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Research Brief

CALIBRATION OF THE SYSOPS COMPUTER MODEL

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The System Operations Model (SYSOPS) is a simulation tool for planning of operations and control of water distribution networks. It is presently installed in a Hewlett-Packard desktop computer of the Metropolitan Waterworks and Sewerage System (MWSS), and is configured to simulate the primary distribution system (PDS). Previous usage has been limited to engineering design due to its uncalibrated state. The NHRC was commissioned by the MWSS to calibrate SYSOPS so that it can be used as envisioned. This research project was started in March 1989.

The PDS consists of a network of numerous large pipes (250 to 3200 mm. in diameter) delivering water from three treatment plants to most of Metro Manila, supplemented by intermediate reservoirs and pumping stations. The pipe network is a mixture of pipe sizes and materials assembled through a period of several decades in various projects. The complexity of simulating such a network is compounded by the present practice of throttling of several valves as part of a water conservation program.

Given treatment plant production, reservoir levels, and pumping schedules, a SYSOPS simulation run computes the discharge in each link and pressure at each node. There are 686 links, a link analogous to a series of pipes, and 522 nodes. Each node is an interconnection of two or more pipes, and it is where demands (consumption) of adjacent consumers are extracted.

Calibration is done by adjusting demands in nodes and roughness coefficients of pipes with the aim of closely simulating flows and pressures measured at gaging points strategically scattered throughout the network. From the numerous existing gaging points of the MWSS, 48 were selected for a measurement program that involved concurrent readings at 12 locations. At each gaging point, discharge was measured using a pitometer inserted into the pipe through a corporation stop cock, with a bourdon type gage attached to a tap for static pressure. The number of available instruments and personnel to do the simultaneous readings governed the breadth of the field measurements.

Actual calibration was done in two levels in accordance with the conduct of the field measurements. The first level set of 12 points were located at pipes 900 mm. and larger. Second level data were for smaller pipes down to 300 mm. and were used for more detailed adjustments. The calibration effort involved more than 40 model runs.

Compared to its uncalibrated state, the model now displays significant increase in discharge simulation accuracy. On the other hand, only marginal improvement with respect to pressure was attained. This is attributed to distortions of pressure distribution by throttled valves which cannot be correctly simulated using incomplete and uncertain data on their openings that were available at the time of measurements.

Nonetheless, the calibrated model is now a more precise tool for planning and engineering design of system improvements. Some operational studies such as exploring the reapportioning of production among the Balara and La Mesa treatment plants can be done. Others requiring detailed pressure distributions need further refinements to the calibration. The NHRC has recommended that the value status data be updated for simulation accuracy. Periodic calibration is desirable because fo sustained expansion and rehabilitation works on the distribution network.