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Analysis and Design of Dam Structures

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ABSTRACT

A dam also can be used to acquire water or for garage of water which can be calmly dispensed between places. Dams usually serve the primary reason of retain water; as different systems including floodgates or levees (additionally referred to as dikes) be use to handle or avoid run circulate particular land areas. This study focuses commonly on run-of-the-river hydroelectric systems underneath 5 megawatts (MW) implemented at a current dam.

Keywords: Levees, Dams, Flood and Gates

1. INTRODUCTION

Hydropower makes use of the downward force of water to show mills and generate energy. The dimensions of the hydroelectric plant are at once associated with the amount and surge of water. There are 3 forms of hydropower centers: run-of the river (otherwise known as hydrokinetic or diversion), impoundment, and pumped garage. This consists of new hydroelectric era capability done by multiplied performance or additions of latest ability at an present hydropower undertaking. This additionally includes new electric powered generation tasks that are run-of-the-river initiatives, especially at existing non-energy dams.

2. METHODOLOGY

- Introductions
- Literature review
- Dams
- Power generations
- Design specifications
- Manual design
- Etabs analysis
- Conclusion

3. DAMS

3.1 Dam Definition

A dam is a barrier that prevents or restricts the go with the flow of water or underground Streams. Reservoirs created by means of dams not handiest suppress floods however additionally offer water for sports which include irrigation, human intake, commercial use, aquaculture, and navigability. Figure 1 shows the Arc Dam of the study.

Figure 1 Arc Dam

Figure 2 shows the Gravity Dam.

Figure 2 Gravity Dam

4. DESIGN SPECIFICATIONS

Figure 3 shows the Dam and its Components.

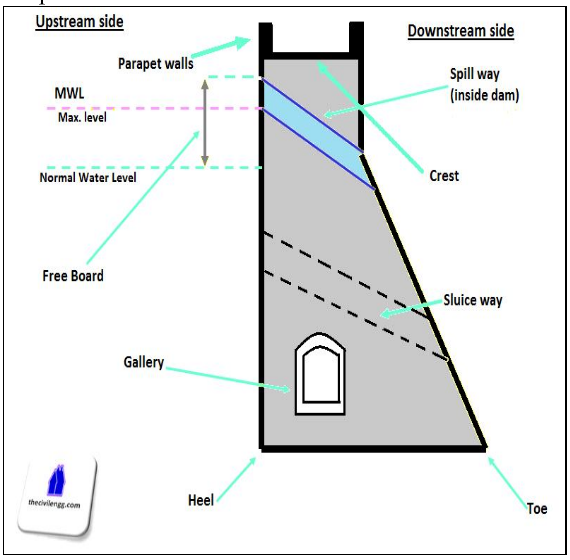

Figure 3 Dam and its Components

Figure 4 shows the Dam-Side View.

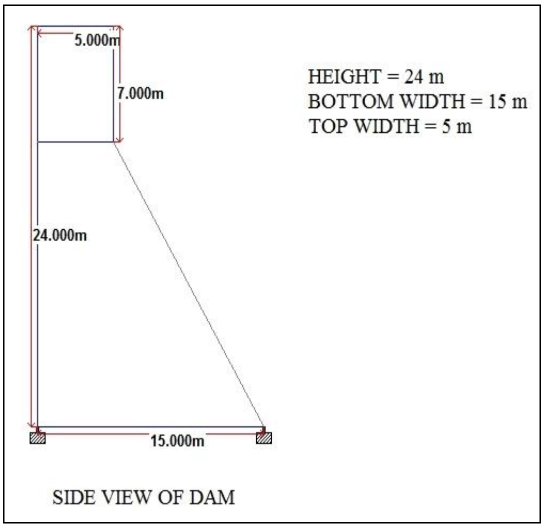

Figure 4 Dam – Side View

Reservoir capacity = 109500 m^3
Number of residents in the surrounding areas = 2500
Water demand per capita per day = 0.13 m^3

5. MANUAL DESIGN

5.1 Design of Dam

5.1.1 Given Data

Reservoir capacity = 109500 m^3
Breadth of dam = 15 m
Length of dam = 300 m
Elevation of dam = 24 m
Unit weight of masonry γ = 20 kN/m^3
Unit weight of water = 1000 kg/ m^3
Permissible shear stress of joint = 14 kg/cm^3
Discharge = (Area of region) (Area under curve) / Time
= (4393*1000000) (55,609.67)/ (365*24*60*60*1000)
= 7746.5 m^3/second
Number of residents in the surrounding areas = 2500
Mass of the dam (W) = bHγ
b = Breadth,
H = Height
γ = Density of Masonry
Weight of the dam (W) = 15x24x 20
= 7200 kN

5.1.2 Vertical Forces

5.1.2.1 Self weight of the dam

= [(½ × 10*17) + (5× 24)]]× 2000
= 410000 kg

5.1.2.2 Uplift pressure

= ½ *15*(10*1000)
= 75000 kg

$\sum V$ = Self weight of dam – (uplift pressure)
= 410000 - 75000
= 335000 kg

5.1.3 Horizontal Water Pressure

$\sum H$ **= wh²/2**
$= 1000 \times 24^2/2$
= 288000 kg

5.2 Moment Calculation about Toe

5.2.1 Moment Appropriate to Self Weight of the Dam

= {(24*5*2000)*(2.5)} + {(0.5*10*17*2000)*(((2/3)*10) +5)}
= 2582200 kg-m

5.2.2 Moment Due to Uplift Force

= 335000 * (2/3)*15
= 3350000 kg-m (-ve)

