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Probability Based Approach for Predicting Breach Width for Barak Valley, Assam

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Abstract:
Embankment breaching is a matter of serious problem in Assam. Along with the problem of embankment breaching, problem of sudden flood, embankment erosion occur. Very few works have been done on embankment breaching, especially in Barak Valley. Several breach records for the river dike of Barak Valley have been collected. Based on the available data, an attempt has been made here to analysis the probability of occurrence of different breach width.

Keywords: Embankment breaching, breach causes, frequency curve, probability analysis.

I. INTRODUCTION:

Embankment structures are man-made structures; most of the earthen embankments were built up of cohesive soil or impervious soil, mostly to provide flood protection or from flood water level of some magnitude. Propagation of flood wave on downstream of the river dike depends to a great extent on the way the dikes fail. The embankment suffered damages due to rain-cut, sliding, leakages, piping, sloughing, slumping down etc., the embankment section became inadequate to withstand the flood pressure at several reaches. As soon as the flood season approaches severe bank erosion along with erosion at toe and slope of embankment has started.

II. LITERATURE REVIEW:

Based on some literature review embankment breaching study and breach analysis have been done: Von Thun, Gillette, et al (1990) [7] and Mac Donald, T.C and Langridge-Monopolis.J (1984) [6] analysed various dams failure by empirical equations and calculated breach width at mid-height, side slope angles and failure time for assumed trapezoidal breach dam and also developed graphical relationship for predicting breach characteristics on dam erosion. Froehlich,D.C., (1995a) [3], (1995b)[4] analysed 22 dam failures and 63 embankment failure cases using regression method and developed new empirical equations for estimating peak outflow for breach dams, for for estimate average breach width, side slope ratio and breach formation time. Fread D.L., (1998a) [1], (1998b)[2] describe the algorithm and a user's manual for running simulation in DAMBRK model and BREACH model. Gogoi.L and Borpujari.C (2014) investigate the bank line erosion in Majuli Island and some protective measures for reducing the impact have been suggested.[5]

III. EMBANKMENT BREACHING PROBLEM IN BARAK VALLEY:

It is observed that, severe bank erosion (for e.g embankment breaching occurs in Longai River on 2015 due to erosion as shown in figure1) and overtopping took place during the past few years. On observation, it is seen that due to concentration of velocities along the outer curve, the bed has been scoured deep. The flow through these deep channels with concentrated velocities is hitting on the bank obliquely for which acute bank erosion is take place. The situation has been further aggravated during high flood of 2006 and 2010. The deep channel flow line of river has been sifted near the bank and thereby formation of vertical eddies and churning of bed materials was observed and which also aggravates in sliding down. Moreover, there has been acute sloughing of the bank of the river due to profuse seepage action in country side. It is observed that the intensity of sloughing is increasing every year and now the rivers are threatening.

Figure .3.1: Breaching occur in Longai River due to erosion

IV. STUDY AREA:

The Barak Valley is also known as south Assam is located in the north eastern part of India and the total area covers 3786 sq kms. The north eastern part of India gets flood almost every year due to heavy rainfall. Due to frequent occurrence of flood causes serious problem of failure of river dikes. Barak River, Sonai River, katakhal River, Longai River, Shingla River, Kushiyara River are the important rivers of Barak Valley.

V. DATA ACQUISITION FROM RECORDED EMBANKMENT BREACHES:

Breach records have been collected of river dikes of Barak Valley, Assam from 2006 to 2016, breach records of eleven years have been considered.

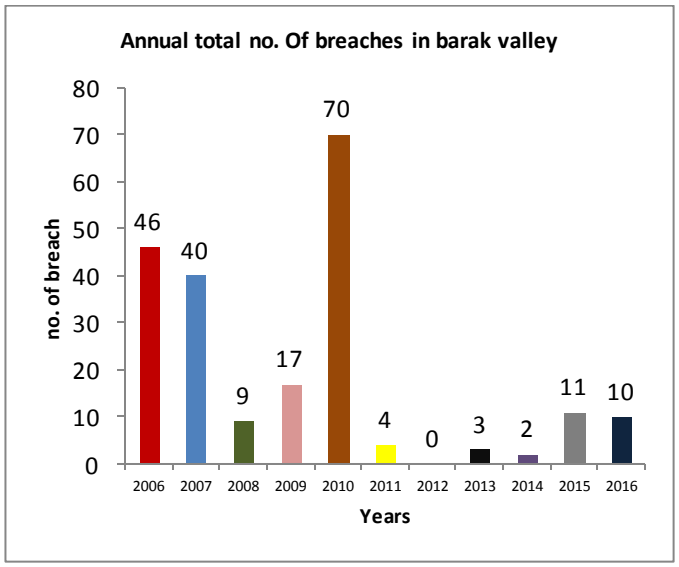

Figure. 4.1: Number of breaches occurs annually from 2006-2016

The number of breach occur per year from 2006 to 2016 is shown in the figure2. It has been observed that from 2006 to 2016, the highest number of breach occur in 2010 and highest flood level recorded at 2010. Due to such flood waves along with high velocity, many reaches sustained damages in the form of erosion, overtopping, sliding, sloughing, leakage etc. along the river course. In the year 2010, it is recorded that water level is above the danger level and sever erosion along with continuous sloughing in various places threat of great disaster.

