EXPERIMENTAL PROCEDURE

A series of laboratory tests were carried out at the experimental facility to measure the hydrographs generated by different rainfall events on the roofs, inlets, and outfall. In addition, depths were measured at different points on the surface. The locations and IDs of the measuring points are shown in Figure 1. For further information about measure point coordinates, sensors used, adquisition time and units see the file “measuring_points_info.csv” in folder “06_Hydraulic_tests_dataset”.

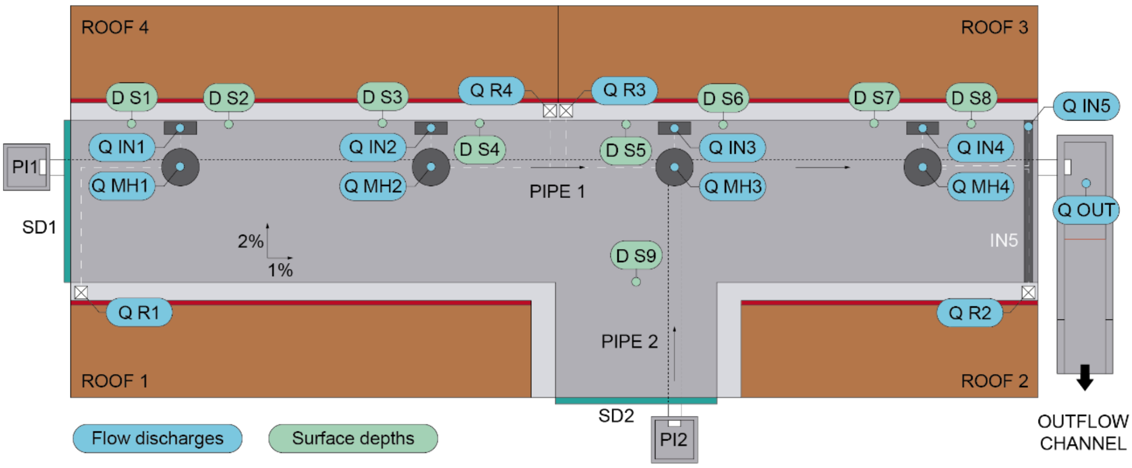

Figure 1. Measuring points in hydraulic experiments.

The experiments consist of 2 sets: Set 1 in which runoff is generated using the rainfall simulator for 6 different hyetographs with different intensity and temporal variability (Figure 2) and Set 2 in which in addition to the hyetographs a runoff discharge of 1 L/s is generated in each of the runoff generators (SD1 and SD2). The hydraulic tests configurations and tests ID are shown in Table 1.

Table 1. Summary of the hydraulic test configurations

	Set 1						Set 2					
	T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**T10**	**T11**	**T12**
Rainfall	H1	H2	H3	H4	H5	H6	H1	H2	H3	H4	H5	H6
Runoff	✕	✕	✕	✕	✕	✕	✓	✓	✓	✓	✓	✓

The laboratory work was divided into three main blocks:

1. **Characterization of the rain:**

   A grid of 325 vessels was located over the facility to generate rain intensity maps based on the mass captured by each vessel during a limited period of rainfall (Figure 3). This procedure was replicated for each intensity generated by the rainfall simulator.

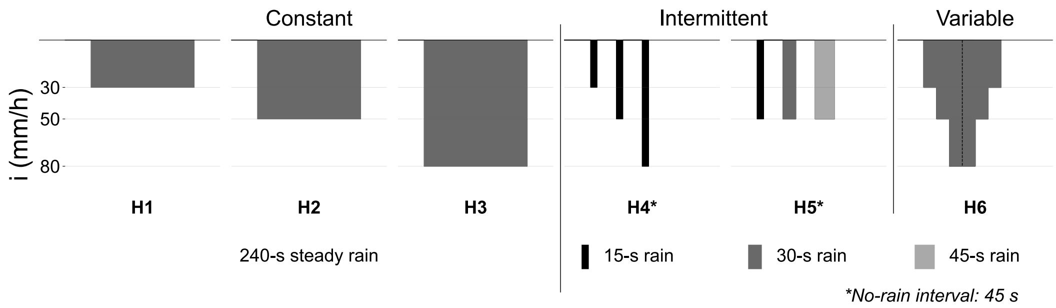

Figure 2. Rainfall hyetographs used in the experimental tests.

Figure 3. Grid of 325 vessels was located over the whole facility to accurately measure rainfall intensity and its spatial uniformity.

2. Topographic survey of the surface and sewer networks:

A high-resolution 3D surface model of the roofs, roads and pavements of the facility was obtained using the Intel® RealSense™ LiDAR Camera L515 sensor and the RecFusion 2.1.0 scanning software (Figure 4). The geometry of the sewer network was obtained using traditional survey methods.

Figure 4. 3D LiDAR reconstruction of roofs and surface (left) using the Intel® RealSense™ LiDAR Camera L515 sensor (right down) and 3D model obtained (right up).

3. Experimental tests:

First, the discharges generated at the outlet of each roof were measured indirectly by recording the depth increments of a water tank located at the end of each gutter (Figure 5a). Then, the flow captured by the inlets was measured using a pre-calibrated triangular weir located at the outlet of the gully pot. The depth at the gully pot was measured with an ultrasonic depth sensor carefully located below the inlet grate (Figure 5b). Similarly, the total discharge at the outlet of the sewer system was measured by recording the water level over a triangular weir (Figure 5c). In addition, depths at different points of the road surface and pipes were measured (Figure 5d). The experiments were carried out for the 6 different combinations of rain hyetographs and different combinations of surface runoff inflows.

Figure 5. Experimental set-up to measure roof discharges (a), inlet discharges (b), outfall flow (d) and surface depths (d).

Further information of the roofs experimental procedure and set up can be found in:

Sañudo, E., Cea, L., & Puertas, J. (2022). Comparison of three different numerical implementations to model rainfall-runoff transformation on roofs. *Hydrological Processes*, *36*(5). https://doi.org/10.1002/hyp.14588