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Measuring Flow Rate through Canal Check Gates

New methods give canal operators more flow control

What Is The Problem?

Irrigation canals have typically been operated to maintain steady water levels in each canal pool. However, to improve water delivery efficiency, today operators are also often asked to control flow rates at key check structures. Typically, this requires constructing dedicated flow measurement structures or purchasing flow metering equipment—often at significant cost.

What Is The Solution?

When dedicated flow measurement devices are not practical, canal regulating gates themselves can be calibrated to serve as flow measurement devices. However, traditional gate calibration methods have had poor accuracy in some flow conditions. Now, new software is improving the accuracy of flow rate calibrations for both radial gates (also called tainter gates) and vertical slide gates commonly used to regulate large irrigation canals.

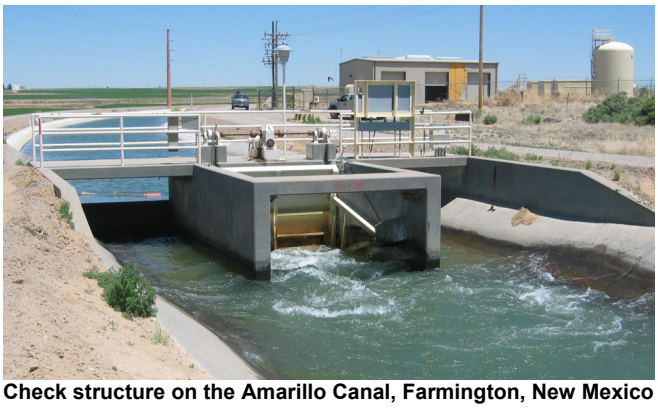
Laboratory testing has led to improvement of the calibration methods incorporated in the new software, increasing flow measurement accuracy for several challenging flow conditions:

- Transitional and submerged flow
- Gates discharging into downstream canals that are much wider than the gate itself
- Nonuniform operation of multiple gates located beside one another in a single check structure

With these improvements, the measurement accuracy obtained from calibrated gates can approach that of dedicated flow measurement devices. This saves money and also provides flow measurement capability to canal operators at exactly the most useful location in the canal system, the point of flow control.

Who Can Benefit?

The new WinGate software will be useful to operators of open-channel water delivery systems controlled by check structures containing radial gates or vertical slide gates. Gates may need to be improved by adding gate position sensors and upstream and downstream water level sensors. However, in many cases, this equipment is already installed. Some field investigations may be needed to account for the type and condition of the gate seals, which can affect the flow measurement calibration.



Check structure on the Amarillo Canal, Farmington, New Mexico

Where Have We Applied This Solution?

Early versions of the WinGate software have been used during field testing for canals and radial gates on the Navajo Indian Irrigation Project (Farmington, New Mexico). Beta testers of the software have used it effectively on the Coachella Canal and the All-American Canal. Researchers in Spain have also applied the gate calibration method in WinGate (the Energy-Momentum, or E-M method) to vertical slide gates.

Future Development Plans

Recent laboratory scale model test data for radial gates are being used now to make further improvements to the Energy-Momentum calibration method, and those improvements are being incorporated into WinGate at this time. A journal article describing the latest work was submitted for review in the summer of 2011.

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Collaborators

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