WaPUG Spring Meeting 1990

LABORATORY TESTING OF FLOW REGULATORS

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INTRODUCTION: Flow control devices in sewers are now very common as A. Weedon reported in the last WaPUG meeting that 1500 vortex regulators are in use today. Yet , very little is known about the theory behind theses devices as well as their performance in-situ under steady flow conditions, non-steady flow conditions and with the effects of blockage. A research programme being carried out at the South Bank Polytechnic by D. Butler, P.N. Luu and H. Parsian is aimed at providing information on these problems.

THE TEST RIG: The test rig is constructed within the purpose built hydraulic laboratory (completed in 1971) which includes a low level (3 metres) constant head tank (30 cu. metres capacity) and a large sump (50 cu.metres) with circulation by 3 centrifugal pumps capable of delivering over 100 litres per second. The test rig consists of a mock up of a full size manhole with one face made of acrylic transparency to facilitate observation. The incoming 200mm diameter sewer is fed from the constant head tank some 3m above the invert of the pipe and flow is regulated by a pneumatically actuated butterfly valve interfaced to a computer. Water levels in the manhole are constinuously recorded during testing by an ultrasonic depth sensor. The outflow is directed along an open channel to a Venturi flume to be measured (by depth sensor and computer), then being led to the sump in the basement.

LABORATORY TESTING PROGRAMME: Different types of flow control devices are being tested, beginning with simple ones such as orifices and throttle pipe. Vortex regulators and others will come later. A typical set of tests will include:
- steady state head-discharge relationship
- performance under various hydrographs and flow conditions
- head loss determination
- effect of high tail water (drowned outlet)
- geometry changes including baffle, benching etc.
- testing for "blockability" of the device, tendency to rag up

It is envisaged that one month will be required to test each type of orifice and two for each vortex device, and the testing programme will be completed within two years.

Fluidic aspects of the vortex regulators and other devices will also be studied during this programme.

FIELD PERFORMANCE MONITORING of vortex regulators will be carried out in parallel with the lab testing programme in the London Borough of Haringey .

REFERENCES:

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4. Balford D.J."Design & Operation of outlet controls, Symp. on Development in Drainage, Jan. 1990.

LABORATORY TESTING OF FLOW REGULATORS - P N LUU (SOUTH BANK POLYTECHNIC)

R Long - Scott Wilson Kirkpatrick
Have you any plans to test using fluids containing solids?

Ans: Flow with solids has not been tested, but it is something which should be considered.

J Packman - IOH
Conditions upstream of the flume appeared turbulent in the photographs. Has there ever been any problems with super-critical flow and consequently any problems with depth measurement in the flume?

Ans: These problems have not yet been experienced.

D J Balmforth - Sheffield City Polytechnic
Do downstream conditions allow for drowning of the orifice and have such conditions been tested?

Ans: Yes, these conditions have been tested.

D J Balmforth -Sheffield City Polytechnic
Have the results been checked against the recommended orifice coefficients in the WaPUG user notes?

Ans: No, but it can be done.

A Eadon - Severn Trent Water
What are the objectives of the research, investigation or to produce a design guide?

Ans: Both. We want to study the theory behind regulators as we feel that the theories need investigation. We would like to determine which substances cause blockages. The aims will also become more defined as the research progresses.

Neil Harding - Hertsmere B C
Do you intend to compare your observed results with what WASSP predicts?

Ans: Indirectly yes, we intend to verify (or otherwise) the equations used in WASSP.

M Osborne - HRL
How do you intend to test "blockability"?

Ans: No testing has been carried out yet, but it will probably involve objects of differing shape and size.

T Weeden - Thames Water
From the lack of feedback at last year's Autumn Meeting, nobody seems to be aware of blockages. I am concerned that all testing is being done with clean water, what about testing with sewage?

Ans: I agree we will have to emulate sewage, probably by introducing particles into the flow - there is the logistical problem of recovering the particles.

C Hutchinson - WRc

I believe some work has been done at Sheffield City Polytechnic on a full scale vortex overflow using real sewage, therefore it can be done.

M Osborne (HRL)

Ideally we need a laboratory constructing around a live sewer somewhere! Will you be undertaking any monitoring of actual devices in the field?

Ans: No, we are only checking the design equations.

R Ramsden -Stockport D C

Have you done any work on the shape of orifices?

Ans: We are only looking at circular orifices, common sense tells us that these will be least prone to blockages.
(A circle presents minimum area for maximum opening size).

P Wildbore - WRc

At the Autumn Meeting T Weeden estimated that some 1500 flow regulators are in use in the UK. Has there ever been a market survey to verify this figure?

N Harding - Hertsmere B C

I agree that such a survey is necessary, we should at least know how many are in actual use.