FUTURE DEVELOPMENTS IN SHORT TERM SEWER FLOW SURVEY INSTRUMENTATION

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The present transportable instrumentation to measure velocity and/or depth of flow in sewers was specified, designed and built to assist with the verification of the output from WASSP-SIM models.

The manufacturers, Golden River and Detectronics, use the same velocity and depth sensors (ultrasonic doppler and differential pressure transducers) but records the data differently. Golden River senses velocity and depth continuously and records at preset time intervals, usually 2 minutes, whereas Detectronics logs at a longer time interval until a preset threshold level is reached. Then recordings are obtained at a faster rate ie 2 minutes or less. Space Age, another manufacturer, at present produce an acoustic level only device but they are investigating the feasibility of incorporating a doppler velocity device.

All the measurements are recorded, processed and compared with the WASSP-SIM output to highlight gross deficiencies in the model's input data.

The present equipment has been used in pipe/conduit ranging in size from 150mm diameter pipe, measuring less than 10lt/s, upto 3m diameter conduit measuring over $6m^3/s$. This range of flow is too wide for a single instrument.

The accuracy of flow measurement in pipe 300m to 750m diameter should be in the range ± 10 to 20% for flows between 10 to 500lt/s.

The future requirement is to.

1. Measure over the flow range not with a single device but with three. This would be aimed at improving the accuracy of measurement, especially the velocity. The velocity/depth monitors are being designed to fit into:

   a) Pipes **less than 375mm diameter.** This may involve some form of constriction device to be inserted in the upstream or downstream pipe (containing a velocity and/or depth sensor). Remote sensing in small

Because of the small number of loggers the flow surveys have been of the 'sequential' type with short period (2-3 usable event) data collected for representative sub-areas. Simultaneously, flows in the parallel sewers have been monitored over a longer period. In the Flow Survey Manual it is suggested that at least 16 loggers should be used for a system of the size of Dunfermline and that sequential flow surveys should only be used for 'minor' schemes. However, even with the recommended 'fixed time and event dependent' survey one particular storm will rarely cover the catchment sufficiently for the flow to be routed through the entire system, and various parts of the system will need to be verified using different storm events. Thus the impossibility of observing the routing through of an entire storm may not be a significant limitation for the sequential flow survey. The 'saturation' approach of the fixed time and event survey for model verification seems to have become the standard method. This approach is only necessary where either the methodology for flow surveys is being developed or where immediate answers are required for urgent problems. As the use of the simulation model and attendant verification becomes better understood, then longer term but less intense flow surveys could become more appropriate. The building up of expertise in a small team within an Authority, who have a relatively small number of loggers, will eventually lead over a period of time to all of the Authorities' sewerage systems being filed in model form on a computer database.

CONCLUSIONS

In order to economise on data collection programmes there is an urgent need to develop a more universally reliable sewered sub-area model.

The current standard for model verification is the saturation survey method of 'fixed time and event dependence' as recommended in the Flow Survey Manual. This approach is not necessarily the best for all circumstances and may only be the most appropriate until such time as the current urgent problems have been resolved. The sequential flow survey using fewer loggers may become more applicable where sewerage systems are to be modelled for rehabilitation works within longer planned timescales.

Authorities can better develop in-house expertise and achieve a more intimate knowledge of their systems, flow loggers, and simulation models if small teams are designated to develop computer models over longer periods. These teams should collect the sewer data, specify and operate the flow loggers, and set-up and verify the model.

October 1985