# RIVER REGULATION WORKS FOR NAVIGATION IN BRAIDED CHANNELS

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## 1. INTRODUCTION

The Ayeyarwady River (length 2170 km; average width 1200 m; drainage area 413710 km$^2$) in Myanmar is the major river transportation route and contributes to the Myanmar economy. It is a melt water and rain fed (south-west monsoon) river. Water levels between dry and wet seasons vary up to 13 meters. This variation in water level and planform changes of the river with numerous sandbars create not only navigational problems in the river but also floods in the cities by disrupting the flow in the rainy season along the river. The objective of river regulation works is to provide the desired channel dimension and alignment with little or no maintenance dredging. The proper use of dikes and revetments can achieve this objective.

## 2. BACKGROUND INFORMATION FOR WATERWAYS AND REGULATION WORKS IN THE AYEYARWADY RIVER

Most of Myanmar Rivers are used for navigation and in domestic water supply and agriculture. The most heavily used for waterways is the Ayeyarwady River and its delta. The navigable length is 1534 km.

It is monsoon-dominated river, with high discharges of around 30,000 m³/s in wet season and low discharges in dry season around 3,000 m³/s.

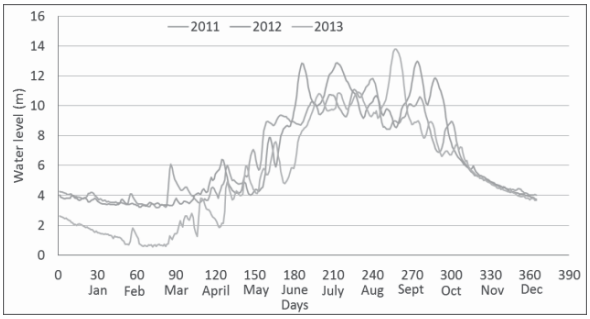


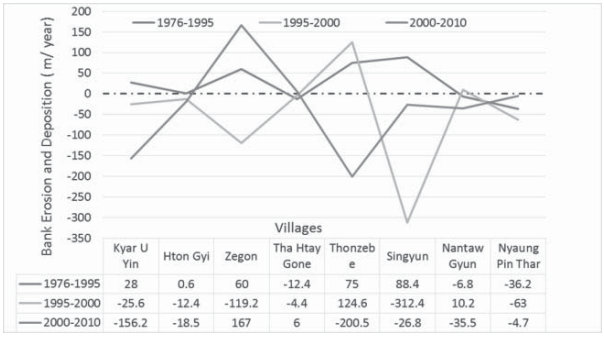

Fig 1. Water level at Sagaing station

From the (Fig.1), it can be seen that the water level differences are large throughout the year. The highest water level reaches during May to October and falling stage starts at November. As a result of small discharges during the dry season, water depth can drop to levels for which barging become problematic. The existing river training works are insufficient to meet the present situation of national demands.

## 3. BANK EROSION AND DEPOSITION

The villages upstream of the study reach (Fig.2) where bank erosion and deposition (Fig.3) is estimated by using the satellite images (1976 to 2010).


Fig 2.Location of the villages




| | Kyar U Yin | Hton Gyi | Zegon | Tha Htay Gone | Thonzebe | Singyun | Nantaw Gyun | Nyaung Pin Thar |
|---|---|---|---|---|---|---|---|---|
| 1976-1995 | 28 | 0.6 | 60 | -12.4 | 75 | 88.4 | -6.8 | -36.2 |
| 1995-2000 | -25.6 | -12.4 | -119.2 | -4.4 | 124.6 | -312.4 | 10.2 | -63 |
| 2000-2010 | -156.2 | -18.5 | 167 | 6 | -200.5 | -26.8 | -35.5 | -4.7 |

Fig 3. Bank erosion and deposition along the river

Both deposition and erosion had taken place, it can

be concluded that bank erosion is more predominately upstream of the study reach. The river flows with braided pattern with large sandbar and shifts to the left eroding the bank near Mandalay. Sandbars are formed along the river and getting bigger and bigger year by year. These sandbars clog the water flow and reduce navigable depth and width of the river.