5.2.3 Moment Due to Horizontal Water Pressure

= 288000 * (24/3)
= 2304000 kg-m
$\sum M$ = 2582200 – 3350000 + 2304000 = 1536200 kg-m

6. ETABS ANALYSIS

The progressive and progressive new ETABS is the closing incorporated software package deal for the structural evaluation and layout of homes. E-TABS afford an unequaled suite of equipment for structural engineers designing buildings, whether or not they're operating on one-tale business structures or the tallest industrial high-rises.

7. ANALYSIS RESULTS

Table 1 shows the Base Reaction of the study.

Table 1: Base Reactions

Load Case/Combo	**FX kN**	**FY kN**	**FZ kN**	**MX kN-m**	**MY kN-m**
LOAD CASE 1	0	0	-279059	-41858804	3742745

Table 2 shows the Story Results.

Table 2: Story Results

Story	**Load Case/Combo**	**Direction**	**Max mm**	**Avg mm**	**Ratio**
Story2	Dead	Y	0	0	
Story1	Dead	Y	0	0	
Base	Dead	Y	0	0	
Story2	Live	Y	0	0	
Story1	Live	Y	0	0	
Base	Live	Y	0	0	
Story2	1 LOAD CASE 1	X	0.2	0.2	1.000036
Story1	1 LOAD CASE 1	Y	0	0	
Base	1 LOAD CASE 1	Y	0	0	

Figure 5 shows the Maximum Stress Diagram

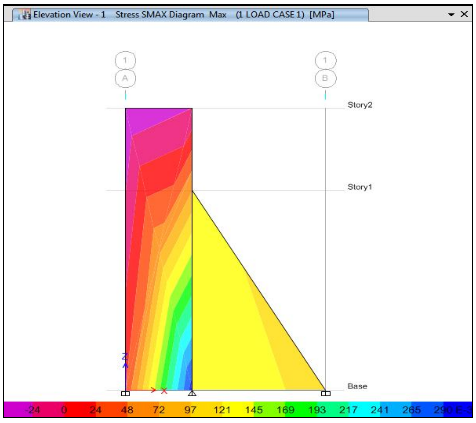

Figure 5 Maximum Stress Diagram

Figure 6 shows the Minimum Stress Diagram.

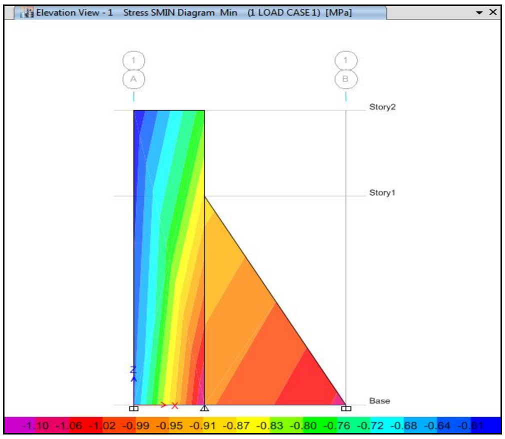

Figure 6 Minimum Stress Diagram

Figure 7 shows the Displacement.

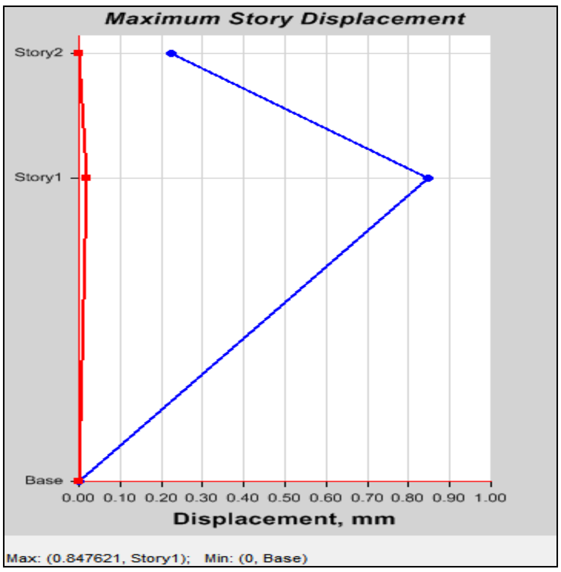

Figure 7 Displacement

8. CONCLUSION

Hydroelectric energy is green electricity. Not like diesel power plant, or thermal energy plant, which requires diesel and coal, the handiest fuel required in hydroelectric power plants is water. India have set a objective of 10 GW thru small hydro energy plants alone which is workable. Hydropower is an abundant, low cost source of electricity in spite of excessive prematurely building expenses. It is also a bendy and dependable source of strength compared to other renewable options, as it could be stored for use at a later time. Dammed reservoirs that are commonly used in these plants additionally help with flood control and reliable water deliver.

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