RECLAMATION Managing Water in the West

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The Knowledge Stream
Research Update

Simplified Overshot Gate Development

Overshot gates that irrigation districts can construct themselves

Bottom Line

Irrigation districts can construct these gates and maintain them using commonly available tools and techniques.

Better, Faster, Cheaper

These overshot gates are less expensive than commercially available gates and can be tailored to an irrigation district's needs and fabrication capabilities.

Principal Investigator

Tom Gill
tgill@usbr.gov
303-445-2201

R&D Office Contact

Miguel Rocha
Science and Technology Program Coordinator
mrocha@usbr.gov
303-445-2841

Collaborators

Reclamation:

- **Science and Technology Program**
- **Nebraska-Kansas Area Office**
- **Dakotas Area Office**

External:

- **New Mexico State University**
- **Buford-Trenton Irrigation**
- **Nebraska Bostwick Irrigation**
- **South Platte Ditch Company**
- **Tucumcari Irrigation District**
- **Carlsbad Irrigation**

Problem

Control structures in irrigation canals raise the upstream water surface elevation to deliver water into lateral canals or farm turnouts. Irrigation districts have historically preferred stoplog controls (wooden planks) as control structures. As flows pass over the top, stoplog controls enable floating debris to pass on downstream, reducing maintenance. They also provide for better control of flows than controls structures pass flows under the structure (such as sluice gates), as there is less variation of the upstream water level as the flow rate moving through the canal changes.

In typical control operations, stoplogs are stacked in slots up to a height that will raise the water level to a desired elevation. The portion of flow continuing downstream past the check passes over the stoplogs. Since stoplogs must be physically installed or removed, this type of control is not readily adaptable for automated or remote control operations.

As water districts seek to adopt modernized canal operating technologies, they commonly face the need to upgrade stoplog controls. Stoplogs must be replaced with gates that can be readily motorized to be compatible with automated or remote control operation. Overshot gates offer a way to maintain the advantages of over-the-top flows offered by stoplogs. However, the various commercially produced overshot gate systems available represent a level of investment that can prevent many irrigation districts from considering adoption of modernized canal technologies beyond anything more than a demonstration-level scale.

Solution

This Science and Technology Program research project is partnered with cooperating irrigation districts and the Water Conservation Programs at Reclamation's Dakotas and Nebraska-Kansas Area Offices to establish field demonstration sites for self-constructed overshot gates. Each of the prototype overshot gate installations in this project have been configured for simple construction and installation at the existing structures. Additionally, we used differing gate operating mechanisms at the various sites to suit the cooperating districts' preferences and fabrication capabilities.

Application

We constructed and installed prototype overshot gates at:

- South Platte Ditch Company near Merino, Colorado
- Nebraska Bostwick Irrigation District near Red Cloud, Nebraska
- Buford-Trenton Irrigation District near Trenton, North Dakota

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At all the demonstration sites, overshot gates were fabricated for installation in existing stoplog bays. All gates are powered by solar-charged 12-volt DC motors. All of the demonstration site gates are set up for local manual operation and for automated/remote operation. The remote terminal units can be programmed to adjust a gate automatically or for a gate to be operated.

Figures 1, 2, and 3 show overshot gates installed at Buford-Trenton Irrigation District, at Nebraska Bostwick Irrigation District, and at the South Platte Ditch Company, respectively. These overshot gates, which were built using in-house capabilities and equipment at the respective districts, are able to fully meet operational objectives of the cooperating districts.

In figures 1 and 2, rubber belting is attached to the sides of the overshot gate leaf to seal against concrete piers on each side of the bay of the control structure. The overshot gates at these sites are simply a steel gate leaf with the upstream edge hinged to the floor of the structure and a lifting system attached to the downstream gate edge. The existing control structure in figure 3 features wide flange steel sections installed vertically to form the stoplog slots. Bottom and side sheets constructed of steel plates were required for this overshot gate, which was designed as a "drop-in" structure to install in the existing stoplog slots.

These overshot gates are a cost-effective option for districts. For example, the "drop-in" style 4-foot-wide gate shown in figure 3 was constructed and installed (including the 12-volt DC actuator) for approximately $3,000, or about $750 per foot of width. This compares with commercially produced overshot gates in the cost range of $2,500 per foot width.

Figure 1: Burford-Trenton Irrigation District.

Figure 2: Nebraska Bostwick Irrigation District.

Figure 3: South Platte Ditch Company.

"The overshot gate on our spill structure fully meets our needs at a fraction of the cost of a commercially built gate. With the linear actuator, the gate is SCADA ready and will be automated for upstream level control."

Charlie Bartlett,
South Platte Ditch Company
Board Member

Future Plans

Reclamation researchers are working to develop a "standardized" materials list and general design methodology that will be suitable for fabricating overshot gates over a range of gate sizes for "drop-in" installations in existing stoplog bays in irrigation canal check structures. We are working in cooperation with a research team from New Mexico State University to further refine the overshot gate design concept with planned demonstration sites at Tucumcari Irrigation District and Carlsbad Irrigation District.