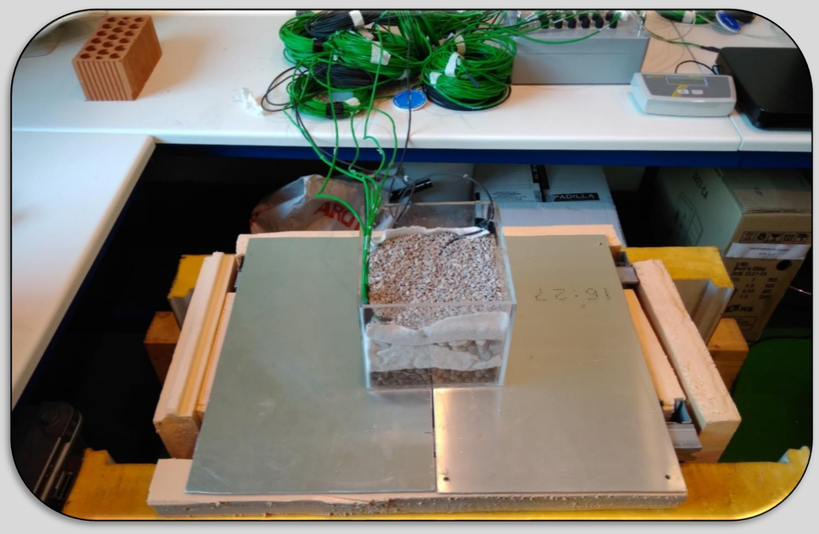
HYDROLOGICAL IMPACT OF EXPANDED CLAY MATERIAL INTRODUCED IN DIFFERENT SUDS: A LABORATORY-BASED ASSESSMENT

The philosophy of conventional urban drainage has been, for many decades, to convey runoff far away from the city center by using pipes and other subsurface methods, and therefore, giving rainfall a negative connotation, being concealed from the surface. Sustainable Urban Drainage Systems (SUDS) changed this paradigm by valuing water as a vital resource which improves our life whilst controlling floods, reducing diffuse pollution and enabling the reuse of runoff after being treated through their structures, amongst other benefits such as biodiversity and amenity. There are many possible materials that could be used as part of SUDS structures, depending upon the intended function.

METHODOLOGY

HYDRAULIC TEST

Three replicates of this design were used to determine the infiltration capacity of different materials: expanded clay, limestone aggregate and blast furnace slag. The system has a 20 cm sub-base layer, geotextile, 5 cm base and a top surface. The runoff simulation was carried out with different intensities (267, 321 and 375 mm/h). Total of 27 trials of 40 min.



THERMAL TEST

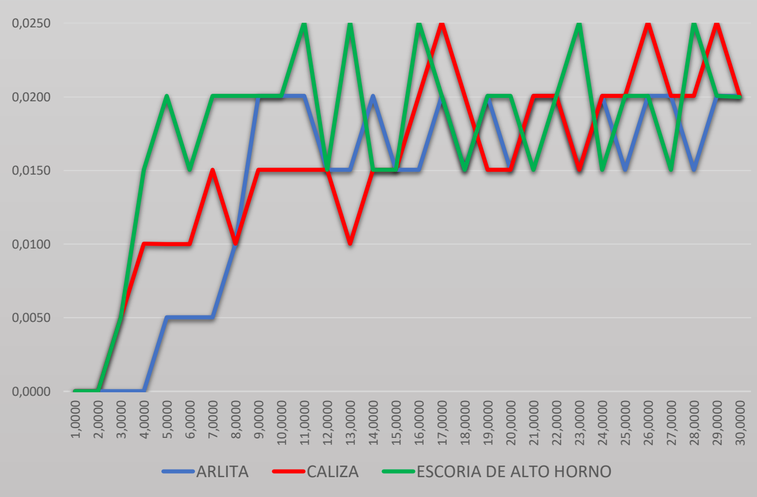
A box-platform with three layers of expanded clay and limestone aggregate of different granulometries is used. The sides of the systems are thermally insulated and heat flow is applied to the bottom. A stainless steel plate is used to homogenize the heat transfer and temperature sensors are placed at different depths. Data is collected for 48 hours during the test period.

