

# SMALL SCALE INFILTRATION ON PORTUGUESE COBBLESTONE PAVEMENT - FIELD MEASUREMENTS WITH A DOUBLE RING INFILTROMETER -



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## Introduction

runoff recharge at the same time.

### **Materials and methods**

Rapid urban growth helps to The main objective of this study is to evaluate the smallincrease the imperviousness of scale infiltration losses through portuguese cobblestone small scale basins, contributing to paving (the portuguese expression is "calçada à the occurrence of urban flooding. *portuguesa*") by field measurements and laboratory The use of permeable paving in simulations. This pavement usually consists of urban areas helps to reduce surface rectangular hand-cut natural stones, mainly limestone, favouring groundwater and its use is widespread in portuguese towns. In this study, cobblestone pavements with different size of stones (small and coarse blocks) were analyzed (Fig. 1).



Fig. 1 – Blocks density analysis for pavement with: a) small blocks and b) coarse blocks.

#### **Field measurements**

and the second

A double ring infiltrometer, consisting of two metal cylinders sealed to the pavement's surface and filled with water, was used. Two different techniques for simulating infiltration were applied: constant head and falling head (Fig. 2).

#### Laboratory simulations

Joints parallel to the Joints at 45° to the runoff direction runoff direction

1987, 10 consecutive rainfall events of 3

minutes, with a 10 minutes interval,

were conducted.

**Small rainfall** 

simulator

Fig. 4 – Laboratory

equipment to study

the rainfall-runoff

process.



Fig. 2 – Disposal of the equipment: a) and b) falling head test; c) and d) constant head test.



The area occupied by the blocks of Portuguese cobblestone pavement is almost independent of their size and corresponds to about 75% of the paved area.

Figures 5 and 6 shows that, for two of the study sites, the saturated hydraulic conductivity was: 13 mm/h for the coarse blocks pavement and 53 mm/h for the small blocks pavement.

# **Conclusions**

Both field measurements and laboratory tests showed that the coarse blocks pavement promoted lower infiltration rates when compared to the small blocks pavement, for approximately the same joints area.

Keywords: Portuguese cobblestone pavement; Infiltration; Permeable pavements; Infiltrometer; Small rainfall simulator.

The laboratory experiments showed that the runoff coefficient increased strongly with time, since the pavements get wetted with the consecutive rainfall events (Fig. 8).

higher on the pavements with joints at 45° to direction when comparing to the pavements with joints parallel to the runoff direction (Fig 7).

These experiments demonstrate that portuguese cobblestone pavement contributes to reduction of the surface runoff when compared with other impervious surfaces and that the size of the blocks and direction of joints influence the infiltration rate.

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