Wallingford Procedure Users Group

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Modelling Ancillaries

by

Professor David Balmforth, Director of the School of Construction
Sheffield Hallam University

Philosophy of Modelling

This is based on three important principles:-

i Ancillaries have an important effect on system performance

ii The modeller must know the performance of the prototype before modelling

iii The modeller must understand the algorithms used in the software

The sensitivity of the model output to ancillary data specification is second only to contributing area data. If the user cannot interpret how an ancillary operates in practice then it is unreasonable to expect the software to be able to interpret it. The key to successful modelling is choosing data that reproduces the same flows and depths in the model as occur in the prototype, even if that means specifying dimensions that differ appreciably from prototype values.

Understanding Ancillary Performance

The process of understanding ancillary performance may be divided into three parts:-

i Collecting information

ii Analysing performance

iii Insitu monitoring of performance

Often, because of pressure on time, the modeller does not collect all the information that may be available. There are a variety of sources of information, including record drawings, design calculations, survey reports, maintenance reports, operations records and information collected during site visits. The latter is particularly important.

The successful modeller will have a basic understanding of hydraulic engineering, and a return to "first principles" is often the best approach User guides, text books and information gained from meetings with other modellers are all useful guides to hydraulic analysis. Calculation of flows and water levels can often be verified by observing the levels of staining on the walls of ancillary chambers.

In-site Monitoring

Occasionally it will be necessary to obtain information on ancillary performance by monitoring. This can be done as part of a flow survey, but the objectives of a flow survey may differ from the objectives of ancillary monitoring to measure performance. The water level in the chamber should always be monitored independently. Upstream flow loggers should be placed well upstream to avoid regions of low velocity and reverse flows occurring near the entry to the chamber as it fills. Flow loggers in overflow pipes often suffer from low depths and it may be necessary to introduce a small weir into the pipe. High velocities downstream of the throttle usually prevent a flow logger being installed Instead a throttle may be calibrated by a "blocking-off" test. Here the throttle is blocked and the chamber is allowed to fill. The throttle block is then quickly released and the falling water level recorded against time. Calculating the storage from the known water level at each time step, and knowing the inflow, enables the head-discharge relationship for the throttle to be calculated. Remember that downstream surcharging can affect ancillary performance.

Understanding the Model

Only through a full understanding of the algorithms used in the model can a successful model of an ancillary be built. Of necessity most numerical models are a simplification of the real situation. Modellers are advised, therefore to avoid complexity in their models.

To understand the model the modeller should,

- i Thoroughly read the user manual and user notes
- ii Attend suitable training courses
- iii Talk to experienced modellers
- iv Thoroughly test their models for the full range of flow conditions, carefully matching the output to known prototype performance.

Some Tips on Modelling Ancillaries

Bifurcations:- The sewer most heavily surcharged downstream should be chosen as the continuation sewer. Duplicate sewers should be modelled as single equivalent pipes. Instabilities may be cured by artificially upsizing the overflow pipe.

Leaping Weir:-	Most of the flow goes to the river; use a high overflow weir coefficient and a low continuation coefficient.
Low-side Weir:-	Don't try to model the chamber geometry. Adjust the weir height and upsize the downstream sewer (see user note 14).
Siphon Overflows:-	Model as a pumped overflow.
Tank Sewer:-	Avoid using the backwater flag, use the level pool effect.
Off-line Tank:-	Prevent short-circuiting by reducing the diameter of the continuation sewer.
Inverted Siphon:-	Model on straight through alignment.
Pumping Station:-	Remember the algorithm ignores surcharging in the continuation pipe
Verification:-	Ancillaries may perform differently with the more severe design-storm events, compared with recorded events used in verification.

END

MODELLING ANCILLARIES, PROF. DAVID BALMFORTH, SHEFFIELD HALLAM UNIVERSITY

Question

Jim Grandison, ADS Environmental Services

In the view of the value of site visits and the importance your paper puts on verification under different flow conditions, what value can be obtained from monitoring all overflows on a continuous basis?

Answer

In the flow survey you need to position monitors so as to evaluate the performance of your key ancillaries. Monitoring to establish how an ancillary performs requires much more careful monitoring than for a standard survey site.

As far as continuous monitoring is concerned 6 - 9 months can be done with fairly standard flow survey monitors and the Arx depth logger. If you are looking at permanent installation then the equipment must be telemetry linked with its own power supply.

There are 3 types of survey:

1. *Normal short term flow survey*
2. *Flow measurement to evaluate overflow performance*
3. *Long term monitoring*

These need different equipment and resourcing.

What is the value to modelling of the long term data?

It depends on the model, if it is a large model for evaluation of high capital cost works then it is worth investing in a good long term flow survey. For a small system it may not be worth while. It again comes back to tailoring the model building and flow survey to the purpose.