EVAPORATION TEST

To determine the influence of the expanded clay on evaporation, 9 devices are prepared, consisting of a 20 cm sub-base and a 5 cm base layer. Three different systems are made: Terram 1000 geotextile, Danofelt PY150 geotextile and without geotextile. The data were collected during the 21 days of the test with initial saturation condition and identical environmental conditions.

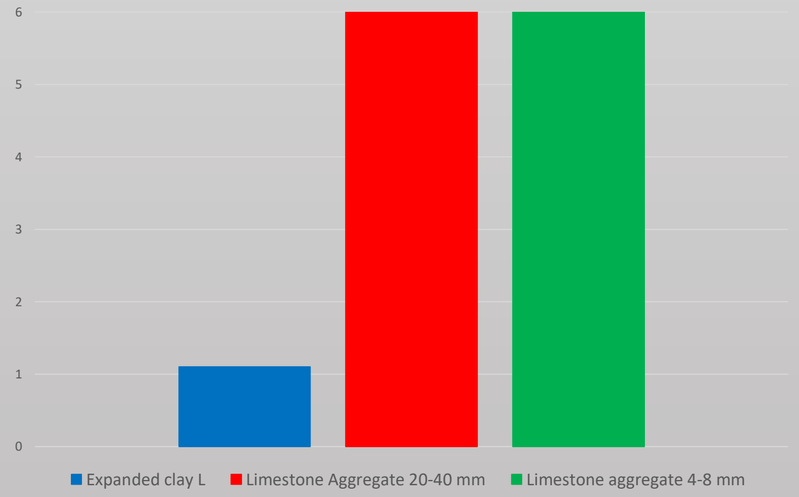
RESULTS AND DISCUSSIONS

Runoff infiltration (L/m2)



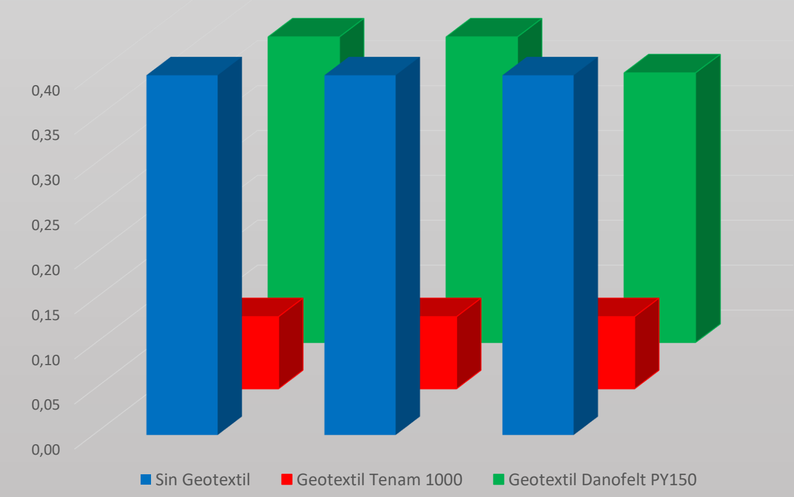
Delay in the appearance of peak flow up to 7-8 minutes from the start and reduction of maximum flow rates during the flood.

Thermal transmittance (W/m2·K)



Low thermal transmittance is equivalent to less heat flowing through the material and will therefore act better as an insulator.

Weight loss (kg)



Terram 1000 geotextile further reduces evaporation. The presence of expanded clay will delay evaporation over time.

CONCLUSIONS

The expanded clay introduced into the subbase layer significantly influences the infiltration rates. Its presence delays the peak flow period by almost two minutes compared to the other materials tested, in addition to reducing surface runoff thanks to its hydraulic capabilities. From the thermal point of view, expanded clay has much higher insulation characteristics than other materials commonly used in this type of drainage system, so it is considered to have a very interesting potential for use as a construction element that allows the accumulation of thermal energy.

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