Analysis and Design of Check Dam For Medium Flow River

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Abstract- *Designing of Check Dam is one of the serious and important project for civil engineering .But with proper knowledge and data a stable Check dam can be designed to meet the necessary requirements. Also while designing one should design it in a economic manner. Designing of check dam unnecessarily big may result in wastage of investment and resources. So the proper analysis of site is relevant. So in this project a proper analysis of Mahanadi river basin is carried out. The average annual precipitation of catchment, yield series and flood Discharge. After obtaining a suitable data the cross section of the Check Dam is designed.*

Keywords- Rain fall data, Flood Discharge, Auto CAD, Hydrological analysis, Kosa stream, Mahanadi

I. INTRODUCTION

This paper focus on the two things that is first the proper hydrological and geological analysis of the project site and from the further obtained data the design of stable check Dam is carried out. A check dam is a small barrier or dam constructed across a swale, drainage ditch or other area of concentrated flow for the purpose of reducing channel erosion. Channel erosion is reduced because check dams flatten the gradient of the flow channel and slow the velocity of channel flow. Most check dams are constructed of rock, but hay bales, logs and other materials may be acceptable. Contrary to popular opinion, most check dams trap an insignificant volume of sediment. Check dam are small barrier using stones, cement and concrete built across the direction of water flow on a shallow river or stream to harvest rain water.

They retain excess flow during rains in small catchment areas behind the dam, and the stored water is mainly used for irrigation .Water harvesting using check dams has the potential to transform infertile drylands to productive agricultural lands, revive rivers during the dry season, recharge groundwater and sustain ecology

PURPOSE OF THE PROJECT

purpose of the project is to study and analysis the hydrological and geological features of the project site. And determination of benefits by check dam in local community like drinking, bathing and irrigation water facilities, change in cropping pattern. Change in water table in wells. With the obtaining of required data a stable check dam is designed.

Study Area

Firstly we have studied the impact of check dam that have constructed on the other location and the benefits obtained from the construction of that proposed check dam on local community.

Figure 1. Satellite view of study area

Location of the project site

The project site is located 5km away from Chandulal Chandrakar Medical College in Kurud village near Bhilai city, District Durg, Chhattisgarh (pin -491223) at latitude 20.9479737, longitude 81.2884112. There is tributary of Mahanadi river known as Kosa stream is passed.

II. OBJECTIVES

The objectives of this paper are followings:

- To analysis the impact of check dam on the area or site where the structure has constructed in the river or a stream.
- Study of ground water recharge, river bed slope, height of embankment, water harvesting amount, annual rainfall, soil structure, climate, river runoff, and nature of catchment area.
- Determination of benefits by check dam in local community like drinking, bathing and irrigation water facilities, change in cropping pattern and change in water table in wells.
- And from this analysis and study further design of check dam at suitable location is carried.
- For the design of check dam proper hydrological and geological analysis of selected site has done.

III. METHODOLOGY

HYDROLOGICAL AND GEOLOGICAL ANALYSIS DATA

Trial Pit

The area consists of both alluvial soil and sandy soils. Agriculture is being practiced in alluvial soil area.

Geotechnical Information: Shallow test pits up to 1.5 m depth dug to study the geotechnical profile of soil (table 1).

Table 1.

Depth (cm)	Description
0 (ground surface)	Top soil, black organic, fragments of different rock sizes, clayey silt.
0-25	Dark Brown, moist Silty clay with traces of rock pebbles.
25-50	Grey, moist clayey silt with a trace of rock fragments.
50-75	Brown, wet medium Silty Sand.
75-100	Clayey silt with a trace of rock fragments.
100-150	Same as previous sample

