roof substrate physical properties**

Zhangjie Peng

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1. **Introduction**

The dataset describes the Soil Water Release Curve (SWRC) and Hydraulic Conductivity Function (HCF) of four representative green roof substrates. The runoff and moisture content data collected during the detention tests with the substrates is also included in this dataset.

This dataset provides the data used in the journal paper:

Peng, Z., Smith, C., Stovin, V., 2020. The importance of unsaturated hydraulic conductivity measurements for green roof detention modelling. *J. Hydrol.* 590, 125273.

Please see <https://doi.org/10.1016/j.jhydrol.2020.125273> for more information.

Note that additional material characterisation data (FLL tests) is already available directly from the journal paper.

The data was collected by Zhangjie Peng at the University of Sheffield, under the supervision of Prof. Virginia Stovin, as part of her PhD thesis.

Peng, Z. (2021), Detention performance of green roof systems: Experimental characterisations and numerical modelling, PhD Thesis, University of Sheffield.

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The pressure extractor data in the SWRC were originally collected by Joerg Werdin at The University of Sheffield as part of the EU FP7 Marie Curie Industry-Academia Partnerships and Pathways (IAPP) ‘Green Roof Systems’ project.

1. **File naming and data format**

This data set consists of four files, this readme file and three Microsoft Excel .xlsx format workbooks.

**SWRC.xlsx**

This file contains four sheets, and each sheet is named as the substrate name (i.e. MCS, HLS, SCS and NSM). Each sheet contains the measured SWRC data points using the Hanging Column and Pressure Extractor methods (it should be noted that the SWRC for the NSM was characterised only based on the Hanging Column method). This data is presented as the mean value of three replication tests and the maximum and minimum values of the three replication tests. The calibrated parameters for the van Genuchten and Durner models based on the measured data points were also listed in the sheet, the estimated SWRCs based on the van Genucthen and Durner models were also included in the sheet. The measured data points and estimated curves were plotted for each substrate in the sheet.

**HCF.xlsx**

This file contains four sheets, and each sheet is named as the substrate name (i.e. MCS, HLS, SCS and NSM). Each sheet contains the HCF data points measured using the steady-state and transient methods. The transient data was characterised as Evaporation or Drainage data depending on the physical processes. The two tests were performed on different test samples, and the data is labelled as ‘Test 1’ and ‘Test 2’ to separate the data for each test. The parameters for the Durner-Mualem model to estimate the HCF for each substrate are listed in the sheet. In addition, the parameters for the three-segment curve, derived from the measured data points (i.e. based on the Test 1 data, Test 2 data and the mean value of the two tests) are also included in the sheet. The data used to plot the estimated HCF curves are also included in the sheet, and the moisture content data in the sheet was estimated based on the fitted Durner model SWRC. The measured data points and estimated HCF curves are plotted in the sheet. Due to the failure of tensiometers, no data was collected in the drainage phase for the SCS in both tests, and no data was collected in the drainage phase for the HLS in Test 1.

**Detention\_Tests.xlsx**

This file contains four sheets, and each sheet is named according to the number of the relevant design storm (i.e. Design\_Storm\_1, Design\_Storm\_2, Design\_Storm\_3 and Design\_Storm\_4). The descriptions of the design storms can be found in Peng et al. (2020). The column labelled ‘Design Rainfall’ is the designed rainfall intensity, and the column labelled ‘No Substrate’ is the measured runoff at the bottom of the substrate column without substrate. The data comprises runoff and moisture content and is the average of three repeat tests. For the detention tests conducted with the 100 mm substrates, only data from one moisture content probe was collected. For the 200 mm substrates, the moisture content at the top and bottom of the substrates was collected. A full description of the experiment, moisture content probe calibrations and the locations of the moisture content probes can be found in Peng (2021).