OHIO DEPARTMENT OF TRANSPORTATION

Stream Channel Maintenance at Bridge Crossings in Ohio

Collaborative Approach Leads to Innovation and Implementation

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The Ohio Department of Transportation (DOT) has increased the involvement of districts and counties in the research process during the past five years. By soliciting ideas and encouraging collaboration between the central office, the districts, and the counties, Ohio DOT has solved significant problems effectively through research projects, often gaining a large return on the investments.

In addition to the cost savings, collaborative research projects often have improved morale and a sense of job ownership among participants. Collaboration between Ohio DOT and a multidisciplinary research team was a key to the success of a research project on alternative stream channel maintenance at bridge crossings (*1*).

Problem

Streams are dynamic. Natural processes, such as bank erosion and sediment deposition, are necessary for a healthy stream system. The movements and adjustments of streams, however, often create problems at crossings with bridge structures, which must remain in a fixed location. Typical problems at bridge crossings include the following:

PHOTO: RICHARD W. SHATZER, OHIO DOT

Stream vanes constructed of precast concrete block at the SR-20 bridge over Bean Creek in Fulton County, Ohio.

- Deposition of sediment upstream of a bridge—this can misalign the flow through the opening and can affect the conveyance capacity of the structure;
- Incision of the channel, which can expose the foundations of the abutments and piers; and
- Lateral migration of the stream banks, which can lead to erosion.

Throughout the state, crews from Ohio DOT counties routinely maintain stream channels to minimize the impact of stream dynamics on bridges. Generally, district and county crews have relied on labor-intensive practices to remove debris jams, to dredge the sediments that have accumulated at bridge openings, and to armor stream banks and the structural components of bridges that are affected by erosion.

These measures are rarely sustainable, however, and many require frequent and costly maintenance that can become a burden to county forces and can lead to allowable, but repeated, impacts on the environment. Ohio DOT sought solutions from the stream engineering community—such as natural channel design practices, as well as tools—to assist district staff and county crews in solving maintenance issues.

Solution

Ohio DOT worked with the research team to accomplish the following:

- Assess the skills of county maintenance forces,
- Inventory the construction equipment available to county crews, and
- Evaluate the accessibility of specialized construction materials.

With this information, the research team identified a viable subset of the stream channel maintenance practices described in Federal Highway Administration manuals (*2*) and in the peer-reviewed literature (*3, 4*). The researchers discussed potential solutions with Ohio DOT staff and together selected

FIGURE 1 Examples of natural channel design practices explored by Ohio DOT researchers (*clockwise from top left*): single-arm vane, cross vane, W-weir, and two-stage channel.

specific practices and construction materials for field testing. The team developed preliminary designs for nine project sites; through an iterative process, Ohio DOT and the research team refined the proposals.

The selected practices included single-arm vanes, cross vanes, W-weirs, and two-stage channels—all common in stream restoration. The team made minor modifications to adapt the practices for installation near bridges. Tests on alternative construction materials included tied concrete matting, concrete cloth for slope stabilization, and concrete blocks as a substitute for the irregularly shaped quarried limestone boulders typically used in vane structures.

Application

Pilot projects were implemented at eight sites in Ohio DOT Districts 2 and 3. Five sites received vane structures; one site implemented the two-stage channel design; and five of the sites used slope stabilization and new construction materials.

The implementation in Wayne County on State Route 83 at Savage Run provides an example of the success. The deposition of sediment at the site had partly blocked the bridge opening and had misaligned the stream flow, causing erosion at the upstream wing wall—that is, the retaining wall next to the abutment. The poor alignment also caused sediment deposition downstream of the bridge, and this was affecting the conveyance capacity of the opening.

Multiple attempts to protect the abutments included riprap and grouted riprap, but additional maintenance was still necessary. Ohio DOT staff and the research team decided on a single-arm vane structure to guide the flow away from the eroding embankment, to align with the bridge opening.

Ohio DOT staff suggested constructing the vane with large concrete blocks, which are cheaper, readily available, and structurally superior to the quarried limestone blocks typically used. The work was completed in three days, and after two years, the vane continues to meet the objectives of the project.

Benefits

The collaboration between Ohio DOT and the research team led to improvements on many projects and promoted acceptance of unfamiliar maintenance practices and of new construction materials. Actual project costs were less than originally estimated—for example, by approximately 75 percent on two of the vane projects. This was attributable to the use of innovative construction materials, the purposeful avoidance of challenging conditions—such as high stream flows—and the high level of skill and dedication of the county maintenance crews that implemented the projects.

In addition to the welcome cost savings, the most significant benefit from this project was the collaboration—not only between the central office, the districts, and the counties but between the environmental, hydraulics, structures, and other offices. County forces have recommended that the department be proactive in the design of bridges; this led to a joint meeting of the department administrators from environmental, hydraulics, and structures to determine how to move forward with what would be a major cultural change.

This project demonstrated the agency's guiding concept of one DOT—research determined the funding and the direction, the districts and counties defined the problems, and all of the agency worked together to create and implement the solutions. Stream Channel Maintenance at Bridge Crossings is one of several projects that have taken this collaborative approach to problem solving through research.

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Suggestions for Research Pays Off topics are welcome. Contact Stephen Maher, Transportation Research Board, Keck 486, 500 Fifth Street, NW, Washington, DC 20001; 202-334-2955; smaher@nas.edu.

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