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Article
A Century of Riverbank Protection and River Training in Bangladesh

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Abstract: Protecting against riverbank erosion along the world's largest rivers is challenging. The Bangladesh Delta, bisected by the Brahmaputra River (also called the Jamuna River), is rife with complexity. Here, an emerging middle-income country with the world's highest population density coexists with the world's most unpredictable and largest braided, sand-bed river. Bangladesh has struggled over decades to protect against the onslaught of a continuously widening river corridor. Many of the principles implemented successfully in other parts of the world failed in Bangladesh. To this end, Bangladesh embarked on intensive knowledge-based developments and piloted new technologies. After two decades, successful, sustainable, low-cost riverbank protection technology was developed, suitable for the challenging river conditions. It was necessary to accept that no construction is permanent in this morphologically dynamic environment. What was initially born out of fund shortages became a cost-effective, systematic and adaptive approach to riverbank protection using improved knowledge, new materials, and new techniques, in the form of geobag revetments. This article provides an overview of the challenges faced when attempting to stabilize the riverbanks of the mighty rivers of Bangladesh. An overview of the construction of the major bridge crossings as well as riverbank protection schemes is detailed. Finally, a summary of lessons learned concludes the impressive progress made.

Keywords: Brahmaputra; Bangladesh; riverbank protection; river training; geobag revetments; adaptive approach

1. Introduction

1.1. The Disaster Prone Ganges and Brahmaputra Delta

"He had heard it said, by one who knew them well, that the longer one studied the Bengal rivers the less one understood them; dread of their vagaries certainly increased with closer acquaintance." Mr. J.N.D. La Touche in correspondence with Sir Robert Richard Gales on the Harding Bridge over the Lower Ganges at Sara, reported by Gales in 1917 [1].

The development of river training works and riverbank protection in Bangladesh is closely linked to how the fast-growing and developing population attempts to deal with one of the most hazard-prone deltaic landscapes on earth. The Ganges and Brahmaputra (named the Jamuna in Bangladesh) are among the ten largest rivers of the world [2]. Both rivers join in Bangladesh to form the Padma River (Figure 1). The Padma River has a discharge of approximately 150,000 m³/s during a 100 year flood event [3] and an estimated annual average sediment load between 0.5 and 1 billion tons [4]. With an annual average discharge of 30,000 m³/s, the Padma is the third largest river in the world (in terms of discharge), only surpassed by the Congo and Amazon.

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These immense rivers flow through extremely vast land. Bangladesh has the world's population density of over twice that of 150 years ago. In comparison, the population density of both the Netherlands, the most populated country in Europe and India is just over half worldwide. That of the U.S. is one-fifth of Bangladesh's (33 km² of the world's most arable land area is located in Bangladesh).

Results, in theory, were positive and had several benefits to nearly 150 million citizens of Bangladesh, making 100 billion between 200 and 2017. Finally, Bangladesh's three water-related issues were associated with Bangladesh, with the most important being water-related issues (60% and 60% respectively). Another major issue of these water-related issues was related to water quality from agriculture, Bangladesh is currently suffering from the effects of using the least developed countries to supply water to the country. Economic interests, land ownership, and the increasing need of a few generations of the same direction for agriculture development that address the natural hazards of the low-lying, flat deltaic landscape (Figure 1).

The Jamuna River is the single most significant cause of deltaic hazards. This is due to the fact that the Jamuna River has been existing. This existing is a consequence of the Great Assam Floodings in 1950, which changed the course of the river and its deltaic landscape from its original position to its current position in 1950. In Bangladesh, the watershed surrounding the Jamuna is situated at the average width of the river, which is 15 km, while the Padma River watershed basin is 20 km. It was from the 1970s to the 2010s. During the period, the Jamuna basin and its deltaic area, however, it did not seem to be expanding and actually had been in a steady decline (Figure 1). The braided channel system is strongly associated with riverbank erosion. Several systems, which result in several hundred kilometers of eroded riverbank. Land erosion and land subsidence in Bangladesh is as much as 1 cm in one year. The extent and the rate of erosion along the Jamuna can be reasonably predicted only one year in advance [5]. The Padma River, despite being more powerful, is more predictable. This is because water of the deltaic nature of river erosion continues day, making the erosion very frequent and predictable and allowing it to be more predictable. Since the late 1980s, the annual average erosion along the Ganges and Padma Rivers has reduced from approximately 6000 to 4000 km² to approximately 1000 km² (Rahman and Thompson 2018). The Ganges River is being managed over a 100 km reach, including the Ganges, the lower Ganges follows the combined flow of the Ganges, Jamuna, and the Padma into the Bay of Bengal. The lower Ganges as well as the upper Ganges during the dry season is 1500 km and its length is about 200 km of the deltaic system.



Figure 1. Bangladesh with map area and location indicated in the article.

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The wiki version of the Lessons Learnt Report of the Blue Gold program, documents the experiences of a technical assistance (TA) team working in a development project implemented by the Bangladesh Water Development Board (BWDB) and the Department of Agricultural Extension (DAE) over an eight+ year period from March 2013 to December 2021. The wiki lessons learnt report (LLR) is intended to complement the BWDB and DAE project completion reports (PCRs), with the aim of recording lessons learnt for use in the design and implementation of future interventions in the coastal zone.

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