REAL TIME CONTROL OF URBAN DRAINAGE SYSTEMS

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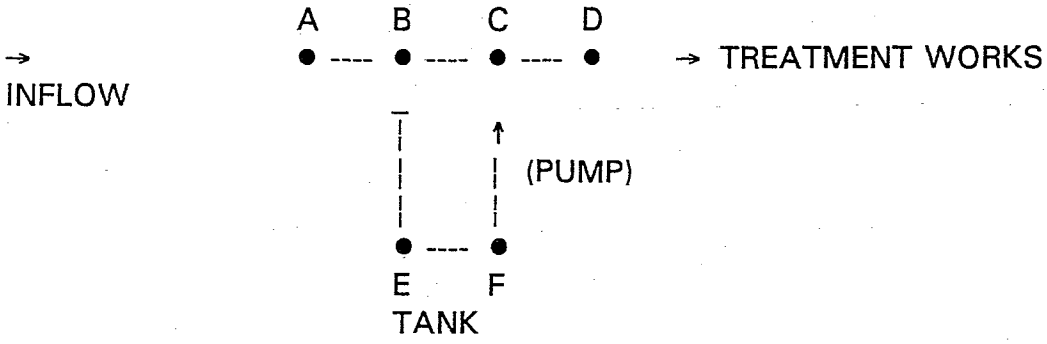
1.0 Introduction

Real Time Control (RTC) has been around for many years. However, Britain has been slower than the rest of Europe to recognise the potential for Urban Drainage Systems (UDS). This is because of the need to justify the cost on economic grounds and the mystery surrounding it.

In this paper we intend to dispel some of the mystery by defining RTC and how it is used. Engineers will be directed to the economic considerations with a view of why we want RTC and its future.

2.0 Real Time Control of Urban Drainage Systems

Real Time Control (RTC) of Urban Drainage Systems (UDS) uses continuous monitoring and control of the flow processes in the system. An UDS is operated in real-time if the data from the continuous monitoring is used to operate flow control devices during an 'event'. To illustrate the basic principals of RTC we can consider the control of the flow to the treatment works, as an example.



In the above system there is an inflow at A and an outfall at D. At point B we are able to divert flow to point E where there is a storage tank. The flow in A-B is continually monitored. When the flow in A-B reaches a set value, part of the flow is diverted into the storage tank at E. When the flow in A-B falls below a set value, the flow to the treatment works is maintained by increasing the return flow in F-C.

3.0 Why RTC

Having understood what is meant by RTC in UDS we can ask the question. Why do we want it?

To get the best out of a system, you need a dynamic solution to a dynamic problem. RTC of UDS is a dynamic solution. The objectives of RTC are to improve performance and reduce hazards; to prevent flooding and overflow into receiving waters before the existing capacity of the system is used up while optimising flow rates to the treatment works. Highly polluted water associated with the first foul flush can be retained and cleaner flow later in the storm can be allowed to spill. By improving the performance of the existing system you can continually minimise the requirements of your design horizon, minimise expensive capital works.

4.0 RTC in SPIDA and Implementation of RTC

SPIDA is a component in the WALLRUS suite that allows for the simulation of flows in complex and looped systems. An RTC option has been developed to allow the modelling of global regulation of continuous regulators. This option has been successfully used, for example, to model proposed detention storage in the Upper Bièvre catchment in the Paris basin.

5.0 The Future for RTC in UDS

The benefits of using RTC in urban drainage systems are potentially very large. However, the problems associated with the design are complex and there is a need to be cautious. The cost of implementing a RTC system must not be allowed to outweigh the cost benefits.

With a view to identifying the cost benefits in using RTC on a particular sewer system, HR have recently started a major research project. The primary focus of the project is to develop a simulation tool and to use it to design effective RTC systems for real catchments. The project, funded by the DoE and HR Wallingford, will run for 4 years. Further details available on request.

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Question

Paul Davies, Chesterfield Borough Council

You seem mainly to be dealing with Reactive Control Systems, what about predictive systems you mention, what if scenarios that will ultimately lead on to optimisation systems, what is being included on the research in that?

Answer

The project covers the development of a simulation tool which can be used to build a planning model of the system. Both control rules and optimisation are included.

However, it is advisable to use control rules to learn and understand the system before applying optimisation.

Question

Dave Walters, MW Barber Group

The control appears to be local control are there plans to integrate it over the whole network? and do you appreciate you are re-inventing the wheel pilot studies have to be carried out?

Answer

The control covers ***both*** *local and global control. An example of local control is the automatic control of a penstock on a storage tank. An example of global control is to measure the flow into the treatment works to control the level of a weir on a storage tank at the head of the system.*

Rainfall can be used to control the simulation. Spatial rainfall is accounted for in the contributing areas. Thesse are allocated rainfall profiles or radar squares.

Other RTC pilot studies have been carried out. However, they have not answered the correct questions. The results are not on general release.