Building flood resistant cities

Popular Science Summary of the report 'A case study of runoff coefficients for urban areas with different drainage systems.'

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In this report, we compare two methods that cities use to manage rainwater and prevent flooding. Modern city planners are using structures such as ponds and parks to make areas more resistant to floods. Read on to find out how these systems work.

When rain falls on a city, the water from the rainwater is usually transported away from buildings, streets and other surfaces as soon as possible using underground pipes. This is meant to prevent flooding. However, these pipes have a fixed capacity and if the rainfall is very heavy, this capacity will be exceeded and the pipes system will flood.

The rainwater that enters the pipe is usually the water that falls on hard surfaces like roads and roofs, which cannot absorb much water. Grassy surfaces and natural soil, on the other hand, can absorb some water. Thus, these kinds of surfaces are being employed by urban planners nowadays to reduce the amount of water entering the pipes, so that they do not overflow. In addition to using natural surfaces, they also use structures like ponds that can store water. These kinds of rainwater management techniques are present above the surface of the ground and are called sustainable drainage systems (SuDS).

The runoff coefficient is an important parameter, which describes what fraction of the incoming rainwater does not get lost in the soil or atmosphere and instead flows out of the area.

The residential area called Eco-city Augustenborg in Malmö uses SuDS as well as a typical pipe system, making it possible to compare the two systems on one site. Measurement stations at different locations on the site, measured the rainfall and the outflow from the area over a period of one and a half years. In this study, we use this measured data to study the differences between how the pipe system and the SuDS operate, which gives city planners some understanding on how to design better systems in the future. We also use the measured data to calculate the runoff coefficient of the hard surfaces (like roofs and tarred roads) and the permeable surfaces (like parks, yards, sand, etc.) in Augustenborg.

Finally, we used a computer model called MIKE URBAN in this project and calibrated based on the runoff coefficients obtained from the measured data. MIKE URBAN is the software used by many city planners to design drainage systems. In this project, we suggest a very simplified way in which measured data can be used to calibrate the model to a satisfactory level.

In this project, we also explain the relationship between different types of surfaces in an urban area that are important for rainwater runoff studies such as this.