Average Rainfall Precipitation

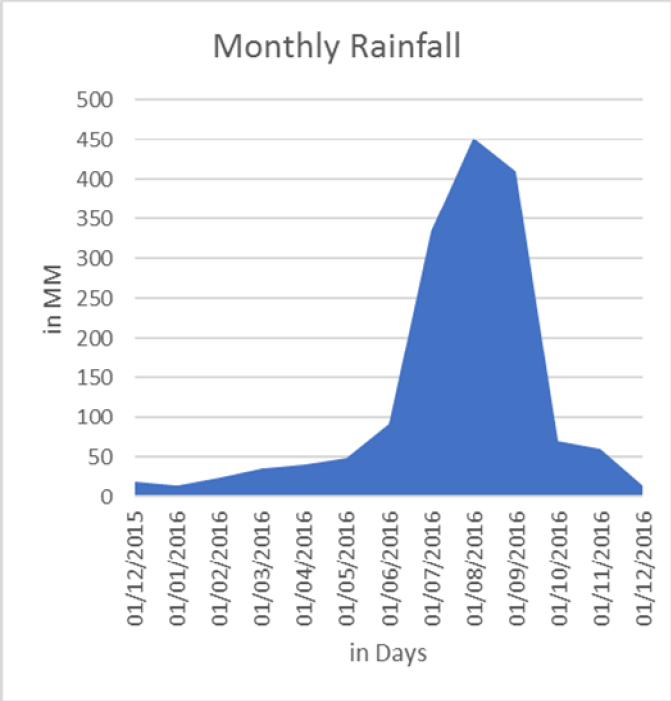

Figure 2. Average Rainfall precipitation data

River Bed Slope

Calculation Slope can be given by,

$$\text{Slope of Bed} = \frac{V.D}{H.D} \times 100$$

Where, V.D= Vertical distance to flat bed
H.D= Horizontal distance of river from flat to slope bed

Average Cloud and Humidity

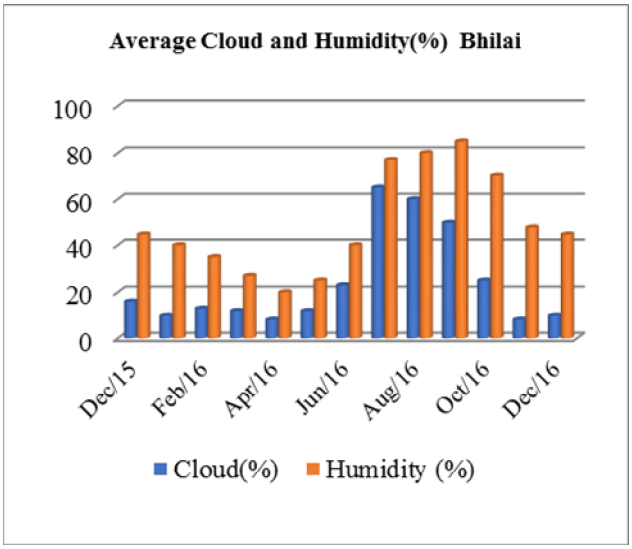

Figure 3.

Temperature Variation

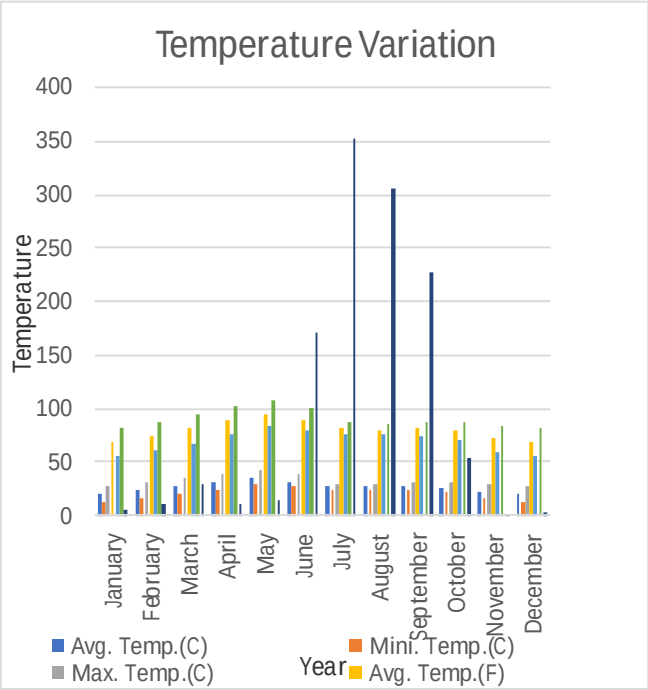

Figure 4.

