

JOINT TRANSPORTATION RESEARCH PROGRAM

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Approaches to the Design of Biotechnical Streambank Stabilization

Volume I—A Guide to the Literature

Introduction

Streambank stabilization has traditionally been performed with riprap or other hard-armor techniques for which reliable design and installation procedures are available. Due to concerns about the environmental impact of riprap and the consequent regulatory pressures, the Indiana Department of Transportation (INDOT) is interested in finding softer, more environmentally sensitive alternatives to the pure hard-armor approaches. This report examines the literature on biotechnical approaches, which emphasizes the use of vegetative elements, possibly in combination with hard-armor elements. Documents of particular interest would be those helpful in formulating detailed design guidelines for the application of biotechnical techniques to Indiana conditions, and, specifically, INDOT projects.

Findings

The review found a large body of literature related to biotechnical engineering of slopes and/or streambanks. These were divided into (i) works of synthesis, frequently monographs or federal and state agency reports and manuals, including those of state departments of transportation, that discussed a broad range of topics, often reviewing the previous literature (up to 2003), and (ii) works of narrower scope, frequently recent (2003 and after) articles in research journals but also sometimes federal agency publications with a very specific focus. For the present purposes, the works of synthesis were more useful as they usually presented a consensus view of the issues and had more immediate implications for design. In addition to providing

detailed descriptions of various techniques, such as vegetated mechanically stabilized earth (also known as soil lifts) and live staking, they also discussed the selection of techniques for different conditions. A number of short works, mainly originating from the U.S. Army Corps of Engineers and devoted to a single technique, were also identified.

From the review, several points might be highlighted:

- Prior to any design of a bank stabilization scheme, whether hard-armor or biotechnical, project goals should be clearly formulated, fluvial geomorphology aspects should be considered to assess the extent to which a local solution will be adequate, and the main mechanisms of bank movement should be identified.
- The toe zone often represents the region critical for the success of bank stabilization (whether by hard- or soft-armoring techniques) and merits special attention.
- A biotechnical strategy combining hard and soft elements will likely be the most widely applicable and more conservatively reliable approach.

Implementation

The results of this literature review will be implemented

- in developing draft design guidelines and standards for INDOT,
- as a reference for INDOT Engineering Services and Design Support, and
- by its broader dissemination through INDOT Environmental Services.

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