Therefore, it is necessary to evaluate the performance of river regulation work to improve not only for the navigation but also for extreme events mitigation in braided channel.

## 4. RESULTS AND DISCUSSION

The difference in the water level of the Ayeyarwady River between wet season and dry season is around 13 m, which is fairly large. Two dimensional bed deformation analysis which can treat suspended sediment is conducted to evaluate river bed deformation on braided channel. The river bed deformation analysis is carried out under 2 cases such as without dike and with dike installation. The locations of bank and dikes are as shown in (Fig.4).

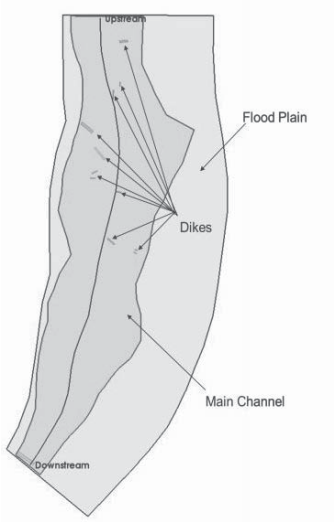



Fig 4. Computational domain and locations of dikes

The results of bed deformation and water depth are as shown in Figs.5 and 6. In case of without dikes simulation, it can be seen that the local sediment problems are deposition in navigation channel and then the channel is braided more. On the other hand, if the dikes are installed along the channel, the water surface level near Mandalay rises up. Small bar is subsequently formed downstream of the dike, therefore, the erosion in channel bed (thalweg) is occurred. It is good to maintain a navigable depth.

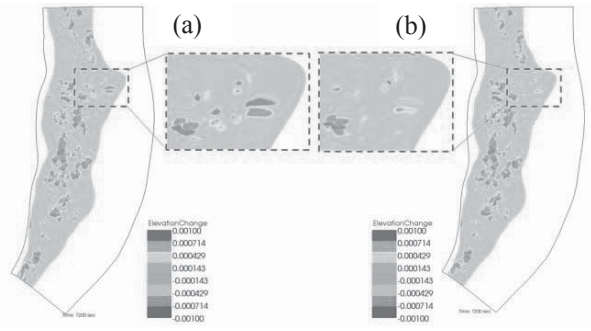



Fig 5. Contour lines of bed elevation change (a) without dikes and (b) with dikes

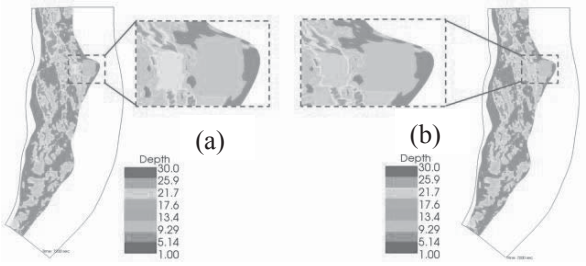



Fig 6. Contour lines of water depth (a) without dikes and (b) with dikes

## 5. CONCLUSION

Dikes are the useful to change the river flow direction and have been used in Myanmar to keep navigation channel. However, the location and the shapes of the dikes are decided on the basis of engineer's experience. These dikes would be effectively reduced the dredging frequency. In order to set dikes in braided channels under high suspended concentration to keep the navigation channel, the spatiotemporal change of braided channels under the high suspended load must be clarified.

**References:**

(1) DWIR (2009 Sept). Information Booklet and report for waterway in Mandalay Region

(2) Simmance, A. 2013. Environmental Flows for the Ayeyarwady (Irrawaddy) River Basin, Myanmar. Unpublished. UNESCO-IHE Online Course on Environmental Flows