VI. EMBANKMENT BREACHING IN BARAK VALLEY 2006-2016 AND ITS CAUSES

From the collected data i.e from 2006-2016, the percentage of different types of failure causes have been calculated as shown in the table below:

Table .6.1: Percentage of different breach causes

Sl. No.	Causes	Percentage
1	Hydraulic failure	74.50%
	a. Overtopping	57.07%
	b. Erosion	17.07%
2	Seepage	8.40%
3	Sloughing	6.13%
4	Others	11.33%

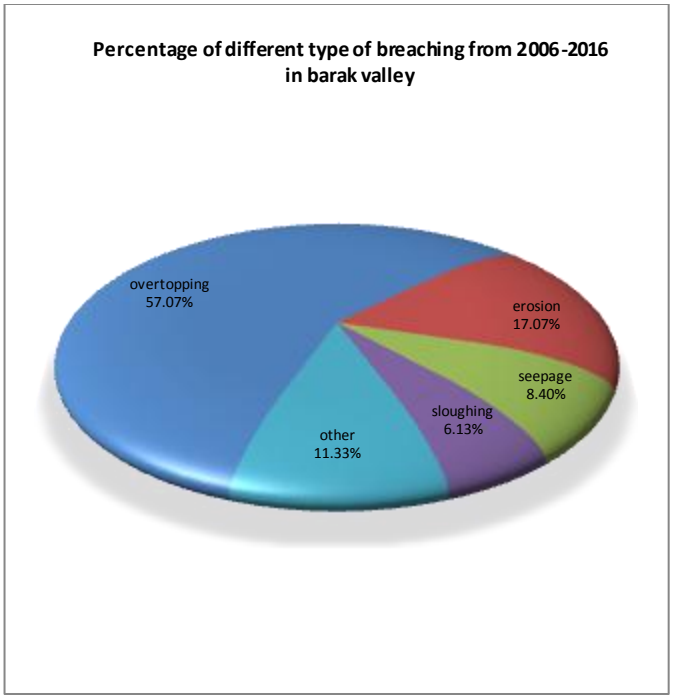

Figure 6.1: Percentage of different types of breaches from 2006-2016 in Barak Valley

From collected data i.e from 2006 to 2016, it is observed that majority of failure occur due to hydraulic causes (74.50%) out of which 57.07% of failure is mainly due to overtopping. Due to continuously rain in the catchment and heavy siltation in the river bed occur unexpected flood; due to imperfection of river dike overtopping occur. In case of meandering river, strong current, causes erosion failure (17.07%) and 8.40% of failure is occur due to seepage/leakage either at toe or through dike section or foundation.

VII. PROBABILITY BASED APPROACH FOR PREDICTING BREACH WIDTH:

It has been observed that from the collected breach failure data, the ranges of breach width from as small as 4m to as large as 380m. Therefore, probability based approach has been adopted for predict the breach width.

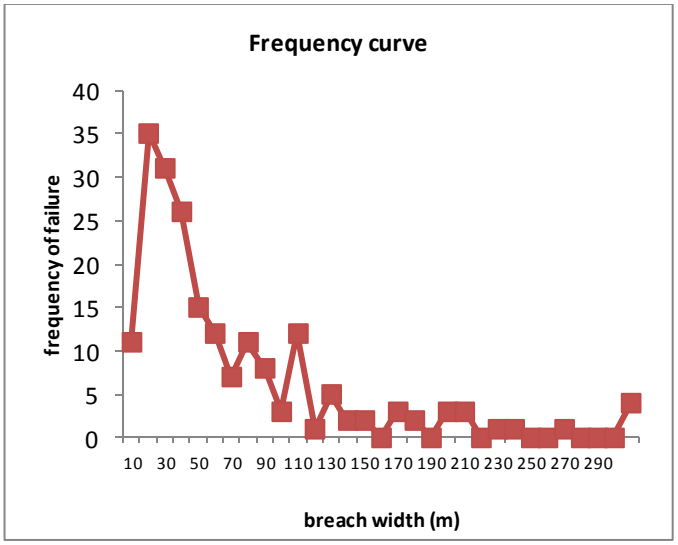

Figure .7.1: Frequency curve of breaching with respect to breach width

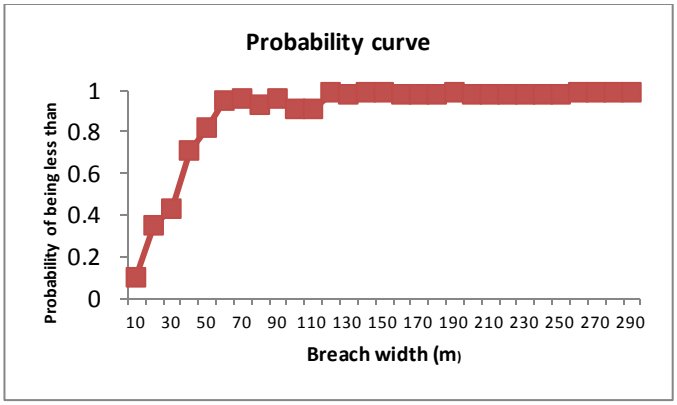

Figure 7.2: Probability curve of breaching with respect to breach width

From the frequency analysis curve, it is clear that most of the failure occur between 10-50m breaches widths. On the basis of available data, probability of breach width being-less-than upper limit of the class value has been calculated, with 50% probability the breadth width is less than 30m, and with 60% probability the breach width is less than 40m and so on so forth. Higher value of probability means enlargement of breach width but it occur in very rare cases.

VIII. CONCLUSION:

The proposed model of dike breach prediction, probability of "being-less-than-the-breach-width" is considered. For predicting the breach width, data series has been collected from 2006-2016, of different rivers and tributaries of Barak Valley.

IX. ACKNOWLEGEMENT

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