IV. DESIGN OF CHECK DAM DATA

Catchment area = 1,30,000 m^2

Nature of catchment = good

Average annual rainfall = 540.557mm
T.B.L=846.00m
F.S.L=844.50m

G.L = 840.00m
F.L = 839.00m

Design of flood

By Ryve's formula

$Q=1000A^{3/4}$

$= 1000\times(0.0501)^{3/4}$

=105.89 cusecs
=3.0010 cumes

Design of weir

$Q=1.84\times(L-knH)\times H^{3/2}$
$3.001=1.84(L-0.1\times2\times1)1^{3/2}$
L=1.83m

Therefore provide 6m
Discharge intensity = 3.001/6
=0.5cumes
Normal scour depth(R) = $1.35(q^2/f)^{1/3}$
$= 1.35\times(0.5^2/1)^{\frac{1}{3}}$
=0.85m
Therefore provide 1m
F.S.L=844.50m
T.B.L=844.500+1.5=846.000m
Top width of weir

$B_1=0.55(\sqrt{H}+\sqrt{h})$

$=0.55(\sqrt{4.5}+\sqrt{1})$
=1.71
Provide 1.8m
Bottom width

$B_2= H+h/\sqrt{(L-1)}$

$=4.5+1/\sqrt{(2.25-1)} = 4.9m$
Provide 5m
Design of abutment
Height of abutment=846.00-840.00
H'=6m
Length of abutment=bottom width of weir =5m
Provide top width 0.5m

Bottom width=$0.4\times H'=0.4\times6=2.4m$
Provide 2.5m
Bottom width

$B_2=H+h/\sqrt{}(£-1) =4.5+1/\sqrt{}(2.25-1)$
=4.9m
Provide 5m
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Height of abutment=846.00-840.00

H'= 6m
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Provide top width 0.5m

Bottom width=$0.4\times H'=0.4\times6$
=2.4m
Provide 2.5m

Design of return wall

Provide same c/s for the u/s and d/s return wall as the C/S got from wing wall of junction return wall

Provide length of return wall up to suitable length to protect the bund with a minimum distance of 2m

Design of apron

L_D =2.21C√H"/13 take C=4

=2.21×4×√4.5/13

=5.2m

Adopt 6m.

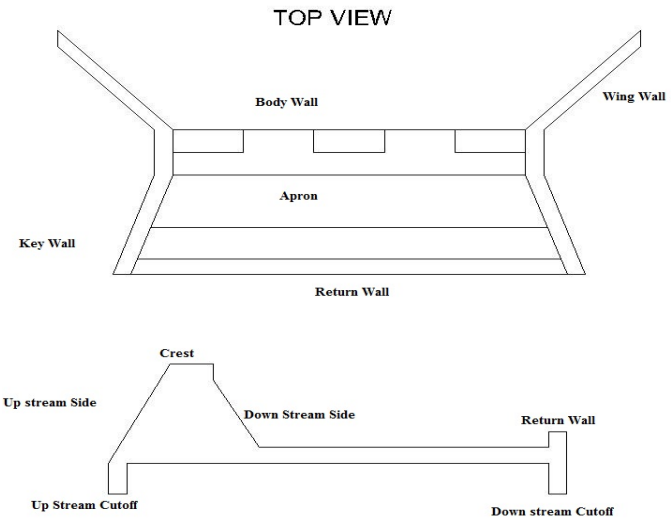

Figure 4. Drawing of Check Dam

V. STABILITY ANALYSIS

This is the most important part of this project. Designing a dam is not only of the prior importance, designing it safe against failure criterion is the main deal. The constructed dam should be safe against adverse meteorological condition and the geological feature of the location. The following stability condition were taken into consideration for analysis as mentioned below:

- Stability of the downstream slope during steady seepage
- Stability of the foundation against shear
- Overall stability of the dam section

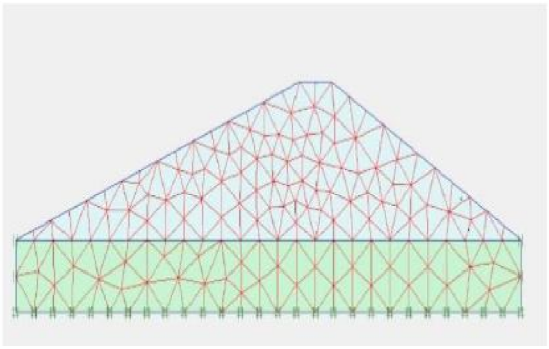

Figure 5. Earthen bund

VI. CONCLUSION

- The study is a strong indications of benefits perceived from the construction of check dam.
- The above analysis indicates the factors and data needed for design and construction of check dam.
- The study shows the impacts in various regions before and after construction of check dam.
- In this study the various approach methods and site considerations are carried out

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